Medicina Intensiva 48 (2024) 424–428

medicina intensiva

http://www.medintensiva.org/en/

SCIENTIFIC LETTER

Assessment of early traumatic mortality using post-mortem computed tomography

Valoración de la mortalidad traumática precoz mediante tomografía computarizada *post mortem*

Dear Editor:

Trauma is one of the leading causes of death and potential years of life lost worldwide. Nearly 5% of trauma patients die during their initial care, often without the cause of death being identified by the clinician.[1] Additionally, incorrect placement of medical devices is a common thing that can contribute to increased morbidity and mortality.[2,3]

The study of preventable mortality (PM) is part of quality programs in trauma care systems. The World Health Organization (WHO) defines PM as cases with Injury Severity Scores (ISS) < 20, and/or an estimated survival probability by the Trauma and Injury Severity Score (TRISS) > 50%. Rates < 2% are considered acceptable for a trauma center.[4]

A significant limitation for the study of PM is the absence of injury identification in patients who die early. Such patients are not well represented in large trauma registries.[5] Autopsy is considered the gold standard to assess the cause of death. However, its performance has decreased in recent years, as it requires time and resources, and clinical data for analysis are difficult to obtain.[2,6,7]

The use of post-mortem computed tomography (PMCT) is a widely used tool in the field of forensic medicine and is growing thanks to its low invasiveness, speed, and low cost. Its use in severe cases of trauma can help health care workers identify the cause of death, often hidden when based solely on physical examination and basic radiology. Additionally, it allows for completing trauma records and verifying the correct placement of medical devices used during patient care.[3,5,6] However, no similar studies have ever been conducted in our country to this date.

This is our pilot experience performing PMCT on trauma patients who died during initial care. The radiological study was conducted after death was declared to avoid post-mortem artifacts. A baseline study of the whole body, including limbs, was performed without the administration of IV contrast and without removing the medical devices used during patient care. Infusion pumps and drainage suction devices were disconnected, though mechanical ventilation was maintained to prevent lung collapse.

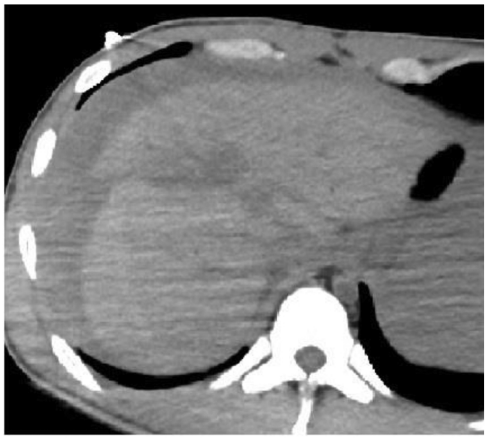

Figure 1 Abdominal CT scan without IV contrast. Hepatic lacerations compromising the entire thickness of the liver up to the inferior vena cava. Extensive hemoperitoneum resulting from intrahepatic vessel injury.

The PMCT readings were interpreted by 2 independent radiologists experienced in the management of polytrauma patients. The most plausible cause of death and the calculated ISS were determined in a joint clinical session between the Radiodiagnosis and Intensive Medicine services after reviewing the images and medical history.

The project was evaluated by the hospital research ethics committee with a favorable result, required family consent for the analysis of the images and data obtained. Since PMCT is a non-invasive imaging modality without any repercussions on the cadaver and its results can be affected by the time until it is eventually performed, implicit consent was used for immediate performance after death.

We have managed 7 cases since 2022. All of them were men, being the most frequent injury mechanism falls ($n = 4$; 57%), followed by motorcycle accidents ($n = 2$; 28%), and gunshots ($n = 1$; 15%). The mean age was 46 years ±16, and the median ISS calculated by post-mortem tomography, 50 (±16).

The most probable cause of death was identified in 100% of the patients, being thoracic trauma the main contributor, followed by hemorrhagic shock. Fig. 1 illustrates an example of hemorrhagic shock due to a high-grade liver injury.

