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ORIGINAL RESEARCH

The beneficial learning by simulation in the acquisition of non-technical skills among medical students

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Abstract

Introduction: Medical simulation is a new learning method recently introduced in medical education and has grown tremendously. "Never the first time on the patient", it is with this objective that medical simulation has become for several years an essential teaching method for health professionals and medical students. It is proven to improve both technical and non-technical skills (NTSs).

Methods: We carried out a pre-experimental study at the simulation center of the emergency medical service of the eastern center of Tunisia and the simulation center of the Faculty of Medicine of Sousse during the academic year 2020-2021. Our target population was students in the third year of the second cycle of medical studies.

We led four days of simulation-based training; it was included the community health program of the Faculty of Medicine of Sousse. NTSs were evaluated by the Anesthesia Non-Technical Skills (ANTS) score, at the start of the training (t0) (Workshop 2), at the end of the training (t1) (Workshop 6-7), and during the practical exam (t2).

Results: Our study population consisted of 67 medical students from the Faculty of Medicine of Sousse. Most students were females (67.7%). The mean age was 23.16 (±0.7).

The mean ANTS score before training at (t0) was 30.85+/- 10.8. At the end of the training, the mean ANTS score (t1) became 44.36+/- 8.8 ($p < 0.001$). At the final assessment, the mean ATNS score at (t2) was 48.99+/-11.8. The difference in mean between the assessment at t0 and t1 and the final assessment (t2) was statistically significant with $p < 0.001$. We compared the means of different items of the ANTS score, during the training to the end, and we found a significant improvement in work organization (10,03,10,94 and 15,79), teamwork (9,96,13,96 and 14,6) situational awareness (4,61, 8,91 and 9,25) and Decision-making (5.34, 7.66 and 9.34) with $p < 0.001$.

Conclusion: Simulation-based training for the medical and paramedical public contributes to patient safety and more effective care provided in critical situations. Our study confirmed the importance of this teaching method in acquiring and strengthening NTS.

Keywords: Crisis Resource Management; High Fidelity simulation training; Medical students

INTRODUCTION

Medical simulation is a new learning method recently introduced in medical education and has grown tremendously.

Simulation-based teaching in the health sciences is defined by the High Authority of Health (HAS) as being “the use of equipment, virtual reality or a standardized patient to reproduce situations or healthcare environments, to teach diagnostic and therapeutic procedures, to repeat processes and medical concepts, or decision-a making by a health professional or team of professionals” [1].

"Never the first time on the patient", it is with this objective that medical simulation has become for several years an essential teaching method for health professionals and medical students. It is proven to improve both technical and non-technical skills.

Medical studies mainly focus on individuals gaining theoretical, procedural, and technical knowledge. Non-technical skills (NTS) are rarely acquired by traditional methods of teaching. Several studies have proven that these skills improve the quality of teamwork, which helps to avoid human errors in patient care [2].

Simulation-based learning offers the possibility to acquire NTS in a psychologically safe environment allowing control of the situation and constructive discussion of errors without negative consequences.

The Cardiopulmonary resuscitation (CPR) training is a simulation-based training recently introduced (in 2020) in the Sousse medical school program for DCEM 3 students.

We can evaluate the impact of simulation in acquiring and improving NTS through different scores: Measurement scale for the evaluation of an emergency team (TEAM scale), OTPA grid (Obstetric Team Performance Assessment) [3], Ottawa CRM score, and the Anesthesiologists’ Non-Technical Skills score (ANTS) which is validated [4].

Our study aimed to study the evolution of the total NTS scale along the study and the score of each item of the ANTS scale by comparing the NTC score before the simulation-based training with that during and after the training.

METHODS

Type of study: We carried out a pre-experimental study at the simulation center of the Emergency Medical Service of the eastern center of Tunisia (CESU 03) and the simulation center of the Faculty of Medicine of Sousse (CESIM) during the academic year 2020-2021.

Study population: Our target population was the third year of the second cycle of medical students, in the faculty of medicine of Sousse. They were divided into four different groups. Students who had or were suspected to have COVID-19 were excluded due to safety measures.

Measurement: We used the «ANTS» score which is validated by the learned societies of emergency and resuscitation which are: SRLF/ SFAR/ SFMU/ SoFra.SimS(4). The total score is 60 points according to 4 items: task management which was noted on 16 points, teamwork (20 points), situational awareness (12 points), and decision making (12 points).

Program of the training: We led four days of training by simulation "CPR" which is part of the 5.2 community health program of the Faculty of Medicine of Sousse.

The CPR training consisted of different practical workshops. These workshops were led by qualified instructors in simulation teaching. All stages of the simulation session were respected; a briefing, clinical scenario, and constructive debriefing. The workshops were as above:

- Workshop 1: Basic Life Support "BLS" and defibrillation.
- Workshop 2: Management of a critical patient using the ABCDE approach.
- Workshop 3: Airway Management and Intra-Bone Access
- Workshop 4: ECG monitoring and rhythm recognition.
- Plenary session: Advanced Life Support «ALS» algorithm with a demonstration presented by the trainers.
- Workshop 5: Shockable rhythms and post-resuscitation care.
- Workshop 6: Non-shockable rhythms and Decision making.
- Workshop 7: Special circumstances: Anaphylaxis, Asthma, Electrolytic disorders.

During this training, 30 clinical scenarios were carried out. Each student played the role of the team leader in teamwork for the care of a patient in critical condition in at least 5 different scenarios. These CNTs will be evaluated by the ANTS score, at the start of the training (t0) (Workshop 2), at the end of the training (t1) (Workshop 6-7), and during the practical exam (t2). The practical exam was carried out two weeks away from the training days.

Data analysis: The results were analyzed using SPSS software, version 23. Qualitative variables were represented by numbers and percentages. Quantitative variables were represented by means and standard deviations. We used the non-parametric "Wilcoxon" test to study correlations of the mean score of ATNS. The significance level was set at a p-value < 0.05.

RESULTS

Our study population consisted of 67 medical students from the Faculty of Medicine of Sousse. Most students were females (67.7%) with a sex ratio of 0.59. The mean age was 23.16 (±0.7) years with extremes ranging from 22 to 26 years.

The mean ANTS score before training at (t0) was 30.85+/- 10.8 with a minimum of 17 and a maximum of 51. At the end of the training, the mean ANTS score (t1) became 44.36+/- 8.8. The maximum score was 59 and the minimum was 30 ($p < 0.001$).

At the final assessment during the exam, the mean ATNS score at (t2) was 48.99+/-11.8 with a minimum of 33 and a maximum of 62. The difference in mean between the assessment at t0 and t1 and the final assessment (t2) was statistically significant ($p < 0.001$).

We compared the means of different items of the ANTS score. The items were work organization, teamwork, situational awareness, and decision-making. During the training to the end, we noted a significant improvement in work organization (10,03,10,94 and 15,79), teamwork (9,96,13,96 and 14,6) situational awareness (4,61, 8,91 and 9,25), and Decision-making (5.34, 7.66 and 9.34) with $p < 0.001$.

Table 1: The mean ANTS score of different items before, during, and at the end of training

Non-technical skills	T0	T1	p	T2	p
Work Organisation l (/16)	10.03	10.94	0.001	15.79	0.001
Teamwork (/20)	9.96	13.96	0.001	14.6	0.001
Situational awareness(/12)	4.61	8.91	0.001	9.25	0.001
Decision-making (/12)	5.34	7.66	0.001	9.34	0.001
Total score (/60)	30.85	44.36	0.001	48.99	0.001

DISCUSSION

Our work aims to evaluate NTS acquisition among medical students of Sousse Medical School during simulation-based training.

We conducted a pre-experimental study. Most students were females (67.7%), with a 23-year mean age.

We found a statistically significant improvement in ANTS scores from the beginning to the end of the training. The mean score at the beginning of training (t0) was 30.85+/- 10.8, 44.36+/-8.8 at the end of training (t1), and 48.99+/-11.8 at the final exam (t2).

It was the same for all the different items of the ANTS score, as we assessed their mean score separately at the beginning, at the end of the training, and during the final exam.

Our results were consistent with various studies that showed medical simulation to be an essential tool in the acquisition of NTS.

In the literature, learning through simulation, allows students to develop the expected behaviors towards critical situations in the professional environment in the most pragmatic way possible. Indeed, simulation helps to develop clinical reflexes and improve them [5].

A meta-analysis including 619 studies did a comparison between traditional learning and simulation and found simulation was systematically associated with the better acquisition of knowledge, and clinical skills NTS [6].

Another meta-analysis published in 2010 [7] demonstrated that simulation-based teaching can improve individual performance in technical tasks and management of critical events [8,9].

In the early 2000s, the committee responsible for the quality of health care in America published a report “To Err is Human” [4] showing the importance of the human factor in medical errors. Over 70% of adverse medical events were reported to be related to communication and coordination problems [10].

In Tunisia, a study conducted at EMS 03 in Sousse evaluating the impact of a simulation training accredited by the European resuscitation council “Immediate Life Support ILS’’ on practical acquisition found a significant improvement in both technical skills (TS) and NTS with a great increase in the ANTS score from the beginning to the end of training [16].

A study carried out in Morocco also confirmed the educational contribution of simulation in the improvement of knowledge and practical acquisitions [17].

A recent study conducted in the USA did a 10-month simulation training program for 231 medical students from Texas. It found a statistically

significant improvement in NTS from the 6th session [18].

The General Medical Council of the UK strongly recommends medical simulation be taught in the first year to familiarize all young medical students with this method of learning [15].

In the literature, several studies demonstrated that simulation replicating real critical situations and focusing on teaching verbal and non-verbal communication or leadership has become an essential tool in error reduction strategies [19].

In a study conducted in France with 3 months of simulation training, MOTTIER et al. [20] also confirmed that simulation training allows improvement in NTS, which corresponds to level two of the Kirkpatrick scale. Given these results, other studies would be necessary to assure long-term retention of these new skills [21].

Further, Thomas et al. [22] showed in their study that a combination of theoretical training with simulation improved team-related TLCs compared to those based solely on simulation.

Moreover, a meta-analysis published in 2017 showed that simulation improves skills but not knowledge acquisition [23]. This leads us to conclude that a duality in teaching methods is necessary for better medical learning.

However, an American study revealed in the Journal of the Society for Simulation in Healthcare that the ANTS score was complex, even experienced clinicians and simulation instructors may have difficulty using it, and suggested that BARS '' Behavioral-anchored rating scales would be an alternative to the ANTS scale for NTS assessment [24].

Study Limitation: The sample of our study was small including only 67 students; a study with a larger sample would have yielded more meaningful results.

The evaluation of NTS acquisition in our study was done over a short period; only 4 days of simulation training. A long-term evaluation may also be proposed.

CONCLUSION

Simulation training for the medical and paramedical public contributes to patient safety and more effective care provided in critical situations. Our study confirmed the importance of this teaching method in acquiring and strengthening NTS.

REFERENCES

1. *Simulation en santé [Internet]. Haute Autorité de Santé. [cité 17 avr 2022]. Disponible sur: https://www.has-sante.fr/jcms/c_2807140/fr/simulation-en-sante*
2. *Haroutunian N, Yersin B, Trueb L, Zingg T. Qualité du travail en équipe et du leadership lors de réanimations : validité et fiabilité des échelles « Mayo High Performance Teamwork Scale (MHPTS) » et « Leadership Behavior Description Questionnaire (LBDQ) ». Anesth. Rea. 2019, 5: 22-30.*
3. *Fransen AF, de Boer L, Kienhorst D, Truijens SE, van Runnard Heimel PJ, Oei SG. Assessing teamwork performance in obstetrics: A systematic search and review of validated tools. Eur J Obstet Gynecol Reprod Biol. 2017;216:184-91.*
4. *Recommandations de Pratiques Professionnelles SRLF – SFAR–SFMU–SOFRASIMS. « Intérêts de l'apprentissage par simulation en soins critiques Recommandations communes » https://sfar.org/interets-de-lapprentissage-par-simulation-en-soins-critiques/*
5. *Paquay L, Sirota R. La construction d'un espace discursif en éducation. Mise en oeuvre et diffusion d'un modèle de formation des enseignants : le praticien réflexif. Recherche & formation 2001 ; 36 : 5-16.*
6. *Cook DA, Hatala R, Brydges R, Zendejas B, Szostek JH, Wang AT, et al. Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. JAMA. 2011;306:978-88.*
7. *McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. A critical review of simulation-based medical education research: 2003-2009. Med Educ. 2010;44:50-63.*

8. *Wayne DB, Didwania A, Feinglass J, Fudala MJ, Barsuk JH, McGaghie WC. Simulation-based education improves quality of care during cardiac arrest team responses at an academic teaching hospital: a case-control study. Chest. janv 2008;133:56-61.*

9. *Ammirati C, Amsallem C, Gignon M, Bertrand C, Pelaccia T. Les techniques modernes en pédagogie appliquée aux gestes et soins d'urgence. 2011;16.*

10. *Linda T. Kohn, Janet M. Corrigan, Molla S. Donaldson. To Err Is Human: Building a Safer Health System |The National Academies Press.2000; DOI: 10.17226/9728.*

11. *Manser T. Teamwork and patient safety in dynamic domains of healthcare: a review of the literature. Acta Anaesthesiol Scand. févr 2009;53(2):143-51.*

12. *Lynch A. Simulation-based acquisition of non-technical skills to improve patient safety. Seminars in Pediatric Surgery [Internet]. 1 avr 2020 [cité 17 avr 2022];29(2):150906. Disponible sur: https://www.sciencedirect.com/science/article/pii/S1055858620300263*

13. *Does Team Training Improve Team Performance? A Meta-Analysis - Eduardo Salas, Deborah DiazGranados, Cameron Klein, C. Shawn Burke, Kevin C. Stagl, Gerald F. Goodwin, Stanley M. Halpin, 2008 [Internet]. [cité 17 avr 2022]. Disponible sur: https://journals.sagepub.com/doi/10.1518/001872008X375009*

14. *Association Between Implementation of a Medical Team Training Program and Surgical Mortality | Surgery | JAMA | JAMA Network [Internet]. [cité 17 avr 2022]. Disponible sur: https://jamanetwork.com/journals/jama/fullarticle/186748*

15. *GMC. Tomorrow's Doctors. London: General Medical Council; 2009. :108. Disponible sur: http://www.ub.edu/medicina_unitateducaciomedica/documentos/TomorrowsDoctors_2009.pdf*

16. *Loghmari.D Évaluation de l'impact pédagogique d'une formation par simulation pour le personnel paramédical des urgences Mémoire Sousse 2021.*

17. *IRAQI A.LA PLACE DE LA SIMULATION MEDICALE COMME OUTIL D'APPRENTISSAGE POUR LES ETUDIANTS EN 5 EME ANNEE DE MEDECINE « ETUDE PROSPECTIVE » Thése Marroc 2017.*

18. *Menon V, Bhoja R, Reisch J, Kosemund M, Hogg D, Ambardekar A. Acquisition of Teamwork and Communication Skills Using High-Technology Simulation for Preclerkship Medical Students. Simul Healthc. 1 déc 2021;16(6):e181-7.*

19. *Bradley P, Postlethwaite K. Setting up a clinical skills learning facility. Med Educ. nov 2003;37 Suppl 1:6-13.*

20. *SEVESTRE.E Évaluation de l'apprentissage des compétences non techniques en médecine d'urgence par l'intermédiaire de la simulation haute-fidélité. These Toulouse 2017.*

21. *Heitz C, Eyck RT, Smith M, Fitch M. Simulation in Medical Student Education: Survey of Clerkship Directors in Emergency Medicine. West J Emerg Med [Internet]. nov 2011 [cité 17 avr 2022];12(4):455-60. Disponible sur: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3236142/*

22. *Thomas EJ, Williams AL, Reichman EF, Lasky RE, Crandell S, Taggart WR. Team training in the neonatal resuscitation program for interns: teamwork and quality of resuscitations. Pediatrics. mars 2010;125(3):539-46.*

23. *Beal MD, Kinnear J, Anderson CR, Martin TD, Wamboldt R, Hooper L. The Effectiveness of Medical Simulation in Teaching Medical Students Critical Care Medicine: A Systematic Review and Meta-Analysis. Simul Healthc. avr 2017;12(2):104-16.*

24. *Watkins SC, Roberts DA, Boulet JR, McEvoy MD, Weinger MB. Evaluation of a Simpler Tool to Assess Nontechnical Skills During Simulated Critical Events. Simul Healthc. avr 2017;12(2):69-75.*

Acute cerebral insults in the emergency department: epidemiology and predictive factors of highly sensitive troponin level's increase

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Abstract

Background: several acute neurological diseases, such as stroke and subarachnoid hemorrhage have been associated with transient cardiac dysfunction and simultaneous elevation of troponin. Our purpose is to study the clinical and epidemiological characteristics of acute neurological disease and to determinate the predictive factors of highly sensitive troponin elevation

Methods: this is a prospective and analytic study conducted at The Emergency Department of The Military Hospital of Tunis. It included 106 patients diagnosed with acute cerebral disease and having highly sensitive troponin measurement at admission over a period of 10 months. A multivariate analysis was conducted to identify the predictive factors of troponin elevation.

Results: The mean age of our patients was 62±19 years and the gender ratio was 1.4. Hypertension was the most common cardiovascular risk factor (46%). The most common acute neurological diseases were ischemic stroke (47%) followed by seizures (14%) and hemorrhagic stroke (13%). Thirty-six patients (35%) had a high troponin level, 18 patients (17%) had repolarization abnormalities and 8 patients (8%) had both troponin elevation and ST segment abnormalities. A high troponin level was found in 50% of patients with brain tumors, 47% of patients with seizures, 38% of patients with ischemic stroke and 33% patients with subarachnoid hemorrhage.

In this multivariate analysis, the independent predictive factors of troponin elevation in patients with acute neurological disease were: age greater than 65 (OR=2.75, CI: 2.801-5.456), diabetes (OR=1.47, CI: 1.546-3.956) and Glasgow Coma Scale (GCS) less than 15 (OR=0.53, CI: 2.213-4.329)

Conclusion: The troponin level was high in 35% of patients with acute neurological disease. Predictive factors of troponin elevation were: age greater than 65, diabetes, history of atrial fibrillation and a GCS under 15.

Keywords: Brain; Emergency; Heart; Insults; Troponin

BACKGROUND

Acute brain insults are a frequent cause of patients presenting to the ED. It is also an important cause of functional disability and mortality among these patients. Numerous acute brain injuries such as stroke, subarachnoid hemorrhage, and seizures were associated with transitory heart malfunction with simultaneous troponin level increase [1].

are often unknown by the different stakeholders (emergency physician, neurologist, cardiologist). Also, increased troponin levels can occur in some conditions other than coronary artery disease whose symptoms can be atypical or hidden by the neurological signs. The challenge for the emergency physician is to recognize patients at high risk of myocardial repercussions because it is associated with poor prognosis. Therefore, the management of these patients should be multidisciplinary. Our study aims to identify the epidemiological and clinical features of brain insults as well as to determine the predictive factors of troponin elevation among these patients.

METHODS

Patients and data acquisition: Consecutive patients admitted with acute brain insult were prospectively enrolled over 10 months in a database and followed during their hospitalization in the ED.

We included 106 patients diagnosed with ischemic or hemorrhagic stroke, spontaneous or

We calculated the absolute frequencies and the relative frequencies (percentages) for the

Many studies showed that an increase in plasma catecholamine occurs after acute brain insults causing acute myocardial damage with elevated troponin levels. The increase in troponin levels could allow us to identify the patients having an acute brain insult with cardiovascular consequences. However, the cardiac repercussions of neurological insults

post-traumatic subdural and extradural hematoma, seizures, expansive intracranial process, and post-traumatic cerebral hematoma.

Data prospectively collected included the following parameters: age, gender, medical history, clinical examination data, and laboratory data including cardiac Troponin I (cTNI) levels and brain imaging results.

According to the final diagnosis, the patient was subsequently oriented towards the appropriate hospital department.

Blood samples: For the measurement of cTNI levels, the automated benchtop immunoanalyzer VIDAS based on the Enzyme Linked Assay (ELFA) technology was used. According to the local standards, a cTNI cut-off level of ≥ 19 ng/ml was considered a significant elevation; values of 19 ng/ml on admission were rated as increased when the second sample confirmed an elevation of ≥ 10 ng/ml.

Statistical analysis: The Statistical analysis of our collected data was performed using SPSS software version 23.

qualitative variables. We calculated means, medians, and standard deviations and

determined the extreme values for the quantitative variableThe comparisons of the percentages of independent series were carried out by the Chi-square test of Pearson, and in the event of invalidity of the previous test we used the two-tailed Fisher test.

The comparisons of means of independent series were carried out with the student's t-test, and in the event of this test not being valid, we used the nonparametric test of Mann and Whitney.

To identify the factors of troponin elevation during acute brain insults, we compared two groups:

- G1: acute cerebral insults and positive troponin
- G2: acute cerebral insults and negative troponin

We conducted a multivariate, step-wise, decreasing logistic regression analysis. The multivariate analysis made it possible to calculate adjusted odds ratios, measuring the proper role of each factor.

For all statistical tests, the significance level "p" was fixed at 0.05.

RESULTS

Among the 106 patients who were included in the final analysis, the mean age was 62 years (SD ±19); the gender ratio was 1.4. The most common cardiovascular risk factor was hypertension (46%) followed by Diabetes (41%). Thirty-eight patients had at least two cardiovascular risk factors. In our study, 14% of patients had a medical history of coronary disease, 5% had valvular disease with atrial fibrillation. A medical history of stroke was found among 23 patients. The reason for consultation was a motor deficit (41%) and an altered state of consciousness (34%). On admission, neurological examination showed a GCS of 9/15 in 11% of cases. The mean GCS was 14±3. A motor deficit was found in 49% of cases divided as follows: hemiparesis (49%), hemiplegia (36%), and monoparesis (15%). Ten patients had mental confusion and 7 patients had seizures. An ECG was performed for all patients showing: atrial fibrillation (21%), repolarization disorder (17%), tachycardia (27%) and bradycardia (2%). A cranial CT scan was also performed for all patients. It was normal for 34% of patients. Otherwise, it showed ischemic stroke (27%), hemorrhagic stroke (13%), subarachnoid hemorrhage (11%), extradural hematoma (3%), subdural hematoma (3%), intracranial hemorrhage (8%), and expansive intracranial process (1%).

Troponin levels were high for 36 patients. The average troponin value was 166±39 ng/l. High Troponin levels were found in patients with expansive intracranial process (50%), seizures (47%), ischemic stroke (38%) and subarachnoid hemorrhage (33%).

Repolarization disorders were present in 22% of patients with ischemic strokes. These disorders were T-wave inversion in 6 patients and ST segment depression in 5 patients.

The table 1 resumes the different repolarization disorders associated to high troponin levels among patients with acute brain insults.

Table 1: the different repolarization disorders associated to high troponin levels among patients with acute brain insults.

Type of repolarization disorders	High troponin levels N (%)
T wave inversion	4 (11%)
ST segment depression	4 (11%)
T wave inversion with ST segment depression	1 (3%)

The duration of hospitalization was less than 12 hours for 90% of our patients. Seventy-six percent of patients diagnosed with ischemic stroke were hospitalized in neurology department and 91% of those diagnosed with

subarachnoid hemorrhage were hospitalized in neurosurgery department. The death rate in the ED was 3%. Troponin levels were normal among the patients who died.

Age over 65 and diabetes were significantly associated with high troponin levels (significance levels were respectively p=0,016 and p=0,032). Also, GCS under 15 was significantly associated to high troponin levels (p=0,04). Independent factors associated to the elevation in troponin levels among patients having brain insults were: age over 65, diabetes, atrial fibrillation, and GCS under 15 (Table 2).

Table 2: Independent factors associated to the elevation in troponin levels among patients having brain insults

	p	OR	CI
Age over 65	0,033	2,79	[2.801-5.456]
diabetes	0,048	1,47	[1.546-3.956]
GCS under 15	0,006	0,53	[2.213-4.329]
History of AF	0,04	0,05	[1,185-3,387]

DISCUSSION

In our study the mean age of patients having acute brain insults was 62±19 and the gender ratio of 1, 4. This is consistent with the findings of Sandhu and al [1]. who included 175 patients admitted for ischemic stroke, 107 patients admitted for brain hemorrhage and 96 patients admitted for subarachnoid hemorrhage where the mean age was respectively 67, 61 and 51.

he most common cardiovascular risk factor in our study was hypertension (46%). It was also the case in the study of Tsivgoulis and al [2]. that included 703 patients for acute brain insults where hypertension was the first cardiovascular risk factor with a rate of 81%. Concerning atrial fibrillation, it was found among 27% of our patients while it was present among 28% of the patients included in Anders and al.'s study[3] that also found 17% patients with ischemic stroke history.

Clinical study

A prospective metacentric study conducted in Brazil by Carvalho and al (4), including 2407 patients for acute brain insults, motor deficit was the most frequent reason of consultation (71%) followed by headaches (27%). This result is close to our: motor deficit (41%) and headaches (25%). Ischemic stroke (47%) was the most common acute brain insult diagnosed among our study population preceding hemorrhagic stoke (13%). This finding is similar to both results from Carvalho and al [4] . and Tsivgoulis and al. works[2].

Troponin levels can rise without necrosis nor ischemia but it always indicates the presence of acute or chronic myocardial injury. The importance of myocardial involvement during brain injury is highlighted in autopsy studies in

which the frequency of trans mural myocardial injury is more important after death of neurological origin [5].

The nerve center controlling the cardiovascular system is located in the brainstem and hypothalamus. The right insula is involved in the cardiac sympathetic nervous activity while the left insula regulates the cardiac parasympathetic nervous activity. The damage in one of these areas causes an imbalance in the sympathetic/parasympathetic cardiac nervous activity [6]. The amygdala, located in the internal part of the temporal lobe, inhibits the Nucleus Tractus Solitarii and activates the lateral rostroventral segment of the brainstem leading to the decrease of the parasympathetic activity and the increase of sympathetic activity [7].

The increase in troponin levels during stroke can be caused by an ischemic myocardial injury secondary either to the erosion of an atherosclerotic plate in coronary arteries or the imbalance between oxygen demand and supply. The myocardial injury during stroke can also be caused by a neurogenic myocardial cytolysis. In fact a sympathetic hyperactivity occurs during stroke leading to a catecholamine discharge that causes a myofibrillary degeneration which is responsible of non-ischemic myocardial injury and troponin liberation.

According to literature, almost 19% of patients develop severe cardiac complications in the first few weeks following the ischemic stroke with a maximum frequency in the first 3 days. Cardiac-related death occurs in 4% of patients [8].

The rise in troponin levels is common after an ischemic stroke. It is found in 5 to 34% of patients. It predicts a poor prognosis on mortality and neurological outcome [9]. In our study troponin levels were high in 38% of patients diagnosed with ischemic stroke.

The incidence of troponin level increase tends to vary across studies. In fact it is influenced by the characteristics of the study population. Some studies excluded patients having renal failure or history of heart disease. A literature review conducted by Kerr and al [10]. including 15 studies showed a high troponin level in 18% of cases. There was no significant difference between studies including or excluding patients with anterior renal failure.

> Traumatic brain injury generates an important catecholamine discharge that enhances the cardiac and cerebral oxygen requirements and causes the increase in troponin levels [20,21]

Concerning the hemorrhagic stroke, the physiopathological mechanism is similar to the ischemic stroke [11]. Hays and al [12] included 235 patients having hemorrhagic stroke in their study. 36% of them had high troponin levels. In another study including 208 patients with hemorrhagic stroke conducted by Tummala and al [13], the rate of cases with increased troponin levels was 49%. These outcomes are deemed to be higher than the results from our work were the rate of patients with hemorrhagic stroke associated to increased

troponin level was 14%. The liberation of troponin in subarachnoid hemorrhage is the consequence of an adrenergic myocarditis whose mechanism is very close to that observed in encephalic death [14]. The increase in troponin levels is frequently observed among patients with hemorrhagic stroke secondary to ruptured aneurysm (68%). It is an early and specific marker of heart involvement. Its peak plasma concentrations occurs in 2 days [15]. In a literature revue that included 12 studies conducted on 2214 patients admitted for subarachnoid hemorrhage, troponin level increase was found in 21 to25% of cases with a mean rate of 30% [16]. In our study this rate was of 33%.

After a seizure, cytosolic troponin is liberated from the cardiomyocites [17] . In our study increased troponin levels were found among 47% of patients with seizures. This outcome is considered to be higher than the results established by literature where this rate was of 8% [18] and 11%[19]. Namely that in these studies, as in ours, patients with chronic renal failure and acute coronary syndrome were not included.

In the work of Prathep and al [22], troponin levels were high among 22% of patients hospitalized for post traumatic brain injury. However no patient with subdural, epidural or cerebral hematoma was registered with high troponin levels in our study. This may be explained by the small number of cases included with these conditions.

Concerning the cases of intracranial expansive processes included in our study, the rate of high troponin levels was 50%. Unfortunately, troponin level's increase in intracranial expansive process has been poorly studied up to this point.

Acute brain insults and repolarization disorder

Cardiac electrical abnormalities are frequent after acute brain insults (90%) even in patients with no history of heart disease [23]

In our study, repolarization disorders were present in 22% of patients with ischemic stroke. They were represented by T wave inversion (12%) and ST segment depression (10%). Our results are close to those found by Faiz and al. (24) where T wave inversion and ST segment depression were observed in respectively 15% and 14% of the ischemic stroke cases included.

However only 7% of cases with hemorrhagic stroke were registered with repolarization disorder which contrasts with the results from literature where this rate amounts to 64% [24] . Regarding subarachnoid hemorrhage, the most common repolarization disorder is T wave inversion (17%) followed by ST segment depression (14%). In our study these rates were both of 8%. Other ECG modifications can be can be registered such as QT prolongation [25, 26].

Among our study population, 13% of seizure cases had T wave inversion. This disorder was reported in 3 to 8% of cases in literature [27,28].

We registered 33% cases of repolarization disorders among patients with epidural, subdural and brain hematoma while Busl and al [29]. registered 11% cases.

Concerning expansive intracranial process, repolarization disorders were registered in 13% of cases included in our study against 24% in the study of Povoa and al [30]. that excluded patients with hypertension, valvular and coronary disease.

Predictive factors of troponin level's increase in patients with acute neurologic disease

The table 3 resumes the studies that analyzed the independent predictive factors of troponin levels increase in acute brain insults and compares them to our study.

Table 3: Independent predictive factors of troponin levels increase in acute brain insults in other studies compared to our study.

