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CLINICAL INFORMATION

Looking for the reason of hemodynamic instability: a case report of the role of intraoperative ultrasound



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Abstract

Background and objectives: A prompt and effective management of trauma patient is necessary. The aim of this case report is to highlight the importance of intraoperative echocardiography as a useful tool in patients suffering from refractory hemodynamic instability no otherwise explained.

Case report: A 41 year-old woman suffered a car accident. At the emergency department, no abnormalities were found in ECG or chest X-ray. Abdominal ultrasound revealed the presence of abdominal free liquid and the patient was submitted to urgent exploratory laparotomy. Nevertheless, she persisted suffering arterial hypotension and metabolic acidosis. Looking for the reason of her hemodynamic instability, intraoperative transthoracic echocardiography was performed, finding out the presence of pericardial effusion. Once the cardiac surgeon extracted pericardial clots, patient's situation improved clinically and analytically.

Conclusion: Every anesthesiologist should be able to use the intraoperative echocardiography as an effective tool in order to establish the appropriate measures to promote the survival of patients suffering severe trauma.

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PALAVRAS-CHAVE

Acidente de trânsito;
Monitorização
intraoperatória;
Ecocardiografia;
Tamponamento
cardíaco

Buscando o motivo da instabilidade hemodinâmica: relato de caso sobre o papel do ultrassom intraoperatório

Resumo

Justificativa e objetivos: O atendimento rápido e eficaz do paciente de trauma é necessário. O objetivo deste relato de caso foi destacar a importância do ecocardiograma intraoperatório como uma ferramenta útil em pacientes que sofrem de instabilidade hemodinâmica refratária sem explicação aparente.

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Relato de caso: Uma mulher de 41 anos sofreu um acidente de automóvel. No departamento de emergência, nenhuma anormalidade foi encontrada no ECG ou na radiografia de tórax. Uma ultrassonografia abdominal revelou a presença de líquido livre no abdome, e a paciente foi submetida à laparotomia exploradora de urgência. No entanto, a paciente continuou apresentando hipotensão arterial e acidose metabólica. Na busca pelo motivo de sua instabilidade hemodinâmica, um ecocardiograma transtorácico foi realizado no período intraoperatório e constatou a presença de derrame pericárdico. Após a remoção dos coágulos pericárdicos pelo cirurgião cardíaco, a condição da paciente melhorou clínica e analiticamente.

Conclusão: Todo anestesiológico deve saber utilizar o ecocardiograma intraoperatório como ferramenta eficaz para estabelecer as medidas adequadas para promover a sobrevivência de pacientes com traumatismos graves.

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Introduction

Trauma is the most important cause of death in people under 40 years and the third leading cause of death among all age groups.¹ Severe traumas are defined as those provoking potentially life-threatening injuries. In our environment, traffic accidents are the principal cause of severe trauma.

Initial management of patients suffering severe trauma requires a rapid assessment of the lesions, as well as a quick management of those life-threatening injuries. During the first hours after trauma, most of deaths are caused by the presence of hemothorax, pneumothorax, splenic rupture, hepatic laceration or multiple lesions associated with a significant blood loss. It is necessary a prompt and effective management during this first "golden hour". Because of the importance of time, a systematic approach avoids errors that may cause the death of the patient. Initial ultrasonography is nowadays available at the emergency department (ED) and gives also invaluable early information.

We report the case of a patient treated after suffering a traffic accident and a subsequent severe refractory shock. Findings on the initial ultrasound evaluation gave us a wrong diagnostic, resulting in exploratory laparotomy. Nevertheless, the use of intraoperative ultrasound helped us to discover the cause of hemodynamic instability and to proceed to the appropriate management.