Regarding medical devices, they were removed in two patients prior to performing the PMCT. Still, we could identify the incorrect positioning of some devices in 80% of the

DOI of original article: https://doi.org/10.1016/j.medin.2023.12.010

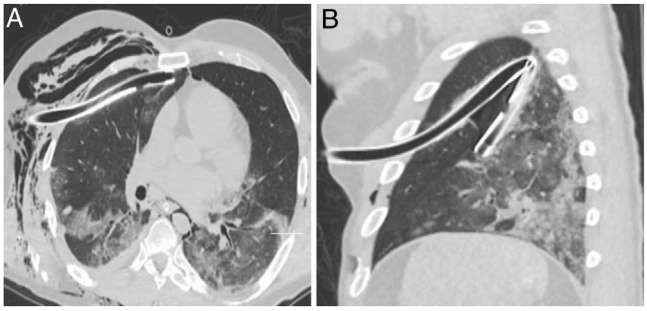

Figure 2 Thoracic CT scan without IV contrast with a lung window.
A. Right chest tube with an intraparenchymal trajectory.
B. Kinked left chest tube within the fissure.

remaining cases, being the most common incorrect position the inadequate placement of the endotracheal tube in relation to the carina. The most severe case was the incorrect placement of 2 chest tubes in the same patient, as shown in Fig. 2.

There was 1 case of PM based on ISS and TRISS. The results related to the cause of death, associated injuries, devices, and PM are shown in Table 1 of the Supplementary data.

The main limitation of PMCT is the identification of solid organ injuries and vascular lesions due to the absence of IV contrast and spontaneous circulation. This may cause severe injuries to go unnoticed.[6,8] However, such injuries were inferred through indirect data such as the presence of significant hemoperitoneum, organ deformity, or perivascular hematoma. In addition, indirect findings of exsanguination, such as hemothorax/hemoperitoneum, or large injuries to vital organs incompatible with life, are enough to identify the cause of death without having to pinpoint the exact bleeding site. Post-mortem angiography with IV contrast would improve these results but adds complexity to the study and use of resources. Additionally, its clinical utility compared to PMCT without IV contrast is currently uncertain to date.[8]

Based on this experience, we believe that the use of PMCT can be an epidemiological tool to analyze the cause of death in patients who die early from trauma, study PM, assess the quality of care, and become an educational tool to implement improvements in the health care protocols of such patients.

Authors' contributions

All authors contributed to the drafting of the manuscript and are part of the project.

Funding

None declared.

Conflict of interest

None declared.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi: https://doi.org/10.1016/j.medine.2024.01.005.

References

1. Schmitt-Sody M, Kurz S, Reiser M, Kanz G, Kirchhoff C, Peschel O, et al. Analysis of death in major trauma: value of promt post mortem computed tomography (pmCT) in comparasion to office hour autopsy. Scand J Trauma Resusc Emerg Med. 2016;24:38, http://dx.doi.org/10.1186/s13049-016-0231-6.
2. Lotan E, Portnoy E, Konen E, Simon D, Guranda L. The role of early postmortem CT in the evaluation of support-line misplacement in patients wiht severe trauma. AJR Am J Roentgenol. 2015;204:3–7, http://dx.doi.org/10.2214/AJR.14.12796.
3. Hofer L, Corcoran B, Drahos AL, Levin JH, Steenburg SD. Post-mortem computed tomography assessment of medical support device position following fatal trauma: a single-center experience. Emerg Radiol. 2022;29:887–93, http://dx.doi.org/10.1007/s10140-022-02072-y.
4. World Health Organization. Guidelines for trauma quality improvement programmes. Ginebra: World Health Organization; 2009.
5. Steenburg SD, Spitzer T, Rhodes A. Post-mortem computed tomography improves completeness of the trauma registry: a single institution experience. Emerg Radiol. 2019;26:5–13, http://dx.doi.org/10.1007/s10140-018-1637-4.
6. Chandy PE, Murray N, Khasanova E, Nasir MU, Nicolau S, Macri F. Postmortem CT in trauma. An overview. Can Assoc Radiol J. 2020;71:403–14, http://dx.doi.org/10.1177/0846537120909503.
7. Pham L, Portelli Tremont JN, Bruderick A, Nazarian J, Udekwu PA, Rutherford EJ, et al. Post-mortem CT delivers fast and accurate injury identification in trauma patients. Am Surg. 2022;88:973–80, http://dx.doi.org/10.1177/00031348221078985.
8. Levin JH, Pecoraro A, Ochs V, Meagher A, Steenburg SD, Hammer PM. Characterization of fatal blunt injuries using postmortem computed tomography. J Trauma Acute Care Surg. 2023;95:186–90, http://dx.doi.org/10.1097/TA.0000000000004012.

Lidia Orejón García[a,*], Laín Ibáñez Sanz[b], Marcos Valiente Fernández[a], Francisco de Paula Delgado Moya[a], Elena Martinez Chamorro[b], Mario Chico Fernández[a]

[a] *Servicio de Medicina Intensiva, Hospital Universitario 12 de Octubre, Madrid, Spain*
[b] *Servicio de Radiodiagnóstico, Hospital Universitario 12 de Octubre, Madrid, Spain*

* Corresponding author.
E-mail address: lidia.orejon@salud.madrid.org
(L. Orejón García).