Study	Brain insult	Number of cases	Predictive factors of troponin levels increase
Abdi and al (62)	ischemic stroke	114	Age over 70, renal failure, repolarization disorder, NHISS score over 9
Batal ad al (25)	ischemic stroke	1718	Advanced age, Hypertension, smoking, congestive heart failure, high NHISS score
Faiz and al (27)	Ischemic stroke	287	Age over 76, congestive heart failure, diabetes, renal failure, coronary disease
Tanabe and al (41)	Subarachnoid hemorrhage	103	Severe neurologic symptoms evaluated by Hunt Hess score
Miketic and al (42)	Subarachnoid hemorrhage	239	Severe neurologic symptoms evaluated by GCS
Sieweke and al (49)	seizures	741	Presence of cardiovascular risk factors
Chung and al (72)	Hemorrhagic stroke	253	Hypertension, masculine gender
Salim and al (58)	Brain Trauma	420	Severe neurologic symptoms evaluated by GCS
Our study	Stokes, subarachnoid hemorrhage, Brain trauma, intracranial expansive process	106	Age over 65, diabetes, history of atrial fibrillation, GCS under 15

Acute brain insults and increased troponin levels

According to the literature, the increase in troponin levels during acute brain insults is of bad prognosis leading to a higher mortality rate and severe neurological squeals. In fact, early mortality (in less than 30days) was significantly higher [31] as well as the mortality rate observed within a 5 years follow up [9]. There is also an increase of the in-hospital deaths among these patients[1,12]. High troponin levels predict a poor neurological recovery [32]and the dependency on third party[33].

CONCLUSION

In conclusion, assaying troponin levels is advisable in any patient admitted in the ED for acute brain insult. The different stakeholders (emergency physician, neurologist, neurosurgeon, cardiologist, and radiologist) should be involved in the management of these patients for a better evaluation and decision making.

REFERENCES

1. Sandhu R, Aronow WS, Rajdev A, Sukhija R, Amin H, D'aquila K, et al. Relation of cardiac troponin I levels with in-hospital mortality in patients with ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage. Am J Cardiol. 2008;102:632–4.

2. Tsivgoulis G, Patousi A, Pikilidou M, Birbilis T, Katsanos AH, Mantatzis M, et al. Stroke Incidence and Outcomes in Northeastern Greece: The Evros Stroke Registry. Stroke. 2018;49:288–95.

3. Anders B, Alonso A, Artemis D, Schäfer A, Ebert A, Kablau M, et al. What does elevated high-sensitive troponin I in stroke patients mean: concomitant acute myocardial infarction or a marker for high-risk patients? Cerebrovasc Dis Basel Switz. 2013;36:211–7.

4. de Carvalho JJF, Alves MB, Viana GÁA, Machado CB, dos Santos BFC, Kanamura AH, et al. Stroke epidemiology, patterns of management, and outcomes in Fortaleza, Brazil: a hospital-based multicenter prospective study. Stroke. 2011;42:3341–6.

5. Kolin A, Norris JW. Myocardial damage from acute cerebral lesions. Stroke. 1984;15:990–3.

6. Oppenheimer SM, Saleh TM, Wilson JX, Cechetto DF. Plasma and organ catecholamine levels following stimulation of the rat insular cortex. Brain Res. 1992 13;569:221–8.

7. Saha S. Role of the central nucleus of the amygdala in the control of blood pressure: descending pathways to medullary cardiovascular nuclei. Clin Exp Pharmacol Physiol. 2005;32:450–6.

8. Prosser J, MacGregor L, Lees KR, Diener H-C, Hacke W, Davis S, et al. Predictors of early cardiac morbidity and mortality after ischemic stroke. Stroke. 2007;38:2295–302.

9. Jensen JK, Atar D, Mickley H. Mechanism of troponin elevations in patients with acute ischemic stroke. Am J Cardiol. 2007;99:867–70.

10. Kerr G, Ray G, Wu O, Stott DJ, Langhorne P. Elevated troponin after stroke: a systematic review. Cerebrovasc Dis Basel Switz. 2009;28:220–6.

11. Manikandan S. Heart in the brain injured. J Neuroanaesth Crit Care. 2016;03:S12–5.

12. Hays A, Diringer MN. Elevated troponin levels are associated with higher mortality following intracerebral hemorrhage. Neurology. 2006;66:1330–4.

13. Tummala P, Makhlouf N, Kumar A. Troponin Elevation in Spontaneous Intracranial Hemorrhage. Neurology. 2015;84:30– 8.

14.Masuda T, Sato K, Yamamoto S, Matsuyama N, Shimohama T, Matsunaga A, et al. Sympathetic nervous activity and myocardial damage immediately after subarachnoid hemorrhage in a unique animal model. Stroke. 2002;33:1671–6.

15. Sharma D. Perioperative Management of Aneurysmal Subarachnoid Hemorrhage: A Narrative Review. Anesthesiology. 2020;133:1283–305.

16. Zhang L, Wang Z, Qi S. Cardiac Troponin Elevation and Outcome after Subarachnoid Hemorrhage: A Systematic Review and Meta-analysis. J Stroke Cerebrovasc Dis Off J Natl Stroke Assoc. 2015;24:2375–84.

17. Metcalf CS, Poelzing S, Little JG, Bealer SL. Status epilepticus induces cardiac myofilament damage and increased susceptibility to arrhythmias in rats. Am J Physiol Heart Circ Physiol. 2009;297: 2120-2127.

18. Sieweke N, Allendörfer J, Franzen W, Feustel A, Reichenberger F, Pabst W, et al. Cardiac Troponin I elevation after epileptic seizure. BMC Neurol. 2012 17;12:58.

19. Chatzikonstantinou A, Ebert AD, Hennerici MG. Temporal seizure focus and status epilepticus are associated with high-sensitive troponin I elevation after epileptic seizures. Epilepsy Res. 2015;115:77–80.

20. Arbabi S, Ahrns KS, Wahl WL, Hemmila MR, Wang SC, Brandt M-M, et al. Beta-blocker use is associated with improved outcomes in adult burn patients. J Trauma. 2004;56:265–9; discussion 269-271.

21. Salim A, Hadjizacharia P, Brown C, Inaba K, Teixeira PGR, Chan L, et al. Significance of Troponin Elevation After Severe Traumatic Brain Injury. J Trauma Acute Care Surg. 2008;64:46–52.

22. Prathep S, Sharma D, Hallman M, Joffe A, Krishnamoorthy V, Mackensen GB, et al. Preliminary report on cardiac dysfunction after isolated traumatic brain injury. Crit Care Med. 2014;42:142–7.

23. Goldstein DS. The electrocardiogram in stroke: relationship to pathophysiological type and comparison with prior tracings. Stroke. 1979;10:253–9.

24. Faiz KW, Thommessen B, Einvik G, Brekke PH, Omland T, Rønning OM. Determinants of high sensitivity

cardiac troponin T elevation in acute ischemic stroke. BMC Neurol. 2014 3;14:96.

25. Brouwers PJ, Wijdicks EF, Hasan D, Vermeulen M, Wever EF, Frericks H, et al. Serial electrocardiographic recording in aneurysmal subarachnoid hemorrhage. Stroke. 1989;20:1162–7.

26. Salvati M, Cosentino F, Artico M, Ferrari M, Franchi D, Domenicucci M, et al. Electrocardiographic changes in subarachnoid hemorrhage secondary to cerebral aneurysm. Report of 70 cases. Ital J Neurol Sci. 1992;13:409–13.

27. Zijlmans M, Flanagan D, Gotman J. Heart rate changes and ECG abnormalities during epileptic seizures: prevalence and definition of an objective clinical sign. Epilepsia. 2002;43:847–54.

28. Kishk NA, Sharaf Y, Ebraheim AM, Baghdady Y, Alieldin N, Afify A, et al. Interictal cardiac repolarization abnormalities in people with epilepsy. Epilepsy Behav EB. 2018;79:106–11.

29. Busl KM, Raju M, Ouyang B, Garg RK, Temes RE. Cardiac abnormalities in patients with acute subdural hemorrhage. Neurocrit Care. 2013;19:176–82.

30. de Lemos JA. Increasingly sensitive assays for cardiac troponins: a review. JAMA. 2013;309:2262–9.

31. Dixit A, Chow G, Sarkar A. Neurologic Presentation of Triple A Syndrome. Pediatr Neurol. 2011;45:347–9.

32. Miketic JK, Hravnak M, Sereika SM, Crago EA. Elevated cardiac troponin I and functional recovery and disability in patients after aneurysmal subarachnoid hemorrhage. Am J Crit Care Off Publ Am Assoc Crit-Care Nurses. 2010;19:522–8.

33. Fure B, Bruun Wyller T, Thommessen B. Electrocardiographic and troponin T changes in acute ischaemic stroke. J Intern Med. 2006;259:592–7.

Can we predict the clinical scenario of acute heart failure based only on NT proBNP rate without using echocardiography?

Auteurs

Affiliation

Abstract

Background:

The acute heart failure (AHF) is a common pattern to seek care in the emergency department (ED). The objective of our study was to investigate the relationship between NT pro-BNP and acute heart failure (AHF) syndrome in the emergency department (ED).

Methods:

We conducted a descriptive prospective study over eight months. Were included all patients who presented to the emergency department (ED) with dyspnea and in whom the diagnosis of acute heart failure (AHF) was made. All patients had an NT pro-BNP laboratory test and underwent echocardiography.

Results:

One hundred seven patients were included. Mean age was 65 ± 12 years. Sex ratio was 2.34. A clinical scenario CS1 was noted in 28% of cases, CS2 in 36% of cases, CS4 in 16% of cases, CS3 in 12% of cases and CS5 in 8% of cases. Thirty percent of patients had preserved left ventricular ejection fraction (LVEF) with diastolic dysfunction and 70% had a reduced left ventricular ejection fraction (LVEF). Elevated left ventricular filling pressures were found in 95% of patients. Disorders of wall motion in 14% of cases and isolated right heart failure in 12% of cases. The median natriuretic brain peptides (NT pro-BNP) level was higher when left ventricular ejection fraction (LVEF) was preserved: 4073 [410 – 25 550] pg / ml vs2025 [409 – 25 200] pg / ml (p=0,043).

Conclusion:

Natriuretic brain peptides level was a good predictor of the clinical scenario CS1 with a cut-off at 5565 pg / ml. Though, the potential clinical applications of B-type natriuretic peptide in AHFS should be more studied.

Key words: Echocardiography; Emergency; Heart Failure; Natriuretic Peptides.

BACKGROUND

Acute heart failure (AHF) is increasingly common among emergency department (ED) patients. It is a major problem on several levels: for the individual patient, for the healthcare system due to the complexity of diagnosis and treatment, and for society because of its high costs.

The term acute heart failure includes a wide variety of clinical presentations ranging from AHF de novo, acute decompensated heart failure, isolated right heart failure and cardiogenic shock.

The diagnosis of AHFS is sometimes difficult in emergency situations. Emergency physicians have often recourse to specific diagnostic methods: biochemical by NT pro-BNP dosage, or imaging: transthoracic Doppler echocardiography.

The dosage of NT pro-BNP is simple to realize but it does not completely dispense echocardiography. Echocardiography provides powerful assessment of cardiac function: systolic dysfunction, diastolic dysfunction or right heart failure.

The relationship between the rate of NT pro-BNP and AHFS is not well studied in the literature.

Some studies have shown that a very high rate of NT pro-BNP would orient towards left ventricle (LV) systolic dysfunction and lower rates would rather be related to diastolic dysfunction.

The objective of our study was to investigate the relationship between the rate of NT pro-BNP and the AHFS, referring to echocardiography data. In other words, can we predict the clinical scenario of acute heart failure based only on NT pro-BNP rate without using echocardiography?

METHODS

Design: A prospective observational study was conducted over a period of 8 months. The study was approved by the hospital's Research Ethics Committee.

Participants: The study was conducted in the ED of the military hospital of Tunis, the capital of Tunisia. The ED has an active teaching program. The ED had approximately 38,000 patient visits per year. We included all patients aged of 18 years and more, who presented to the ED with acute dyspnea and in whom the diagnosis of AHF was retained.

The AHF was defined based on the recommendations of the European Society of Cardiology [1].

Were not included all the patients aged below 18 years and those with known significant valve disease.

Were excluded the patients with negative rate of NT pro-BNP for AHF:

- NT pro-BNP below 300 pg / ml [2].
- NT pro-BNP in the gray area, and negative after adjusting according to age [3].
- NT pro-BNP in the gray area, and negative after adjusting according to creatinine clearance (<60 ml / min [3,4]). (figure 1)

- Patients in which echocardiography was not in favor of AHF.

- Patients lost or with incomplete data.

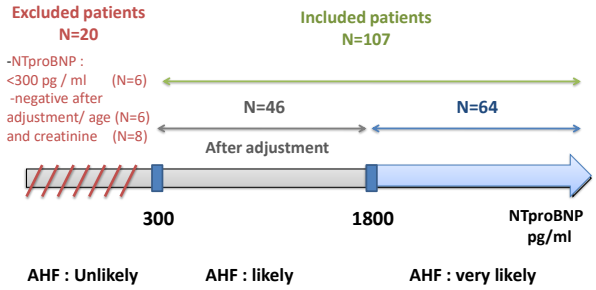

Figure 1: distribution of patients according to NT proBNP rates

Study design: The study design is summarized in figure 2.

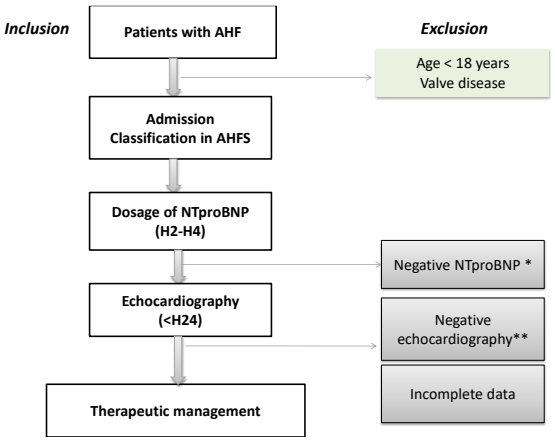

Figure 2: study design

Each patient was classified according to AHFS classification. We adopted for all patients, a classification proposed by an international, multidisciplinary group of experts [5].

This classification is based primarily on systolic blood pressure (SBP), presence of peripheral signs of shock, the association with acute coronary syndrome (ACS), or an isolated right heart failure. These five clinical scenarios (CS) define the AHFS (Table 1).

Table 1: Clinical scenarios in acute heart failure syndrome, critical care 2008 [5]

Clinical scenario	Characteristics
CS1	SBP > 140mmHg Symptoms develop abruptly Predominantly diffuse pulmonary edema Minimal systemic edema (patient may be euvolemic or hypovolemic) Acute elevation of filling pressure often with preserved LVEF Vascular pathophysiology
CS2	SBP 100-140 mmHg Symptoms develop gradually, together with a gradual increase in body weight Predominantly systemic edema Minimal pulmonary edema Chronic elevation of filling pressure, including increased venous pressure and elevated pulmonary arterial pressure Manifestations of organ dysfunction (renal impairement, liver dysfunction, anemia, hypoalbuminemia)
CS3	SBP < 100 mmHg Rapid or gradual onset of symptoms Predominantly signs of hypoperfusion Minimal systemic and pulmonary edema Elevation of filling pressure Two subsets : Clear hypoperfusion or cardiogenic shock No hypoperfusion/cardiogenic shock
CS4	Symptoms and signs of acute heart failure Evidence of ACS Isolated elevation of cardiac troponin is inadequate for CS4 classification
CS5	Rapid or gradual onset No pulmonary edema Right ventricular dysfunction Signs of systemic venous congestion

An appropriate therapeutic management for all patients has been started by emergency physicians.

All patients had a dosage of NT proBNP within 2 to 4 hours, and an echocardiography, performed by the same operator, within a period not exceeding 24 hours.

The echocardiography was performed according to the American recommendations (ASE) [6, 7] by Vivid 7 Dimension Echocardiographic.

Were noted all the demographics, clinical, biological, echocardiographic and evolutionary criteria.

Statistical analysis: Statistics were calculated by SPSS (version 20.0).

Dichotomized data wereanalyzed by the Chi2-test. The level of significance was p =0.05.ROC (Receiver Operator Characteristics) analysis was performedto calculate sensitivity, specificity, negative andpositive predictive values and an optimal cut-point of NT proBNP to detect AHFS.

RESULTS

During the study period, the AHFS accounted for 6.8 % consultants to the ED.

One hundred and seven patients were enrolled. The patients flow diagram is summarized in figure 3.

The Mean age was 65 ± 12 years. The sex ratio was 2.34. Patient characteristics are summarized in Table 2.

Based on the clinic A hypertensive heart failure (CS 1) was noted in 28% of cases, a normotensive heart failure (CS2) in 36% and heart failure associated with acute coronary syndrome (CS4) in 16 % of cases. Hypotensive heart failure (CS3) was noted in 12% of cases and isolated right heart failure (CS5) in 8% of cases.

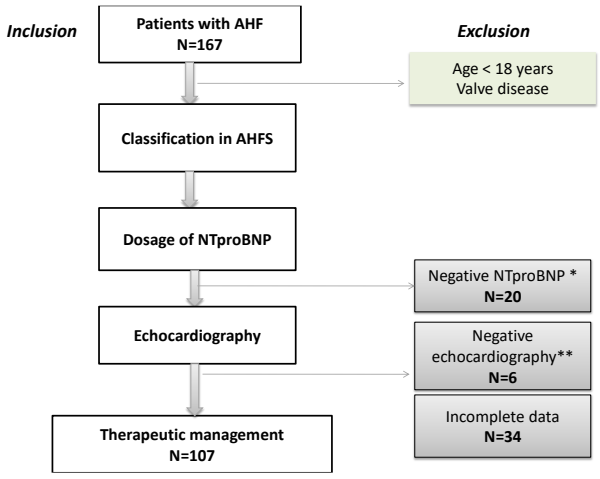

Figure 3: patient flow diagram

* NT pro-BNP negative: NT pro-BNP<300 pg / ml (6 patients) or NT pro-BNP in the gray zone and still negative after adjustment according to age (6 patients) and to creatinine clearance (8 patients)
** Echocardiography not in favor of AHF

NT pro-BNP median rates were 4576 [780 – 25 550] pg / ml for CS1 group, 2370 [410 – 25 500] pg / ml for CS2 group, 1324 [409 – 14 205] pg / ml for CS3 group, 1404 [457 – 19 889] pg / ml for CS4 group and 2394 [1150 – 15 291] pg / ml for group CS5.

Concerning the echocardiography data, 30% of patients had preserved left ventricular ejection fraction (LVEF) with diastolic dysfunction and 70% had a reduced LVEF.

Elevated LV filling pressures were found in 95% of patients. Disorders of wall motion in 14% of cases and isolated right heart failure in 12% of cases.

Table 2: Patients comorbidities

Comorbidites	N (%)
Hypertension	55 (51)
Diabetes	57 (53)
Cardiopathy	48 (50)
Heartfailure	56 (52)
Dyslipemia	29 (27)
Respiratoryinsufficiency	14 (13)
Chronicrenalfailure	11 (10)
Valvulopathy	7 (6)
Arrythmia	23 (21)
Smoking	51 (48)

The most important level of NT pro-BNP was associated with a restrictive profile and an E / E'> 15 (Figures 4, 5).

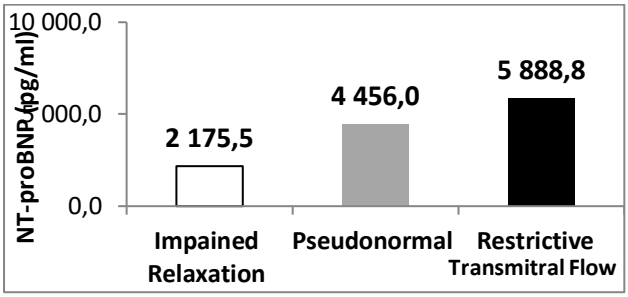

Figure 4: NT pro-BNP and transmitral flow

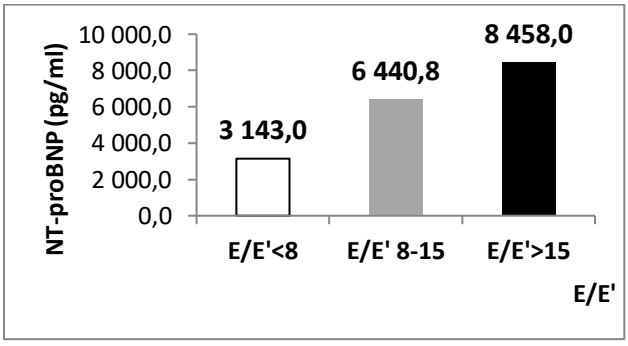

Figure 5: NT proBNP and E/E' ratio

The median NT pro-BNP level was higher when LVEF was preserved: 4073 [410 – 25 550]pg / ml vs2025 [409 – 25 200] pg / ml (p=0,043).

The median NT pro-BNP level significantly differs according to the clinical scenario and to the LVEF (figure 6).

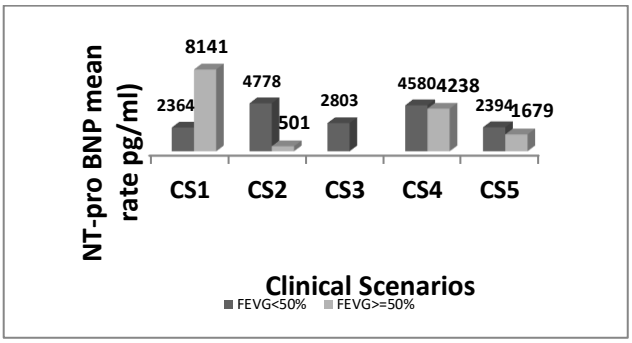

Figure 6: Distribution of the mean rates of NT proBNPaccording to clinical scenarios and to echographic data

The NT pro-BNP is a good predictor of CS1with a cut-off of5565 pg / ml, with an area under the curve (AUC) of 0.69; p = 0.002; confidence interval (CI) 95% [0.58 to 0.80]; 52% sensitivity; a specificity of 86%, a likelihood ratio (LR) Positive LR + 3.71 and a negative LR to 0.26.

Regarding the other clinical scenarios, the difference was not statistically significant.

DISCUSSION

This study showed that the mean NT pro-BNP was higher when LVEF was preserved. We found that the NT pro-BNP could predict the clinical scenario CS1 from a threshold of 5565 pg / ml.

Acute heart failure is a major health care problem. It represents more than 26 million visits to the ED worldwide [2] and more than 1 million hospitalizations annually in the United States and Europe [8,9].

In Tunisia, we do not have yet a heart failure registry. However, in a study conducted in the ED of Ben Arous Regional Hospital in Tunisia in 2009 [10], the prevalence of AHFS was 5.5 % consultants. Our results were similar to previous findings.

Regarding the clinical distribution of AHFS, the majority of our patients had a clinical scenario CS2 (36%) which was in line with previous findings [11,12,13].

Concerning the mean rates of NT pro-BNP in each clinical scenario, unlike other studies [14-16], the highest levels of NT pro-BNP were found in hypertensive heart failure (CS1). Besides, the LV filling pressures in CSA were the highest. Indeed, according to Throughton [17], the rates of NT proBNP increase proportionally to the LV filling pressures. He demonstrated that E ' and the ratio E / E' were associated with high levels of NT-pro-BNP. In our study, the highest NT pro-BNP rate (8454 pg / ml) was found in patients who had an E / E '> 15 (figure 3,4).

This difference could be explained by the fact that most similar studies were conducted in cardiology departments or Intensive care units (ICU) and only few in the ED [14-16]. The acute phase has already been subdued and the LV filling pressures were no longer elevated.

Tshöpe [18] had also shown that the rate of NT pro-BNP increased with the severity of the diastolic dysfunction with a rate of 151.6 pg / ml for the patients who had the relaxation disorders vs 308.1 pg / mL for the pseudonormal profile and 2307.1 pg / ml for those with a restrictive profile.These rates were lower compared to those found in our study: 2175 pg / ml in case of relaxation disorders, 4456 pg / ml for pseudonormal profile and 5888 pg / ml for restrictive profile (figure 4).The Tshöpe study was also conducted in the cardiology department, the dosage of NT pro-BNP was made after adequate treatment was introduced.

Another explanation suggested by Solomon [19]: Apart from acute decompensation, patients with hypertension have higher NT pro-BNP baseline rates than those with chronic heart failure. During Acute Decompensated heart failure, NT pro-BNP rates increase with the elevation of LV filling pressure. The LV filling pressures are more pronounced for the CS1 compared to CS2. This could explain the higher rates of NT pro-BNP for hypertensive AHF in our study. However, in our population, the baseline NT pro-BNP rates were missed.

In our study, a NT pro-BNP cut-off of 5565 pg / ml was predictive of CS1. To our knowledge, the level of NT pro-BNP for each clinical scenario has not been studied yet.

Further studies are warranted to identify a cut-off of NT pro-BNP that could predict the clinical scenario of AHFS.

Study limitations: Some limitations of our study should be addressed. In our study, the mean NT pro-BNP was higher when LVEF was preserved. The NT pro-BNP could predict the clinical scenario CS1 but it did not predict other clinical scenarios considering the small sample size.

Indeed, the number of patients included was low compared to other international studies. larger-scale studies, including multicenter, are needed.

Concerning the NT pro-BNP levels, it would have been interesting to have the basic rate of NT pro-BNP for all patients in order to calculate the delta NT pro-BNP.

CONCLUSION

In conclusion, the mean NT pro-BNP was higher when LVEF was preserved. The NT pro-BNP could predict the clinical scenario CS1 from a threshold of 5565 pg / ml.

Peptide measurements provide information complementary or incremental to echocardiography for assessment of cardiac function, clinical status, and outcome. Tough, the potential clinical applications of B-type natriuretic peptide in AHFS should be more studied.

What is known about this topic

- Acute heart failure (AHF) is public health issue characterized by high mortality and high rate of hospital admissions and re-hospitalizations.
- The diagnosis of AHF may not be straight forward and at times may be difficult in an undifferentiated patient with acute dyspnea, especially in patients with advanced age and comorbid disease.
- Some studies have shown that a very high rate of NT pro-BNP would orient towards left ventricle (LV) systolic dysfunction and lower rates would rather be related to diastolic dysfunction.

What this study adds

- The NT pro-BNP could predict the clinical scenario CS1 but it did not predict other clinical scenarios considering the small sample size.
- Peptide measurements provide information complementary or incremental to echocardiography for assessment of cardiac function, clinical status, and outcome

REFERENCES

[1] McMurray J, Adamopoulos S, Anker S, Auricchio A , Böhm M, Dickstein K and al. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2012: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2012 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association (HFA) of the ESC. Eur Heart J. 2012;335(14):1787-847.

[2] Nieminen MS, Brutsaert D, Dickstein K, Drexler H, Follath F, Harjola VP and al. EuroHeart Failure Survey II (EHFS II): a survey on hospitalized acute heart failure patients: description of population. Eur Heart J. 2006;27(22):2725-36.

[3] Anwaruddin S, Lloyd-Jones DM, Baggish A, Chen A, Krauser D, Tung R and al. Renal function, congestive heart failure, and amino-terminal pro-brain natriuretic peptide measurement: results from the ProBNP Investigation of Dyspnea in the Emergency Department (PRIDE) Study. J Am Coll Cardiol. 2006;47(1):91-7.

[4] Jourdain P, Lefevre G, Oddoze C, Spain V, Dievart F, Jondeau G and al. [NT-proBNP in practice: from chemistry to medicine]. Ann Cardiol Angeiol. 2009;58(3):165-79.

[5] Mebazaa A, Gheorghiade M, Pina I, Harjola V, Hollenberg S, Follath F and al. Practical recommendations for prehospital and early in-hospital management of patients presenting with acute heart failure syndromes. Crit Care Med. 2008;36(1 Suppl):129-39.

[6] Douglas PS, Khandheria B, Stainback R, Weissman N, Brindis R., Patel M and al. ACCF/ASE/ACEP/ASNC/SCAI/SCCT/SCMR 2007 appropriateness criteria for transthoracic and transesophageal echocardiography: a report of the American College of Cardiology Foundation Quality Strategic Directions Committee Appropriateness Criteria Working Group, American Society of Echocardiography,

American College of Emergency Physicians, American Society of Nuclear Cardiology, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and the Society for Cardiovascular Magnetic Resonance endorsed by the American College of Chest Physicians and the Society of Critical Care Medicine. J Am Coll Cardiol. 2007;50(2):187-204.

[7] Nagueh SF, Appleton CP, Gillebert TC, Appleton C, Byrd B, Dokainish H and al. Recommendations for the evaluation of left ventricular diastolic function by echocardiography. Eur J Echocardiogr. 2009;10(2):165-93.

[8] Cleland JG, Swedberg K, Follath F, Komajda M, Cohen- Solal A, Aguilar JC and al. The EuroHeart Failure survey programme-- a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis. Eur Heart J. 2003;24(5):442-63.

[9] Rudiger A, Harjola VP, Muller A, Mattila E, Saila P, Nieminen M and al. Acute heart failure: clinical presentation, one-year mortality and prognostic factors. Eur J Heart Fail. 2005;7(4):662-70.

[10] Hamed R. Prise en charge des syndromes d'insuffisance cardiaque aiguë auxurgences [thèse]. Médecine: Tunis; 2009. 117p.

[11] Maggioni AP, Dahlstrom U, Filippatos G, Chioncel O, Leiro MC , Drozdz J and al. EURObservational Research Programme: the Heart Failure Pilot Survey (ESC-HF Pilot). Eur J Heart Fail. 2010;12(10):1076-84.

[12] Fonarow G, Abraham W, Albert N, Stough WG, Gheorghiade M, Greenberg BH and al. Impact of evidence-based heart failure therapy use at hospital discharge on treatment rates during follow-up: a report from the Organized Program to Initiate Lifesaving Treatment in Hospitalized Patients With Heart Failure (OPTIMIZE-HF). J Am Coll Cardiol. 2005;45:345-6.

[13] Weintraub NL, Collins SP, Pang PS , Levy PD, Anderson AS, Arslanian-Engoren L and al. Acute heart failure syndromes: emergency department presentation, treatment, and disposition: current approaches and future aims: a scientific statement from the American Heart Association. Circulation. 2010;122(19):1975-96.

[14] Filippatos G, Teerlink JR, Farmakis D, Cotter G, Davison BA, Felke GM and al. Serelaxin in acute heart failure patients with preserved left ventricular ejection fraction: results from the RELAX-AHF trial. Eur Heart J. 2014;35(16):1041-50.

[15] Steinberg BA, Zhao X, Heidenreich PA, Peterson E, Bhatt D, Cannon C and al. Trends in patients hospitalized with heart failure and preserved left ventricular ejection fraction: prevalence, therapies, and outcomes. Circulation. 2012;126(1):65-75.

[16] O'Donoghue M, Chen A, Baggish AL, Anwaruddin S, Krauser DG, Tung R and al. The effects of ejection fraction on N-terminal ProBNP and BNP levels in patients with acute CHF: analysis from the ProBNP Investigation of Dyspnea in the Emergency Department (PRIDE) study. J Card Fail. 2005;11(5 suppl):9-14.

[17] Troughton RW, Richards AM. B-type natriuretic peptides and echocardiographic measures of cardiac structure and function. JACC Cardiovasc Imaging. 2009;2(2):216-25.

[18] Tschope C, Kasner M, Westermann D, Gaub R, Poller WC, Schultheiss HP. The role of NT-proBNP in the diagnostics of isolated diastolic dysfunction: correlation with echocardiographic and invasive measurements. Eur Heart J. 2005;26(21):2277-84.

[19] Rautureau Y, Baxter GF. Acute actions of natriuretic peptides in coronary vasculature and ischaemic myocardium. Curr Pharm Des. 2004;10(20):2477-82.