Case report

A 41 year-old woman was transferred to the ED after suffering a traffic accident with frontal collision. At the initial physical examination, the patient presented a Glasgow Coma Score 15 pts., was able to mobilize the 4 extremities and maintained pelvic stability. Chest X-ray on arrival showed fracture of multiple costal arches, with a small chamber of right basal pneumothorax (Fig. 1) and ECG revealed sinus tachycardia at 125 bpm. After arrival, the patient suffered hemodynamic deterioration despite volume resuscitation (2000 mL crystalloids, 500 mL colloids and one unit of red blood cells – RBC) and the administration

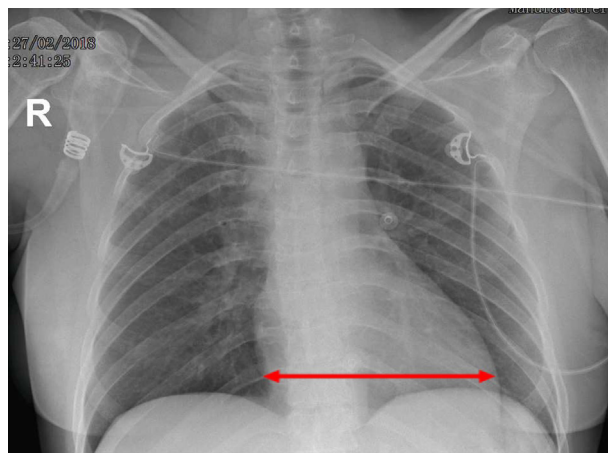


Figure 1 Preoperative chest X-ray. Arrow, cardiothoracic index within the upper limit of normality.

of vasoactive drugs (norepinephrine at $1 \text{ mcg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). Abdominal ultrasound revealed the presence of free perihaptic and peri-splenic liquid, as well as a collection ($6.5 \text{ cm} \times 5 \text{ cm}$) next to the spleen in relation to subcapsular splenic hematoma. Given the sonographic findings, it was decided to perform urgent exploratory laparotomy. She arrived at operating theater showing tachypnea, SpO_2 94% and suffering hypotension despite continuous perfusion of norepinephrine. Surgery was performed under balanced general anesthesia, without finding a bleeding point despite a detailed review of peritoneal cavity, retro-peritoneum and pelvic region.

During the surgery, the patient suffered persistent arterial hypotension and severe metabolic acidosis (pH 6.99, pCO_2 35.4 mmHg, pO_2 461 mmHg, bicarbonate $9 \text{ mmol} \cdot \text{L}^{-1}$, excess of bases $-22.9 \text{ mmol} \cdot \text{L}^{-1}$), but presented transient hemodynamic recovery in relation to the volume infusion. Although jugular venous distention was not observed, a high central venous pressure was documented (36 mmHg). Therefore, the presence of cardiac tamponade was suspected. Intraoperative transthoracic echocardiogram was



Figure 2 Intraoperative transthoracic echocardiogram. Arrows, pericardial effusion.

performed, identifying a 25 mm circumferential pericardial effusion with diastolic compression of the right atrium (Fig. 2). Cardiac surgery team was contacted and they performed a subxiphoid pericardial window in which severe hemopericardium was visualized with abundant clots. A median sternotomy was completed, extracting multiple clots and a large amount of blood and excluding the presence of perforation of cardiac cavities or any lesion of large vessels. After pericardial drainage, patient's situation improved clinically and analytically, reversing the metabolic acidosis (pH 7.32, pCO₂ 42.9 mmHg, pO₂ 235 mmHg, bicarbonate 21.2 mmol.L⁻¹, excess of bases -4 mmol.L⁻¹) and it was able to remove the vasoactive support. It was transfused five units of RBC, two units of fresh frozen plasma, 2 g fibrinogen, 1 g tranexamic acid and 500 UI prothrombin complex, estimating an intraoperative bleeding of 1500 mL.

After surgery, a CT-total body was performed, excluding acute lesions and finding a moderate amount of free intra-abdominal fluid and in the retro-peritoneum. Thoracic sections showed minimal chambers of bilateral pneumothorax and pneumomediastinum, as well as a moderate amount of pleural effusion, associated atelectasis and multiple rib fractures.

