

INTERNATIONAL TRAUMA LIFE SUPPORT

ADVANCES IN MANAGEMENT OF TRAUMATIC CARDIAC ARREST

The guidelines and references contained in this document are current as of the date of publication and in no way replace physician medical oversight.

INTRODUCTION

Survival from traumatic cardiac arrest is poor and some consider resuscitation of this patient group futile.^{1,2,3} A 10-year retrospective database review in a HEMS based trauma system conducted in 2006 confirmed that the survival rates are poor but comparable (or better than) published survival rates for out-of-hospital cardiac arrest of any cause.⁴ Ongoing advances in resuscitation science, trauma care both in the military and civilian practice, indicates a change is required in management of this difficult cohort of patients who otherwise may have resuscitation withheld with a chance of survival with good neurological outcomes.

BACKGROUND

The National Association of EMS Physicians and the American College of Surgeons Committee produced guidelines in 2003 about withholding or termination of resuscitation in out-of-hospital traumatic cardiopulmonary arrest.³ Since then, however, a relatively large study in 2006 and smaller studies confirmed a better outcome than in previous studies with survivors found in several subgroups.⁴ Survival rates are highly variable depending on the etiology and traumatic pathologies associated with an improved chance of successful resuscitation, which include hypoxia, tension pneumothorax, and cardiac tamponade.^{4,5,6} With the emergence of prehospital resuscitative thoracotomy, ultrasound and other advances in hemorrhage control, airway and ventilation management and monitoring (end-tidal CO₂ and wave capnography), more recent studies observed better outcomes.^{7,8} The military published outcomes in a prospective observational study in 2011, quoting a return to spontaneous circulation (ROSC) of 27% and survival to discharge rate of 8% at a military field hospital in Afghanistan.⁷ The dogma of traumatic cardiac arrest was also challenged in a publication reviewing recent literature on the pathophysiology of traumatic cardiac arrest, describing how the military has challenged the assumption that outcome is universally poor in these patients.⁸

To embrace the changes in thinking and from emerging evidence, the European Resuscitation Council in its 2015 guidelines included a section on cardiac arrest in a trauma patient.⁹ Several algorithms subsequently were developed and introduced in different trauma systems.^{10,11}



Improving Trauma Care Worldwide

CONSIDERATIONS

The 8th edition ITLS Provider manual reflects the thinking and practice relevant to earlier years; with emerging studies in the military and subsequently civilian population, it is felt that the ITLS recommendations should align with current thinking and available published evidence.

Traumatic cardiac arrest (TCA) is a unique disease in which clinicians are frequently confronted by a healthy heart that has arrested as a result of hypoxia, hemorrhage or obstructive shock. Consequently, there are different management priorities in TCA and potential deviations from existing non-TCA algorithms. Emphasis on rapid treatment of all potentially reversible pathology is the basis of treatment guidelines, which are addressed in several treatment algorithms.^{10,11}

The diagnosis of TCA is based on rapid clinical assessment using the ITLS Primary Survey. Patients with agonal, abnormal or absent spontaneous respiration and absence of a central pulse over a 10-second period should immediately prompt entry into the algorithm. Those in a peri-arrest state with cardiovascular instability, including bradycardia, profound hypotension or rapidly falling blood pressure, loss of peripheral pulses, together with deteriorating level of consciousness, should alert the emergency care provider of imminent cardiac arrest and entry into the algorithm as well.

The reversible pathologies that require rapid treatment can be remembered in a mnemonic, HTTH: Hypoxia, Tension pneumothorax, Tamponade, and Hypovolemia.

Two algorithms are presented and can be adapted to regional and local availability of services and personnel.^{9,10,11}

Chest compressions are ineffective and take a lower priority than the immediate treatment of reversible causes encountered in TCA such as hypovolemia, cardiac tamponade, or tension pneumothorax.

Short prehospital times are associated with increased survival rates for major trauma and TCA. The time elapsed between injury and surgical control of bleeding should therefore be minimized and the patient should be immediately transferred to a trauma center for ongoing damage control resuscitation.

