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CASE REPORT

Return of Spontaneous Circulation in Traumatic Cardiac Arrest Achieved by Traumatic-Based Resuscitation – A Case Report

WINNIE WONG SIAW TIN, NIK AZLAN NIK MUHAMAD

Department of Emergency Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia

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ABSTRAK

Dalam beberapa tahun kebelakangan ini, pendekatan terhadap henti jantung traumatik (TCA) telah mengalami transformasi yang ketara, bergerak daripada kaedah yang dahulu dianggap tidak berkesan kepada intervensi yang lebih menjanjikan dan berstruktur. Garis Panduan Majlis Resusitasi Eropah (ERC) telah mewujudkan satu rangka kerja untuk pengurusan TCA. Kami membentangkan kes pemulihan kitaran spontan (ROSC) dalam TCA yang dicapai melalui resusitasi berasaskan trauma mengikut garis panduan ini. Seorang lelaki berumur 50 tahun yang terjatuh dari ketinggian 10 kaki tiba di Jabatan Kecemasan dalam keadaan henti jantung. Resusitasi kardiopulmonari (CPR) segera dimulakan. Pesakit diintubasi menggunakan intubasi endotrakeal untuk pengurusan saluran pernafasan. Oksigen dan pengudaraan diberikan melalui 'bag-valve-mask'. Tekanan dada dimulakan dan bolus cecair intravena diberikan untuk menangani hipovolemia. Tekanan manual digunakan untuk menghentikan pendarahan besar dari kulit kepala dan telinga kiri. ROSC dicapai selepas dekompresi dada bilateral. Garis panduan ERC mempunyai kadar ROSC yang lebih tinggi serta kecenderungan ke arah peningkatan kelangsungan hidup sehingga keluar dari hospital. Pengamal perubatan harus memberi keutamaan kepada rawatan yang cepat dan agresif terhadap punca-punca yang boleh dipulihkan dalam pesakit TCA.

Kata kunci: *Henti jantung; resusitasi kardiopulmonari; trauma*

ABSTRACT

In recent years, the approach to traumatic cardiac arrest (TCA) has undergone a significant transformation, moving from what was once considered futile to a more promising and structured intervention. The European Resuscitation Council (ERC) Guidelines established a framework for the management of TCA. We presented a case of return of spontaneous circulation (ROSC) in traumatic cardiac arrest achieved by traumatic – based resuscitation adhered to this guideline. A 50-years-old man who fell from a height of 10 feet arrived at Emergency Department in cardiac arrest. Immediate cardiopulmonary resuscitation (CPR) was initiated. The patient was intubated using endotracheal

Address for correspondence and reprint requests: Winnie Wong Siaw Tin. Department of Emergency Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia. Tel: +6016 5895125 Email: winniewongsiawtin@gmail.com

intubation for airway management. Oxygen and ventilation were delivered through bag-valve-mask. Chest compressions were started, and warm intravenous fluid and blood transfusions were administered to address hypovolemia. Manual compression was applied to stop massive bleeding from the scalp and the left ear. ROSC was achieved following bilateral chest decompression. TCA algorithm had higher rate of ROSC as well as a trend towards improved survival to discharge. Practitioners should prioritise the rapid and aggressive treatment of potential reversible causes in TCA patients.

Keywords: Cardiac arrest, cardiopulmonary resuscitation; trauma

INTRODUCTION

Traumatic cardiac arrest (TCA) occurs when a severely injured individual stops to produce spontaneous cardiac output. The survival rates following traumatic arrest have been proven to be poor.

In recent years, the approach to TCA has undergone a significant transformation, moving from what was once considered futile to a more promising and structured intervention. This shift can be attributed to various factors such as better understanding of the pathophysiology of TCA, separation from other causes of cardiac arrest, refined guidelines and improved training among health care worker. In addition, introduction of novel therapeutic intervention and advancement in diagnostic further reshape the management of TCA (Schober et al. 2024).

The European Resuscitation Council (ERC) Guidelines established a framework for the management of TCA. We presented a case of return of spontaneous circulation (ROSC) in TCA achieved by traumatic – based resuscitation adhered to this guideline.

CASE REPORT

A previously healthy 50-years-old man fell from a height of 10 feet and arrived at Emergency Department in cardiac arrest. He was brought in by his colleague 30 minutes after the trauma. He was unconscious after fall and sustained bleeding from the scalp.