Predicting diabetic ketoacidosis severity score: proposal of a therapeutic strategy adapted to emergency department

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Abstract

Background: We investigated independent severity predictors of diabetic ketoacidosis and developed a prediction rule for emergency physicians to classify patients into severity groups.

Methods: This study was done in a university-affiliated medical center. Consecutive adult patients (>15 years old) visiting the emergency department (ED) between July 2016 and July 2018 were enrolled when they met the criteria of DKA. Hospitalization in an intensive care setting was the primary endpoint.

Results: We included 176 patients diagnosed with DKA in the ED. We found 7 independent severity predictors: Altered mental status, venous pH, bicarbonate level, blood glucose, Serum creatinine, H4 serum chloremia and effective serum osmolality at admission. After assigning weights to each predictor, we developed a predicting DKA severity score that stratifies patients into groups: low severity (score<3): treatment in a general ward or the ED; and high (score≥3): treatment in the ICU. The area under the curve for the rule was 0.863.

Conclusions: The score is a simple and rapid rule for predicting severity and classifying patients with DKA.

Keywords: Diabetic Ketoacidosis; Score; Outcomes; Emergency

INTRODUCTION

Diabetes is a public health problem and pathology burdened with significant morbidity and mortality due to its acute and chronic complications.

Diabetic ketoacidosis (DKA) is a serious, potentially lethal complication of diabetes and may be the initial mode of presentation for patients with new-onset T1D. It results from an absolute or relative insulin deficit with the immediate consequence of hyperglycemia and ketosis, which is itself responsible for water depletion and hydro-electrolyte disorders [2]. Regardless of the observed decrease in the death rate, DKA remain a serious health problem, especially in developing and undeveloped countries [1].

A better understanding of the pathophysiology combined with more uniform diagnostic and therapeutic treatment has led to a marked decline in developed countries, where its mortality varies between 0% and 5% [3, 4, and 5]. This metabolic disorder constitutes one of the main reasons for admission in the emergency department (ED) [1]. Several series studied mortality predictors and classified them in score [6, 7, 8, and 9].

The aim of this study was to identify the

clinical and evolutionary profile of the

population admitted in the ED with a diagnosis of DKA, and use multivariate logistic regression analysis to investigate independent severity predictors, and develop a prediction rule useful for ED physicians, one that allows them to classify patients with DKA into severity groups, and that allows them to make an appropriate management decision (treatment in the ICU, a general ward, or only in the ED).

METHODS

Study design, setting, population, and selection of participants: This study was done in university-affiliated medical center in Tunisia with an ED staffed with board-certified emergency physicians. Consecutive adult patients (>15 years old) visiting the ED between July 2016 and July 2018 were enrolled when they met the following criteria [3]: DKA was defined as plasma glucose >2.5g/L, a high anion gap metabolic acidosis (serum HCO3 <15 mmol/L, and pH >7.3), and positive urine ketones or serum ketones. Any other mode of decompensation: simple hyperglycemia, simple ketosis, hyperosmolar, a combination of hyperglycemia-hyperosmolar state (osmolarity> 320 mOsm/L) or a mixed syndrome ketoacetic and hyperosmolar was excluded. The effective serum osmolality was calculated with the formula: 2[measured Na+ (mEq/L)] + [glucose (mg/dL)]/18.

Data collection: Patients were prospectively selected in the ED. Insufficient information was retrospectively collected by checking medical records after the patients had been discharged from the hospital. The processing of the files was carried out on the basis of a pre-established sheet. The data has been grouped into five themes: General data (age, sex, background, and the evolutionary profile of diabetes); clinical data; biological data at admission, at H4, at H8 and at H12; and the analysis of triggering factors (therapeutic errors, infectious states, etc.). Therapeutic management and progressive characteristics (length of stay, mortality, and complications) were noted. We collected the quantity of insulin administered during the first 24 hours, the methods of its administration, as well as the other adjuvant therapies: rehydration, antibiotic treatment.

Statistical analysis: All analyses were done using SPSS 25.0 for Windows. Descriptive statistics (mean and standard deviation [SD] for continuous variables and frequencies and proportions for categorical variables) were calculated.

Comparisons between two groups were made using either an independent-samples t-test (assuming normal distribution) for the continuous variables.

Either a $\chi 2$ test was used for categorical variables. Odds ratios (ORs), along with the corresponding 95% confidence intervals (CIs), were also computed as appropriate. The area under the receiver operating characteristic (ROC) curves was used to compare a model's specifications along with its sensitivity and specificity. The results of the multivariate stepwise (forward) logistic regression analysis were then used to develop a prediction rule. Weights were assigned to each predictor according to their predicting β values of multiple logistic regression analysis. A Predicting DKA severity score was calculated for each patient. The scores on each different weight were used to determine their respective cutoff points for risk stratification by ROC curve with the highest sum of sensitivity and specificity. For all analyses, a result was considered statistically significant at the $P < .05$ level of significance.

RESULTS

A total of 176 cases of DKA were included from 2016 to 2018. The mean age was 35.3 +/- 18.6 years, 32.4% were aged from 20 to 30 years, and 77 patients were male (sex ratio = 0.77). Diabetes was known in 150 patients (85.2%) of whom 60.8% were type 1 diabetics. 14.8% patients were admitted for a primary diagnosis of DKA. The most common symptoms at presentation were abdominal pain (41.5%), and lethargy (13.1%). Other signs and symptoms at presentation were fever (9.1%), polyuria and polydipsia (8%), Kussmaul breathing (5.7%), chest pain (1.7%).The most frequent decompensation factors were infection in 36.9% and discontinuation of treatment in 23.9% cases.

The average blood glucose was 28 +/- 7.6 m mol / L, the mean venous pH was 7.14+/- 0.12, and blood HCO3- was 7.9 +/- 3.98 m mol / L. The main hydration solution was 0.9% saline solution. The mean serum amount infused was 3.90±2.02 L / 24h. The mean dose of intravenous insulin infused in the first 24 hours was 43.94±12.74 IU / 24h. The mean time to switch to subcutaneous insulin therapy was 24.8±16.4 hours. Only five patients with hypoglycemia were noted during treatment (2.8%). The length of stay in the ED was 16.1±13.5 hours. 19.7% patients were discharged out of the ED, after clinical and biological recovery as well as the control of the cause of decompensation. In contrast, 121 patients (68.8%) were transferred to an endocrinology ward, and 13 (7.4%) were admitted to the intensive care unit. The average total hospital length of stay was 6.41±6 days. Five cases of death (2.8%) were described in our study. Then patients were prospectively assigned to 2 groups as follows: *1*) first group consisted of 13 patients who were admitted to the intensive care unit; *2*) second group consisted of 121 patients who were admitted to General ward (endocrinology). They were compared to detect patients requiring intensive care upon admission to the emergency room (Table 1).

A multiple logistic regression analysis with stepwise variable selection using backward selection was performed and odds ratios with 95% confidence intervals were calculated for each predictor.

Table 1 : Comparison between UIC group and Endocrinology Ward group

Measures	Patients in ICU	Patients in Ward	P Values
Number	13	121	-
Age	37.2±19.2	35.1±18.6	0.694
DM duration	7.5±5.8	7±6.8	0.773
Males	7.8%	62.3%	0.106
PR	107.5±20.5	109.2±21.1	0.784
SBP	12.7±1.7	12.1±2.3	0.395
DBP	6.8±1.4	4±1.4	0.693
RR	27.8±3.8	25.9±6.8	0.297
GCS	14.2±2	14.8±0.7	0.002
Blood glucose	34.3 ± 8.5	27.6 ±7.4	0.002
Urea	11.7 ± 11	7.2± 4.8	0.02
Serum creatinine	166±196	94.7±89.4	0.025
Na+	132.3±6.4	131.6±4.8	0.62
K+	4.7±0.9	4.5±0.9	0.3
pH H0	7±0.10	7.20±0.10	p<0.001
HCO3- H0	4.5±3.4	8.2± 3.9	0.001
Osmolarity	298.9±14.4	290.7±10.7	0.01
pH H4	7.20 ± 0.10	7.30 ± 0.10	0.001
HCO3- H4	8.1 ± 3.5	12.6± 4.7	0.001
Na+ H4	134.1 ± 6.4	134±4.6	0.95
K+ H4	4 ± 0.8	3.7± 0.8	0.218
Cl H4	110.1 ± 6.4	103.7± 3.7	0.005
pH H8	7.20± 0.10	7.30 ±0.10	<0.001
HCO3- H8	10.3 ±4.3	14.5 ±4.3	0.002
pH H12	7.20 ± 0.10	7.30 ± 0.10	0.003
HCO3- H12	11.2 ± 5.1	15.2 ± 4.2	0.007
Na+ H12	133.8 ± 6.4	135± 4.2	0.396
K+ H12	3.8± 0.9	3.7 ±0.7	0.466
Cl H12	111 ± 5.4	105 ± 6.4	0.007
Mortality rate	4	1	<0.001

DM= diabetes mellitus; ICU= intensive care unit; PR=pulse rate; RR= respiratory rate; SBP= systolic blood pressure; DBP=diastolic blood pressure;

The results were used to develop a clinical and biological severity score, to detect patients who need admission in ICU.

After this analysis, 7 independent severity predictors were retained: Altered mental status, venous pH, bicarbonate level, blood glucose, Serum creatinine, H4 serum chloremia and effective serum osmolality at admission. A weight was assigned to each element of this score according to its predictive β value (table 2).

Table 2: Predicting DKA Severity Score

Variable	weights
Glasgow Coma Scale (GCS) < 15	1
Venous pH < 7.14	2
Serum HCO3- < 7.7 m moles/l	1
Blood glucose > 28,1 m moles/l	1
Serum creatinine > 100	1
Chloremia at H4 > 104	1
Serum Osmolarity> 291m osm/l	1

Low severity: score<3; High severity: score≥3

This score will allow ED physicians to classify patients according to their clinical and biological gravity and therefore to better manage them in the most appropriate environment. Finally, it was calculated for each patient in our population. The mean score was 5.5 ± 1.4 for those who were admitted to the intensive care unit, and 2.8 ± 1.9 for the rest of the patients (p = 0.0001).

Our population can then be classified into two severity groups: low with a score <3 and high with a score ≥3 [OR (95% CI), 10.7 (1.36-84.5)]. A Score greater than 3 is predictive of severity. It has a high predictive power (Area under the ROC curve is 0.863, with 100% sensitivity and 71.2% specificity) (Figure 1).

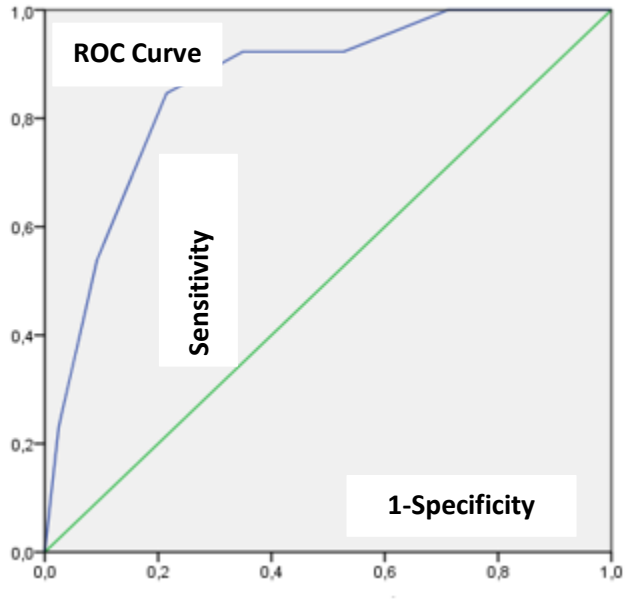

Figure 1: Presentation of the sensitivity and specificity of the severity score

DISCUSSION

In Tunisia, the prevalence of diabetics was passed from 9% in 2007 to 15% in 2017. The age of onset is getting younger and younger, which exposes people to more acute and chronic complications [10,11,12]. Acute complications of diabetes are a reason for frequent consultation and hospitalization in emergency departments [12,13]. Among these complications, ketoacidosis (DKA) which is an acute and severe complication, given the importance of its morbidity and mortality [3,14]. Its annual incidence in USA is estimated between 4.6 and 8 episodes/1000 diabetics with a constant increase [10,12,15,16]. This incidence is even greater in other countries, notably in England, Sweden and the developing countries [15]. In a large study published in December 2015, admissions for DKA represented 1.1% of all ICU admissions in Australia and New Ireland between 2000 and 2013 [17].

In prior studies predictors of DKA mortality were studied and scored: A study carried out in Parakou hospital ICU in Benin over a period of 10 months, showed that the occurrence of complications was associated with advanced age, low socioeconomic level, high serum osmolarity and long consultation time. It objectified a mortality rate of 14%, having as predictive factors the advanced age and long period before consultation [6]. Another study done in Taiwan, developed a mortality predictor score (PHD) founding 6 independent mortality predictors: Absent tachycardia, Hypotension, Anemia, Severe coma, Cancer history, and Infection [7]. The study by Stéphanie T. Chung (Jamaica 2006) concluded that mortality increased significantly with age, and that the main mortality predictors were altered mental status on admission, co-morbidity, age, diabetes duration, and association of DKA with hyperosmolar syndrome [8]. For Stamatis P. et al, mortality predictors were co-morbidity, pH <7.0, total dose of IV insulin injected in the first 12 hours> 50 IU, blood glucose> 16.7 mmol / L after 12 hours of treatment, altered mental status and persistent fever after 24 hours [18]. Several series studied mortality predictors and ranked them as scores, but there were enough series that studied severity predictors and admission risk ICU.

We developed a novel decision rule to predict severity and manage ED patients with DKA. ED and ICU physicians can usefully evaluate 7 variables. Patients with a high score should be

deemed critically ill and sent to the ICU for advanced treatment such as aggressive fluid resuscitation, strict intravenous insulin control, detailed investigation and management of the precipitating factors, and careful prevention of possible treatment complications. For patients with low score, a general ward admission or ED treatment may be sufficient, which would help preserve medical resources for patients in greater need.

Blood PH at admission, with a high β-value, was the strongest severity predictor. Altered mental status has been proposed as the only independent severity predictor, which is easier to quantify in clinical practice. Blood PH and effective serum osmolality are important for evaluating DKA; these two factors appear to be significant severity predictors in our study. Blood creatinine, which reflects the importance of water deficit, can be at the origin of functional renal failure [19]. It can also be falsely high due to the presence of ketone bodies. Chloremia at H4 is a variable that was kept in our score as a severity factor. Indeed, rehydration with isotonic saline serum promotes the appearance of hyperchloremic acidosis which should be avoided [3].

LIMITATIONS

This study has several limitations. First, some clinical presentations or records may not have been completely documented. Second, this was a single-center study. Third, the sample size might not be large enough to make conclusions with good statistical power. Additional studies with larger sample sizes are necessary. Fourth, although we have validated the prediction rule in a prospective cohort, external validation in other populations is necessary.

CONCLUSION

Diabetic ketoacidosis occurs in young people treated with insulin therapy. Infection appears to be the most implicated factor in decompensation. A Score greater than 3 is predictive of severity, requiring care in an ICU with a mortality rate remaining low thanks to this score.

REFERENCES

[1] Diabète [Internet]. [Cité 23 avr 2019]. Disponible sur: https://www.who.int/fr/news-room/fact-sheets/detail/diabetes

[2] Kitabchi, A. E., Umpierrez, G. E., Miles, J. M., & Fisher, J. N. (2009). Hyperglycemic crises in adult patients with diabetes. Diabetes care, 32(7), 1335-1343.

[3] Kitabchi, A. E., Murphy, M. B., Spencer, J., Matteri, R., & Karas, J. (2008). Is a priming dose of insulin necessary in a low-dose insulin protocol for the treatment of diabetic ketoacidosis?. Diabetes care, 31(11), 2081-2085.

[4] American Diabetes Association. (2004). Hyperglycemic crises in diabetes. Diabetes Care, 27(suppl 1), s94-s102.

[5] Maldonado, M. R., Chong, E. R., Oehl, M. A., & Balasubramanyam, A. (2003). Economic impact of diabetic ketoacidosis in a multiethnic indigent population: analysis of costs based on the precipitating cause. Diabetes care, 26(4), 1265-1269.

[6] Tchaou, B. A., Gomina, M., Agbo, A. H. M., & Akpona, S. A. (2014). Complications aigues métaboliques du diabete sucre dans l'unite de reanimation de l'hopital universitaire de parakou (benin). European Scientific Journal, 10(24).

[7] Huang, C. C., Kuo, S. C., Chien, T. W., Lin, H. J., Guo, H. R., Chen, W. L., ... & Su, S. B. (2013). Predicting the hyperglycemic crisis death (PHD) score: a new decision rule for emergency and critical care. The American journal of emergency medicine, 31(5), 830-834.

[8] Chung, S. T., Perue, G. G., Johnson, A., Younger, N., Hoo, C. S., Pascoe, R. W., & Boyne, M. S. (2006). Predictors of hyperglycaemic crises and their associated mortality in Jamaica. Diabetes research and clinical practice, 73(2), 184-190.

[9] Chen, H. F., Wang, C. Y., Lee, H. Y., See, T. T., Chen, M. H., Jiang, J. Y., ... & Li, C. Y. (2010). Short-term case fatality rate and associated factors among inpatients with diabetic ketoacidosis and hyperglycemic hyperosmolar state: a hospital-based analysis over a 15-year period. Internal Medicine, 49(8), 729-737.

[10] Van Ness-Otunnu, R., & Hack, J. B. (2013). Hyperglycemic crisis. The Journal of emergency medicine, 45(5), 797-805.

[11] Gosmanov, A. R., Gosmanova, E. O., & Kitabchi, A. E. (2018). Hyperglycemic crises: diabetic ketoacidosis (DKA), and hyperglycemic hyperosmolar state (HHS). In Endotext [Internet]. MDText. com, Inc.

[12] Zhang, P., Zhang, X., Brown, J., Vistisen, D., Sicree, R., Shaw, J., & Nichols, G. (2010). Global healthcare expenditure on diabetes for 2010 and 2030. Diabetes research and clinical practice, 87(3), 293-301.

[13] Mazer, M., & Chen, E. (2009). Is subcutaneous administration of rapid-acting insulin as effective as intravenous insulin for treating diabetic ketoacidosis?. Annals of emergency medicine, 53(2), 259-263.

[14] Foster, J. R., Morrison, G., & Fraser, D. D. (2011). Diabetic ketoacidosis-associated stroke in children and youth. Stroke research and treatment, 2011.

[15] Nyenwe, E. A., & Kitabchi, A. E. (2011). Evidence-based management of hyperglycemic emergencies in diabetes mellitus. Diabetes research and clinical practice, 94(3), 340-351.

[16] Abdulrahman, G. O., Amphlett, B., & Okosieme, O. E. (2013). Trends in hospital admissions with diabetic ketoacidosis in Wales, 1999–2010. Diabetes research and clinical practice, 100(1), e7-e10.

[17] Venkatesh, B., Pilcher, D., Prins, J., Bellomo, R., Morgan, T. J., & Bailey, M. (2015). Incidence and outcome of adults with diabetic ketoacidosis admitted to ICUs in Australia and New Zealand. Critical Care, 19(1), 451.

[18] Efstathiou, S. P., Tsiakou, A. G., Tsioulos, D. I., Zacharos, I. D., Mitromaras, A. G., Mastorantonakis, S. E., ... & Mountokalakis, T. D. (2002). A mortality prediction model in diabetic ketoacidosis. Clinical endocrinology, 57(5), 595-601.

[19] Chiasson, J. L., Aris-Jilwan, N., Bélanger, R., Bertrand, S., Beauregard, H., Ékoé, J. M., ... & Havrankova, J. (2003). Diagnosis and treatment of diabetic ketoacidosis and the hyperglycemic hyperosmolar state. Canadian Medical Association Journal, 168(7), 859-866.

[20] Lokrou, A., & ZOHOU-GUEYE, C. (1995). L'acido-cétose diabétique en Côte-d'Ivoire. Etude d'une population féminine homogène au CHU de Treichville. Proposition d'une stratégie thérapeutique adaptée à l'Afrique. Revue française d'endocrinologie clinique, nutrition et métabolisme, 36(6), 565-570.

A measles outbreak in Tunisia: Experience of an Emergency department in Sousse

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Abstract

Background: Measles is one of the most contagious diseases of humans. It is caused by the measles virus and occurs as a seasonal disease in endemic areas[1]. We describe the epidemiologic features of a measles outbreak in Tunisia, specifically in the city of Sousse within the Emergency Department (ED) of Farhat Hached.

Methods: We performed descriptive analyses of data on demographic characteristics, clinical and laboratory evaluations, clinical outcomes of all declared measles cases and containment measures in the ED of Farhat Hached in Sousse during the period of two months (March to April 2019).

Results: During the current ongoing measles outbreak in Tunisia, a total of 57 confirmed measles cases have encountered our ED and have been declared. 61.4% of the studied population were men and 31.6% were unvaccinated. The median age of measles patients was35 years [16;55].12.3% of them were health care providers working at the ED of Farhat Hached.

The main clinical presentations were eruptive fever (64.9%), eruptive fever with gastrointestinal disorders (21.1%) and eruptive fever with dyspnea (14%).35.1% of all patients were hospitalized with a mean hospital length of stay of 4.53 days ($\pm$1.92).

The vaccination status of infected patients seemed to tttttt their hospitalization rate as 44.4% of the unvaccinated patients were admitted to the infectious diseases ward while only 27% of the vaccinated patients were hospitalized.

Conclusion: Up to this date, measles cases including health care professionals are still being diagnosed in the ED of Farhat Hached in Sousse. Thus, response strategies should provide a better vaccination coverage within the exposed population as well as effective containment measures.

Keywords: Measles; Outcomes; Epidemiology; Emergency

BACKGROUND

Measles is a highly contagious,albeit vaccine-preventable, disease thatcan lead to serious complications [2]. The average age for acquiring measles depends onbiological and epidemiological factors, mainly populationimmunity and birth rate.As vaccination coverage increases, the average age of measles infection can shift to adolescents and young adults.These older groups remain susceptible because they had not been vaccinated or exposed to wild-type measles virus due to decreased transmission among younger vaccinated groups.In the absence of efforts to vaccinate the older susceptible populations, measles virus introduction can result in an outbreak, reflecting the immunity gaps among these age cohorts[1]. In Tunisia, measles vaccination was first introduced in1979 and since 1981; two doses of measles vaccine

weregiven at 9 and 15 months of age as part of the routinevaccination schedule. Since then, two outbreaks were observed: in 1981 (2870 cases)and in 1985 (4766 cases). From 1987 to 1998, the annualincidence of reported measles cases considerably declined. Only one major outbreak was observed during thisperiod, in 1992, with 11,872 reported cases [3]. Another measles outbreak began in Tunisia from January 2019. We report measles cases confirmed in the Emergency Department (ED) of Farhat Hached in Sousse between March and April 2019.

METHODS

Definitions and diagnostic features: The WHO definition of suspected measles is a case with fever and maculopapular (non-vesicular) rash, or a case where a health-care worker suspects measles. Laboratory confirmation of measles is based on detection of anti-measles virus IgM antibodies by enzyme-linked immunosorbent assay (ELISA), or the detection of measles virus RNA by reverse transcriptase polymerase chain reaction (RT-PCR) in throat swaps, oral fluid or nasopharyngeal mucus or urine [1].

Data collection: We prospectively obtained patients demographic characteristics, medical history, vaccination status, date of symptoms onset and their clinical outcomes using both face-to-face interviews.

Statistical analysis: We performed descriptive analyses, and reported the results as frequencies and proportionsfor categorical variables and as median valuesand ranges for continuous variables.Analyses were performed with the use of SPSS software version 22.

RESULTS

During the period of the study (1rst of March to April 30), 57 cases of measles were confirmed and declared.

The studied population did not include children aged less than 16 years and 61.4% of them were men. The median age of case patients was 35 years [16; 55]. Of the 57 cases, 12.3% were health care providers working in the ED of Farhat Hached during the outbreak's period. As for the vaccination status of the case patients, 31.6% of them were not vaccinated. Out of 7 infected health care providers, only 2 were not vaccinated. The vaccination status of case patients is shown in the figure below (Figure 1).

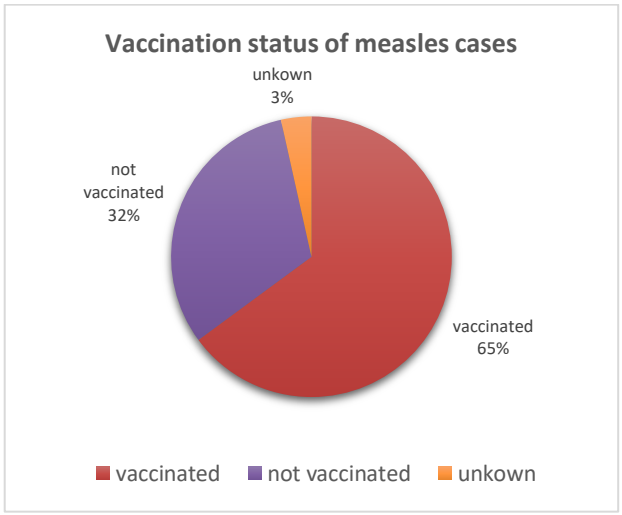

Figure 1: Vaccination status of measles cases

The source patient who was an unvaccinated 40 year-old woman, encountered the ED of FarhatHached on March 10th. The chronology of the outbreak is as detailed in **Figure 2**.

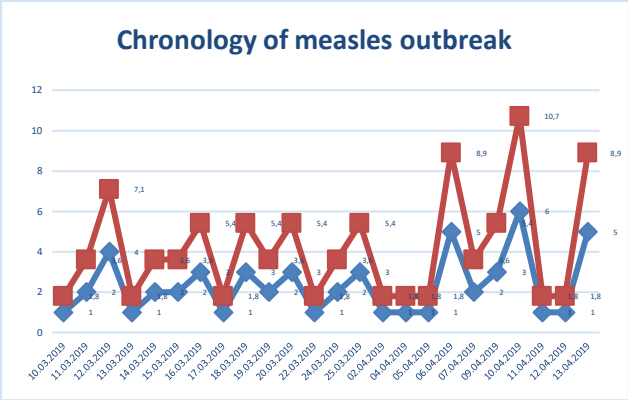

Figure 2: Chronology of measles outbreak

Clinical presentations:

Three main clinical presentations were observed during the outbreak's period: Eruptive fever in most of the cases, eruptive fever with gastrointestinal disorders and eruptive fever with dyspnea. More details are shown in the figure below (Figure 3).

During the study period, 35.1% of the case patients were admitted to the infectious diseases wardwith a mean length of stay of 4.53 days (±1.92).Only one patient who was a 55 year-old doctor working in the outbreak's ED, was admitted to the ICU (Intensive Care Unit) and stayed there for 4 days.

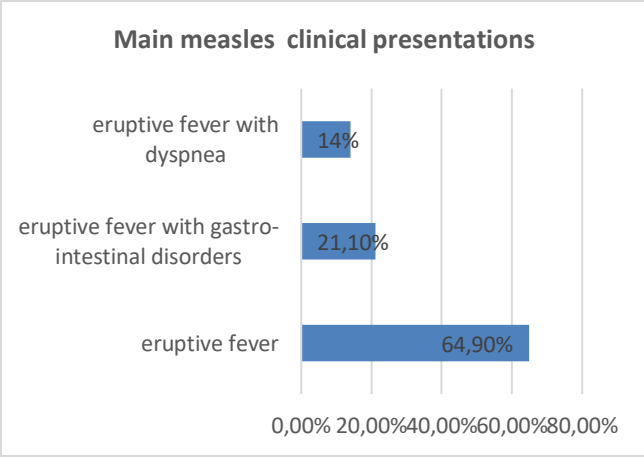

Figure 3: Main measles clinical presentations

The vaccination status of infected patients seemed to have an impact on their hospitalization rate as *44.4%* of the unvaccinated patients were admitted to the infectious diseases ward while only *27%* of the vaccinated patients were hospitalized. The vaccination status of hospitalized case patients is shown in the figure 4.

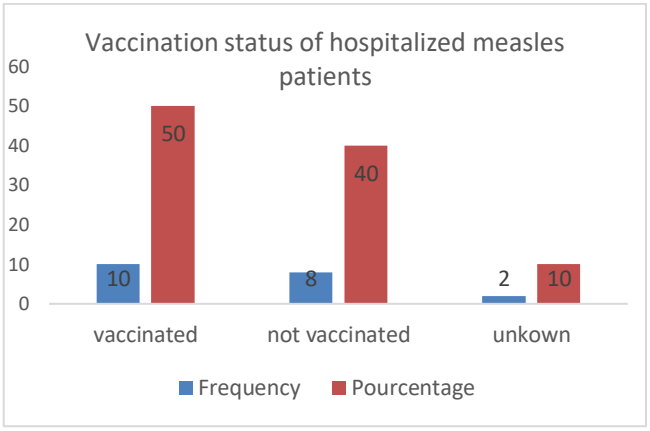

Figure 4 : Vaccination status of hospitalized measles patients

DISCUSSION

Despite of the increasing vaccination coverage in Tunisia since the introduction of measles vaccination (two doses of measles vaccine at 9 and 15 months of age), this outbreak proves that measles is still endemic in our country. This could be explained by the immunity gaps among older groups of age who had not been vaccinated or exposed to wild-type measles virus type due to the decreased transmission among younger vaccinated groups [1].

In the last few years, some of measles outbreaks around the world have been reported[8], [9],[10]. A lot of them occurred in countries were measles is considered to be eradicated[5], [6], [7], such as the case of Measles outbreak in a refugee settlement in Calais, France (January to February 2016), where 13 confirmed measles cases were identified among migrants, healthcare workers in hospital and volunteers working on site [4]. In the United States (US) as well, a measles

outbreak within an under immunized Amish Community in Ohio was reported in the year of 2014. Even though measles was considered to be eradicated in the US since 2000, an outbreak of measles originated from two unvaccinated Amish men in whom measles was incubating at the time of their return to the United States from the Philippines [2].

In this study, the source of measles outbreak in the ED of Farhat Hached has not been identified.

Measles case patients did include health care providers who were infected independently of their vaccination status. The measles spread between health care providers was limited to 7 case patients thanks to the containment measures conducted in the ED's outbreak, such as the use of the isolation facial masks by the medical and the paramedical staff, the creation of quarantine unit were all measles case patients stayed as well as the vaccination campaign conducted in the hospital of Farhat Hached that included all healthcare providers born after 1980.

As for measles case patients' outcomes, the majority of them were admitted to the infectious diseases ward except for one patient who was admitted to the ICU. All of the admitted case patients presented to the ED with complicated clinical presentations (eruptive fever with either gastrointestinal disorders or dyspnea).

The vaccination status of infected patients seemed to have an impact on their hospitalization rate as*44.4%* of the unvaccinated patients were admitted to the infectious diseases ward while *only 27%* of the vaccinated patients were hospitalized. This means that unvaccinated patients are more prone to having measles-related complications. Thus, more attention and healthcare resources should be given by health authorities to improve vaccination coverage especially among susceptible populations such as healthcare providers and other exposed populations.

LIMITATIONS

One of the study's limitations, is that it did not discuss the exact origins of the measles outbreak nor its spread on the national level. This may be due to the lack of data available on the national situation of the outbreak.