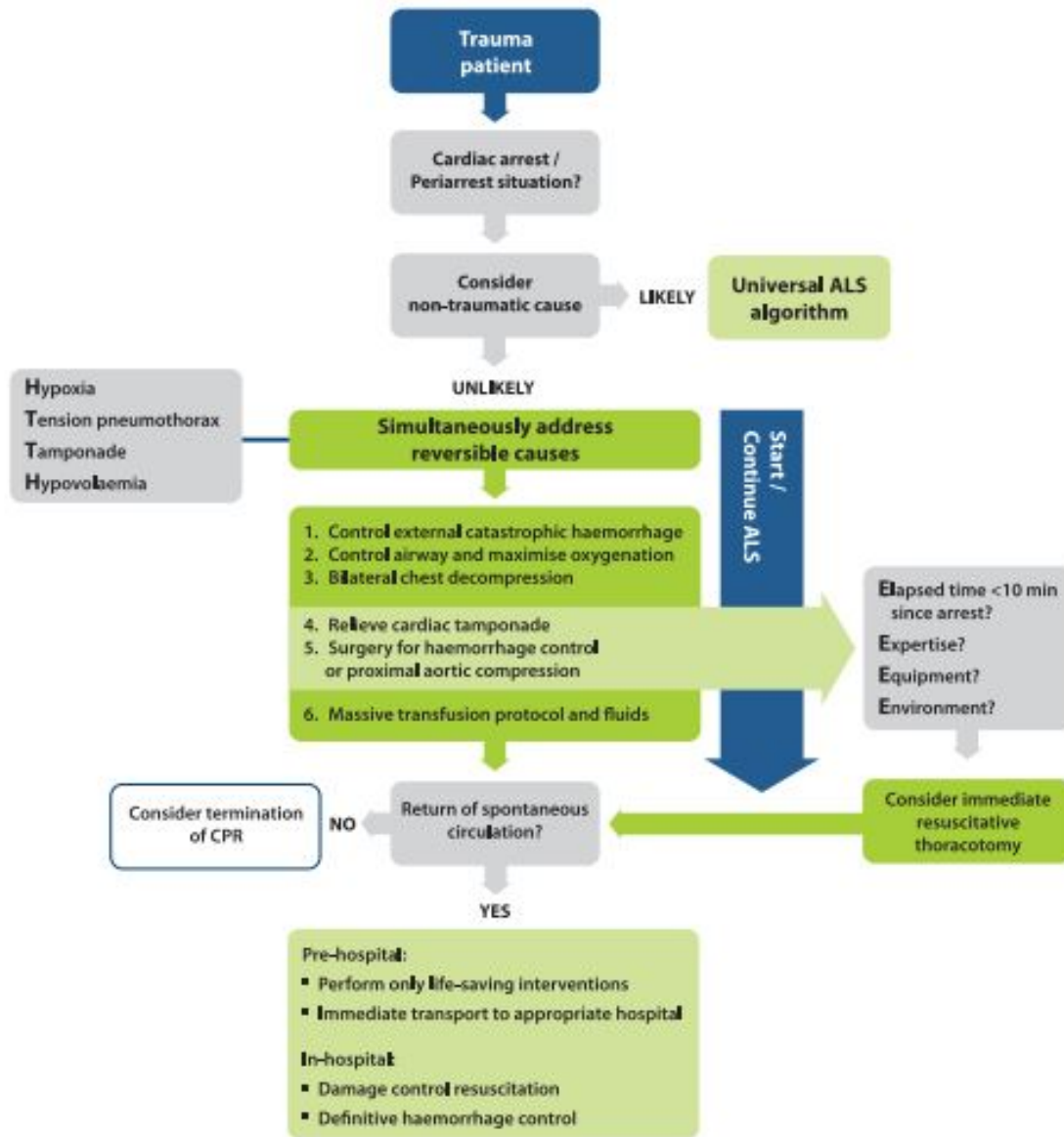
It is, however, recognized that prolonged resuscitation and transport of TCA patients with irreversible causes to trauma centers are both inappropriate and a waste of health care resources. Unfortunately, with recent advances, it is impossible to precisely identify a set of parameters that will identify this cohort.⁴ Best evidence would suggest that a loss of vital signs in excess of 10 minutes before arrival of EMS at the scene, the absence of ROSC after