Immediate cardiopulmonary resuscitation (CPR) was initiated. The patient was intubated with an endotracheal tube for airway management and oxygen was delivered using a bag-valve-mask. Chest compressions were started and warm intravenous 0.9% normal saline was administered to address potential hypovolemia. Manual compression was applied to stop massive bleeding from the scalp and the left ear. ROSC was achieved following bilateral chest decompression and three cycles of CPR. Bilateral chest decompression was done with finger thoracotomy.

After achieving ROSC, primary survey revealed an abrasion wound on the right upper back and reduced air entry in the right lung, suggestive of a pneumothorax or hemothorax. A chest tube was inserted to address the issue. Due to persistent tachycardia and hypotension, the patient received a blood transfusion to manage ongoing hemorrhage.

Following stabilisation, a whole-body computerised tomography (CT) scan was conducted, revealing extensive injuries. These included multiple bilateral rib fractures, leading to right hemopneumothorax and lung contusion. Additionally, multiple intracranial hemorrhages were detected, along with fractures in several skull and facial bones. There was also fracture in the C4 and C5

vertebrae.

The patient was assessed by surgical, neurosurgical and orthopedic team. In view of poor prognosis, the decision was made to manage the patient conservatively without surgical intervention. Unfortunately, the patient passed away in the emergency department.

DISCUSSION

The present case described a TCA resuscitated by traumatic based resuscitation instead of traditional resuscitation for non-traumatic cases. Trauma related cardiac arrest stands apart from cardiac arrest due to medical causes. TCA patients typically tend to be relatively young (~40 years), predominantly males (~80%) and generally healthy (~60%) before the incident (Ohlén et al. 2022). These demographics, together with previous health status suggest a potential for recovery among TCA patients.

A cohort study conducted in Dermark highlighted key differences between TCA and non-traumatic out of hospital cardiac arrest (OHCA). The study found that TCA patients were generally younger and mostly male compare to those with non-TCA. Additionally, survival rates for TCA were lower, with distinct predictors of outcomes. These differences in epidemiology and prognostic factors emphasise that TCA and non-TCA are clinically distinct condition (Wolthers et al. 2023). The high mortality associated with TCA has led to development of specific guidelines tailored to its management. Over the past thirty years, the unique nature of TCA compare to non-TCA has been increasingly recognised. Luna and colleagues found that supplemental chest compressions offer no benefit in patients with profound hypovolemia and were unlikely to provide effective organ perfusion in trauma victims (Luna et al. 1989).

The etiology of TCA can be broadly categorised into potentially reversible causes and non-reversible causes, such as extensive irreparable damage to vital organ. In the presented case, reversible causes may include tension pneumothorax and hypovolemia, while an irreversible cause could be brain herniation. However, making a diagnostic decision upon the patient's arrival at the trauma center can often be challenging. Consequently, therapeutic interventions are frequently initiated in patients with hindsight non-reversible causes of TCA. Despite this, the core principles of treatment remain similar to those for medical cardiac arrest, with a greater emphasis on identifying and treating reversible causes (Lewis & Perkins 2023). However, it's important to note that there is currently no universally accepted approach to comprehensively address this aspect of TCA management.

The ERC Guidelines 2021 provide a structured framework for managing of TCA, prioritising the identification of potentially reversible causes such as hypovolemia, hypoxia, tension pneumothorax and cardiac tamponade. Treatment strategies are tailored to address these underlying causes, including hemorrhage control, oxygenation, relief of tension pneumothorax/tamponade and correction of hypovolemia (Lott et al. 2021). Below is the ERC TCA/peri-arrest algorithm (Figure 1).

Several studies have explored the impact of implementing traumatic based resuscitation that prioritise controlling major external hemorrhage, securing the airway, bilateral chest decompression and a fluid challenge ahead of chest compressions. A retrospective study conducted in Victoria found no significant difference in patient outcomes, including prehospital ROSC, survival to hospital admission, and survival to hospital