Current situation and characteristics of centers specialized in management of aneurysmal subarachnoid hemorrhage in Spain

Situación actual y características de los centros especializados en el manejo de la hemorragia subaracnoidea aneurismática en España

Dear Editor,

Of the different cerebrovascular accidents, non-traumatic subarachnoid hemorrhage (SAH) is considered to be the least common presentation, representing 5%–10% of all cases. In Spain, the incidence ranges between 4.2 and 5.7 cases per 100,000 inhabitants and year, depending on the source.[1,2]

Spontaneous subarachnoid hemorrhage is characterized by high morbidity and mortality. The most recent studies at the national level report a mortality rate of 24%–27%.[1,2] The disorder poses an important sociosanitary problem since the affected individuals are typically young, previously healthy, during working age. The years of potential productive life lost are estimated to be similar to those recorded in intracranial hemorrhage or ischemic stroke.[3]

Due to the complexity of the management of the disease, different international guides underscore the need for close and continuous monitoring of patients with SAH, mainly in Intensive Care Units (ICUs) belonging to tertiary hospitals with multidisciplinary teams and a large volume of patients (>35 patients/year).[4,5] This has been shown to reduce mortality and complications that can have an impact on patient quality of life.[6]

Within the Spontaneous Subarachnoid Hemorrhage Registry (REMOS study), a survey has been carried out to know the current situation and characteristics of the centers specialized in the management of SAH in Spain. An invitation to participate was sent by e-mail to the members of the Neurointensive and Trauma Working Group of the Spanish Society of Intensive and Critical Care Medicine and Coronary Units (SEMICYUC), which currently has 369 members from 96 centers throughout the country. This same Working Group had already surveyed patients with cerebrovascular disease, but collected different data.[7] No Ethics Committee approval was requested, given the voluntary and anonymous nature of the participation and the absence of patient-related data. The survey was open from October 2021 to July 2023, the initially entered data were corroborated at the end of the period. The survey is available as Supplementary material (Supplementary material 1).

The present study analyzes the data obtained from the survey. A descriptive statistical analysis was made and data was reported as number (percentage) or median (interquartile range [IQR]). The response rate was calculated concerning the number of centers represented within the Working Group. In the case of duplicate responses, these were reviewed and, in the event of discrepancies between them, the authors were contacted for clarification.

A total of 56 responses were received, and after removing duplicates, we included information corresponding to 48 hospitals from all over Spain, representing a response rate of 50% (Supplementary material 2). The most extensively represented regions were the Community of Madrid (10 hospitals) and Catalonia (7 hospitals). These were followed by the Valencian Community, Andalusia and Castilla y León, with 5 hospitals each (Fig. 1). The vast majority (98%) were public hospitals.

A little over half of the collaborating centers (52.1%) have more than 800 hospital beds, 33.3% have 500–800 beds, and 14.6% have less than 500 beds. The median number of ICU beds in the participating centers was 30 (IQR 23–39); 10.5% of the centers had 50 or more ICU beds.

Patients with SAH were mainly admitted to polyvalent ICUs (in 70.8% of the centers) or neurotrauma ICUs (22.9%). The annual number of admissions of patients with SAH was less than 25 in 14.6% of the centers, 25–50 in 39.6%, 50–75 in 25%, and over 75 in 20.8%.

With regard to the availability of neurosurgeons in the corresponding centers, 64.6% of the hospitals had at least one neurosurgeon present 24 h a day, while in the rest of the centers, neurosurgeon was on-call from home after 3:00 pm. On the other hand, the interventional neuroradiologist was present from 8:00 am to 3:00 pm, followed by on-call duty, in 81.3% of the centers, while in 10% of the centers this specialist was only present from 8:00 am to 3:00 pm. Only 8.3% of the centers had an interventional radiologist present on an uninterrupted basis.

Exclusion of the aneurysm was performed in the first 72 h in all the centers. In one-half of the hospitals it was carried out on a scheduled basis in the morning hours, and sometimes also in the course of duty during the afternoon. In 23% of the centers, exclusion was performed on an urgent basis, while in 18.8% it was carried out on a scheduled basis in the morning hours. Four hospitals reported other treatment periods: scheduled or urgent intervention on weekends, in some cases urgent and in others scheduled on the follow-

DOI of refers to article: https://doi.org/10.1016/j.medin.2024.01.008