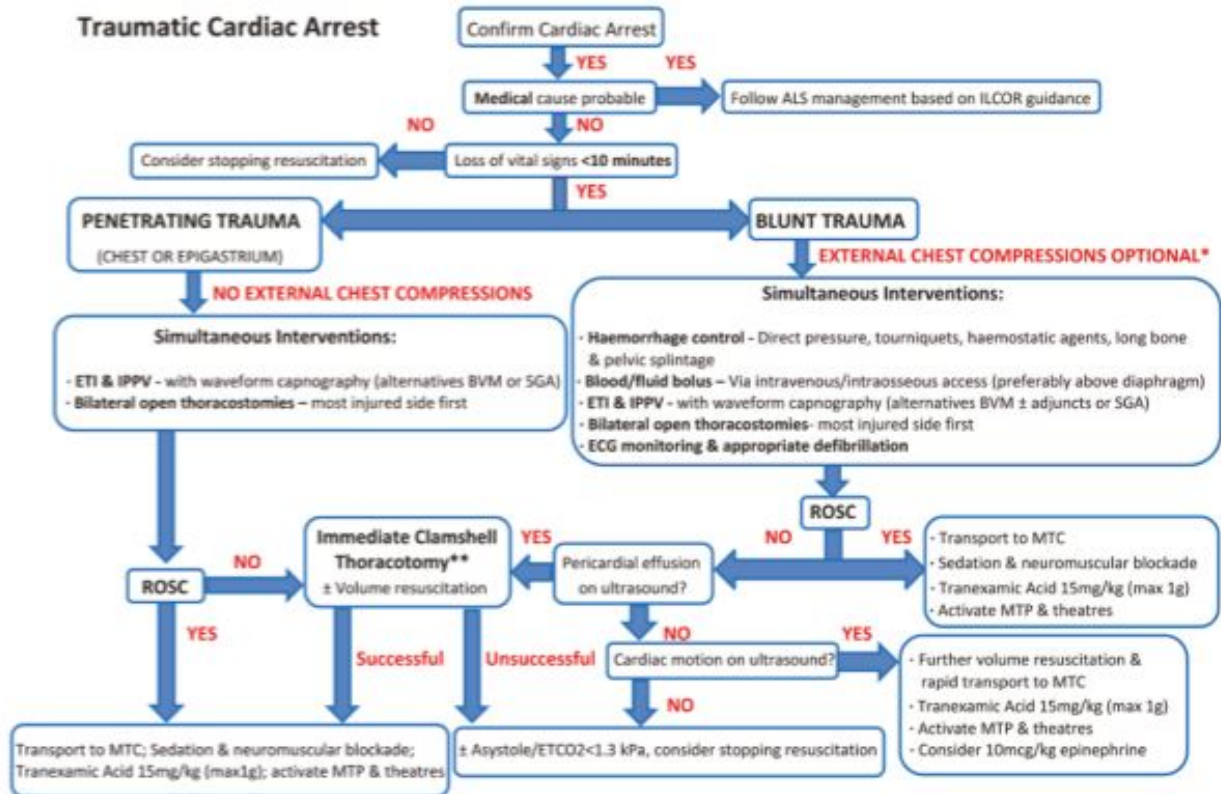
Improving Trauma Care Worldwide

addressing the reversible causes (HTTH), asystole/ETCO₂ <1.3 kPa and CPR in excess of 20 minutes indicate futility. These are reasonable criteria to withhold transport and termination of resuscitation.

ALGORITHM 1- European Resuscitation Council Guidelines 2015



ALGORITHM 2- Greater Sydney Area HEMS – Prehospital Emergency Medicine
 Sherren et al. Critical Care 2013,17:308



Improving Trauma Care Worldwide

MEDICAL OVERSIGHT

Medical oversight should review current literature and develop prehospital EMS protocols in regard to trauma triage and documentation. Implementation should be monitored and supervised through a quality assurance program.