In this study we did not cover the measles spread among children aged less than 16yearssince they did not encounter the ED of Farhat Hached.

CONCLUSION

Up to this date, measles cases including health care professionals are still being diagnosed in the ED of FarhatHached in Sousse.

Thus, response strategies should provide a better vaccination coverage within the exposed population as well as effective containment measures.

REFERENCES

[1]: Measles vaccines: WHO position paper – April 2017,WEEKLY EPIDEMIOLOGICAL RECORD, NO 17, 28 APRIL 2017

[2]: The new England journal of medicine,A Measles Outbreak in an Underimmunized Amish Community in Ohio, n engl j med 375;14 nejm.org October 6, 2016

[3]: Measles surveillance and control in Tunisia: 1979–2000, Vaccine 21 (2003) 440–445.

[4]: Measles outbreak in a refugee settlement in Calais, France: January to February 2016, www.eurosurveillance.org

[5]: Measles Outbreak — California, December 2014–February 2015, Jennifer Zipprich, PhD1, Kathleen Winter, MPH1, Jill Hacker, PhD1, Dongxiang Xia, MD, PhD1, James Watt, MD1, Kathleen Harriman, PhD1

[6]: Measles at Disneyland, a Problem for All Ages.Neal A. Halsey, MD, and Daniel A. Salmon, PhD, MPH. Annals of Internal Medicine.

[7]:Large ongoing measles outbreak in a religiouscommunity in the Netherlands since May 2013. M J Knol (mirjam.knol@rivm.nl)1, A T Urbanus1, E M Swart1, L Mollema1, W L Ruijs1,2, R S van Binnendijk1, M J te Wierik1,3, H E deMelker1, A Timen1, S J Hahné1

[8]:Healthcare-Associated Measles After aNationwide Outbreak in MongoliaJason G. Lake,1 Ulzii-Orshikh Luvsansharav,1 José E. Hagan,2 James L. Goodson,2Nyamsuren Jigjidsuren,3 Narantuya Gombojamts,3 Benjamin J. Park, 1 and Rachel Smith1, Clinical Infectious Diseases.

[9]: Transmission potential of modified measles during anoutbreak, Japan, March–May 2018, Kenji Mizumoto1,2, Tetsuro Kobayashi1,2, Gerardo Chowell1,3www.eurosurveillance.org

[10]: Ongoing measles outbreak in Greece related tothe recent European-wide epidemic,Epidemiology and Infectioncambridge.org/hyg

Epidemiological and prognostic factors associated with road traffic accidents occurring in the Center East of Tunisia.

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Abstract

Introduction: Road Traffic accidents (RTAs) are a major public health concern associated with significant morbidity and mortality. The objective of this study was to describe the epidemiological aspects of RTAs and their prognostic factors in the center east of Tunisia.

Methods: This was a prospective cross sectional descriptive study conducted in the Emergency Medical Services area 03 of the center east of Tunisia for a period of 18 months from February 1 2020 to July 31 2021.

Results: Three hundred forty five patients were included. Among them 82.8% were male (Mean age: 33±17.2 years). The injured patient was the driver in 57.1% of cases. Traffic accidents involving pedestrians and motorists were the most frequent types of accident (18.8%). Traffic accidents often occurred on Monday and Saturday (18.2% and 16.8%) between 6 p.m. and midnight (36.2%). In 54.4% of cases, injured patients did not meet effective safety measures such as helmet use and seat belt. Etiological events related to the patients that lead to traffic accident were, alcoholism is 29 cases (26.1%), excessive speed in 25 cases (22.5%). Etiological events related to the road were poor road conditions in 34 cases (39.5%). Etiological climate related events were rainy weather in 33 cases (47.1%). Thirty-one victims were died in the first 24 hours (8.9%). Univariate analysis of epidemiological factors of victims of RTAs showed 4 factors significant predicting mortality included in our study: location of the traffic accident in the city of "Kairouan" (p=0.005), road related factors: low-light areas (p=0.029), weather related factors: rainy weather (p=0.003) and patient related factors: alcoholism (p=0.044).

Conclusion: Road Traffic accidents are of considerable socio-economic importance for our community. It is necessary to know how to manage a RTA's victim through the circumstances of the accident and its risk factors.

Keywords: Emergency Medical Services; Epidemiology; Traffic accidents

INTRODUCTION

Road Traffic accidents (RTAs) are a major public health problem; they are responsible of high rates of mortality and morbidity [1].

It is the leading cause of death in young people aged between 15 and 29 years. According to the July 2017 world health organization (WHO) Report, over 1.3 million of people dies, every year, from RTAs and 20-50 million people suffer from traumatic consequences [2].

Tunisia has the second highest mortality prevalence in the Maghreb region. RTAs are the fifth leading cause of death, responsible of 3.3% of all observed deaths in Tunisia [3]. The 2016 National Road Safety Observatory announced around 1,505 of deaths related to RTAs [3].

In Tunisia, there are around thirty accidents per day; these accidents are responsible of around four deaths and about forty serious and minor injuries per day. These figures are 50% higher than the European average [3].

This carnage strikes a considerable human heritage, which is thus destroyed with very heavy social and economic consequences. Indeed, for each person killed, injured or disabled by traffic accident, a whole group of other people including the family and the entourage of the person concerned are deeply affected [4].

However, we have noted a drop in the incidence of RTA since the SARS CoV2 pandemic, which could be explained by the confinement procedure imposed by several countries.

In Tunisia, the incidence of RTA has dropped reaching 23.4% during the confinement period; from March to June 2020. The epidemiological characteristics have also been modified [5].

We conducted this study to describe the epidemiology of RTAs in the east center of Tunisia and to investigate its associated and gravity factors. This study may help as a better health resource allocation and policymaking.

METHODS

Type of study: A cross-sectional descriptive study was carried out by the emergency medical services of the East Center of Tunisia (EMS 03) during a period of 18 months; from February 1, 2020 to July 31, 2021.

The study population: Our study population was a non-probability sample of convenience.

We included all victims of RTAs occurring in the territory of the EMS 03 and which the regulation room played a part in the decision of transport. This territory of EMS 03 includes four governorates: Sousse, Monastir, Kairouan and Mehdia. It represents 8.16% of the total surface of Tunisia.

Victim of RTCs off territory, victims of other type of accidents and victims died before the intervention of the EMS03 were not included in this study.

Collection of data: The data was collected from the regulation files and the intervention forms

filled by the mobile intensive care unit (MICU) at the scene of the accident. The data has been aggregated on a pre-established data collection" sheet for the study. The circumstances of the RTA were grouped into three categories: related to the patient, related to the state of the road and related to the climate.

We did a 24-hour follow-up of victims who were transported to the emergency departments or to the intensive care unit (ICU).

RESULTS

We included 345 RTA victims, 82.8% of them were male with a sex ratio H/F of 4.84.

The mean age of the victims was 33 +- 17.2 years with extremes ranging from 2 to 81 years. Victims were mainly young subjects aged between 15 and 29 years with a prevalence of 36.2%.

The majority of victims had no medical history (72.1%). Diabetes represented the most common comorbidity among victims with past medical history (35.4%). Most of the identified victims were drivers (57.1%) followed by pedestrians (24.6%) then vehicle passengers (18.3%). (Table 1)

The city of Sousse had the highest prevalence of RTA with a rate of 57.1%. In the governorate of Sousse, "Sahloul" region had the highest prevalence of RTAs (16.7%).

In our study, we noted that the prevalence of RTAs was higher on Monday (18.2%) and Saturday (16.8%), however, it was the lowest on Wednesday (12.4%).

Table 1: Socio-demographic characteristics of the study population.

	Injured n (%)	**Deceased n (%)**	**P**
Age			
< 15 years	70 (20.2)	3 (9.6)	0.656
15 – 29 year	125 (36.2)	10 (32.2)	0.723
30 – 59 year	115 (33.5)	12 (38.7)	0.919
>60 year	35 (10.1)	6 (19.3)	0.917
Sexe			
male	286 (82.8)	28 (90.3)	0.116
female	59 (17.2)	3 (9.7)	0.102
Comorbidities			
No	249 (72.1)	22 (70.9)	0.841
Yes	96 (27.9)	9 (29.1)	0.286
Diabetes	34 (35.4)	2 (22.2)	0.845
	23 (23.9)	1 (11.1)	0.586
Cardiovascular			
hypertension	9 (9.3)	0	-
Neurological	9 (9.3)	1 (11.1)	0.586
Psychiatric	7 (7.2)	0	
Others	5 (5.6)	4 (44.4)	0.336
Unknown	9 (9.3)	1 (11.1)	0.586
Type of road user			
Pedestrians			
Drivers	85 (24.6)	6 (19.3)	0.714
Passengers	197 (57.1)	22 (70.9)	0.569
	63 (18.3)	4 (12.9)	0.189

According to the hours of occurrence of RTA, we found that the highest rate of RTAs was during the time interval between 6 p.m. and midnight (36.2%).

Regarding the flow of accident victims, we found that the peak of accidents was in the month of February 2020 with a percentage of 27%

while the lowest accident rate was in the month of April 2020 with a percentage of 9.2 %.

Table 2: Epidemiological characteristics of RTA

	Injured n (%)	Deceased n (%)	p
Hour			
06h-12h	71 (20.5)	7 (22.5)	0.832
12h-18h	114 (33)	8 (25.3)	0.823
18h-00h	125 (36.2)	13 (41.9)	0.489
00h-06h	35 (10.3)	3 (9.6)	0.479
Day			
Monday	63 (18.2)	4 (12.9)	0.616
Tuesday	44 (12.7)	3 (9.6)	0.624
Wednesday	43 (12.4)	6 (19.3)	0.324
Thursday	44 (12.7)	4 (12.9)	0.227
Friday	48 (13.9)	4 (12.9)	0.227
Saturday	58 (16.8)	7 (22.8)	0.345
Sunday	45 (13.3)	3 (9.6)	0.624
Place			
Governorate			
Sousse	197 (57.1)	10 (32.2)	0.071
Monastir	41 (11.8)	5 (16.1)	0.116
Mahdia	49 (14.2)	4 (12.9)	0.189
Kairouan	58 (16.9)	12 (38.4)	**0.005**
Urban	238 (68.9)	15 (48.3)	0.187
Rural	107 (31.3)	16 (51.7)	0.194
Type of RTA			
Pedestrian ***light vehicle***	65 (18.8)	4 (12.9)	0.196
Two wheels ***light vehicle***	62 (17.9)	7 (22.5)	0.140
Two wheels	56 (16.2)	1 (3.22)	0.199
Light vehicle	47 (13.6)	6 (19.3)	0.148
Light vehicle ***light vehicle***	49 (14.2)	5 (16.1)	0.096
Pedestrian ***two wheels***	16 (4.6)	0	0.646
Two wheels ***two wheels***	14 (4)	2 (6.4)	0.646
Light vehicle ***heavy vehicle***	15 (4.3)	2 (6.4)	0.646
Light vehicle ***van***	6 (1.7)	2 (6.4)	0.199
Two wheels ***van***	4 (1.1)	0	0.199
Two wheels ***heavy vehicle***	5 (1.4)	1 (3.22)	
Heavy vehicle	2 (0.5)	0	
Pedestrian ***heavy vehicle***	2 (0.5)	1 (3.22)	
Pedestrian-bus	1 (0.2)	0	
Bus	1 (0.2)	0	

The most prevalent type of accident was a crash between light vehicles (VL) against pedestrian with a prevalence of 18.8%, followed by two wheels -VL (17.9%). (Table 2)

actors related to victims were found in 32.2% of cases. The factor with the highest prevalence of RTA injuries was alcohol consumption (26.1%) followed by speeding (22.5%), drug intake (neuroleptics, opiates: codeine, anxiolytics) (15.3%), fatigue (12.6%) and mental state (8.1%).

Regarding weather, related factors, rainy weather had the highest prevalence of RTAs (47.1%), followed by foggy weather (27.1%) then other weather conditions such as the presence of clouds or storms (25.8%). Weather related factors were found in 20.3% of cases.

As for factors related the road condition which were present in 25% of cases, RTAs were more likely to happen when driving on a road with bas condition (39.5%). Poor lighting was involved in 34.8% of cases and in 18.6% of cases, the road surface was slippery. Other road conditions were present in 7.1% such as traffic and roadwork.

Concerning safety measures among the drivers, only 45.4% of them wore helmets or wore the seat belt.

According to “vittel” criteria, regarding RTAs kinetic elements; 54.6% of victims did not respect safety measures (no helmet or seat belt), 22.5% of RTAs were associated to high speed, 11.8% of victims were ejected, 7.6% of RTAs

were deadly for other passenger in the same accident and in 4.4% of RTAs, the car was significantly deformed.

According to victim's type of transport, 58.5% of victims were transported by the mobile care unit team, 31.1% of theme were transported by civil protection and 10.4% by a type B ambulance or by simple means.

In our study we had 31 (8.9%) victims died in the first 24 hours after the accident.

The most of them are young (38.7% aged between 30-59 years) ;male (90.3%) ; drivers (70.9%) and the most of the drivers deceased (16 victims) did not respect safety measures (72.7%).

We conducted an analytical study focused on mortality risk factors based on the statistical significance of Pearson's chi-squared test.

The univariate analysis of the epidemiological factors of road accident victims showed only 4 statistically significant predictors of death in our population: Place of occurrence of the accident according to the governorate: Kairouan; Road related factor: Poor lighting; Weather condition: Rainy; Circumstances related to the victim: Alcohol consumption. Table 3 details these results.

DISCUSSION

In our study, we found that men are 4 times more exposed to the risk of RTAs than women are. Such a predominance has been reported in several studies: according to the road safety in France in the report on accident rates of the year 2018, death on the road occurred three times more in men (2,492) than in women (756). This ratio was found in other occidental countries [6].

Table 3 : Special circumstances related to RTAs

Factors	Injuried n (%)	Deceased n (%)	
Related to the victim			
No particular factor	234 (67.8)	18 (58)	0.274
With particular factor	111 (32.2)	13 (42)	0.454
Alcohol consumption	29 (26.1)	2 (15.3)	**0.044**
Speeding	25 (22.5)	1 (7.6)	0.668
Medication	17 (15.3)	3 (23)	0.945
Mental state	14 (8.1)	1 (7.6)	0.668
Fatigue	9 (12.6)	3 (23)	0.945
Others	17 (15.3)	3 (23)	0.945
Related to weather			
No particular factor	275 (79.7)	24 (77.4)	0.012
With particular factor	70 (20.3)	7 (22.6)	0.018
Rainy	33 (47.1)	7 (100)	**0.003**
Foggy	19 (27.1)	0	
Others (clouds, storms)	18 (25.8)	0	
Related the road condition			
No particular factor	259 (75)	19	0.004
With particular factor	86 (25)	(61.2)	0.013
Poor lighting	30 (34.8)	12 (38.8)	**0.029**
Bad road state	34 (39.5)	2 (16.6)	0.278
Slippery surface	16 (18.6)	9 (75)	0.378
Others (Traffic, roadworks)	6 (7.1)	1 (8.3) 0	

Similarly, to most countries in the world, we found that the young population was the one to pay the heaviest price in terms of traffic accidents. In our series of studies, the average age was 33 years and the most affected age group was between 15 and 29 years. In the "road safety in France "report on accident rates for the year 2018, in terms of the number of deaths and injuries, people aged between 20-24 years were the most affected by road accidents; followed by the ones aged between 15-19 year and between 25-29 years [6].

Regarding the flow of accident victims, we found that the peak of accidents was in the month of February 2020 with a percentage of 27% while the lowest accident rate was in the month of April 2020 with a percentage of 9.2 %.

These results were not found in the literature; In fact, the traffic accident rate is classically higher during summer. A study carried out in France in 2001 found that the winter months (January to March) were at a low level of accidents followed by a rise in the spring that culminates during the summer with a gradual descent during the fall [7].

The differences between our results and those found in the literature can be explained by the lockdown implemented in April 2020 for the fight against the covid-19 pandemic; therefore, the month of February 2020 represents the most accident-prone month in our study.

The days of the week with the highest numbers of traffic accidents was Monday and Saturday.

The most accident-prone time interval during the day was from 6 p.m. to midnight, while the time interval with the lowest number of accidents was from 6 a.m. to 12 p.m.

Similar results have been found in other studies: in fact, a study carried out in France by Gayrard A et al; showed that the days at the start of the week had a lower average number of deceased accident victims at 17 deaths per day. Weekends had an average of 27 deaths per day [7]. The 2018 study by Bernagaud AS et al; showed that there was an increase of 18% in the number of accidents during the morning rush hour (7 a.m. to 9 a.m.) and of 52 % during the evening rush hour (5 p.m. to 7 p.m.) [6].

In our study, the third of the RTAs had special circumstances: the most important one was alcohol consumption in 26.1% of cases, and excessive speed in 22.5% of cases, several others studies have found similar results [8-9-10].

The subject of the contributing factors to RTAs is both complicated and recurrent in the field of road safety [11]. In fact, in the search for the causal factors of RTAs, there are several factors related to both the driver and the environment. The contribution of human factors in traffic accidents is far from being easy to isolate in accidental mechanisms. In fact, among the main human factors contributing to road accidents, we typically find speeding and alcohol consumption. Each of these variables has been the subject of abundant literature, which has largely proven their harmful effect on driving activity.

In our sample, it was found that 24% of RTAs occurred under poor weather conditions and 29.5% of RTAs were influenced by road-related factors. Among the road deaths in our study, 36.8% were associated with particular weather conditions, and 21% were associated with road-related conditions.

Several other studies showed the impact of these conditions on the incidence and severity of road accidents; A Finnish study published in 2018

assessed the relative accident risk of different road and weather conditions. The study analyzed traffic accidents on 43 major Finnish roads between the years 2014-2016 [12]. To simplify the analysis, the potentially dangerous conditions were combined into five categories: slippery road, very slippery road, poor visibility, icy rain and slush. All road weather conditions had an increased relative crash risk of more than 50%

In our study, 54.6% of victims did not respect safety measures (no helmet or seat belt). Among the deceased victims, the most of them (16 victims) did not take road safety measures, in particular wearing a helmet or a seat belt.

Similar results have been found in the literature: It was the case of the accident rate report for 2018 in France, which insisted on the importance of wearing seat belts as well as helmets. In the period 2013-2017 [6], 1,779 people who died in road accidents were not wearing their seatbelts.

LIMITS OF THE STUDY

Our study was conducted during the COVID-19 lock down, for that reason; the size of our sample was small. This may influence research findings by making p-values stray from significance affecting the ability to study associations. It is more difficult to distinguish between a real effect and random variation.

Despite these limitations, this study offers a picture on the epidemiology of RTAs and its associated factors in Tunisia, which may aid in identifying factors suitable for the development of preventive programs and the allocation of resources by Tunisian health authorities.

CONCLUSION

Our study focused on a series of 345 victims of RTAs in the territory of EMS 03 in the Center East of Tunisia. We described the epidemiological and prognostic characteristics of the RTAs. The results showed the circumstances and etiological factors of RTAs as well as the epidemiological and clinical profiles most frequently found.

In fact, the majority of victims were males (82.8%), and young with an age between 15 and 29 years (36.2%). In 18.8 % of cases, the victim was a pedestrian hit by VL and in 17.9% of cases; the victim was a driver of a two-wheeled vehicle hit by a light vehicle. Safety measures were taken only in 45.4 % of drivers victims.

Weather related factors were found in 20.3% of cases. Road-related factors were found in 25% of cases.

Accidents took place most frequently in Sousse (57.1%), on Monday and Saturday (18.1 and 16.8%) of cases. The injured person was taken to the emergency department by the mobile care unit team in almost half of the cases.

Through this study, we were able to identify the severity and the mortality predictive factors. Thus, all measures that can preserve life must be implemented, such as adapting the traffic environment to users and educating and training

drivers and pedestrians to change their behavior in the desired direction.

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REFERENCES

[1] Organisation mondiale de la santé « Rapport de l'organisation mondiale de la santé 2018, situation sur la sécurité routière dans le monde ». Disponible sur : https://www.who.int/violence_injury_prevention/road_safety_status/2018/French-Summary-GSRRS2018.pdf.

[2] Observatoire national de la sécurité routière de l'année 2021.
http://onsr.nat.tn/onsr/index.php?page=4ar&ty=cause&an=2021
http://onsr.nat.tn/onsr/pdf/2021.pdf .

[3] Organisation mondiale de la santé « rapport de l'organisation mondiale de la santé 2017,10 faits sur la sécurité routière dans le monde ». Disponible sur : https://www.who.int/features/factfiles/roadsafety/fr/.

[4] M. S. Ouannes « La sécurité routière en Tunisie Comprendre les problèmes pour mieux agir », Center for Applied Policy Research, C·A·Perspectives on Tunisia No. 04-2016. Disponible sur : https://www.onsr.nat.tn/bibliotheque/maktaba/1585726922.pdf.

[5] S. Milosevic, « Drivers' fatigue studies », Ergonomics, vol. 40, no 3, p. 381-389, mars 1997, doi: 10.1080/001401397188215.

[6] France et Observatoire national interministériel de sécurité routière, La sécurité routière en France: Bilan de l'accidentalité de l'année 2018. 2019. https://www.onisr.securite-routiere.interieur.gouv.fr/ .

[7] J.-F. Mattéi, « Jean-François Mattéi »: in Quadrige, Presses Universitaires de France, 2015, p. 475-480. Doi: 10.3917/puf.zarka.2015.01.0475.

[8] M. HOWARD, M. JACKSON, G. KENNEDY, P. SWANN, M. BARNES, and R. PIERCE, « The interactive effects of extended wakefulness and low-dose alcohol on simulated driving and vigilance », 2007.

[9] A. VAKULIN, S. BAULK, P. CATCHESIDE, et R. ANDERSON, « Effects of moderate sleep deprivation and low-dose alcohol on driving simulator performance and perception in young men. », 2007.

[10] G. MAYCOCK, « Sleepiness and driving: the experience of UK car drivers. », Journal of Sleep Research, 1996. Disponible sur: https://pubmed.ncbi.nlm.nih.gov/9065874/.

[11] « Drowsy driving and automobile crashes. NCSDR/NHTSA Expert panel on driver fatigue and sleepiness ». Disponible sur : https://www.nhtsa.gov/sites/nhtsa.gov/files/808707.pdf.

[12] F. Malin, I. Norros, et S. Innamaa, « Accident risk of road and weather conditions on different road types », Accident Analysis & Prevention, vol. 122, p. 181-188, janv. 2019, doi: 10.1016/j.aap.2018.10.014.

Overview of the Post-night shift syndrome in the COVID-19 pandemic era: predictors in a North African sample of physicians

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Abstract

OBJECTIVES: This study aimed to detect the post-night shift syndrome among physicians and to evaluate its predicting factors.

METHODS: Observational cross-sectional study involving physicians working night shifts during the study period (December 2019-February 2021). The post-night shift symptoms are divided into four dimensions: somatic, behavior, mood, and psychological.

RESULTS: Sixty-five participants have developed PNS syndrome (25.70%).

The independent predictors of developing PNS syndrome were working in a COVID-19 unit, the number of admissions, and the number of sleeping hours.

CONCLUSION: The night shift is a condition that primarily affects physicians. The PNS may cause several disorders and may decrease the physicians' well-being. At the beginning of the COVID-19 pandemic, working in a COVID-19 unit was a predictor of the development of PNS syndrome.

KEYWORDS: Post-night shift syndrome; Symptoms; COVID-19; Predictors.

INTRODUCTION

Physician well-being is an increasing focus in the medical community. Increased workload and long work hours among residents can contribute to increased stress. Past studies have shown that night shift work is a major factor in career dissatisfaction, burnout, work-family conflict, and dysphoria [1]. Furthermore, the risk of night shifts is such that the World Health Organization International Agency for Research of Cancer has listed it as a possible Carcinogen [2].

Post-night shift syndrome was recently described in an observational, multicentric study in the emergency units of Hérault and Gard [3]. In addition, there is no room for doubt that COVID-19 has introduced unique stresses to the healthcare system, namely to caregivers. It is, therefore, argued that the experience of a global pandemic like COVID-19 could be considered a mass traumatic event [4,5]. In this view, it is unsurprising that night shifts during the pandemic could be more stressful and disturbing.

A few studies have investigated post-night shift syndrome, particularly during the COVID-19 pandemic [6–8]. This study aimed to detect the post-night shift syndrome among physicians and to evaluate its predicting factors.

METHODS

It was an observational cross-sectional study conducted in the two university hospitals, including all the physicians working night shifts during the study period.

We have enrolled 253 physicians who accepted to participate in the study. Inclusion criteria concerned all physicians (intern, resident, university hospital doctors, specialists, generalists) working night shifts whatever their specialty or department.

This study was conducted for 15 months, from December 2019 to February 2021, 3 months before the pandemic, and 12 months after the beginning of the pandemic in Tunisia(Figure 1) [9].

A computerized and anonymized questionnaire was spread among all physicians via Google forms. It was published on Facebook and via e-mail.

The questionnaire consisted of 2 parts: the first for a normal day and the second for a post-night shift.

During a normal day, we assessed the Perceived Stress Scale (PSS), and a questionnaire compiled the post-night shift symptoms divided into four dimensions: somatic, behavior, mood, and psychological. Symptoms collected were based on a synthesis of questionnaires elaborated by a recent study ([3].

We have used the visual analogical scale (VAS) to rate the different symptoms felt. Higher scores indicated greater levels of irritability, anxiety, etc.

VAS is less sensitive to confusion bias and is quick and easy to perform [10]

After a night shift, another questionnaire gathered the shift feelings, the day after shift feelings, and data about the shift.

- Used scales:
  - The Perceived Stress Scale is the most widely used psychological instrument for measuring the perception of stress. The original version of the PSS was shortened from 14 to 10 items to improve completion rates and ease of scoring. It has been proven that the shorter version has higher internal consistency and

construct validity and is thus psychometrically superior [11].

Participants were asked about their feelings and thoughts during the past and to indicate how often they felt or thought a certain way in response to 10 questions.

Each item was rated 0 (never), 1 (almost never), 2 (sometimes), 3 (fairly often), or 4 (very often), four items were reverse coded (On questions 4, 5, 7, and 8 the scores are changed like this: 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0), and all items were summed to obtain scale scores. The total scores range from 0 to 40, with higher scores indicating greater perceived stress (11).

- Scores ranging from 0-13 would be considered low stress.
- Scores ranging from 14-26 would be considered moderate stress.
- Scores ranging from 27-40 would be considered high perceived stress.

The internal validity of the PSS score was verified, with an alpha Cronbach coefficient at 0.92

- Post-nightshift symptoms and attitude: To be able to assess, compare and analyze the characteristics of the post-nightshift syndrome, we have chosen to establish a score. The VAS of the different symptoms (somatic, behavior, mood, psychological) collected were averaged and reduced to a score out of 200.
  - Somatic symptoms: tiredness, discomfort, gastralgia, headaches, diffuse pain.
  - Behavioral symptoms: unfinished activities, reckless spending, Verbal fluency disorders, over-commitment, Cynicism.
  - Mood disorder: irritability, mood swings, intolerance, anxiety, Impulsivity.
  - Psychological symptoms: attention disorder, memory disorder, Word finding difficulties, feeling of being easily influenced, Slow thinking.
  - Consumption: tea, coffee, tobacco, alcohol, stimulant drugs, hypnotic drugs.

We have chosen the highest quartile as a cut-off to indicate PNS syndrome. The internal validity of the PSS score was verified, with an alpha Cronbach coefficient of 0.94.

- Data about the shift
  - The number of night shifts per month, and duration of the night shift.
  - Compensatory rest before and or after the night shift.
  - The number of doctors per night shift.
  - The number of sleep hours, and admissions (planned and unplanned) during the night shift.
  - Time of each meal, if taken.

- Accessibility to additional exams, quality of teamwork, and accessibility to specialist advice.

- Data added after the COVID-19 pandemic: when the COVID-19 pandemic has begun, we decided to add these parameters to the questionnaire.
  - The number of COVID-19 samples was carried out personally.
  - The number of suspected patients with a COVID score is greater than 4.
  - The number of COVID + patients.
  - In this section, we compared the group of participants with PNS syndrome to those with no PNS syndrome.
  - Statistical analyses: Spearman correlation was realized to describe the relationship between the PNS and each item of the same questionnaire and the total score of PSS. The level of significance was set at 0.05.

To compare qualitative variables, we used the Person Chi square-test and the Fisher exact test. Considering the small number of senior physicians answering the questionnaire, we have chosen to exclude them from this analytical study; only the residents' and interns' data were analyzed (n=244).

To compare quantitative variables, we used the Mann–Whitney U test. In the multivariate analysis, we used a multiple logistic stepwise regression procedure to elucidate the independent predictors of developing PNS syndrome. Odds ratios were estimated from the b coefficients obtained, with respective 95% confidence intervals (CI 95%). The significance level was a two-sided $p < 0.05$ for all the used tests.

RESULTS

Among the six hundred and twelve physicians invited to participate in the study, 253 completed the questionnaire representing a 41.34% response rate (Figure 1).

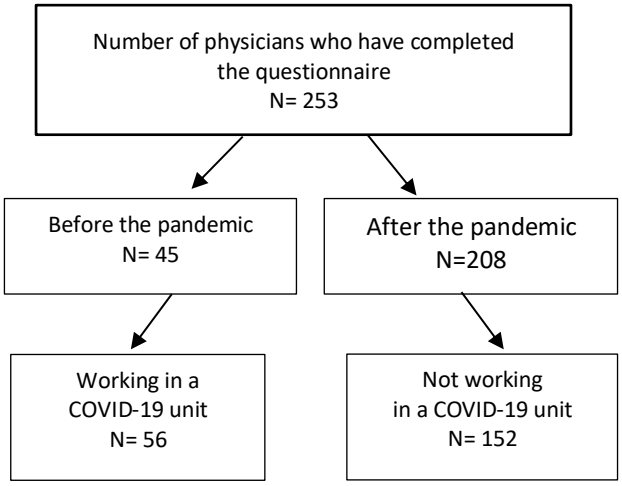

Figure1: Study's flow chart

The median age of the participants was 27 years [26-28.5] with an M/F sex ratio of 0.77 (143 women). The residents represented the most responding participants (196, 77.6%), among whom 28.5% were second-year residents. The most represented specialties among residents, specialists and university hospital physicians (n=202) were family medicine (64, 25.3%) and emergency medicine (22, 8.7%). Fifty-one participants have not indicated their specialty. The median number of shifts per month was 6

[4.75-7]. Two hundred and eight of the physicians included have had shifts after the beginning of the COVID-19 pandemic (82.21%).

Table 1. Correlation between PNS scale and sociodemographic and shifts' characteristics

	***PNS scale* p (r)**
Sociodemographic characteristics	
Age	0.40 (0.05)
Number of children	0.41 (0.05)
Marital status	NS
Data about the shift	
Number of shifts per month	0.002 (0.20)
Number of physicians per shift	0.57 (0.036)
Compensatory rest before the shift	10^{-3} (-0.23)
Compensatory rest after the shift	0.59 (-0.03)
Number of sleep hours	10^{-3} (-0.26)
Number of admissions	10^{-3} (0.29)
Planned admissions	10^{-3} (0.24)
Unplanned admissions	0.002 (0.20)
Quality of teamwork	0.072 (-0.17)
Accessibility to complementary exams	10^{-3} (-0.25)
Accessibility to specialist advice	0.01 (-0.164)
Data related to COVID-19	
Number of COVID-19 samples carried out personally	0.008 (0.32)
Number of suspected patients with a COVID score greater than 4	0.002 (0.22)
Number of COVID + patients	10^{-3} (0.30)

The median PNS score was 85 [57.00-111.50] ranging from 7 to 200. Considering the highest quartile (111) as the cutoff to indicate a PNS syndrome, we have found that 65 physicians have developed PNS syndrome (25.70%).

