

Prehospital Thoracotomy: A Commentary

Ahmed Alsuliamani & Rizq Badawi

Abstract-

Traumatic cardiac arrest is a critical condition with potentially rectifiable causes, such as airway obstruction, tension pneumothorax, cardiac tamponade, or exsanguinating bleeding. The evolution of advanced prehospital trauma care has led to increased consideration of prehospital thoracotomy, an invasive procedure aimed at rapidly identifying the cause of arrest and implementing temporary measures to improve survival. While studies have reported promising outcomes, the appropriateness of performing prehospital thoracotomy, as well as its incorporation into the skill set of paramedics, both remain subjects of debate. This commentary examines the applicability, logistical challenges, and potential alternatives associated with prehospital thoracotomy in the context of traumatic cardiac arrest.

***Index Terms*— traumatic cardiac arrest, prehospital thoracotomy, advanced prehospital trauma care, paramedic training, needle thoracotomy, prehospital ultrasound, tamponade needle decompression**

I. INTRODUCTION

Traumatic cardiac arrest represents a critical condition in which timely intervention can rectify potentially reversible causes, such as airway obstruction, tension pneumothorax, cardiac tamponade, or exsanguinating bleeding [1,2]. The evolution of advanced prehospital trauma care has seen a shift from rapid evacuation from the battlefield to the performance of advanced procedures at the scene. Notably, prehospital advanced life support (ALS) interventions have been shown to minimise the severity of injuries, reduce mortality rates, and improve outcomes [3]. This has prompted increased consideration of prehospital

thoracotomy, an invasive procedure aimed at rapidly identifying the cause of arrest and implementing temporary measures to improve survival. While studies have reported promising outcomes, the appropriateness of performing prehospital thoracotomy and its incorporation into the skill set of paramedics remain subjects of debate.

II. PREHOSPITAL THORACOTOMY FROM AN EVIDENCE-BASED PERSPECTIVE

In general, prehospital thoracotomy demonstrated notable effectiveness in reducing mortality and positively influencing neurological outcomes [4]. Research by Ahmad et al. revealed a significant likelihood of survival in individuals with thoracic trauma who underwent prompt thoracotomy. The overall survival rate among the 475 patients studied was 95.58% [5]. Another study reported that thirteen out of seventy-one survivors had a good neurological outcome. [6]. Athanasiou et al. reported that, of 39 patients who underwent thoracotomy at the scene, four survived and three achieved good neurological recoveries [7]. Other prehospital observations have documented two neurologically intact survivors following such procedure [8,9].

III. LOGISTICAL CHALLENGES AND CONSIDERATIONS

Despite its potential benefits, the appropriateness of performing prehospital thoracotomy and its incorporation into the competencies of paramedics remains controversial. The procedure includes pericardiotomy to remove clots as a cause of tamponade, aortic clamping to divert blood flow, and manipulation of the lung hilum. Two primary approaches have been identified in the literature, each with its own advantages. The first is the left anterolateral thoracotomy, where the heart is exposed by opening the lateral chest using a retractor. Another approach, advocated for better

exposure, is the clamshell, in which the incision is extended across the chest. Both manoeuvres are intended to be performed within a similar time frame [10].

The procedure's invasive nature and its associated time, space, and personnel requirements present significant challenges. The time factor is critical, even with equipped instruments in the vehicle, and the limited space and risk of needle stick injury further complicate the procedure. If we consider that we have controlled the time factor for scene assessment and scene control and that the patient is inside the ambulance, space emerges as the next influencing factor. Even in spacious vehicles, the ability to perform this procedure comfortably will require the assistance of another person. Additionally, the performance thoracotomy in the field may raise concerns regarding scene control, patient privacy, and sub-optimal sterility. The challenges of managing bleeding and performing pericardiotomy while transporting the patient to hospital further complicate the logistics of prehospital thoracotomy.