CONCLUSION

ITLS believes there is adequate evidence that resuscitation in traumatic cardiac arrest is not always futile. The mortality from traumatic cardiac arrest remains high but survival with good neurological outcome from cardiopulmonary arrest following major trauma has been reported in a number of military and civilian publications. Several advances in rapid, effective intervention to address potential reversible causes additionally justifies development of an algorithm for identification and prehospital management.

Two examples of algorithms are illustrated that adhere to the principles and best guidance that can be adapted to local resources and circumstances.^{9,11}



Improving Trauma Care Worldwide

REFERENCES

1. Rosemurgy AS, Norris PA, Olson SM, et al. Prehospital traumatic cardiac arrest: the cost of futility. *J Trauma*. 1993; 35:468-474.
2. Stockinger ZT, McSwain NE. Additional evidence in support of withholding terminating cardiopulmonary resuscitation for trauma patients in the field. *J Am Coll Surg*. 2004;198:227-231.
3. Hopson LR, Hirsh E, Delgado J, et al. Guidelines for withholding or termination of resuscitation in prehospital traumatic cardiopulmonary arrest. *J Am Coll Surg*. 2003;196:106-112.
4. Lockey D, Crewdson K, Davies G. Traumatic Cardiac Arrest: Who are the survivors? *Annals of Emergency Medicine* Volume 48 No3: September 2006: 240-244.
5. Pickens JJ, Copass MK, Bulger EM. Trauma patients receiving CPR: predictors of survival. *J Trauma*. 2005; 58:951-958.
6. Cera SM, Mostafa G, Sing RF, et al. Physiologic predictors of survival in post- traumatic arrest. *Am Surg*. 2003; 69:140-144.
7. Tarmey N, Park C, Bartels O, et al. Outcomes following military traumatic cardiorespiratory arrest: A prospective observational study. *Resuscitation*. 82 (2011) 1194-1197.
8. Smith JE, LeClerc S, Hunt P. Challenging the dogma of traumatic cardiac arrest management: a military perspective. *Emerg Med J*. 2015;32:955-960.
9. Truhlaf A, Deakin C. European Resuscitation Council Guidelines for Resuscitation 2015 Section 4 Cardiac Arrest in special circumstances. *Resuscitation*. 95 (2015) 148-201.
10. Lockey DJ, Lyon RM, Davies GE. Development of a simple algorithm to guide the effective management of traumatic cardiac arrest. *Resuscitation*. 84(2013) 738-742.
11. Sherren PB, Reid C, Habig K et al. Algorithm for the resuscitation of traumatic cardiac arrest patients in a physician-staffed helicopter emergency medical service. *Critical Care*. 2013,17:308.



Improving Trauma Care Worldwide

Current Thinking

Advanced in Management of Traumatic Cardiac Arrest International Trauma Life Support

The guidelines and references contained in this document are current as of the date of publication and in no way replace physician medical oversight.

Abstract

This is the current thinking of International Trauma Life Support (ITLS) with regard to the management of traumatic cardiac arrest patients.

Current Thinking

It is the position of International Trauma Life Support that:

1. There is sufficient evidence to support the identification and early aggressive management of traumatic cardiac arrest (TCA) patients in the prehospital setting.
2. Management is aimed at addressing the reversible causes to traumatic cardiac arrest: hypoxia, tension pneumothorax, cardiac tamponade and hypovolemia (HTTH).
3. Consideration should be given to omitting external chest compressions in traumatic cardiac arrest or delaying them until preload and obstructive causes have been addressed.
4. A locally developed algorithm with a standardized approach for traumatic cardiac arrest together with adequate training and clinical governance will save lives when applied to patients with a chance of survival.
5. Outcomes are better with traumatic cardiac arrest from penetrating trauma.
6. Loss of vital signs in excess of 10 minutes before arrival of EMS at the scene, the absence of ROSC after addressing the reversible causes (HTTH), asystole/ETCO₂ <1.3 kPa and CPR in excess of 20 mins indicates futility and are indications to withhold transport and termination of resuscitation at scene.



Improving Trauma Care Worldwide