The post-night-shift scale was correlated neither with age nor with the number of children. Data related to the COVID-19 pandemic were strongly correlated with the PNS scale mainly the number of COVID-19 patients seen during the shift (10^{-3}) (Table 1). The PSS was correlated with the PNS scale (p=0.01) but this correlation was weak (r=0.162).

Table 2. Correlation between the four dimensions of the PNS scale with the overall

Post nightshift symptoms	PNS scale P (r)
Somatic symptoms	
Tiredness	10^{-3} (0.65)
Discomfort	10^{-3} (0.71)
Gastralgia	10^{-3} (0.61)
Diffuse pain	10^{-3} (0.68)
Headaches	10^{-3} (0.63)
Behavioral symptoms	
Unfinished activities	10^{-3} (0.61)
Verbal fluency disorders	10^{-3}(0.66)
Over-commitment	10^{-3} (0.50)
Cynicism	10^{-3} (0.51)
Reckless spending	10^{-3} (0.45)
Mood disorders	
Irritability	10^{-3} (0.80)
Mood swings	10^{-3} (0.73)
Intolerance	10^{-3} (0.76)
Anxiety	10^{-3} (0.70)
Impulsivity	10^{-3} (0.69)
Psychological symptoms	
Attention disorder	10^{-3} (0.76)
Word finding difficulties	10^{-3} (0.75)
Memory disorder	10^{-3} (0.73)
The feeling of being easily influenced	10^{-3} (0.62)
Slow thinking	10^{-3} (0.73)

The median libido away from a night shift was 6 [3-8] and on post-nightshift was 4 [1-7]. Concerning the variation of libido, 48 participants have had an increase in libido The delta libido was correlated with the PNS scale (p=0.007).

Table 3. Predictors of PNS syndrome

	PNS syndrome (n=61) Mean rank	*No PNS syndrome (n=183) Mean rank*	*Mann- Whitney U*	*P value*
Age	128.20	120.60	5234.00	0.46
Gender	107.00	127.67	4636.00	0.021
Number of children	125.43	121.52	5402.50	0.48
Number of shifts per month	143.65	115.45	4291.50	0.006
Compensatory rest before the shift	116.50	124.50	5215.50	0.074
Compensatory rest after the shift	125.00	121.67	5429.00	0.71
Number of COVID 19 samples carried out	48.08	32.90	197.00	0.007
Number of suspected patients with a COVID score greater than 4	111.58	86.86	2641.50	0.004
Number of COVID+ patients	110.73	84.93	2525.50	0.002
number of physicians per shift	117.20	124.27	5258.00	0.49
Number of sleep hours per shift	88.26	113.21	3378.00	0.008
Number of admissions	139.22	116.93	4561.50	0.032
Planned admissions	147.31	114.23	4068.00	0.001
Unplanned admissions	129.02	120.33	5184.00	0.40
Accessibility to complementary exams	106.15	127.95	4584.00	0.035
Quality of teamwork	115.30	124.90	5142.00	0.35
Accessibility to a specialist advice	110.97	126.34	4878.00	0.137
Consumption of of hypnotic drugs	122.00	122.67	5246.00	0.111
Consumption of stimulant drugs	120.50	123.17	5520.50	0.75
PSS	134.58	118.47	4844.50	0.120

We have found that coffee, tobacco, and alcohol consumption increased after a night shift. Tobacco consumption was 5.34 (± 9.86) on a normal day ranging from 0 to 30 cigarettes while it was 6.43 (± 13.11) on post-night-shift ranging from 0 to 60 cigarettes.

The four dimensions of the PNS scale were strongly correlated with the overall scale (Table 2). The number of shifts per month, the number of sleep hours, as well as the number of admissions and planned admissions (U=4068.00, p=10-3), were associated with a higher risk of developing PNS syndrome (Table 3). The number of suspected patients with a COVID-19 infection (U=2641.50, p=0.004), the number of COVID+ patients (U=2525.50, P=0.002), as well as the number of samples carried out (U=197.00, p=0.007 were predictors of developing PNS syndrome (Table 3). Working during the pandemic was not correlated with the development of PNS syndrome (p=0.194) while working in a COVID-19 unit was a strong predictor of PNS syndrome (10-3).

Table 4: Independent predictors of Post-night shift

	p-value	*Odds ratio*	*Confidence interval*
Working in a COVID-19 unit	10^{-3}	1.44	[1.09 ,1.92]
The number of admissions	10^{-3}	1.52	[1.21 ,1.90]
The number of sleeping hours	10^{-3}	1.40	[1.10 ,1.80]

The independent predictors of developing PNS syndrome were working in a COVID-19 unit, the number of admissions, and the number of sleeping hours (Table 4).

DISCUSSION

Post-night-shift syndrome can lead to major health concerns and can negatively impact physicians' performance. Our study has confirmed that the night shift is not just a hard-working circumstance but also a highly distressing condition that can lead to a defined syndrome: the post-night-shift syndrome. Most of the physicians have had moderate stress.

Physicians' wellness is frequently discussed, though it is not sufficiently prioritized. The necessity of providing uninterrupted healthcare services worldwide requires many healthcare professionals to work in the night-shift system. Nighttime duty is an important component of physicians' training in most specialties.

During the night shift, physicians are on duty during their biological resting phase and are forced to schedule sleep to their biological active phase. Post-night-shift syndrome was recently described in an observational, multicentric study in the emergency units of Hérault and Gard [3]. Its mechanisms are still debated. It seems to be related to increased levels of Interleukin-8, measured as a stress biomarker, after working a 24-h shift, indicating an increase in inflammatory processes [12]. Moreover, circadian rhythms [diurnal rhythms of cortisol] alert us in the morning hours [pre-shift] but cause us to feel fatigued as cortisol concentrations gradually decline over the day [post-shift] [13]. For example, it has been reported that one night of sleep deprivation increases cortisol release [14]. Human physiology is arranged to sleep at night and to be awake in the daytime. This can be evidenced by hormones released in the circadian rhythm. Among these hormones, melatonin is released during nighttime sleep, but not during daytime sleep. Sudden changes in melatonin release can produce a jet-lag-like condition, disrupting human mental health and sleep rhythm [8].

Furthermore, according to Cakan et Yildiz, a whole-night shift lowered platelet numbers, visual attention, and estradiol levels but increased NRBC, IL-1β, TNF-α, and IL-6 levels. All of these data suggest that night shifts disrupt homeostatic and circadian mechanisms, but the effects of whole-night shifts were much more dramatic than half-night shifts [15]. Furthermore, recent research conducted by Cuesta et al. showed that after a night shift, cytokine release was partly altered in response to the change in the sleep-wake cycle [16]. Another study provides the first time evidence that insufficient sleep restoration over circumscribed cortical areas leads to aberrant behavior. In chronically sleep-restricted subjects, low slow-wave sleep intensity over the right prefrontal cortex - which is linked to risk behavior – may lead to increased and subjectively unnoticed risk-seeking [17].

The COVID-19 pandemic may allegedly have exacerbated occupational fatigue and burnout among doctors. Several studies have found that the COVID-19 pandemic has had an impact on

physicians' well-being [15,16]. We have assessed stress among physicians working nightshifts using the perceived stress scale. We have found that most of the residents have had moderate stress [80.24%]. Similarly, in a cross-sectional study including resident physicians working night shifts, Hassan et al. found that most of the residents have had moderate job stress [18].

In our study, age was not correlated with the development of PNS syndrome. Leso et al demonstrated that shift work (particularly night shifts) has serious immediate negative effects on cognitive functions, especially regarding the cognitive domains related to attention, memory, and response inhibition. These findings found that increasing age is the most important risk factor for cognitive detriment [6]. Gender differences in work injury risk among shift workers have also been explored. However, there is limited empirical evidence showing an interaction between shift work and gender that definitively points to shift work as more adverse for either women or men. In our study, gender was not associated with PNS syndrome. In contrast, Wong et al have proven that shift work is a greater challenge for women than men due to cyclical menstrual changes [19] [20].

We found that the number of sleep hours during the shift is a strong predictor of PNS syndrome [p=0.008]. Similarly, the results of Wali et al' study indicate that the factor that significantly affects mood and performance post-night-shift is the number of hours slept during the night shift [P = 0.03] [21]. Furthermore, Osterode et al have found in their series, including physicians from different departments, that although mean sleep deprivation during night-shift was relatively small [1.5 h] the impairment in participants' mental state was high in all three dimensions [mood, vigilance, and agitation]; $p \leq 0.001$ [22]. Thus, it is crucial to fight against sleep deficiency during night shifts. Indeed, the Accreditation Council for Graduate Medical Education Task Force has recommended strategic napping for residents, especially after 16 hours of continuous duty and between 10 PM and 8 AM [23].

The number of shifts per month was also correlated with PNS syndrome. Several studies have found that physicians working 1 to 4-night shifts per month have lower stress compared to those working more than 9 shifts per month [22-24]. Besides, work control includes also the number of physicians. Being a single resident is associated with job stress [18]. Oppositely, in our study, the number of physicians per shift was not associated with the development of PNS syndrome.

The total number of unplanned admissions also seems to be an important parameter. It was directly linked with tachycardia in emergency physicians working night shifts: each admission increased

the number of minutes of tachycardia ≥100 bpm by 2.0 min [p < 0.019],

and increased the number of minutes of tachycardia ≥ 120 bpm by 0.2 min [p < 0.027] [25]. In contrast, in our study, the number of total admissions and planned admissions were associated with the development of PNS syndrome. Yet, the number of unplanned admissions was not associated with the development of PNS syndrome. This result may be explained by the fact that unplanned admissions concern mainly emergency physicians who are more comfortable with unplanned visits than other specialists.

When caring for patients during a pandemic, physicians are exposed to repeated and prolonged stressors, while their health is endangered due to direct exposure to an infectious disease. It is therefore expected that these stressors have an impact on mental health. In a tertiary infectious disease hospital for COVID-19 in China, the incidence of anxiety was as high as 23.04%, and the incidence of post-traumatic stress disorder was estimated at 27.39% [26]. We have found that the median PNS scale was 85 [57.00-111.50]. Similarly, Fasula et al found that the median PNS scale was 89 among emergency physicians [73.5-157.5] [3]. Indeed, the high-risk contacts [working in the department of respiratory, emergency, intensive care unit, and infectious disease staff were twice more likely to suffer anxiety [p=0.01] and depression [p=0.02] than the non-clinical staff [working in administrative, technical operations] [5]. In a cross-sectional study conducted by Abdulah et Musa, the physicians who dealt with suspected or confirmed cases of COVID-19 were more likely to develop sleep problems and stress after the night shift [27].

LIMITATIONS

A few limitations are to be highlighted. First, the study was conducted on a single site. The results may not reflect the shift conditions across Tunisia. Second, this study was limited by the small size of the sample. Indeed, although physicians tend to adapt to technological advances, it should be kept in mind that some of them have limited technological literacy and do not utilize social media. The results should be replicated in larger samples to validate the contribution of the analyzed variables. Finally, we cannot exclude the possibility that other factors not assessed in our study, such as patient-doctor communication and social support, may also contribute to the development of PNS syndrome.

Despite the limitations abovementioned, we hope that our study findings will provide data support for the targeted interventions on psychological health in Tunisian physicians, especially during the COVID-19 pandemic.

CONCLUSION

The night shift is a condition that primarily affects physicians. The PNS may cause several disorders and may decrease the physicians' well-being. At the beginning of the COVID-19 pandemic, working in a COVID-19 unit was a

predictor of the development of PNS syndrome, as well as the number of COVID-19 patients confirmed and suspected and the number of samples carried out.

These findings suggest the need to reappraise the efficacy and feasibility of current policy regulating the scheduling of physicians and, if warranted, place further limitations on working hours and increase the number of junior physicians

REFERENCES

1. *Smith-Coggins R, Broderick KB, Marco CA. Night Shifts in Emergency Medicine: The American Board of Emergency Medicine Longitudinal Study of Emergency Physicians. The Journal of Emergency Medicine. 2014;47(3):372-8.*
2. *Known and Probable Human Carcinogens [Internet]: https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html*
3. *Fasula C, Marchal A, Krebs H, Moser C, Genre-Grandpierre R, Bobbia X, et al. Le syndrome postgarde de nuit chez les médecins urgentistes : caractéristiques et facteurs influençants. Ann Fr Med Urgence. 2018;8(5):301-8.*
4. *Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA Netw Open. 2020;3(3):e203976.*
5. *Thatrimontrichai A, Weber DJ, Apisarnthanarak A. Mental health among healthcare personnel during COVID-19 in Asia: A systematic review. Journal of the Formosan Medical Association. 2021;120(6):1296-304.*
6. *Leso V, Fontana L, Caturano A, Vetrani I, Fedele M, Iavicoli I. Impact of Shift Work and Long Working Hours on Worker Cognitive Functions: Current Evidence and Future Research Needs. IJERPH. 2021;18(12):6540.*
7. *Costa C, Mondello S, Micali E, Indelicato G, Licciardello AA, Vitale E, et al. Night shift work in resident physicians: does it affect mood states and cognitive levels? Journal of Affective Disorders. 2020;272:289-94.*
8. *Zupancic N, Buick V, Ihan A, Dolenc-Groselj L. Sleep and Safety Improve Physicians' Psychological Functioning at Work During Covid-19 Epidemic. Front Psychol. 2021;11:569324.*
9. *Chakroun H, Lasfar NB, Fall S, Maha A, Moussi AE, Abid S, et al. Premier cas confirmé de COVID-19 importé en Tunisie First case of imported and confirmed COVID-19 in Tunisia. :3.*
10. *Lesage FX, Berjot S, Deschamps F. Clinical stress assessment using a visual analog scale. Occupational Medicine. 2012;62(8):600-5.*
11. *Almadi T, Cathers I, Hamdan Mansour AM, Chow CM. An Arabic version of the Perceived Stress Scale: Translation and validation study. International Journal of Nursing Studies. 2012;49(1):84-9.*
12. *Dutheil F, Trousselard M, Perrier C, Lac G, Chamoux A, Duclos M, et al. Urinary Interleukin-8 Is a Biomarker of Stress in Emergency Physicians, Especially with Advancing Age — The JOBSTRESS* Randomized Trial. Xia Y, éditeur. PLoS ONE. 2013;8(8):e71658.*
13. *Kumari M, Badrick E, Chandola T, Adam EK, Stafford M, Marmot MG, et al. Cortisol secretion and fatigue: Associations in a community-based cohort. Psychoneuroendocrinology. 2009;34(10):1476-85.*
14. *Schwarz J, Gerhardsson A, van Leeuwen W, Lekander M, Ericson M, Fischer H, et al. Does sleep deprivation increase the vulnerability to acute psychosocial stress in young and older adults? Psychoneuroendocrinology. 2018;96:155-65.*
15. *Cakan P, Yildiz S. Effects of Half- or Whole-Night Shifts on Physiological and Cognitive Parameters in Women. The American Journal of the Medical Sciences. 2020;360(5):525-36.*
16. *Cuesta M, Boudreau P, Dubeau-Laramée G, Cermakian N, Boivin DB. Simulated Night Shift Disrupts Circadian Rhythms of Immune Functions in Humans. JI. 2016;196(6):2466-75.*
17. *Maric A, Montvai E, Werth E, Storz M, Leemann J, Weissengruber S, et al. Insufficient sleep: Enhanced risk-seeking relates to low local sleep intensity: Insufficient Sleep Increases Risk-Seeking. Ann Neurol. 2017;82(3):409-18.*
18. *Hassan NM, Abu-Elenin MM, Elsallamy RM, Kabbash IA. Job stress among resident physicians in Tanta University Hospitals, Egypt. Environ Sci Pollut Res. 2020;27(30):37557-64.*
19. *Wong IS, Smith PM, Mustard CA, Gignac MA. For better or worse? Changing shift schedules and the risk of work injury among men and women. Scand J Work Environ Health. 2014;40(6):621-30.*
20. *Kling RN, McLeod CB, Koehoorn M. Sleep Problems and Workplace Injuries in Canada. Sleep. 2010;33(5):611-8.*
21. *Wali S, Qutah K, Abushanab L, Basamh R, Abushanab J, Krayem A. Effect of on-call-related sleep deprivation on physicians' mood and alertness. Ann Thorac Med. 2013;8(1):22.*

22. Osterode W, Schranz S, Jordakieva G. Effects of the night shift on the cognitive load of physicians and urinary steroid hormone profiles – a randomized crossover trial. Chronobiology International. 2018;35(7):946-58.
23. Nasca TJ, Day SH, Amis ES. The New Recommendations on Duty Hours from the ACGME Task Force. N Engl J Med. 2010;363(2):e3.
24. Çalişkan Tür F, Toker İ, Şaşmaz CT, Hacar S, Türe B. Occupational stress experienced by residents and faculty physicians on night shifts. Scand J Trauma Resusc Emerg Med. déc 2016;24(1):34.
25. Dutheil F, Marhar F, Boudet G, Perrier C, Naughton G, Chamoux A, et al. Maximal tachycardia and high cardiac strain during night shifts of emergency physicians. Int Arch Occup Environ Health. 2017;90(6):467-80.
26. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatry Research. 2020;288:112954.
27. Abdulah DM, Musa DH. Insomnia and stress of physicians during COVID-19 outbreak. Sleep Medicine: X. 2020;2:100017.

Serious abdominal traumatic emergencies in the emergency department of a "Trauma Center" hospital of Libreville (Gabon): Epidemiological, diagnostic and evolutionary aspects.

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Abstract

Introduction: Abdominal trauma (AT) represents about 15-20% of lesions observed in traumatology. The objective of this work is to describe the epidemiological, diagnostic and evolutionary aspects of severe AT (TAG) admitted to the emergency care of Owendo University Hospital (Gabon).

Patients and methods: cross-sectional and descriptive study with retrospective collection of data. It took place over a period of twenty-four months in 2022, in the Emergency Department of the CHUO. Only patients with traumatic abdominal pathology classified as serious were included. The variables of the study were: age, sex, mechanism of trauma, pre-hospital management, clinical signs, paraclinical assessment carried out, surgical treatment and evolution. The data were analyzed by Microsoft Excel Pro version 2019 software.

Results: during this period, 4.6% (n=105) of patients presented with abdominal trauma, including 66.7% (n=70) with GAD. The average age of the patients was 29.8 ± 13.8 years. In 70% of cases (n=49), road accidents (AVP) were the main etiologic mechanism, then secondarily aggressions with 11.4% of cases. In peroperative, the splenic lesions were the most found in 60% (n=42) of the cases. Crude mortality was 20% (n=14). Deaths occurred in 64.2% of patients during the first forty-eight hours.

Conclusion: Serious abdominal trauma is characterized by a glaring insufficiency of its pre-hospital care. They are still responsible for high mortality in Gabon as well as in other African countries.

Keywords: Abdomen; Serious; Owendo; Trauma; Emergency.

INTRODUCTION

Traumatic pathology is the first cause of death in young adults and abdominal trauma represents about 15-20% of the lesions observed in traumatology, and is associated with high mortality, of the order of 20% [1-2]. The frequency of blunt abdominal trauma is predominant and estimated between 70 and 86% of abdominal trauma [2]. Traumatic abdominal emergencies are characterized by their immediate severity, extreme in the event of damage to the large vessels, the liver or the spleen. The management of these traumas requires a multidisciplinary collaboration which begins from the prehospital phase with continuity in hospital reception, until the treatment of the lesions and their specific monitoring. The hospital phase requires, if possible, a hospital specializing in severe traumatology such as a “Trauma Center” with an appropriate technical platform and a team well trained in the management of traumatological emergencies. The objective of this work is to describe the epidemiological, diagnostic and evolutionary aspects of serious traumatic abdominal emergencies admitted to the emergency department of the University Hospital Center of Owendo, a hospital with the vocation of "Trauma Center" in Libreville (Gabon).

METHODS

This was a cross-sectional and descriptive study with retrospective data collection. It took place over a period of twenty-four months, from January 1, 2021 to December 31, 2022. The emergency, operating theater and intensive care service of the Owendo University Hospital Center (CHUO), "Trauma Center" in Libreville, served as a place of study. Only patients with abdominal traumatic pathology classified as serious on the basis of the presence of a failure of at least one vital function with proven abdominal morphological lesions were included. All other traumatic emergencies (thoracic trauma, polytrauma without abdominal injury) admitted in the emergency care during the same period were excluded from this work. The variables of the study were: age, sex, mechanism of trauma, pre-hospital management, clinical signs, paraclinical assessment carried out, surgical treatment and evolution. The data were analyzed by Microsoft Excel Pro version 2019 software. This work was carried out according to the recommendations of the Declaration of Helsinki on the use of human beings. The authorizations of the officials of the University Hospital Center of Owendo have been obtained.

RESULTS

During the study period, 2300 patients were admitted to the emergency department for trauma. Among the latter, 4.6% (n=105) had abdominal trauma, including 66.7% (n=70) with disruption of at least one vital function. The average age of the patients was 29.8 ± 13.8 years. The male gender was predominant in 80% of cases (n=56) with a sex ratio of 4M/1F. In 70% of cases (n = 49), accidents in the public road (AVP) were the main etiological mechanism, then secondarily the aggressions with 11.4% of cases. (Table 1). Only 8.6% of cases (n=6) had benefited from medical transport.

Table 1: Retailing of patients according to etiological mechanisms

Etiological Mechanisms	Number (n)	Percentage (%)
Public road accident	**49**	**70**
• Car-Car	16	32,7
• Car-pedestrians	14	28,6
• Car-motorbikes	10	20,4
• Car-hurdles	09	18,3
Falls	11	16
Assaults	08	11
Sport	01	1,5
Work accident	01	1,5
Total	**70**	**100**

The majority (82.9%) of these abdominal trauma emergencies were closed and only 7.1% (n=5) were penetrating. On admission in the emergency care, the main functional sign found was abdominal pain in 87.1% (n=61) of patients. Mucocutaneous pallor was observed in 25.8% of cases and 66% of patients (n=46) presented with tachycardia ≥ 120 bpm. The majority of patients (n= 46) had SBP ≤ 90 mmHg (Table 2).

Table 2: Retailing of patients according to hemodynamic and respiratory parameters

Hemodynamic and respiratory parameters	Number (n)	Frequency (%)
Cardiac frequency (bpm)		
90 ≤ Fc ≤ 99	07	10
100 ≤ Fc ≤ 109	12	17
110 ≤ Fc ≤ 119	05	7
Fc ≥120	46	66
Systolic blood pressure (mmHg)		
100 ≤ PAS ≤ 110	24	34
80 ≤ PAS ≤ 90	05	7
60 ≤ PAS ≤ 70	16	23
Respiratory frequency (cpm)		
12 ≤ FR ≤ 18	37	52,9
19 ≤ FR ≤ 25	08	11,4
26 ≤ FR ≤ 30	15	21,4
FR > 30	10	14,3

On the respiratory, 14.3% (n=10) of the patients had a respiratory rate higher than 30 cycles/min. An altered state of consciousness with a Glasgow score between [9-12] was noted in 14.3% (n=10) of patients. On the digestive level, evisceration was found in 5.7% of cases (n=04), abdominal defense in 80% of cases (n=56) and the navel pain in 75.5% of cases (n=53). At the morphological paraclinical level, the “Fast-echo” was performed in 66% of cases (n=46), conventional ultrasound in 34% of cases (n=24) and abdominal computed tomography in 10% (n=07) of patients. Hemoperitoneum was found in all patients who underwent ultrasound. The average hemoglobin level was 7.2 g/dl with extremes ranging from 3g/dl to 12g/dl. The average platelet rate was 82,000/mm3. The time to surgery was less than 2 hours in 2.8% (n=02) of patients, between 3-6 hours in 37.14% (n=26) of patients and more than 24 hours in 11 % (n=08). In peroperative, the splenic lesions were the most found in 60% (n=42) of the cases. (Table 3). Total splenectomy was the rule in case of splenic involvement (100%), the retroperitoneal hematomas had been respected and a nephrectomy had been performed in front of the bursting of the kidney. (Table 3). In intensive care after the block, the average length of stay was 3.9 days with a mortality rate of 20% (n=14) of patients.

Deaths occurred in 64.2% of patients during the first forty-eight hours.

Table 3: Retailing of patients according to lesions and surgical procedure

Damage	Number (n)	Surgical act
Rupture of the spleen	30	Splenectomy
Spleen crack	12	Splenectomy
Mesenteric wounds	12	Suture
Liver wounds	02	Packing
Liver crack	04	Suturing + surgical
Liver contusion	04	No movement
Colon wounds	08	Excision - suturing
Kidney burst	01	Nephrectomy
Kidney contusion	03	No movement
Hail wounds	04	Excision - suturing
Retroperitoneal hematoma	04	No movement
Bladder wounds	03	Suture
Diaphragm wounds	02	Suture

DISCUSSION

Abdominal traumas are lesions observed in the abdomen, its contents or its walls, by a mechanism that may or may not have respected parietal continuity. They can be isolated (sports accident, aggression), or more frequently, in the context of polytrauma [3]. Serious abdominal traumatic emergencies represent 4.6% of all traumatic emergencies and 2.3% of admissions to the CHUO emergency care. They generally concern young adult male population. This prevalence is not very far from that of Itéké et al in the DRC with 10.9% of traumatic emergencies and 2.7% of admissions to emergency departments [4]. Among the mechanisms involved, road accidents (AVP) rank first (70%, n=49), explaining the seriousness of the injuries. AVP are also incriminated in the work of Ndong A in Senegal with 54.1% of cases [5]. The lack of pre-hospital care in this study reflects the under-medicalization of trauma transport in sub-Saharan Africa in general, most often contributing to the worsening of patients' state and the delay in medical care. This observation was also made by Choua O in Chad and Obame R in Gabon [2-6]. In this study, thirty-six patients (51.4%) had benefited from an abdominal ultrasound including the "Fast-echo" used in 61.1% (n = 22) of cases. "Fast" type ultrasound is of great importance in the initial evaluation of abdominal trauma patients. It aims at detecting post-traumatic peritoneal effusions and also looking for the presence of pleural effusion, however it does not identify the damaged organs. This underuse of ultrasound finds root in the lack of extension of its practice among general practitioners working in the emergency department. The majority of emergency services in the sub-Saharan African context are run by general practitioners barely out of medical school. There is also the fact that some serious pictures of patients in shock were immediately taken to the operating room for an exploratory laparotomy leaving no time for this examination to be carried out. The stabilization of vital distress must be done without delay. In this study, only 2.8% (n=02) of the patients had a delay in treatment in the operating room of less than 2 hours. The block delay was between 3 and 6 hours in 37.14% (n=26) of the patients. These delays are still acceptable in view of the results of

Belemlilga in Bobo-Dioulasso which were beyond 24 hours in 22.2% of patients [7]. Several factors could explain this delay in care in our context, in particular the unavailability of surgical equipment (gowns, gloves) and consumables during the period of this work, which are under patients' responsibility. Early management of operable lesions is a good prognostic factor in this type of traumatic pathology. Surgical management remained classic; a laparotomy had been performed in the face of any clinical or paraclinical picture suggestive of frank haemoperitoneum. The surgical procedures performed depended on the lesions observed. In this work, splenectomy was the rule (42/42), a result close to that of Bio Tamou Sambo et al (17/18) in Benin. [8]. None of the patients had undergone "damage control" or "shortened laparotomy" often recommended in trauma patients presenting with major abdominal bleeding with a risk of coagulopathy [9]. The average length of stay in intensive care was 3.94 days. It can be explained by the effectiveness of the reanimation undertaken but also because of the insufficient number of postoperative complications. The prognosis of a traumatic hemoperitoneum, whatever the circumstances of occurrence, is conditioned by the speed and accuracy of the diagnosis of the lesion and also by the therapeutic option [10]. The mortality rate found was 20%. This rate is similar to that found by Itéké (20.6%) [4], but higher than the rate of Rakotoarivony et al (6.7%) in Madagascar [11]. Among the deaths, 9 cases (35.2%) occurred before the first 48 hours. This observation had already been made by Itéké et al in Congo, which recorded a mortality rate of 42.9% within the same period. Indeed, uncontrolled post-traumatic hemorrhage is the main cause of this mortality [4]. The concept of "damage control" or "shortened laparotomy" is not yet well practiced by CHUO surgeons, despite the indications; this may also be an explanation for the irreversibility of these hemorrhagic shocks on severe abdominal trauma.

CONCLUSION

Serious abdominal traumatic emergencies affect an almost young, male population with the circumstances of occurrence being road accidents and falls. It is characterized by a glaring insufficiency of its pre-hospital care with the consequence of a worsening of the vital prognosis, which leaves little chance to hospital practitioners. On one hand the prehospital care sets difficulties but on the other hand that makes the hospital improves in the diagnostic means as well as in the surgical relay and in reanimation. The accession of FAST-type ultrasound greatly facilitates early diagnosis and surgical management. Serious abdominal trauma is still responsible for high mortality in Gabon, as in other African countries, and the above-mentioned factors remain the cornerstone. Improving its management requires better development of pre-hospital medicine in Gabon, emphasis on training in the use of "Fast-echo" in emergencies and perhaps by strengthening surgical practices such as "damage control" or "abbreviated laparotomy".

REFERENCES

1. Bruder N, Velly L. Réanimation du traumatisé crânien. In: Pourriat JL, Martin C, editors. Principes de réanimation chirurgicale. Paris: Arnette Blackwell; 2005 :1311-1324.

2. Choua O, Rimtebaye K, Yamingue N, Moussa K, Kaboro M. Aspects des traumatismes fermés de l'abdomen opérés à l'Hôpital Général de Référence Nationale de Ndjamena (HGRN), Tchad: à propos de 49 cas. pamj.2017 ; 26 (50) :1-6.

3. Diane B, Lebeau R, Kassi ABF et al. Traumatismes de l'abdomen au CHU de Bouaké. J Afr Chir Digest. 2007; 7(2): 672-78.

4. Itéké FR, Bafunyembaka M, Nfundiko K et al. Urgences Abdominales Traumatiques: Aspects épidémiologique, lésionnel et pronostique au service d'accueil des urgences de l'HGR de Panzi de Bukavu (RD Congo). Rev. Afr. Anesth. Med. Urgence. 2014; 19 (1): 72-75.

5. A Ndong, ISS SARR, ML GUEYE et al. Aspects diagnostiques et thérapeutiques des traumatismes abdominaux : à propos de 68 cas. J Afr Chir 2018; vol 18(2) : 2474-2478.

6. Obame R, Sagbo Ada LV, Nzé Obiang PK et al. Aspects Épidémiologiques, Thérapeutiques et Évolutifs des Polytraumatisés Admis en Réanimation du Centre Hospitalier Universitaire d'Owendo. Health Sci. 2019; 20 (3): 86-89.