IV. ALTERNATIVES AND FUTURE CONSIDERATIONS

Considering the challenges associated with prehospital thoracotomy, less invasive procedures such as needle thoracotomy, surgical airway management, and prompt transport to a medical facility may be more feasible in certain cases. It could be more efficient to expanding the competencies of paramedics to include less time-consuming and less labor-intensive procedures. Moreover, advocating for prehospital thoracocentesis or other invasive procedures may trigger further advocacy for prehospital surgeries, raising questions about the overall role and scope of prehospital care.

V. CONCLUSION

In conclusion, the appropriateness of prehospital thoracotomy in traumatic cardiac arrest remains a subject of debate. While the procedure has shown promising outcomes, its logistical challenges and potential alternatives raise questions as to its practicality in the prehospital setting. Future considerations should focus on expanding the competencies of paramedics, considering less invasive alternatives, and investigating early

diagnosis and management approaches. Ultimately, a comprehensive approach to prehospital care, accounting for time, space, and personnel, is critical for improving patient outcomes in traumatic cardiac arrest.

VI. REFERENCES

- [1] Evans CC, Petersen A, Meier EN, Buick JE, Schreiber M, Kannas D, Austin MA; Resuscitation Outcomes Consortium Investigators. Prehospital traumatic cardiac arrest: Management and outcomes from the Resuscitation Outcomes Consortium Epistry-Trauma and PROPHET registries. *J Trauma Acute Care Surg.* 2016 Aug;81(2):285-93. doi: 10.1097/TA.0000000000001070. PMID: 27070438; PMCID: PMC4961534.
- [2] Burlew CC, Moore EE, Moore FA, Coimbra R, McIntyre RC Jr, Davis JW, Sperry J, Biffl WL. Western Trauma Association Critical Decisions in Trauma: resuscitative thoracotomy. *J Trauma Acute Care Surg.* 2012; 73(6):1359-63. [PubMed: 23188227].
- [3] Isenberg DL, Bissell R. Does advanced life support provide benefits to patients? A literature review. *Prehosp Disaster Med.* 2005 Jul-Aug;20(4):265-70. doi: 10.1017/s1049023x0000265x. PMID: 16128477.
- [4] Dayama A, Sugano D, Spielman D, Stone ME, Kaban J, Mahmoud A, McNelis J. Basic data underlying clinical decision-making and outcome in emergency department thoracotomy: tabular review. *ANZ J Surg.* 2016 Jan-Feb;86(1-2):21-6.
- [5] Ahmad T, Ahmed SW, Hussain N, Khan MI. Role of urgent thoracotomy in improving the survival of patients with severe chest trauma. *J Coll Physicians Surg Pak.* 2009 Sep; 19(9):575-8.
- [6] Davies GE, Lockey DJ. Thirteen survivors of prehospital thoracotomy for penetrating trauma: a prehospital physician-performed resuscitation procedure that can yield good results. *J Trauma.* 2011 May;70(5):E75-8. doi: 10.1097/TA.0b013e3181f6f72f. PMID: 21131854.
- [7] Athanasiou T, Krasopoulos G, Nambiar P, Coats T, Petrou M, Magee P, et al. Emergency thoracotomy in the pre-hospital setting: a procedure requiring clarification. *Eur J Cardiothorac Surg.* 2004; 26:377-385.
- [8] Corral E, Silva J, Suárez RM, Nuñez J, Cuesta C. A successful emergency thoracotomy

performed in the field. *Resuscitation*. 2007;75:530–533.

[9] Deakin CD. From agonal to output: an ECG history of a successful pre-hospital thoracotomy. *Resuscitation*. 2007;75:525–529.

[10] Flaris AN, Simms ER, Prat N, Reynard F, Caillot JL, Voiglio EJ. Clamshell incision versus left anterolateral thoracotomy. Which one is faster when performing a resuscitative thoracotomy? The tortoise and the hare revisited. *World J Surg*. 2015 May;39(5):1306-11. doi: 10.1007/s00268-014-2924-1. PMID: 25561192.