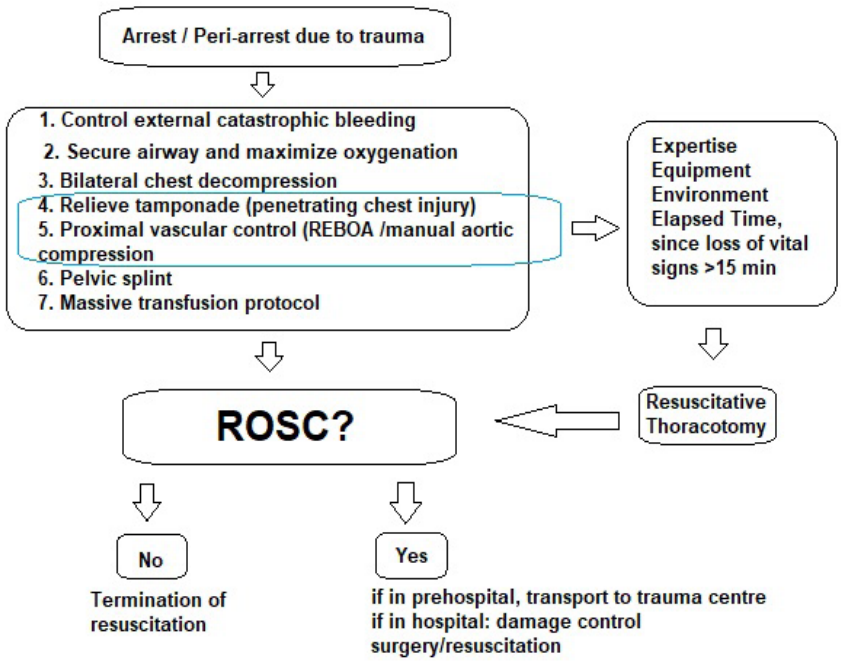

FIGURE 1: ERC traumatic cardiac arrest/ peri-arrest algorithm

discharge, after implementation of trauma-based resuscitation protocol (Alqudah et al. 2021). However, it is important to note that this study focused on the prehospital phase, which differs from our case where the patient was brought in by colleague with no prehospital management.

In contrast, Lee et al. (2022) investigated a similar guideline change in Taiwan, prioritising the identification and treatment of reversible causes of cardiac arrest in TCA patients presenting to an emergency department. The three major treatable causes of TCA i.e. impedance of venous return, hypovolemia and hypoxia were prioritised. The study reported an improved rate of ROSC from 23.6% to 41.5% with the implementation of traumatic based resuscitation. A trend towards improved survival to discharge also observed. Whether these findings are reproducible in other settings requires further investigation (Lee et al. 2022).

In the present case, hypovolemia was managed by controlling external hemorrhage, achieved through manual compression of the bleeding scalp, along with infusion of 0.9% warm saline solution and subsequent transfusion of O packed red blood cells. Hypoxia was addressed by promptly intubating the patient and providing ventilation. Bilateral chest decompression was performed using finger thoracostomy over 5th intercostal space just anterior to mid axillary line to address presumed tension pneumothorax. It is worth noting that thoracic needle decompressions are less effective, but still appropriate for buying time if scalpels or the required expertise for thoracostomies are not readily available (Schober et al. 2024).

According to ERC guideline, treatment options for TCA with internal hemorrhage encompass a spectrum of interventions. These may include placing a pelvic binder to stabilise pelvic fractures, or more invasive techniques such as Resuscitation Endovascular Balloon Occlusion of the Aorta or resuscitative thoracotomy with aortic cross-clamping. However, the indications and benefits of these interventions are not universally accepted. For example, the role of emergency department REBOA and resuscitative thoracotomy in TCA remains a subject of debate.

TCA treatment guidelines are often relied on a combination of expert opinions, retrospective studies, or extrapolated from related medical fields. Prospective, high-quality studies such as randomised controlled trial (RCTs) are notably lacking in this area (Schober et al. 2024).

CONCLUSION

This case demonstrates the potential for achieving ROSC in TCA by adhering to a trauma-based resuscitation protocol aligned with the ERC guidelines. The structured approach of prioritising the management of reversible causes, including hypovolemia, hypoxia, and tension pneumothorax is crucial in improving outcomes for TCA patients. Despite the overall poor prognosis often associated with TCA, this case highlights that rapid and aggressive interventions targeting specific causes can still yield positive responses. We suggest that trauma-based resuscitation algorithms should be incorporated into emergency department protocols to ensure rapid identification and intervention. The standard resuscitation training for healthcare providers should include trauma-specific components, focusing on the unique pathophysiology of TCA and the appropriate algorithms. This will help to ensure that respond team are prepared to manage TCA cases effectively. The lack of universally accepted guidelines and variable outcomes highlight the need for further research. More prospective studies are needed to evaluate the effectiveness of trauma-based resuscitation algorithms compared to traditional resuscitation approaches.

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