7. Belemlilga G. L. H, Zaré C, Sourô Sanou et al. Traumatismes de L'abdomen en Milieu Africain : Aspects Épidémiologiques, Diagnostiques, et Thérapeutiques. ESJ. 2020. 16 (21) : 132-141.

8. Tamou Sambo B, Montcho Hodonou A, Salako A et al. Aspects épidémiologiques, diagnostique et thérapeutique des traumatismes abdominaux à Bembéréké Nord Bénin. ESJ. 2016 ; 12 (9) : 395-405.

9. Avrieux C, Létoublon C, Reche F. Le damage control en traumatologie abdominale sévère. Réanimation. 2007. 16 ; 678-686.

10. Bâ PA, Diop B, Soumah SA, Aidara CM, Mbaye EM, Fall B. Les lésions intestinales au cours des traumatismes fermés de l'abdomen : diagnostic et prise en charge en milieu défavorisé. I Afr Hépato-Gastroentérologie.2013; 7:14-17.

11. S.T. Rakotoarivony, S.D. Rakotomena, H.N. Rakoto-Ratsimba, J.M. Randriamiarana. Aspects épidémiologiques des traumatismes abdominaux par accident de circulation au Centre Hospitalier Universitaire d'Antananarivo. Revue Tropicale de Chirurgie. 2008 ; 2 : 18-21.

Evaluation of initial medical certificates delivered by emergency doctors

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Abstract

OBJECTIVES: The initial medical certificate (IMC) is the first document delivered to an injured person. In this work, we propose to analyze the quality redaction of IMC written by emergency doctors and to propose writing recommendations in order to guarantee a better quality of IMC.

METHODS: This is a retrospective and descriptive study of all IMCs written by emergency doctors in Mahares Emergency Unit and collected at the regional Hospital of Mahres in Sfax, Tunisia, over a period of 22 months (January 1, 2019 - October 31, 2020).

We included initial medical certificates issued for intentional assault and battery (assaults) and unintentional (primarily traffic accidents, workplace accidents,). We excluded all initial medical certificates that were totally illegible.

RESULTS: During this period, we collected 506 IMCs. They were all hand written according to the pre-established model for public sector. 83% of the certificates were perfectly legible. 46% of the physicians used abbreviations in the IMCs.

The surname and first name of the physician were mentioned on 457 certificates (90% of the cases) and his complete identity with his grade and professional address in 6.7% of the cases only. The signature of the physician was present in the vast majority of the certificates (97%), and the stamp was present in only 8% of the cases. The victim's identification (name and surname) was noted in almost all the certificates. However, neither the address nor the occupation of the victim was included in 506 certificates. The majority of prescribing physicians had mentioned the date of clinical examination, the date of the event, as well as the date of writing the IMC (84.8%). The duration of total temporary disability was specified in 91.3% of the cases.

CONCLUSION: In our study, the IMC is generally imperfectlyy and insufficiently written by the doctor. This can have serious medico-legal repercussions for both victim and doctor. Indeed, the victim may lose his rights to compensation and the doctor may be held medical liability.

KEYWORDS: Trauma; Incapacity; Medical liability; Initial medical certificate.

INTRODUCTION

The initial medical certificate (IMC) is the first document delivered to an injured person, or his/her legal representative. It is a particularly frequent and serious act of medical practice as forensic consequences can arise when it's written imperfectly. It may engage the medical liability of the doctor. Therefore, this act must obey to writing rules and objective quality criteria in order to avoid such negative consequences.

In this work, we propose to analyze the quality of IMC written emergency doctors and to propose writing recommendations in order to guarantee a better quality.

METHODS

This is a retrospective and descriptive study of all IMC delivered by emergency doctors and collected at the Emergency unit of Regional Hospital of Mahres in Sfax, Tunisia, over a period of 22 months (January 1, 2019 - October 31, 2020).

We included initial medical certificates issued for intentional assault and battery (assaults) and unintentional (primarily traffic accidents, workplace accidents,). We excluded all initial medical certificates that were totally illegible.

Quantitative variables were expressed as mean with standard deviation. Qualitative variables were expressed in proportions observed in the sample.

RESULTS

In total, we collected 506 descriptive certificates during the study period.

In our series, all the certificates were written on the official model of the Ministry of Health, brought by the Circular No. 2000-72 of 01/09/2000 [1]. In addition, 83% of the certificates were perfectly legible. For the remaining 27%, we had difficulties to decipher some words even after soliciting another reader. Moreover, 46% of the physicians used abbreviations in drafting IMC.

Evaluation of IMCs content:

- ***Administrative data:***

We noted that the hospital structure and the department, as well as the receipt number were mentioned in the majority of cases (87% and 89% respectively) (Table). However, the requestor of IMC was identified in only 56% of cases. It was the victim or his/her legal guardian in 49% of the cases, and it was a certificate on judicial request in 7% of the cases (Table 1).

- ***Identity and professional data relating to the writing doctor:***

The name and the surname of the physician were mentioned on 457 certificates (90% of the cases). However, his complete identity with his grade and professional address were mentioned in only 6.7% of the cases. The signature of the physician was present in the vast majority of the certificates (97%); however, the stamp was present in only 8% of the cases (Table).

- ***Data relating to the patient:***

The victim's identification (name and surname) was noted in almost all the certificates. However, neither the address, nor the occupation of the victim was included in 506 certificates (Table).

Table 1: Evaluation of IMC content

Variable	Modality	Mentioned		Not mentioned	
		n	%	n	%
Administrative data	Hospital and department	440	87	66	13
	Patient file number	396	78	110	22
	Receipt number	449	89	57	11
	Certificate requestor	281	56	225	44
Identity and professional data relating to the doctor writing the IMC	Name and surname	457	90	49	10
	Grade	45	9	461	91
	Place of practice	440	87	66	13
	Mention of the parameters	34	6.7	472	93.3
	Signature	489	97	17	3
	Stamp	39	8	467	92
Data relating to the patient	Name and surname	501	99	5	1
	Age or date of birth	451	89	55	11
	The patient's or legal representative's identity card number (or passport)	402	79	104	21
	Profession	0	0	506	100
	Patient's address	0	0	506	100

- ***Date mentioned on the IMC:***

The date of the accident, the date of the initial examination and the date of writing the CMI were mentioned in 99.6%, 94.3% and 98.4% of cases respectively. The dating was complete (three dates together) in 429 certificates (84.8% of cases).

- ***Anamnesis data***

The facts and the mechanism of the violence were reported by the victim in 71% of cases. The medical and surgical history was mentioned in 19 certificates (i.e. 4% of cases). The victim's complaints were included in 224 certificates (44% of cases).

- ***Clinical examination data:***

Among the 506 certificates, the general clinical examination (blood pressure, pulse, temperature, auscultation, palpation,) was specified in only 43 certificates (8.5% of cases). The general condition (good general condition, altered general condition, conscious and cooperative, Glasgow score...) was reported in 99 certificates (19.6%).

The psychological evaluation was specified in 32 certificates (6.3% of cases). For physical consequences, the nature of traumatic lesions was mentioned in 80% of the cases. The seat of the lesions was noted in the majority of cases (95%). However, the size and shape of the lesions were only mentioned in 20.8% and 19.6% respectively.

- ***Complementary examinations:***

Complementary examinations were done and mentioned in 42.3% of the IMC, but the result was reported in the IMCs in 39.7% of cases. 175 physicians requested a specialist opinion (34.6% of the cases).

- ***Treatments:***

The treatments were specified in 22.7% of the certificates.

Conclusion of the IMC:

The causing agent was specified in only 143 of the IMC (28.3% of cases).

The doctor assigned a total temporary disability in 462 certificates (91.3% of cases).

The expression "subject to complications" appeared on all the certificates.

DISCUSSION:

The issuance of medical certificates is an act dictated by deontology (according to article 27 of the Tunisian Code of Medical Deontology) [2] Thus, the doctor needs to know the rules that authorize the drafting of such certificates and their content.

- ***Writing rules of the initial medical certificate:***

1.1- Effective examination of the patient:

First, the doctor must carry out an anamnesis and an effective personal clinical examination of the patient before writing the certificate.

However, according to the circular n°2000/72 of the Minister of Public Health, the initial medical certificate in hospital emergency rooms is not necessarily issued by the doctor who examined the patient. Indeed, any doctor on duty in the emergency room can issue this certificate retrospectively based on the findings made and noted on the medical file or the emergency register by his colleague, the doctor who initially examined the victim.

In our study, the doctor specified the origin of the request of the IMC in 56% of cases.

The certificate must be delivered by hand to the person concerned, with the exception of the minor or the adult lacking legal capacity. In these last two cases, it is the legal representative who must receive the certificate. If the doctor gives the certificate to a person not authorized to receive it, he risks the implication of his medical liability for disclosure of medical confidentiality [3].

1.3- Form rules of the IMC:

In our study, the certificates were written on the official model of the Ministry of Health, under Circular No. 2000-72 of 01/09/2000 ([1], in all the cases. In addition, 83% of the certificates were perfectly legible. For the remaining 27%, we had difficulties to decipher some words even after soliciting another reader. Moreover, 46% of the physicians used abbreviations in drafting IMC.

The use of the official model of IMC can help doctors to not miss certain necessary elements for good writing IMC and especially of illegibility. Thus, an initial medical certificate must obey certain formal rules. It must be clear, precise, complete, measured and fair.

1.4- Basic rules of an IMC:

- ***Identity and professional data relating to the medical officer:***

The name and the surname of the physician were mentioned on 457 certificates (90% of the cases), however, his complete identity with his grade and professional address were mentioned in only 6.7% of the cases. Complete doctor identification was found in 74% for the study carried out by M.Soumah [4] and 96% for the study carried out by Z. Elleuch [5].

It should be remembered that doctors authorized to write IMC must hold medical doctor's degrees in accordance with the provisions of decree n°

93-1440 of 23 June 1993 relating to specialization in medicine and the legal status of residents [6], of Circular No. 1990/70 [7] and of Circular No. 2000/72 of the Minister of Public Health [1]. Residents and interns who do not have a doctorate in medicine are not authorized to issue IMC.

The signature of the physician was present in the vast majority of the certificates (97%); however, the stamp was present in only 8% of the cases. It was found in published studies [4,8] that the signature and stamp of the doctor were present in all the certificates studied. The signature of the document must be handwritten [9]. This is an ethical obligation since according to article 27 of the code of medical deontology [2].

- ***Data concerning the victim:***

The patient's name and first name were mentioned on all certificates in our study, just like the study carried out by F. Doriat [8], M.Soumah [4] and Z. Elleuch [5]. Indeed, the absence of this parameter cancels the validity of the IMC.

The patient's or legal representative's identity card number was mentioned in 79% of cases in our study and in 80.7% of certificates in the study carried out by Z. Elleuch [5]. The doctor must obligatorily require an identity document from the patient. In the absence of a national identity card, the doctor must assume the identity of the patient by writing "the patient declaring him to be named ..." In fact, from a deontological point of view, the 27 article of the Tunisian code of medical deontology provides: "all documents must contain the exact identity of the patient" [2]. From a legal point of view, and concerning the public official doctor, the 195 article of the Tunisian penal code provides: "is punished by six months to one year of imprisonment and a 120 dinars fine, the public official who will have issued a certificate to a person who is unknown to him without having taken care to have his identity certified by two witnesses. The penalty is three years' imprisonment and a fine of two hundred and forty dinars, if the official was aware of the assumed name "[10].

The age [or date of birth] of the patient was mentioned in 89% of the IMC in our study and the same in 87% in the study by Mr. Soumah [4]. However, neither the address, nor the occupation of the victim was included in 506 certificates. The study of M.Soumah [4] found that the patient's address and profession were mentioned in 62% and 1% respectively. The lack of precision of the patient's address, as well as the profession in our study can be explained by the fact that these parameters are not mentioned in the official ministerial model of the IMC.

1.5- Dates mentioned on the initial medical certificate

The date of the accident, the date of the initial examination and the date of writing the CMI were mentioned in 99.6%, 94.3% and 98.4% of cases respectively. The dating was complete (three dates together) in 429 certificates (84.8% of cases). These dates are important to specify because they constitute the proof of the trauma, allow us to date the injury and to establish the

imputability to the alleged facts [4]. As for the date of writing the IMC, it must be mentioned as dispose Article 27 of the Tunisian code of medical deontology: "documents issued by a doctor must include the date of their issue" [2].

1.6- Anamnesis data

The facts and the mechanism of the violence were reported by the victim in 71% of cases. According to M. Graser et al [11], the evaluation of a patient's bodily injury may vary depending on the circumstances in which the injury occurred. The victims, with identical functional sequelae, can be assigned a variable compensation depending on the type of accident [5,12].

The victim's complaints were included in 224 certificates [44% of cases]. M Soumah [4] found that 15% of certificates did not mention the victim's complaints. The fact of noting discrepancies between the complaints and the clinical examination testifies to the objectivity of the doctor, of his seriousness, and also of his desire to remain in compliance with ethics and medical deontology.

1.7- Clinical examination data

Among the 506 certificates, the general clinical examination [blood pressure, pulse, temperature, auscultation, palpation,] was specified in only 43 certificates [8.5% of cases]. The general condition [good general condition, altered general condition, conscious and cooperative, Glasgow score...] was reported in 99 certificates [19.6%]. The psychological and physical consequences are important to mention because it may indicate the mechanism of injury and more exactly the injurious object which is responsible for it.

1.8- Complementary examinations

Complementary examinations were mentioned in 42.3% of the IMC, but the result was mentioned in 39.7% of cases. 175 physicians requested a specialist opinion [34.6% of the cases]. They were absent in the study carried out by M.Soumah [4] and that of Z. Elleuch [5] in 83% and 53.3% of the certificates respectively. The mention of complementary examinations is mandatory because it allows us to avoid missing a lesion (Fracture, dislocation) and thus prolong the duration of the TTD. Furthermore, they must be mentioned to be part of a subsequent compensation.

1.9- Treatments

The treatments were specified in 22.7% of the certificates. The treatments were mentioned in 58.4% of the certificates. The mention of treatment is important and may influence the duration of the TTD. Indeed, Lasseuguette has shown that the duration of TTD is increased by the duration of hospitalization and by the duration of immobilization of a limb depriving the person of certain autonomy for the elementary acts of daily life [13].

1.10- Conclusion of the IMC

In our study, the causing agent was specified in only 143 of the IMC (28.3% of cases). In the study by Soumah et al [4], the type of weapon used appeared on 244 certificates (98%). The use

or attempted use of a sharp force or firearm is of paramount importance from a legal point of view. Sometimes it proves difficult to pronounce with the type of weapon, especially when the victim consults late or when there has been a surgical intervention that has modified the initial appearance of the lesions.

The doctor assigned a total temporary disability in 462 certificates (91.3% of cases). TTD wasn't mentioned in 8.7% of the cases. This can be explained by can explained by a lack of understanding of the notion of TTD in its criminal sense. Treating doctors often assess the duration of time required for stabilization of injuries, rather than evaluating the TTD which is defined as the time during which the victim is incapacitated and cannot perform the acts of everyday life [4]. Currently, there is no objective scale for evaluating the TTD available to doctors who are required to write IMC. Despite the existence of recommendations from the High Health Authority (HHA) since 2011 [14], confusion continues to reign among doctors around the concept of total temporary disability. The TTD estimation must take into account the objective lesions (seat, nature and severity of the lesions), their functional impact and the duration of care needed[15].

RECOMMENDATIONS

The drafting of initial medical certificates is an act of daily practice.

Our study showed that the quality of writing the IMC suffered from several shortcomings. We therefore offer some recommendations in order to guarantee a better quality of writing:

- ✓ Provide continuing medical education about writing IMC
- ✓ Using the official model of the Ministry of Health is helpful. Indeed, this form avoids the omission of certain necessary elements that the doctor must mention. However, the current form requires some correction. It is considered necessary to:

•Add a section devoted to the patient's complaints

•Allocate more space for writing in order to allow the doctor to make a good description of the lesion and to mention the specialist opinions as well as the results of the complementary examinations carried out.

• Separate the duration of total temporary disability and the duration of work stoppage so that the patient understands that these two entities are different.

- ✓ Making an indicative scale of evaluating TTD.

CONCLUSION

According to our study the IMC is generally poorly and insufficiently written by the doctor. This can have serious medico-legal repercussions for both victim and doctor. Indeed, the victim may lose his rights to compensation and the doctor may be held medical liability. Therefore, we encourage doctors to know and

respect the writing rules of the IMC and this through continuing medical training.

Declaration of interest: none

REFERENCES

1. circulaire n°2000/72 du ministère de la Santé Publique Tunisie

2. République Tunisienne. Décret n°93-1155 du 17 mai 1993 portant code de déontologie médicale. Journal Officiel n° 40 des 28 mai et 1er juin 1993.

3. Pouillard DJ. LES CERTIFICATS MÉDICAUX. 2005;13.

4. Soumah MM, Ngwa HEE, Ndiaye M, Sow ML. Qualité des certificats de coups et blessures volontaires sur adultes à Dakar et Diourbel, Sénégal. Pan African Medical Journal. 2011;10.

5. Elleuch Z. EVALUATION MEDICO-LEGALE DES CERTIFICATS MEDICAUX INITIAUX POUR COUPS ET BLESSURES. Thèse en Médecine. Faculté de médecine de Sfax; 2017.

6. Décret n°93-1440 du 23 juin 1993, relative à la spécialisation en médicine et au statut juridique des résidents. Journal Officiel de la République Tunisienne , N°50. 06 juillet 1993: 941-3.

7. Circulaire n°1990/70 relatif à la perception d'honoraires pour le certificat médical descriptif

8. Doriat F, Peton P, Coudane H, Parant JM, Honore B. Evaluation de la qualité des Certificats Médicaux produits par les consultations Médico-judiciaires de Lorraine. Journal de médecine légale droit médical. 2003;46(7-8):511-6.

9. Welsch S. Responsabilité du médecin: risques et réalités judiciaires. Litec; 2003.

10. Code pénal Tunisien. Publication de l'imprimerie officielle de la république Tunisienne

11. Graser M, Manaouil C, Montpellier D, Loriau J, Jardé O. La normalisation des indemnisations en réparation du dommage corporel: barème, forfait ou indemnité en rapport avec le préjudice. Journal de médecine légale droit médical. 2004;47(1):64-8.

12. Chariot P, Dedouit F, Rey-Salmon C, Bourokba N, Rougé-Maillart C, Tournel G. Examen médical des personnes victimes de violence: fréquence des facteurs aggravants au sens du Code pénal, hétérogénéité des pratiques. La Presse Médicale. 2012;41(11):e553-8.

13. Lasseuguette K, LORIN DE LA GRANDMAISON G, Bourokba N, VENIEL D, DURIGON M. Intérêts et limites d'un barème indicatif de l'Incapacité Totale de Travail (ITT). Journal de médecine légale droit médical. 2004;47(4):123-8.

14. Zribi M, Amar WB, Feki N, Khemekhem Z, Hammami Z, Bardaa S, et al. EVALUATION DE L'INCAPACITE TOTALE TEMPORAIRE ET ETUDE DES CONSEQUENCES MEDICO-LEGALES: ACTIVITE DU SERVICE DE MEDECINE LEGALE DE SFAX EVALUATION OF TEMPORARY TOTAL INCAPACITY AND FORENSIC IMPACT. :6.

15. Bardaa S, Dhouib H, Karray N, Kammoun J, Hammami Z, Maatoug S. Intentional interpersonal violence: Epidemiological and analytical study about 973 cases at the forensic unit in Habib BOURGUIBA University Hospital in Sfax, Tunisia. Forensic Science International: Reports. déc 2020;2:100106.

Cade oil poisoning in pediatrics: about 12 cases

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Abstract

Traditional therapy is a practice that is attracting more and more people, thus reinforcing the crisis of confidence between patient and treatment.

In this context, we propose to study the Tunisian recourse to the use of a type of tar "cade oil" advised sometimes by charlatans by habits and beliefs.

The diagnoses retained in these patients in association with tar poisoning were acute dehydration and febrile gastroenteritis. No specific treatment or antidote for tar was administered. The evolution was favorable for ten patients and fatal for two children.

The use of cade oil is currently rapidly growing. Its irrational use leads to serious, even fatal adverse events as noted in the literature and observed in our study. Preventive measures are required, including awareness-raising action: information and communication, Scientific action

Health action Regulatory action Legal action

Keywords: Cadoil; Poisoning; Epidemiology; Emergency; Outcomes.

INTRODUCTION

One of the changes observed in recent decades in medical practice in Tunisia is the emergence of conduct not justified by science dictated sometimes by charlatans, sometimes by habits rooted in certain ethnic groups.

Grouped in the box of traditional therapy according to its members, and quackery according to science, these practices are attracting more and more people who prefer it to conventional treatments based on chemicals, thus reinforcing the crisis of confidence between patient and medical treatment which continues to grow (1).

Traditional therapy, as a solution to physical, mental or social health problems, is deepening more and more in Tunisian culture.

The danger is that these practices are shared between ancestral knowledge of medicinal herbs and quackery using methods and preparations to have potions and potentially toxic products.

One of the practices more and more observed in Tunisia is that of parental use of "cade oil" commonly called "camel soaps" "tars" or "القطران" to treat their children

It is not uncommon to receive patients who are victims of these practices in hospital. It is in this

context that we propose to study the Tunisian recourse to the use of a type of tar "cade oil" advised sometimes by charlatans sometimes by inherited habits and beliefs. We report the observations of patients suffering from tar poisoning, collected in the pediatrics, emergency and pediatric resuscitation department of the CHU Hédi-Chaker hospital in Sfax during the period from January 2011 to December 2018. It is a retrospective study and the data was collected and analyzed from the hospitalization records of the patients.

RESULTS

Over a 7-year study period, 12 cases were collected at a frequency of 1 to 2 cases each year. The average age was 14 months 20 days with a minimum age of one month and a maximum of 4 years. The distribution of patients by sex was 9 boys and 3 girls, a sex ratio of 3. Three children were of urban origin, or ¼. The remaining 9 patients were from rural areas of Sfax governorate in 5 cases. The socio-economic level was average for all patients.

Two modes of administration have been observed: Inhalation and the transcutaneous route. These two modes in combination were observed in 4 children. Scarification followed by cutaneous application of tar was present in only one case. According to the parents, they used tar to regulate transit and for antipyretic purposes for all of the patients. An analgesic goal has been reported in only one patient. The treatment time was on average 22:43 minutes with extremes of 4 hours to 3 days. Six patients consulted the emergency room within 24 hours.

A chart of gastroenteritis including diarrhea, vomiting and fever was the reason for consultation in the most frequent emergency room (6 patients).

Neurological manifestations were present in 9 patients (such as

drowsiness, nystagmus, axial hypotonia, asthenia, listlessness).

Signs of dehydration (tachycardia, dry mucous membranes, depressed fontanelles, skin fold) were present in 7 patients.

Signs of impaired respiratory mechanics (snoring groans, crackling signs of respiratory struggles) have been described in 5 patients.

The tar was applied in several places for the same patient. The parents applied tar to the ear lobule, all around the nostrils, the forehead, the chest and all 4 limbs. Scarification lesions in the trunk and the 4 limbs have been described in one patient.

For biological abnormalities, biological inflammatory syndrome (in 7 patients) as well as metabolic acidosis (in 5 patients) were noted . Amino acid chromatography (CAA) was done for a single patient and was normal.

The chest X-ray was done in all the patients and was normal in 10 patients.

Only one patient presented with a pulmonary focus and another presented with bronchial syndrome. The brain scan was performed on 3 patients.

A medium abundance subarachnoid hemorrhage was observed in one patient.

In another patient, a hypo dense appearance of the caudate nuclei and the lenticular nuclei was noted and for the third patient, the CT scan was normal. Brain MRI was done for a single patient, showing the presence of Lactates in spectrometry with an appearance suggestive of a toxic or metabolic origin.
The diagnoses retained of these patients in association with tar poisoning are detailed in Table 1.

Table 1: Diagnosed syndromes

diagnoses retained	Number of patients
Acute dehydration stage 1	**2** patients
Acute dehydration stage 2	**2** patients
Acute dehydration stage 3	**2** patients
Febrile gastroenteritis	**4** patients
Asthma attack	**1** patient
Febrile gastroenteritis+ altered state of consciousness	**1** patient

All patients received intravenous hydration. Antibiotic therapy was given for 4 patients due to the presence of an infectious focus and a biological inflammatory syndrome. No specific treatment or antidote for tar was administered. The evolution was favorable for 10 patients who were put out. Two patients had an enameled course of complications such as hemodynamic instability and a state of epilepticus and died.

DISCUSSION

Tar is defined by its method of preparation. In fact, they are obtained from fuels brought to high temperatures. Hence there are several types of fuel such as plants (pine, cedar, cade, ...), coal or shale.

The tars are divided into 3 groups:

• wood tars (pine tar, cedar oil, cade oil, etc.).

• fossiliferous tars (coal tar).

• sedimentary tars (shale combustion for example ...)

When combustion takes place at high temperature, several gases are produced with a dark, insoluble liquid which overcomes water. This is what is known as tar, it has a brown color, a high density and a strong aromatic odor (2). The tars differ from each other by their compositions, their methods of production and the degree of purity [2]. In our study, we are going to focus on cade tar, the essential and main composition of which is cade oils with other compositions that are being researched. This

product is widely used by parents in pediatric settings as part of traditional medicine.

Figure 1: Commercialized cade

This type of tar is produced locally by herbalists and sold in several commercial spaces, especially in downtown Sfax (Sfax medina, rue SIDI BELHSAN).

Cade oil, which is the basis of the composition of cade tar, is a viscous liquid extracted from the wood of the juniper oxycèdre "Juniperus oxycedrus". (Figure 2)

It is a liquid rich in aromatic molecules, dark brown in color [3,4] (Table 2).

Table 2: physical characteristics [3-4]

Features	Specifications
Appearance	Oily Liquid
Color	Dark brown
smell	Smoke
Boiling point	184 ° C at 760 mmHg
Solubility in water	Very slightly soluble
Solubility in ethanol	Partially soluble

Our cade tar, which we are going to talk about, is blackish in color and has an intense smell.

Its clientele appears to be very diverse and includes all levels of the population, whether rural or urban. Consumers are found especially in traditional and conservative cultural circles, loyal to folk medicine and all those who cannot access modern care which agrees with our series, 3/4 of the patients were of rural origin

Figure 2: Juniperus oxycedrus branch [1]

The chemical composition of cade oil is a bit complex. Indeed, it is a complex resin, having in its composition several substances. This complexity is partly due to its own composition and partly to its extraction protocol [5].

It is a product of heterogeneous composition. Its formula is variable, depending on the raw materials, regions, climates and extraction processes.

The characteristic constituents are cadinene (which is a hydrocarbon) and cadinol (which is an alcohol).

Cade oil also contains:

- cyclic and polycyclic hydrocarbons: benzene, toluene, naphthalene, methyl-naphthalenes, and phenanthrene.

- phenols including guaiacol, cresol and resorcinol [4].

From these components follow the clinical features and the objectives of use of this type of tar. Cade oil was widely used in human medicine.

Cade tar is considered an external remedy, it has several therapeutic actions:

- it has long been used to treat scabies in sheep and goats. [4-6]

- in cosmetology, cade tar is used in shampoo for dandruff care, scaly conditions, itchy scalp, and milk crusts [4]

- it is also considered as a treatment applied against psoriasis. [7]

- in veterinary medicine, until the 19th century, cade tar was used as a treatment against ringworms and eczema of animals. It has also been used to heal cracks in horses' hooves. [6-8]

- currently, it is used in the treatment of parasitic infections, by application every 48 hours on sick areas. Cade tar, and especially thanks to its major constituent, cade oil, acts quickly and effectively in the treatment of rebellious dermatoses and various scaly conditions. It seems to have an effect on ulcers and torpid lesions ["static" lesions] by applying a light film of oil. [8-9-10]. the association of cade oil with olive oil [0.25 to 0.5 g of cade oil in a spoon of olive oil] could be effective as an anthelmintic against intestinal worms. Diluted cade oil would cure chronic rhinitis and coryzas. [10]

- this oil would also have a repellent effect against various insects, which would be beneficial to humans, since there are several diseases transmitted via them. This action could in particular be taken advantage of in the pricking of hens as well as in the treatment of plants in order to protect them against various animal aggressions. [8]

In various ancient beliefs and traditions, it was believed that cade oil could help ward off illnesses, depressing emotions, negative thoughts and also harmful spirits [13].

Grandmothers were very familiar with cade oil [13]. In our study, for example, grandmothers were prescribers of cade oil in 5 of the 12 cases collected.

Cade tar toxicity : The toxicity of any composition is first determined by the relative toxicities of its various constituents. But interactions, either of synergy or antagonism should not be overlooked [11]

Cade oil has in its composition various classes of substances with proven toxicity [9-11] (Table 3). The Phenols and sesquiterpene alcohol toxicity which is an important components of cade oil has different toxic effects such as [9-11]: irritating to the mucous membranes and respiratory tract; has a lethal dose from 0.043g / kg. toxic to all cells; corrosive to the skin and mucous membranes; renal involvement and necrosis of the liver; eye irritation; hemorrhage of the pleura and pericardium; splenomegaly; methemoglobinemia. In our series, the observed neurological signs ere apathy, asthenia, clouding.

Table 3: Cade oil toxicity [9-11]

Hydrocarbons	Toxic effect
Cadinene	- hepatocellular necrosis. - dilation of the bile ducts. - disruption of liver enzymes.
Benzene	carcinogenic and very toxic aromatic hydrocarbon. -causes respiratory disorders. -paralysis. -anemia
Toluene	toxic of the central nervous system. - chronic exposure causes neurological disorders, mental confusion, memory loss, headache. - responsible for hematological damage
Naphthalene	lesions of the respiratory system. - formation of tumors of the upper respiratory tract.

One patient had epilepsy and one had a change in consciousness in another.

These neurological signs were caused according to the above tables to the various components of cade oil such as hydrocarbons.

The respiratory signs and hemodynamic signs found have been linked to causative diseases. However, these deductions are always limited, since the blood tests for these materials were not carried out on the one hand, on the other hand the

symptoms can be correlated with the initial disease.

In this context, we can report from the literature two cases of poisoning with cade oil: - a 40-day-old newborn who was treated by skin application with cade oil, for seborrheic dermatitis, manifested an hour and a half later, a convulsion accompanied by a hypotonic coma and dyspnea. [12]; - a 30-year-old woman who, after having drunk half a glass of cade oil, to treat headache, had epi gastralgia associated with headache, low blood pressure and respiratory distress. [12]

this intoxication is so unknown that no cases of such poisoning have been found in the literature.

The mode of administration

Cade tar is known, above all, for dermatological conditions. For this, the most recognized and recommended mode of administration by herbalists is the skin mode.

Indeed, the application of cade oil on the skin has no immediate effect, even at a high concentration, only heat is felt at the time of application.

But it has a particular way of acting, these properties do not appear at the time of application. After a certain time after application, the penetration of the active ingredient into the seed coat becomes possible [7].

In our series, dermal application was the most frequent mode of administration, associated with inhalation by application of cade tar all around the nostrils. As the response time was relatively short and the contact surface area was limited, the clinical signs associated with tar poisoning were absent.