She was transferred to the intensive care unit (ICU) sedated and requiring the administration of vasoactive drugs at low doses. Endotracheal tube was removed 24 h after admission and vasoactive support was removed at 48 h. After admission, control ECG showed a generalized elevation in ST-interval and cardiac enzymes were serial (CK peak of 1206 IU.L⁻¹ and Troponin T peak 296 ng.dL⁻¹). Transthoracic echocardiogram showed a moderate global left ventricular dysfunction without finding any ischemic alteration, valvular disease or pericardial effusion. This ECG alteration was related within the context of pericardial irritation. The patient was transferred to the ward 5 days after the intervention, clinically stable, in excellent clinical condition. Eight days after admission, hospital discharge was possible.

Discussion

Chest trauma is the most important injuries after motor vehicle crash, as a common result of impact and

deceleration injuries. Incidence of chest injuries in traumatized patients is 45–65% and these lesions are associated with a mortality up to 60%.²

Traffic accidents are the leading cause of the majority of blunt cardiac injuries (BCI) and these lesions provoke approximately 20% of deaths in these type of accidents.² On the other hand, traffic accidents are usually paired to injuries in multiple organs, with the possibility of under-diagnosing BCI. Moreover, patient's medical history is usually unspecific and physical examination in the ED's scenario may be difficult, being almost impossible listening the characteristic distant heart tones associated to BCI. Therefore, a high index of suspicion for BCI is fundamental to reach the diagnosis, especially in those patients with refractory hemodynamic instability not otherwise explained.² A delay in its diagnosis provokes a delay in its treatment, worsening the patient's prognosis.

Regarding the difficult diagnosis of this entity, ECG provides little information and is usually unspecific. The most frequent ECG-abnormalities may include sinus tachycardia, arrhythmias, new bundle branch block and ST segment alterations.³ Sinus tachycardia is the normal response to the decrease in stroke volume secondary to acute cardiac tamponade. Information provided by chest X-ray is also normally usefulness, being normal in most cases documented of BCI.² The presence of rib fractures, pneumothorax or enlarged heart silhouette is rare, but may help to the diagnosis in some cases. The elevation of cardiac enzymes is neither specific nor sensitive in the diagnose of BCI.³

In the patient reported, the absence of abnormalities in the ECG or the chest X-ray, associated with the important abdominal pain and the clear ultrasound diagnosis of splenic injury, justified the urgent performance of exploratory laparotomy to resolve the suspected abdominal bleeding. Likewise, the incidence of splenic bleeding in traffic accidents is high and related to a high mortality rate if the treatment is not applied promptly in hemodynamic unstable patients.

Last years, the use of transthoracic or trans-esophageal echocardiography has acquired a considerable relevance as an invaluable diagnostic tool, non-invasive and available in many ED.⁴ Echocardiography allows quantifying the grade of myocardial dysfunction and heart valves disease³ and its use gives the practitioner information to identify the origin of hemodynamic or respiratory instability, contributing to reach a rapid decision about the most appropriate management of the patient. However, ultrasound image changes rapidly with time, as the lesion progresses in the acute patient. Thus, the use of echocardiography in ED scenario could be perfect for a faster and more efficient management of the patient.

During the intraoperative procedure, echocardiography has also become a high-value instrument, allowing anesthesiologists to monitor the progression of injuries. For this reason, it is essential that anesthesiologists acquire an adequate management of all the available tools to reach an accurate diagnosis. Because of the importance of ultrasound to the evolution of anesthesiology as a specialty, it should be developed a fundamentals of perioperative ultrasound education in accredited anesthesiology training programs.⁵

In conclusion, intraoperative echocardiography is a fundamental skill every anesthesiologist should be able to

control, especially in patients suffering from refractory hemodynamic instability, allowing the rapid establishment of the appropriate therapeutic measures to promote patient's survival.

Consent for publication

Written informed consent for publication of clinical data and clinical images was obtained from the patient. No patient's personal data are shown in this article.

Conflicts of interest

The authors declare no conflicts of interest.

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