On the other hand, only one case had a wide cutaneous application including the trunk and the 4 limbs on lesions of scarification, with a rather prolonged time of assumption of responsibility (24 hours). The clinical picture was severely severe with a fatal outcome. We can deduct from these observations that there are several factors that determine the severity of the clinical picture, we cite above all: the extent of the application, the presence or absence of scarifications and the treatment time.

CONCLUSION

The application of cade tar was formerly rarely seen but it is still encountered especially in rural areas, where old beliefs and quackery dominate. From these observations, we were able to extract some epidemiological, clinical and progressive characteristics of tar poisoning which were in most cases of favorable evolution but sometimes the evolution was fatal. From this work, we can pay attention to the education of parents and the awareness of practices whose results we do not know. Parents should be made aware of the dangers involved by using products and applications of which the components are unknown, or the components are being researched. These means of education must be present in district hospitals, educational establishments and the media, which must play an important role in raising awareness of these habits in order to prevent a health risk or even human catastrophes.

REFERENCES:

1. Bouyahmed S. et Ibelaiden N. Caractérisation morphologique et biochimique de l ' espèce Juniperus oxycedrus et essai de la toxicité de ses extraits sur les vers de terre. Mémoire de fin de cycle. Algérie. Université A. Mira - Bejaïa. 2017.
2. livre DORVAULT F, l'officine, 23 éme édition, Evreux.
3. Burri, S. (2010). Production et commerce de la poix et de l'huile de cade en basse Provence au Moyen Âge. anthropobotanica. pp 12-14.
4. Belliot, A. (2007). huile de cade, goudron de houille, ichtyol: utilisations dermatologiques et cosmétologiques. Thèse de doctorat. Université de Nantes. pp 16-32.
5. Dellys M. Prospection du pouvoir antiseptique de l'huile de cade: Tests sur germes pathogènes. Mémoire de Master en pharmacologie moléculaire. Algérie, Université Abderrahmen Mira-Bejaia Faculté des Sciences de la Nature et de la Vie Département de Biologie Physico-chimique. 2012.
6. Lebas, J.PH. (1823). pharmacie vétérinaire, chimique, théorique et pratique à l'usage des élèves, des artistes et des propriétaires. paris : Errata. 259p.
7. Dechambre, A. (1870). Dictionnaire encyclopédique des sciences médicales. Harvard: Asselin. pp 431-447.
8. Poudret, C. (1985). Sur la composition des essences de Genévrier commun, de l'Oxycèdre et du goudron de Cade. these de doctorat. Faculté de Pharmacie de Marseille. 30p.
9. Bouchardat, A. (1848). Répertoire de pharmacie. Paris : Germer balliere. 16p.
10. Bardeau, F. (2009). les huiles essentielles. Paris: Fernand Lanore. 95p.
11. Saviuc, P. (2008). Bulletin de la Société de Toxicologie Clinique. Grenoble: Infotox international. 2p.
12. Saviuc, P. (2012). Bulletin de la Société de Toxicologie Clinique. Grenoble:Infotox international. 5p.
13. CampionnièreL.Journal de médecine et de chirurgie pratiques: à l ' usage des médecins praticiens. 4ème édition Française. Paris. 1891.
14. Cioanca O, Hancianu M, Mihasan M, Hritcu L. Anti-acetylcholinesterase and Antioxidant Activities of Inhaled Juniper Oil on Amyloid Beta (1‑42)- Induced Oxidative Stress in the Rat Hippocampus. NeurochemRes. Mai 2015;40(5):952-60.
15. Mazari K. Etude phytochimique et pouvoir antimirobien de Juniperus phoenicea L., Juniperus oxycedrus L. et Cupressus sempervirens L. de la région de Tlemcen. Doctoral disseratation. Tlemcen. 2009.

Kahler's disease revealed by acute pancreatitis: A case report

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Abstract

Background: The circumstances of the discovery of Kahler's disease are multiple but acute pancreatitis has rarely been described as a pathology revealing this disease. **Case report:** We report the case of a patient who presented with acute pancreatitis, revealing Kahler's disease. **Conclusion:** Kahler's disease is rarely manifested as acute pancreatitis, hence the importance of complementary examinations in this case, especially when no one of its common etiological factors is found and when other nonspecific signs are present.

Key words: Acute Pancreatitis; Kahler's Disease; Hypercalcemia

INTRODUCTION

Kahler's disease or multiple myeloma is a malignant medullary proliferation of plasma cells secreting a monoclonal immunoglobulin. This is the second most common hematological disorder (10%) after non-Hodgkin's lymphoma.

The circumstances of the discovery of Kahler's disease are multiple. Rheumatologic manifestations are the most frequent due to tumor infiltration of bone tissue. Nevertheless, pancreatitis has rarely been described as a pathology revealing this disease.

We report the case of a patient who presented with acute pancreatitis, revealing Kahler's disease.

CASE REPORT

A 58-year-old patient without a past medical history was admitted at the emergency department for an altered conscious state which appeared a week previously and which was accompanied by cough and vomiting. At the examination, the respiratory rate was 24 cpm, and the peripheral oxygen saturation at the ambient air was 88%. The pulmonary auscultation objective crackles on the right pulmonary base. The blood pressure was 100/60 mmHg, the heart rate was 100 bpm. The Glasgow scale was 14 with agitation. The abdomen examination revealed a tender but soft abdomen in all areas. The capillary blood glucose was amounted to 1.19 g/L. The patient was febrile with a temperature amounted to 38.2°C. The chest X-ray showed a right basal alveolar syndrome (Figure 1).

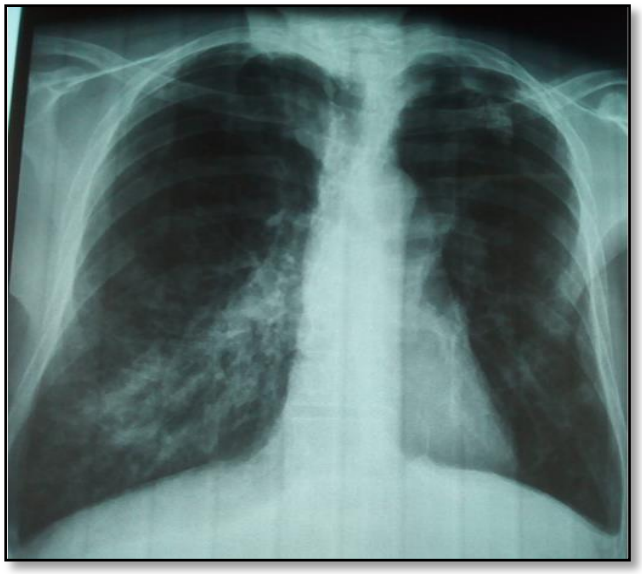

Figure 1: The chest X-ray showing the right basal pneumonia

The cerebral CT-scan showed a heterogenous aspect of the bone structure with no other abnormalities. The Blood tests showed: Leucocytes=16930/mm3, Hb=8.1 g/dL, Platelets=389000/mm3, Creatinine=658 µmol/L, Direct Bilirubin=7.9 umol/L, AST=61 UI/L, ALT=27 UI/L, Lipase level >1200 UI/L.

The abdominal ultrasound examination showed a hyperechogenic appearance of the renal cortex. The diagnosis of pulmonary sepsis associated with acute pancreatitis has been made and adequate treatment was performed. Twenty-four hours later, the patient had a persistent altered conscious state and renal function. A second cerebral CT-scan was then achieved and showed the presence of limited gaps of non-specific appearance in the bone structure of the head. The serum calcium concentration was then measured and its level was 4.07 mmol/L.

The diagnosis of acute pancreatitis due to hypercalcemia was then established. A crane radio was performed. It showed multiple geodes combined with demineralization suggestive of Kahler's disease (Figure 2).

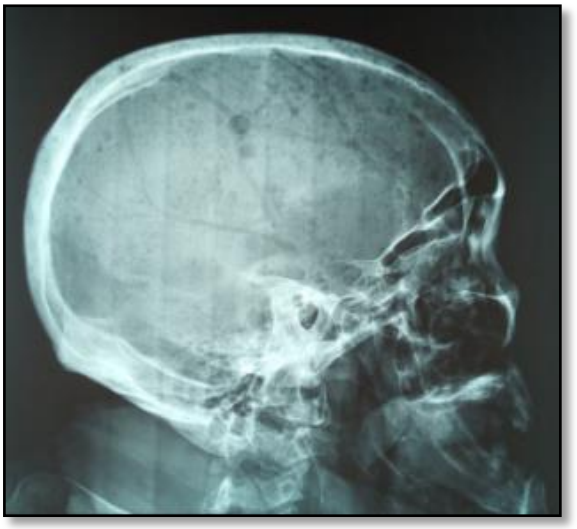

Figure 2: The crane radio showing the holes consecutive to bone destruction

The medical team decided to expand the patient's water intake to 6L/24h and to administer corticoids and diuretics.

The consciousness state of the patient has normalized in parallel with the calcium blood level normalization. The patient was then addressed to the hematology consultation for further explorations to confirm the diagnosis

Thereafter, a serum protein electrophoresis was performed and revealed a marked gamma globulin spike (Figure 3).

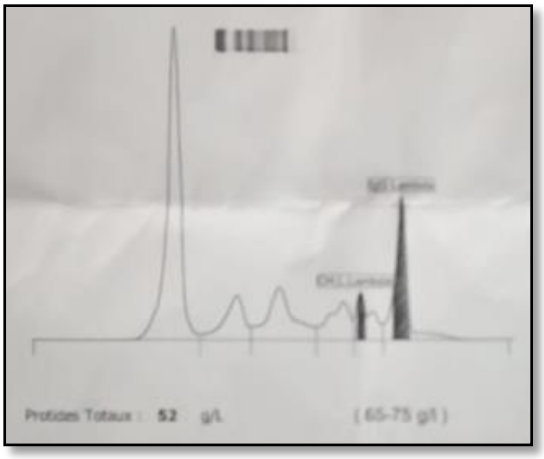

Figure 3: The serum protein electrophoresis revealing a marked gamma globulin spike

Immunofixation of serum proteins was also achieved showing a peak of Lambda light chains associated with an IgG Lambda monoclonal peak.

The immunofixation of urinary proteins revealed proteinuria with the presence of a peak of Lambda light chains.

The patient was hospitalized in the hematology department and he had a good outcome.

DISCUSSION

The common etiological factors of acute pancreatitis are alcohol, gallstone disease, drugs, trauma, viral infection, and hyperlipidemia, but those etiologies are not always identified, and acute pancreatitis is often classified as idiopathic.

Thus, hypercalcemia must be systematically sought in the presence of acute pancreatitis, when there is no obvious cause.

The presentation of multiple myeloma as acute pancreatitis is rarely reported in the literature [1-2].

Multiple myeloma is a complex disorder that causes a multitude of clinical symptoms and signs mediated through a variety of mechanisms.

It is a cancer of the plasma cells in which abnormal plasma cells multiply uncontrollably in the bone marrow, and sometimes in other parts of the body.

It usually evolves from an asymptomatic premalignant stage of clonal plasma cell proliferation termed “monoclonal gammopathy of undetermined significance” (MGUS) [3].

MGUS is present in more than 3% of the population above the age of 50 years and progresses to myeloma or related malignancy at a rate of 1% per year.

The cause of multiple myeloma is unknown. However, there are no known risk factors for multiple myeloma. Researchers suggest that genetic abnormalities, such as c-Myc genes or environmental exposures, may play a role.

The most frequent symptoms of multiple myeloma are bone pains and weakness [3]. Its manifestations are summarized by the "CRAB symptoms": hypercalcemia, Renal failure, Anemia, and Bone lesions. Hypercalcemia is related to osteolysis phenomena [4].

Increased infection susceptibility is also one of the features of this disease [5].

The multiple myeloma is diagnosed with serum or urine protein electrophoresis or immunofixation and bone marrow aspirate analysis.

Skeletal radiographs are important in staging multiple myeloma and revealing lytic lesions, vertebral compression fractures, and osteoporosis.

Magnetic resonance imaging and positron emission tomography or computed tomography were emerging as useful tools in the evaluation of patients with myeloma [6].

Multiple myeloma is considered treatable, but generally incurable. Remissions may be brought about with steroids, chemotherapy, targeted therapy, and transplants. Bisphosphonates and radiation therapy are sometimes used to reduce pain from bone lesions [6-7].

Five-year survival rates approach 33 percent, and the median survival rate is 33 months [6].

In the case of our patient, the diagnosis of Kahler's disease was suspected based on biological and radiologic findings. Once the diagnosis was made, we were able to link each of the unexplained patient's disorders to one of the mechanisms of this disease, such as his confusion, his pneumonia, his renal failure, his anemia, and especially his acute pancreatitis. Hence the originality of our case where the initial clinical presentation of Kahler's disease was atypical and included all of the signs which was rarely described in the literature.

CONCLUSION:

Patients with Kahler's disease have hypercalcemia, but it's rarely manifested as acute pancreatitis. Hence the importance of complementary examinations in case of acute pancreatitis, especially when no one of its common etiological factors is found and when other non specific signs are present.

References

1. *Mishra SB, Azim A, Mukherjee A. Multiple myeloma presenting as acute pancreatitis. Am J Emerg Med. sept 2017;35(9):1385.e1-1385.e2*
2. *Souiki T, Soumeila I. [Acute pancreatitis: a rare mode of revelation of multiple myeloma]. Pan Afr Med J. 2014;17:313*
3. *Kyle RA. Clinical aspects of multiple myeloma and related disorders including amyloidosis. Pathol Biol. févr 1999;47(2):148-57*
4. *Yassine I, Rchachi M, Ouahabi HE, Ajdi F. Les hypercalcémies malignes : à propos de 5 cas. Annales d'Endocrinologie. Septembre 2015;Volume 76, n° 4, pages 480-481*
5. *Kyle RA. Diagnostic criteria of multiple myeloma. Hematol Oncol Clin North Am. avr 1992;6(2):347-58*
6. *Nau KC, Lewis WD. Multiple myeloma: diagnosis and treatment. Am Fam Physician. 1 oct 2008;78(7):853-9*
7. *Dieleman FJ, Dekker AW. [Kahler's disease. Multiple myeloma]. Ned Tijdschr Tandheelkd. mai 2007;114(5):228-30*

A total volvulus of the small intestine on malrotation in adults: A case report.

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INTRODUCTION

Total small-intestinal volvulus on malrotation (TSIVM) classically presents in the neonatal period; it occurs much less frequently in adult age and is often misdiagnosed. Its prognosis is directly related to the risk of ischemia [1]. It is estimated that the prevalence of these congenital malformations in adulthood is in the range of 0.2% and 0.5% [2]. The diagnostic circumstances of this pathology may be an acute bowel obstruction syndrome or a circulatory shock [1]. We report a case of a total volvulus of the small intestine on malrotation in adult diagnosed in the emergency department of the university hospital center Farhat Hached Sousse.

CASE PRESENTATION

A 38-year-old woman presented with acute abdominal pain and an occlusive syndrome evolving 24hours before admission in a context of apyrexia and an altered general state. Physical examination on admission revealed an abdominal bloating and signs of circulatory shock: blood pressure=80/40mmHg, heart rate=140 beats per minute, hypothermia at 36°C and a Glasgow Coma Score at 14. Routine laboratory analysis revealed elevated inflammatory markers. The patient required admission in a resuscitation unit (monitoring, oxygen therapy, central venous catheter, gastric and urinary catheter).The patient was oligo anuric and required fast vascular filling (physiological serum at 20ml/kg) and inotropic medication (Noradrenalin 3mg/h on the electric syringe pump).The patient was stabilized and an abdominal computerized scan with contrast was performed and showed a whirl sign on the first jejuna loop (fig. 1). The diagnosis of occlusion on incomplete mesentery was confirmed and the patient was admitted urgently to the operating room under antibiotic coverage based on Ceftriaxone and Metronidazole. Surgical exploration found signs of suffering on all the transverse small intestine. The patient underwent a total resection of the small intestine with jejunocolic anastomosis. She developed a short bowel syndrome and required parenteral nutrition.

DISCUSSION

Intestinal malrotation results from failure of normal rotation and mesenteric fixation of the gut during embryonic development. A lack of normal peritoneal attachment or a narrow mesenteric base can create abnormal mobility of the midgut, easily leading possibly to volvulus The incidence rate of malrotation is highly variable depending on whether thedata are clinical or from autopsies, but it is estimated that it represents thecause of about 3-5% of cases of mechanical obstructions and 5% of cases of appendicitisand appears in 0.5% of radiological digestive series [2]. Studieson the incidence of malrotation in mixed populations show the influence of ethnicfactors, radioactive or toxic substances and low birth weight, but not of sex or numberof siblings [2]. The incidence of TSIVM is 0.5-1 per 10000 births [3]. TSIVM occursduring the first month of

life in 80% of cases [4]. In olderchildren, malrotation is much less commonly diagnosed andis complicated with total small intestine volvulus in only athird of cases [5]. In adults, TSIVM is very rare but the increased recognition of intestinal malrotation in adults may be explained by the more frequent use of abdominal CT-scan and the refinements of the methods that visualize more correctly the variations in the abdominal anatomy [6-8].intestine malrotation in adults has multiple presentations and the symptoms are non-specific. The clinical diagnosis in adolescents and adults is difficult because it is rarely suspected on clinical grounds [7].The clinical symptoms of malrotation are less specific in adults than in children [1,7]. Thus, in infants under one year, total small intestine volvulus is the most common clinical manifestation, with a clinical presentation of proximal obstruction dominated by early bilious vomiting. However, in adults, TSIVM is less often associated with complications, and more commonly presents with isolated recurrent abdominal pain or combined with other signs such as frequent diarrhea, abdominal bloating, early satiety, food intolerance, upper or lower gastrointestinal bleeding, constipation, etc. [9]. Some patients may even carry diagnosticlabels of functional or psychosomatic pain [10, 11].Patients may havebeen treated elsewhere for othermisdiagnoses such astuberculous peritonitis, acute pancreatitis, or severe gastro-esophageal reflux [12].The majority of adults with congenital intestinal malrotation and volvulus have acute abdominal symptoms and even intestinal strangulation and necrosis [11].Imaging examinations such CT and colour ultrasonography play an important role in the diagnosis of adult congenital intestinal malrotation. Small bowel follow-through is often enough to recognize the type of malrotation, but multimodal imaging offers a better definition of this abnormality. For some conditions, such as this, in which the transverse colon has a posterior location behind the superior mesenteric artery, CT can help to define the type of malrotation by adding additional anatomical information [13].The main specific sign for TSIVM on CT is the ‘‘whirl-wind’’ sign, corresponding to winding of the superior mesenteric vein around the superior mesenteric artery [14].Many authors advocate surgical correction of malrotation due to the difficulty in predicting who will be victim of torsion of the intestine, bringing an urgent, life-threatening condition in the future. So, in case of TSIVM, surgery is indicated in extreme urgency [6, 15]. the need for an emergency operation because of the possibility that there may be massive necrosis of the intestine. The success of surgical treatment lies in judging the rotation form and degree and the correct knowledge of rotation form is the premise of successful lysis and reduction. Other critical aspect is complete lysis of the Ladd’s band, which removes the membranaceous adhesion of peritoneal bands and upper jejunum pressing the duodenum. All surgical procedures should be carefully performed. During lysis, the superior mesenteric vein and artery should be paid

special attention to prevent any damage. In some patients, rotation leads to compression and deformation of the superior mesentery vein, which is often erroneously identified as adhered bands. The vein damage induces the intestine resection will result in short bowel syndrome. The appendix is also resected during surgery to avoid delayed diagnosis due to positional variation of cecum [11].The majority of adult congenital intestine volvulus has a good prognosis. Only those with extensive bowel necrosis have to receive surgical resection [11].

CONCLUSION

Adult congenital midgut volvulus is often manifested with symptoms related to intestinal obstruction. To Some patients it's complicated in malnutrition and intestinal necrosis; if required, surgery should be conducted in an early stage, including intestine volvulus reduction, Ladd's band loosening and appendectomy. The outcomes of these surgical procedures are favorable. Color ultrasonography and CT scan are helpful for preoperative diagnosis and positional crossing and whirlpool volvulus of superior mesenteric vein and artery are the characteristic manifestations of congenital mid gut malrotation. A surgeon's ignorance of this diagnosis can result in potentially fatal extensive small intestinal necrosis or result in short bowel syndrome.

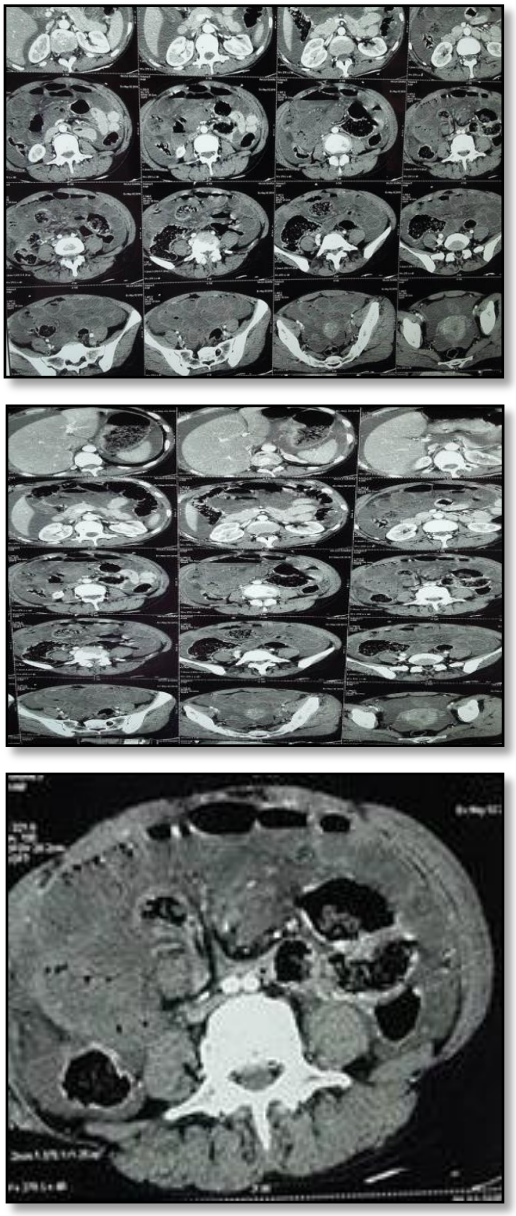

Figure 1. CT showing the ''whirl'' sign.

REFERENCES

1. Kotobi H, Tan V, Lefèvre J, Duramé F, Audry G, Parc Y. Total midgut volvulus in adults with intestinal malrotation. Report of eleven patients. J Visc Surg. 2017;154(3):175-183.

2. Penco JM, Murillo JC, Hernández A, De La Calle Pato U, Masjoan DF, Aceituno FR. Anomalies of intestinal rotation and fixation: consequences of late diagnosis beyond two years of age. Pediatr Surg Int. 2007;23(8):723-30.

3. Peycelon M, Kotobi H. Complications des anomalies embryologiques de la rotation intestinale: prise en charge chez l'adulte. EMC Techniques Chirurgicales - Appareil Digestif 2012;7:1-12.

4. Stewart DR, Colodny AL, Daggett WC. Malrotation of the bowel in infants and children: a 15 year review. Surgery. 1976;79(6):716-20.

5. Malek MM, Burd RS. Surgical treatment of malrotation after infancy: a population-based study. J Pediatr Surg. 2005;40(1):285-9.

6. Husberg B, Salehi K, Peters T, Gunnarsson U, Michanek M, Nordenskjöld A, et al. Congenital intestinal malrotation in adolescent and adult patients: a 12-year clinical and radiological survey. Springerplus. 2016;5:245.

7. Emanuwa OF, Ayantunde AA, Davies TW. Midgut malrotation first presenting as acute bowel obstruction in adulthood: a case report and literature review. World J Emerg Surg. 2011;6(1):22.

8. Pickhardt PJ, Bhalla S. Intestinal malrotation in adolescents and adults: spectrum of clinical and imaging features. AJR Am J Roentgenol. 2002;179(6):1429-35.

9. Nehra D, Goldstein AM. Intestinal malrotation: varied clinical presentation from infancy through adulthood. Surgery. 2011;149(3):386-93.

10. Durkin ET, Lund DP, Shaaban AF, Schurr MJ, Weber SM. Age-related differences in diagnosis and morbidity of intestinal malrotation. J Am Coll Surg. 2008;206(4):658-63.

11. Zheng ZH, Huang JL, Wei HB, Liu JP, Huang Y. Adult congenital intestinal malrotation accompanied by midgut volvulus: report of eight cases. Int J Clin Exp Med. 2014;7(6):1614-8.

12. Nagdeve NG, Qureshi AM, Bhingare PD, Shinde SK. Malrotation beyond infancy. J Pediatr Surg. 2012;47(11):2026-32.

13. Mancuso A, Milia AF, Manetti M, Ruffo M, Pantalone D, Capaccioli L, et al. Multimodal imaging in the diagnosis and evaluation of intestinal malrotations in adults: a case report. Ital J Anat Embryol. 2014;119(3):214-8.

14. Fisher JK. Computed tomographic diagnosis of volvulus in intestinal malrotation. Radiology. 1981;140(1):145-6.

15. Haak BW, Bodewitz ST, Kuijper CF, de Widt-Levert LM. Intestinal malrotation and volvulus in adult life. Int J Surg Case Rep. 2014;5(5):259-61.

Neurologic Manifestations of Infective Endocarditis.

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Abstract

Infective endocarditis (IE) is a life-threatening condition often manifesting as a multisystem disease.The clinical presentations are heterogeneous making the diagnosis sometimes difficult. We report the case of a 59-year -old presented to the emergency department with acute abdominal pain . He described his pain as severe, without exacerbating or relieving factors, and associated with one episode of non bloody, non bilious vomiting. On physical examination: respiratory hemodynamic and neurological state were stable , and the temperature was 39, diffuse abdominal pain especially the epigastric area. initial laboratory tests showed white blood cells count at 12700, no liver or pancreatic dysfunction, hypokalemia at 3,4 and no further metabolic dysfunction. Urin analysis showed 230 leukocytes per µL with negative culture. Peritonitis was suspected. An abdominal computed tomography (CT) with contrast ruled out this diagnosis. The evolution was marked by the deterioration of his neurological state with Glasgow Coma scale of 12 without focal neurologic deficits or clinical meningeal syndrome. We performed a cerebral scan without contrast that showed no stroke or recent trauma. Blood testing for drugs was negative . A lumber puncture was realized; leukocytes <1, no hyperproteinorrachie and a normal glucose ration. MRI with contrast was also negative excluding maxillary sinusitis. Three days after; the state of consciousness has deteriorated; a cerebral computed tomography (CT) with contrast showed no specific lesions. Second cerebral MRI confirmed the presence of rhombencephalitis with bithalamic involvement. We suspected infective encephalitis and realized a Second lumber punction which was negative. PCR herpes, Serology for HIV, hepatitis B virus, hepatitis C virus, enterovirus, West Nile virus and listeria were negative. Drug-induced encephalitis was suspected; toxicological blood test was negative. Third cerebral MRI showed multiple vascular ischemic stroke. In this context, endocarditis was suspected. Transoesophageal echocardiography (TOE) was realized confirming the diagnosis and the abdominal pain was explained by to mesenteric ischemia.

INTRODUCTION

Infective endocarditis (IE) is an infection of the endocardial surface of the heart which may include one or more heart valves, the mural endocardium, or a septal defect. Its intracardiac effects include severe valvular insufficiency, which may lead to intractable. congestive heart failure and myocardial abscesses. It is a life-threatening condition often manifesting as a multisystem disease. Diagnosis is often challenging due to its heterogeneous features and is often delayed due to the non-specific nature of its presentations.

CASE PRESENTATION

A 59-year -old male from a nursing home presented to the emergency department with acute abdominal pain over the past few hours. The patient described his pain as severe, without exacerbating or relieving factors, and associated with one episode of non bloody, non bilious vomiting. He has no past medical history. He was a lifelong nonsmoker, non alcoholic. On physical examination; slight dyspnea, pulsed oxygen saturation was 99 %,hemodynamic state was correct, conscious patient, pinpoint pupils, and the temperature was 39, diffuse abdominal pain especially the epigastric area. However, these physical findings did not correlate with his abdominal pain which he described as severe. Thus, he had received morphine injection. Initial laboratory tests showed white blood cells count at 12700, no liver or pancreatic dysfunction, hypokalemia at 3,4,and no further metabolic dysfunction. Urinanalysis showed 230 leukocytes per µL with negative culture.Peritonitis was suspected. An abdominal computed tomography (CT) withcontrast ruled out this diagnosis. Meanwhile, the patient's clinical condition deteriorated; his state of consciousness was altered with Glasgow Coma scale at 12 without focal neurologic deficits or clinical meningeal syndrome. We performed a cerebral scanwithout contrast that showed no stroke or recent trauma. Blood testing for drugs was negative .A lumber puncture was realized; leukocytes <1, no hyperproteinorrachie and a normal glucose ration. We persued the investigations with cerebral MRI with contrast which was also negative excluding maxillary sinusitis.Three days after; the state of consciousness has deteriorated; a cerebral computed tomography (CT)with contrast showed no specific lesions. Second cerebral MRI confirmed the presence of rhombencephalitis with bithalamic involvement. We suspected infective encephalitis and realized a Second lumber punction which was negative. PCR herpes, Serology for HIV, hepatitis B virus, hepatitis C virus, enterovirus, West Nile virus and listeria were negative. Drug-induced encephalitis was suspected; toxicological blood test was negative. Third cerebral MRI showed multiple vascular ischemic stroke. In this context, echo-doppler of the supra aortic vessels was realized for suspicion of thrombosis and was normal. An endocarditis was suspected transthoracic echocardiography TTE performed the same day didn't objectify vegetations or valvulopathy neither left auricular / ventricular thrombus and no dilatation of left auricular. That's why transoesophageal echocardiography (TOE)was realized showing interauricules septum anevrysm of 14 mm and mitral valve leak that could explain the origin of the stroke, abdominal pain due probably to mesenteric ischemia . The clinical diagnostic threshold for possible infective endocarditis was reached using the modified Duke criteria with three minor criteria; fever at 39; metastatic embolisation (cerebral and abdominal infarcts) and positive echocardiography. Treatment was initiated with empiric antibiotic therapy for septic urines, zovirax for suspicion of encephalitis ; secondarily with curative treatment.

DISCUSSION

Infective endocarditis (IE) is a rare disease, but its impact is significant (1). It affects 3 to 10 per 100,000 per year in the population at large, and epidemiological studies suggest that the incidence is rising (2–3).Reaching a rapid and accurate diagnosis in cases of suspected IE is the challenge. Delayed diagnosis and initiation of therapy lead to complications and worse clinical outcomes (4–5).IE can present acutely or insidiously with non-specific systemic symptoms and/or variable organ pathologies due to complications of septic embolism, haematogenous seeding, immunological phenomena and, rarely, vasculitis, in addition to its cardiac manifestations. Clinical diagnosis is based on the Modified Duke's criteria: two positive blood cultures for a microorganism typical of IE (or two positivecultures drawn 12 h apart for other microorganisms consistent with IE or a single blood culture or serology consistent with Coxiella burnetti infection), together with evidence of endocardial involvement (2 major criteria). Alternatively , various minor criteria, of which 5, or 3 with 1 of the 2 major criteria, are considered diagnostic (6).There are a few concerns about the reliability of Duke's criteria. Failing to realize ablood culture due to initial lack of suspicion of Infectious Endocarditis, while giving empiric antibiotic therapy, may result in subsequent negative cultures after an organism has been isolated.. In this case that we report here, the initial presentation of acute abdominal pain in context of fever with good hemodynamic respiratory and neurological state did not raise the suspicion of endocarditis in the first instance. Echocardiography remains the cornerstone of imaging and is rapid, straightforward, and, in many cases, diagnostic (9). Transthoracic echocardiography (TTE) is the recommended initial modality of choice for both native valve infective endocarditis (NVE) and PVE (10). For suspected NVE, TTE has a sensitivity of 50% to 90% and a specificity of 90%. For suspected PVE, the sensitivity of TTE is lower, at 40% to 70%, et it provides value in assessment of ventricular size and function, hemodynamic severity of valve lesions, and in the diagnosis of anterior prosthetic aortic valve abscesses, which may be difficult to visualize on transesophageal echocardiography (TOE). TEE is indicated when TTE is positive or nondiagnostic, when complications are suspected, or when intracardiac device are present. For suspected NVE, TEE has a sensitivity of 90% to 100% and a specificity of 90% for detection of vegetations, and it is superior to TTE for detection of complications, such as perforations, abscesses, and fistulae (11, 12, 13). In PVE, a recent meta-analysis reported a sensitivity of only 86% (95% confidence interval [CI]: 77% to 92%) for TEE in making the diagnosis , and other imaging modalities are emerging to help make or exclude the diagnosis in cases TEE is non diagnostic. Even when abnormalities are detected, it can be difficult to differentiate nodules from small vegetations or distinguish signs of infection from post-operative change (1). The neurologic complications were classified into the following categories: (1) embolic brain infarction, (2) TIA, (3) cerebral hemorrhage, (4) meningitis, (5) brain abscess, (6) toxic encephalopathy, and (7) headache.

Neurological complications occur in 20–40% of cases and are the presenting features in approximately half of these patients with an embolic event as the most frequent manifestation 42%(2, 6, 14).The risk of stroke is highest at diagnosis and decreases rapidly after the initiation of antibiotic therapy. Although not explicitly recommended in the European Society of Cardiology previous guidelines which only stated that "systematic abdominal and cerebral CT scan may be helpful",[7] CT scan or MRI are common and now recommended diagnostic procedures in patients with IE, even in the absence of neurological symptoms. In the 2008 French survey on IE, (8) 70% of the patients with left-sided IE had a neuro imagingprocedures, of whom 65% hadi t in the absence of any neurological symptom. The aim of these systematic imaging procedures is to assess the existence of asymptomatic complications of IE, which may both support the diagnosis and modify the therapeutic strategy. The visualization of large vegetations often leads practitioners to perform such examinations. Morphine sulphate intoxication may be responsible for leuko encephalopathy which results in hyper intense T2 signals in the white matter of the semio vascular center, corpus callosum and cerebellum. Otherwise, in our patient the lesions are bithalamic and in the cerebellar peduncles.

CONCLUSION

In conclusion, neurologic manifestations of IE mainly occur before antibiotic treatment is began, thus reinforcing our belief that rapid diagnosis and initiation of antibiotic therapy may still be the most effective way to prevent neurologic complications. These data relate the importance of diagnostic alertness to the prognosis of patients with IE.

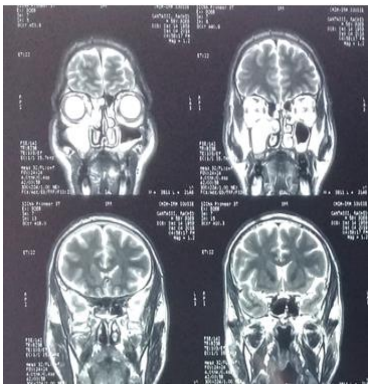

Figure n°1 : First cerebral MRI

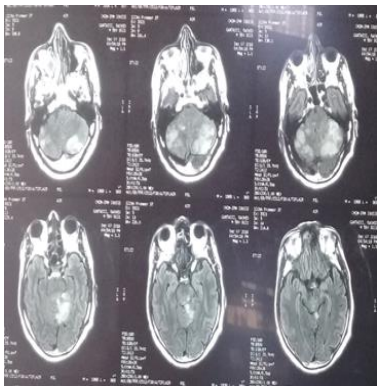

Figure n°2 : Third cerebral MRI

REFERENCES

1. Cahill TJ, Prendergast BD. Infective endocarditis. Lancet 2016;387:882–93.

2. Pant S, Patel NJ, Deshmukh A, et al. Trends in infective endocarditis incidence, microbiology, and valve replacement in the United States from 2000 to 2011. J Am CollCardiol 2015;65:2070–6.

3. Dayer MJ, Jones S, Prendergast B, et al. Incidence of infective endocarditis in England, 2000-13: a secular trend, interrupted time-series analysis. Lancet 2015;385:1219–28.

4. Dickerman SA, Abrutyn E, Barsic B, et al., ICE Investigators. The relationship between the initiation of antimicrobial therapy and the incidence of stroke in infective endocarditis: an analysis from the ICE Prospective Cohort Study (ICE-PCS). Am Heart J 2007;154:1086–94.

5. Lodise TP, McKinnon PS, Swiderski L, et al. Outcomes analysis of delayed antibiotic treatment for hospital-

acquired Staphylococcus aureus bacteremia. Clin Infect Dis 2003;36:1418–23.
6-Li JS, Sexton DJ, Mick N, et al. Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. Clin Infect Dis 2000;30:633–8
7 - Habib G, Hoen B, Tornos P, Thuny F, Prendergast B, Vilacosta I, et al. (2009) Guidelines on the prevention, diagnosis, and treatment of infectiveendocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of InfectiveEndocarditis of the European Society of Cardiology (ESC). Endorsed by the European Society of ClinicalMicrobiology and InfectiousDiseases (ESCMID) and the International Society of Chemotherapy (ISC) for Infection and Cancer. EurHeart J 30: 2369–2413. pmid:19713420
8- Selton-Suty C, Celard M, Le Moing V, Doco-Lecompte T, Chirouze C, Iung B, et al. (2012) Preeminence of Staphylococcus aureus in infectiveendocarditis: a 1-year population-basedsurvey. Clin Infect Dis 54: 1230–1239. pmid:22492317
9- Randolph P.Martin MD.Clinical utility of two dimensional echocardiography in infective endocarditis. The American Journal of Cardiology.1980;46: 379-385.
10- Dillon JC, Feigenbaum H, Konecke LL, et al. Echocardiographic manifestations of valvular vegetations. Am Heart J1973;6:698–704.
11- Reynolds HR, Jagen MA, Tunick PA, et al. Sensitivity of transthoracic versus transesophageal echocardiography for the detection of native valve vegetations in the modern era. J Am Soc Echocardiogr2003;16:67–70.
12- Shapiro SM, Young E, De Guzman S, et al. Transesophageal echocardiography in diagnosis of infective endocarditis. Chest1994;105:377–82.
13- Erbel R, Rohmann S, Drexler M, et al. Improved diagnostic value of echocardiography in patients with infective endocarditis by transoesophageal approach. A prospective study. Eur Heart J1988;9:43–53.
14- Neurologic Manifestations of Infective Endocarditis: A 17-Year Experience in a Teaching Hospital in Finland.Maija Heiro MD. Arch Intern Med. 2000;160(18):2781-2787.

Aneurysmal subarachnoid hemorrhage with electrocardiographic abnormalities: A case report

Abstract

Background: The interaction between cardiovascular system and cerebral damage in patients with subarachnoid hemorrhage (SAH) have been described frequently. Electrocardiographic (ECG) alterations occurring during the course of SAH have been previously reported. The mechanism of cardiovascular alterations after SAH is linked to the adrenergic discharge related to aneurysm rupture. It is important to consider that cardiovascular dysfunction of an underlying neurological etiology may lead to difficulty in diagnosing and optimizing treatment of the latter.

Case report: We report the case of a 58-year-old female patient with a past medical history of controlled hypertension admitted for acute consciousness disorder. Physical examination revealed reduced level of consciousness (Glasgow Coma Scale 7/15), high blood pressure of 220/100. ECG showed normal sinus rhythm, with heart rate of 140 bpm and extended ST-elevation in anterior territory. Computer tomography (CT) angiography revealed subarachnoid hemorrhage (SAH) with cerebral artery aneurysm. ST-elevation regressed later after intubation.

Conclusion: This case illustrates the importance of neurological injury as one of the differential diagnoses while managing ECG changes in cardiovascular disease.

Key-words: *Aneurysm, Electrocardiography, Subarachnoid hemorrhage*

INTRODUCTION

Subarachnoid hemorrhage (SAH) is a relatively rare pathology, it mainly affects healthy young adults. More than 50% of patients hospitalized for SAH are under 50 years old and are mostly women (about 60%). SAH is responsible for a mortality rate of around 50%, of which 10% before arrival at the hospital and 25% in the first 24 hours. Among the survivors, 60% have more or less disabling sequelae (1,2).

SAH neurological complications are, there, rebleeding, vasospasm and delayed cerebral ischemia, hydrocephalus, increased intracranial pressure and seizures. However, there are non-neurological complications that can worsen the prognosis for these patients. These extra neurological complications are mainly, respiratory, metabolic and cardiovascular such as electrocardiographic changes, left ventricular dysfunction, and troponin elevations mimicking myocardial ischemia can also occur (3).

CASE PRESENTATION

A 58-year-old female patient was brought by our emergency medical services after witnessed loss of consciousness in the beach. The patient was with a medical history of controlled hypertension. Np illicit or recreational drug use was known. When we arrived at the scene, physical examination revealed reduced level of consciousness (Glasgow Coma Scale 7/15), high blood pressure of 220/100. Heart sounds were regular with no murmurs and the lungs were clear to auscultation bilaterally. pupils were dilated with minimal pupillary response. The electrocardiogram (ECG) showed normal sinus rhythm, with heart rate of 140 bpm and extended ST-elevation in anterior territory with systematized ventricular bigeminy (Image 1).

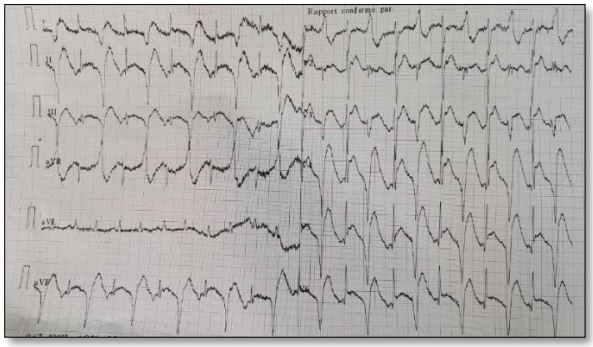

Image 1: Electrocardiogram showing normal sinus rhythm, with extended ST-elevation in anterior territory and ventricular bigeminy.

The patient was transported to the emergency department (ED) after having been stabilized (he was intubated , ventilated and sedated on scene).

After intubation, ECG showed normal sinus rhythm, with 100bpm heart rate with extended ST-elevation in anterior territory, however there was a disappearance of ventricular extrasystoles without having administered any antiarrhythmic medication (Image 2).

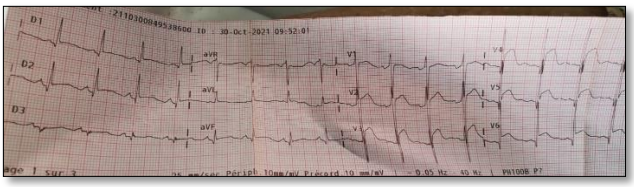

Image 2: Electrocardiogram showing normal sinus rhythm, with 100bpm heart rate and extended ST-elevation in anterior territory.

In the ED, Laboratory exams showed increased levels of high sensitive cardiac troponin T sampled 2 times in an interval of 4 hours (526ng/l then 1200ng/l) . Acute coronary angiography was performed, which revealed normal coronary arteries. For further diagnostic workup, cerebral computed tomography with angiography was performed showing subarachnoid hemorrhage (SAH) with cerebral artery aneurysm (Image 3).

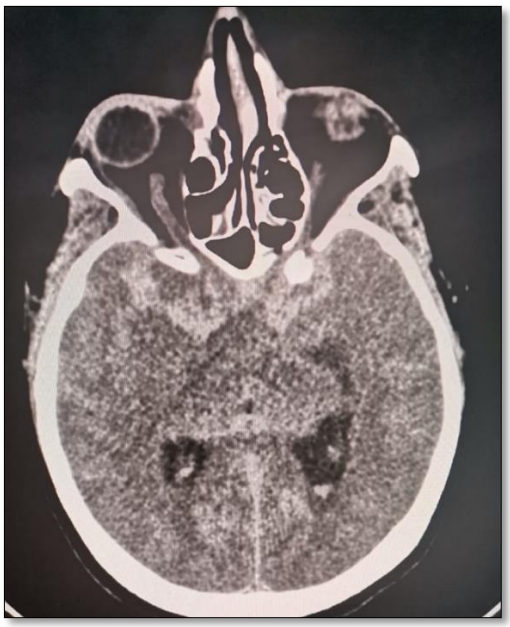

Image 3: Cerebral computed tomography with angiography showing SAH with cerebral artery aneurysm.

Due to severe subarachnoid hemorrhage and loss of brainstem reflexes no additional intervention was recommended by neurosurgery. For further care the patient was transferred to the intensive care unit. On follow-up, the patient presented Staphylococcus aureus ventilator-associated pneumonia with hemodynamic instability but quickly resolved by optimizing the hemodynamic status with secondarily adapted empirical antibiotic therapy.

Neurologically, without any sedation, the patient kept a minimal state of consciousness (an outline of opening and closing of the eyes but very invariable with facial expressions) with tetraplegia.

The patient has been discharged tracheostomized under ventilation at home.

DISCUSSION

The interaction between cardiovascular system and cerebral damage could explain the existence of arrhythmias, or even cardiac arrest during the occurrence of significant psychological stress. Electrocardiographic (ECG) alterations occurring during the course of SAH have been previously reported. Clinically, the neurocardiogenic effects of subarachnoid hemorrhage may present with electrocardiographic changes, elevations of troponin and/or brain type natriuretic peptide, as well as regional wall motion abnormalities, including Takotsubo cardiomyopathy.

SAH-induced ECG abnormalities can be transitory, and the frequency of ECG abnormalities in prospective SAH studies increases to near 100% when serial ECG monitoring is used (4,5) . These ECG abnormalities are nonspecific and tend to change with time;

Several mechanisms for the occurrence of cardiac complications after SAH have been suggested, but none is proven. However, a generally accepted hypothesis is that sympathetic stimulation induces catecholamine release in the myocardium, which may lead to impaired systolic and diastolic function, repolarization abnormalities, and myocardial damage. The first descriptions concerned electrocardiographic changes (changes: T wave, ST and QT segments, arrhythmias) as well as an elevation of myocardial biomarkers (6). These abnormalities are very frequently found (25 to 100% depending on the studies), but they seem, fortunately, rarely linked to myocardial damage (7).

Repolarization disorders are present in 30% of patients (8), QT prolongation is rarer, but favors the appearance of arrhythmias (4% of patients) (9). ECG abnormalities are diffuse and more frequent in cases of severe neurological impairment.

Several studies have not found a correlation between sudden rise in catecholamines levels and the electrical changes (10,11).

BNP is also released in the acute phase of SAH and its elevation is linked to that of troponin, (12). Elevated troponin and BNP are both associated with mortality, but only troponin is associated with poor neurological outcome.

Echocardiography is strongly recommended in the acute phase (13). Contraction abnormalities are observed in 13 to 38% of patients and a decrease in ejection fraction < 50% in 15 to 32% of them (14,15). This complication is not limited to a single coronary territory. These abnormalities most often recover within a few days, but could be predictive of delayed cerebral ischemia. Coronary angiography is normal, confirming that myocardial cell necrosis is related to elevated catecholamines (16).

In case of myocardial dysfunction, cardiac output monitoring should be considered (13). Similarly, blood volume must be monitored. The treatment of serious cardiac complications is that of acute heart failure, favoring inotropic agents. Hemodynamic control can delay the treatment of the aneurysmal sac, without exceeding a few hours.

CONCLUSION

Assessing ECG changes during cerebral damage is important. SAH studies show that catecholamine toxicity is the most probable cause of cardiac injury temporally related to an explosive increase in intracranial pressure. Evaluation and management of patients with SAH and cardiac dysfunction should be aimed at reducing the risk for symptomatic cerebral vasospasm. Newer therapeutic approaches should incorporate this evolving understanding of the pathophysiology.

REFERENCES

1. *European Registers of Stroke (EROS) Investigators, Heuschmann PU, Di Carlo A, Bejot Y, Rastenyte D, Ryglewicz D, et al. Incidence of stroke in Europe at the beginning of the 21st century. Stroke. mai 2009;40(5):1557-63.*
2. *Zacharia BE, Hickman ZL, Grobelny BT, DeRosa P, Kotchetkov I, Ducruet AF, et al. Epidemiology of aneurysmal subarachnoid hemorrhage. Neurosurg Clin N Am. avr 2010;21(2):221-33.*
3. *Mansella G, Jeger R, Bingisser R, Nickel CH. The Neurocardiogenic Spectrum in Subarachnoid Hemorrhage: A Case Report and Review of the Literature. Clin Pract Cases Emerg Med. 18 janv 2017;1(1):16-21.*
4. *Mayer SA, LiMandri G, Sherman D, Lennihan L, Fink ME, Solomon RA, et al. Electrocardiographic markers of abnormal left ventricular wall motion in acute subarachnoid hemorrhage. J Neurosurg. nov 1995;83(5):889-96.*
5. *Brouwers P, Wijdicks E, Hasan D, Vermeulen M, Wever E, Frericks H, et al. Serial electrocardiographic recording in aneurysmal subarachnoid hemorrhage. Stroke J Cereb Circ. 1 oct 1989;20:1162-7.*
6. *Y-Hassan S. The pathogenesis of reversible T-wave inversions or large upright peaked T-waves: Sympathetic T-waves. Int J Cardiol. 15 juill 2015;191:237-43.*
7. *Dufour H, Bonafé A, Bruder N, Boulard G, Ravussin P, Lejeune J-P, et al. Diagnosis in general hospital and immediate care of patients suffering from severe subarachnoid haemorrhage. Ann Fr Anesth Réanimation. juill 2005;24(7):715-20.*
8. *Bilt IAC van der, Hasan D, Vandertop WP, Wilde A a. M, Algra A, Visser FC, et al. Impact of cardiac complications on outcome after aneurysmal subarachnoid hemorrhage: A meta-analysis. Neurology. 17 févr 2009;72(7):635-42.*
9. *Frontera JA, Parra A, Shimbo D, Fernandez A, Schmidt JM, Peter P, et al. Cardiac Arrhythmias after Subarachnoid Hemorrhage: Risk Factors and Impact on Outcome. Cerebrovasc Dis. 2008;26(1):71-8.*
10. *Junttila E, Vaara M, Koskenkari J, Ohtonen P, Karttunen A, Raatikainen P, et al. Repolarization abnormalities in patients with subarachnoid and intracerebral hemorrhage: predisposing factors and association with outcome. Anesth Analg. janv 2013;116(1):190-7.*
11. *Zhang L, Qi S. Electrocardiographic Abnormalities Predict Adverse Clinical Outcomes in Patients with Subarachnoid Hemorrhage. J Stroke*

Cerebrovasc Dis Off J Natl Stroke Assoc. nov 2016;25(11):2653-9.

12. Tung PP, Olmsted E, Kopelnik A, Banki NM, Drew BJ, Ko N, et al. Plasma B-type natriuretic peptide levels are associated with early cardiac dysfunction after subarachnoid hemorrhage. Stroke. juill 2005;36(7):1567-9.

13. Diringer MN, Bleck TP, Claude Hemphill J, Menon D, Shutter L, Vespa P, et al. Critical care management of patients following aneurysmal subarachnoid hemorrhage: recommendations from the Neurocritical Care Society's Multidisciplinary Consensus Conference. Neurocrit Care. sept 2011;15(2):211-40.

14. Banki N, Kopelnik A, Tung P, Lawton MT, Gress D, Drew B, et al. Prospective analysis of prevalence, distribution, and rate of recovery of left ventricular systolic dysfunction in patients with subarachnoid hemorrhage. J Neurosurg. juill 2006;105(1):15-20.

15. Papanikolaou J, Makris D, Karakitsos D, Saranteas T, Karabinis A, Kostopanagiotou G, et al. Cardiac and central vascular functional alterations in the acute phase of aneurysmal subarachnoid hemorrhage. Crit Care Med. janv 2012;40(1):223-32.

16. Lee VH, Oh JK, Mulvagh SL, Wijdicks EFM. Mechanisms in neurogenic stress cardiomyopathy after aneurysmal subarachnoid hemorrhage. Neurocrit Care. 1 déc 2006;5(3):243-9.

Spontaneous simultaneous coronary and carotid dissection in a young cannabis user

INTRODUCTION

Cannabis, known as marijuana, is the most widely used illicit drug in the world. Its consumption is steadily increasing due to its legalization in several countries and its recreational and medical use (1).

Although the mechanisms are not yet well established, the devastating effect of cannabis abuse on the cardiovascular system, even in the absence of other cardiovascular risk factors, is demonstrated.

Diverse cases of cannabis-related acute coronary syndrome (ACS), ischemic strokes, or vascular attacks associated with cannabis use have been reported2.

Herein, we present the first case of cannabis-induced spontaneous simultaneous double coronary and carotid dissection.

CASE PRESENTATION

A 32-year-old Caucasian student male was admitted to our intensive care unit (ICU) for right total hemiplegia and aphasia evolving for 4 hours associated with chest discomfort.

His past medical history revealed no cardiovascular risk factors or symptoms. He was an occasional cannabis smoker and reported daily consumption in the last 5 days.

An initial exam showed stable hemodynamic parameters, the patient was conscious and executed orders successfully with his left extremities, but he had an incomprehensive verbal response. An electrocardiogram showed ST-segment elevation in the anterior leads, compatible with an ST-elevation myocardial infarction (STEMI).

Emergent contrast-enhanced computed tomography (CT) scan showed spontaneous hyper-density regarding the left frontal cortex, a sub-cortical left frontal, and multiple supratentorial regions of hypodensity in a vascular distribution occurred in the white matter- grey-matter (*Figure 1*).

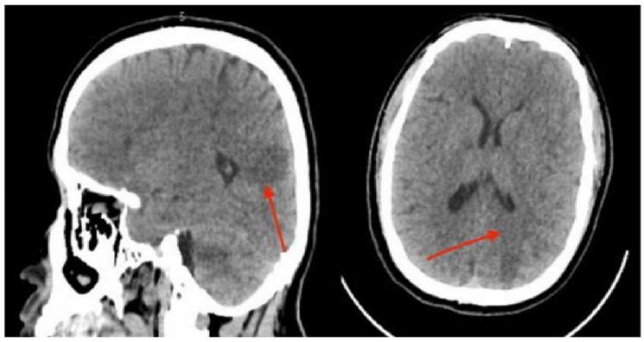

Figure 1: Cerebral contrast-enhanced computed tomography (CT)

In the cervicothoracic section, it showed thrombosed dissection of the left internal carotid artery, extending over 21 mm in height. (*Figure 2*).

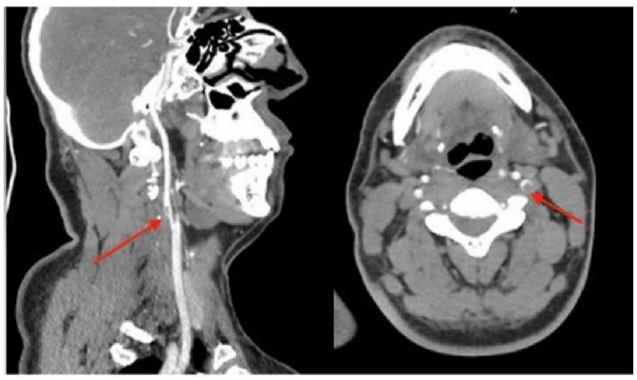

Figure 2 : Cervical contrast-enhanced computed tomography

The evolution was marked by spontaneous regression within 30 minutes of ST-segment elevation and the appearance of anterior negative T waves.

Echocardiography showed limited left ventricular anterior and apical wall motion abnormalities with conserved systolic ejection fraction (LVEF: 55%). The laboratory results were normal except for elevated cardiac enzymes.

Early cardiac catheterization showed an acute thrombotic dissection of the proximal left descending artery with TIMI III blood flow (*Figure 3*).

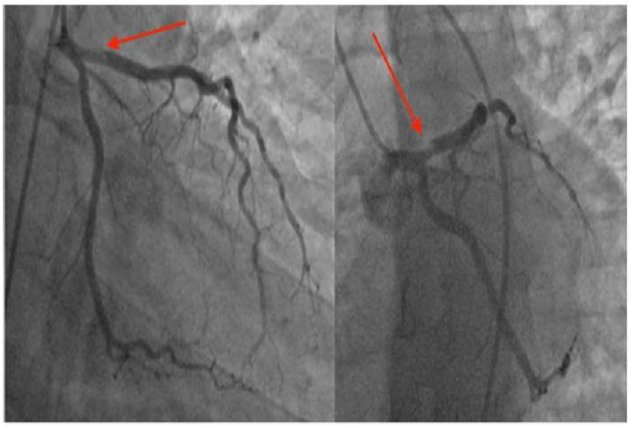

Figure 3 : Coronary angiography

The circumflex artery and the right coronary artery were normal. We decided to respect the lesion, and to put him under double antiplatelet therapy (clopidogrel 75 mg per day, aspirin 160 mg per day), unfractionated heparin, nitrates, and bisoprolol.

A second cerebral CT scan followed 48 hours later and showed favorable evolution of the cerebral lesions, so we decided to continue conservative treatment with close follow-up. The in-hospital outcome was favorable, with regression of aphasia and hemiplegia starting from the fifth day of the hospitalization. He has discharged after 15 days on clopidogrel 75 mg per day, aspirin 160 mg per day, atorvastatin 40 mg per day, and bisoprolol 2.5 mg per day.

At a 3-month clinical control check-up, he retained right lower limb motor sequelae. Cardiac control showed the absence of symptoms, with a good electrocardiographic and echocardiographic evolution (LVEF: 60–65%).

DISCUSSION

Marijuana consumption has been considered benign for a long time, but multiple cardiovascular effects have been described (3). At low or moderate doses, smoked marijuana increases sympathetic activity and reduces parasympathetic activity resulting in tachycardia, and hypertension and may induce atrial fibrillation (4). Conversely, high doses cause bradycardia and hypotension (5).

In experimental conditions, cannabis causes arteriolar vasodilation which probably explains its low toxic potential, however, this is not always the rule. Contrasting effects of cannabinoids have been shown, responsible for vasoconstriction with an acute coronary syndrome, stroke, or peripherical arteriopathy as complications (6).

Marijuana abuse can cause myocardial ischemia by various mechanisms including rupture of high-risk pre-existing plaques (7), coronary

vasospasm, and coronary embolism (8). Hemodynamic and oxidative stress weakens arterial walls and promotes plaque rupture thus allowing platelet activation, thrombus formation, and infarction (9,10). Arterial fragility in our case as a consequence of oxidative stress is the most logical mechanism explaining spontaneous double dissection. A recent systematic review of all cases of cannabis-induced myocardial infarction showed male predominance (95,2%). Angiographic findings reveal involved occluded coronary arteries in 63,2% whose involvement concerned the left anterior descending artery in 42.1% of cases. Conservative management was sufficient in 46.7% of patients (2).

Cerebrovascular ischemic lesions are common in marijuana abuse where reversible cerebrovascular spasm is most often the cause (11). Spontaneous artery dissection is a rare cause of ACS or stroke. It is generally associated with particular clinical situations: the use of contraceptives, pregnancy, Marfan syndrome, connective tissue disorders, trauma, and cocaine abuse (12). Several cases of cannabis-induced dissection have been reported in the literature, affecting coronary and cerebral arteries but also the aorta and renal arteries (13,14). No previous case of spontaneous simultaneous coronary and carotid dissection related to cannabis use has been reported. There is no proven therapeutic strategy for cannabis-related dissection as the literature is limited to case studies. Double antiplatelet therapy without vascular intervention can be attempted in hemodynamically stable patients (2).

CONCLUSION

This case highlights cannabis-related coronary and cerebral complications in early adulthood. An increase in such cases is to be expected in the face of the legalization of cannabis consumption and medical use which is spreading in several countries. If the increase in global consumption becomes unavoidable, the search for predictive factors of complications due to cannabis consumption appears necessary to avoid these serious consequences.

REFERENCES

1. Goyal H, Awad HH, Ghali JK: Role of cannabis in cardiovascular disorders. J Thorac Dis. 2017; 9(7): 2079–2092.

2. Patel RS, Kamil SH, Bachu R, et al.: Marijuana use and acute myocardial infarction: a systematic review of published cases in the literature. Trends Cardiovasc Med. 2020; 30(5): 298–307.

3. Filali T, Lahidheb D, Gommidh M, et al.: Spontaneous multivessel coronary artery dissection associated with cannabis use. J Cardiol Cases. 2012; 7(1): e4–7.

4. Singh A, Saluja S, Kumar A, et al.: Cardiovascular complications of marijuana and related substances: a review. Cardiol Ther. 2018; 7(1): 45–59.

5. Fisher BAC, Ghuran A, Vadamalai V, et al.: Cardiovascular complications induced by cannabis smoking: a case report and review of the literature. Emerg Med J. 2005; 22(9): 679–80.

6. Dines AM, Wood DM, Galicia M, et al.: Presentations to the emergency department following cannabis use--a multi-centre case series from ten European countries. J Med Toxicol. 2015; 11(4): 415–21.

7. Mittleman MA, Lewis RA, Maclure M, et al.: Triggering myocardial infarction by marijuana. Circulation. 2001; 103(23): 2805–9.

8. Velibey Y, Sahin S, Tanık O, et al.: Acute myocardial infarction due to marijuana smoking in a young man: guilty should not be underestimated. Am J Emerg Med. 2015; 33(8): 1114.e1–3.

9. Ul Haq E, Shafiq A, Khan AA, et al.: "Spice" (Synthetic marijuana) induced acute myocardial infarction: a case series. Case Rep Cardiol. 2017; 2017: 9252463.

10. Shah PK: Mechanisms of plaque vulnerability and rupture. J Am Coll Cardiol. 2003; 41(4 Suppl S): 15S–22S.

11. Mouzak A, Agathos P, Kerezoudi E, et al.: Transient ischemic attack in heavy cannabis smokers--how 'safe' is it? Eur Neurol. 2000; 44(1): 42–4.
12. Schmid J, Auer J: Spontaneous coronary artery dissection in a young man - case report. J Cardiothorac Surg. 2011; 6(1): 22.
13. Lou JY, Randhawa MS, Hornacek D, et al.: Images in vascular medicine. Spontaneous renal artery dissection in a cannabis user. Vasc Med. 2015; 20(4): 379–380.
14. Mason EK, Gak AE, Finno JG, et al.: Thoracic aortic dissection associated with marijuana use. J Emerg Med. 2019; 57(2): 235–7.