

# Emergency Resuscitative Thoracotomy: Factors of Survival at St. Barnabas Hospital

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## INTRODUCTION

Emergency Resuscitative Thoracotomy (ERT) can be a lifesaving intervention in the appropriate patient. Early application of ERT with adequate supporting staff and resources results in improved survival and minimizes post ERT morbidity. Penetrating and blunt thoracic trauma comprise nearly 50% of all traumatic injuries. An overwhelming majority of these patients do not require ERT. Current indications for ERT are:

- 1-Salvageable witnessed post injury cardiac arrest, for those with penetrating chest injury
- 2- Persistent post injury hypotension resulting from:
  - Cardiac tamponade
  - Intra-thoracic hemorrhage
  - Air embolism
  - Active intra-abdominal hemorrhage

Studies have concluded that these indications can be left to clinical interpretation at the time of trauma team assessment. Of these studies, many agree that pre-hospital factors related to poor patient outcomes include absence of vital signs, fixed and dilated pupils, absence of motion in extremities, and minimizing pre-hospital transit to <10minutes (Ansensio, et al)-.

In a study by Seamon, MJ pre-hospital procedures by EMS actually resulted in decreased survival for those requiring ERT; 8% survived when brought to the trauma team by EMS and 17.4% survived when brought by police or private transportation. This result concluded that, in the “scoop and run” model, decreased patient transit time resulted in improved survival. Time of transit was increased due to procedures performed by EMS in the field, thus delaying time to the trauma team.

Aside from EMS, other factors related to survival in the SBH system have not been evaluated in other studies. These factors relate to personnel involved in supporting the resuscitative effort. Availability of staff during the ERT is most critical to the survival of these patients. While ATLS guidelines make explicit designation of roles in the trauma bay, they do not define the role of resuscitation, i.e. -tasking staff members with transfusion of blood products or fluids for those in extremis.



In the last 2 years all penetrating cardiac injuries that survived at our facility with lacerations were repaired without cardio-pulmonary bypass.

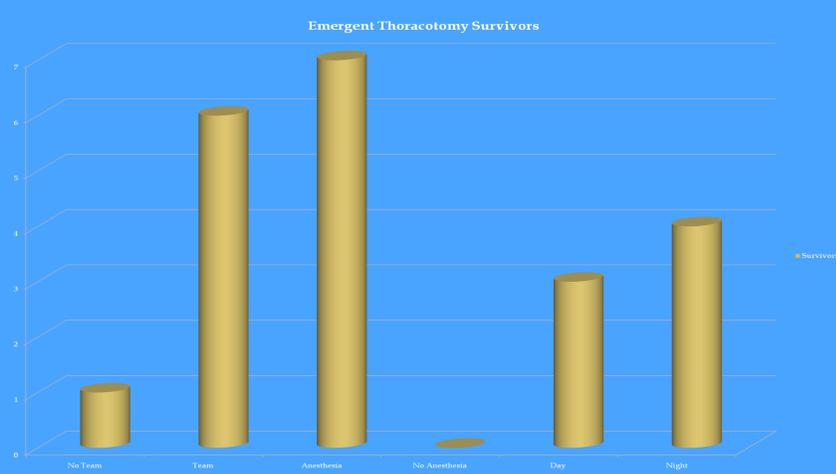
## METHODS

Our study evaluated all trauma patients that were admitted to St. Barnabas Hospital from January 1, 2010 until December 31, 2012 that required ERT. Patients that required ERT were not differentiated by those performed in the Emergency Department (“ED”) versus in the operative suite. Etiologies leading to ERT were limited to those with penetrating chest injury or penetrating abdominal injury with subsequent hypotension. Patients that had blunt chest trauma did not receive ERT at St. Barnabas Hospital.

Indications in our institution for ERT are any penetrating injury to the chest with witnessed loss of vitals, penetrating abdominal injury with hypotension and sudden loss of cardiac activity. These patients must have a loss of vitals witnessed with immediate CPR initiation and a sign of life. The sign of life can include papillary reactivity, electrical activity on the trauma bay monitor, a pulse that was present less than 10 minutes prior and patient movement. Fifteen (15) ERTs were performed during the 2 year time period studied. Of those, seven (-7) survived. Measured variables included: EMS transit time, EMS intervention, time of injury, formation of resuscitation team, and presence of anesthesia.

## RESULTS

Injury	GCS	EMS transit	Shift	Resuscitation team	Anesthesia	Result
GSW R-Ventricle, IVC	10	15 minutes	Night	No	Present	Mortality
Stab wound R-ventricle	7	13 minutes	Night	No	Not present	Mortality
GSW L-subclavian artery	3	12 minutes	Night	No	Present	Mortality
GSW Aortic injury	14	7 minutes	Night	Yes	Present	Mortality
Stab wound R-ventricle	15	7 minutes	Night	Yes	Present	Survival
Stab wound L-common iliac	8	11 minutes	Night	No	Present	Survival
Stab wound R-ventricle	3	10 minutes	Night	Yes	Present	Survival
GSW R-ventricle, R-atrium, IVC	3	15 minutes	Night	Yes	Present	Mortality
Stab wound L-ventricle	3	17 minutes	Day	Yes	Not present	Mortality
Stab wound L-diaphragm, internal mammary a	15	10 minutes	Day	Yes	Present	Survival
Stab wound L-atrium	10	10 minutes	Night	Yes	Present	Survival
Stab wound R-ventricle	15	11 minutes	Day	Yes	Present	Survival
Stab wound R-atrium	11	9 minutes	Night	No	Present	Mortality
Stab wound R-ventricle	11	5 minutes	Night	Yes	Not present	Mortality
Stab wound R-ventricle, diaphragm injury	9	10 minutes	Day	Yes	Present	Survival



## DISCUSSION

On evaluation of our results, 47% of patients survived ERT at St. Barnabas. Studies have shown survival rates ranging between 10-38%. The increased survival rate is likely due to minimal EMS transit times to St. Barnabas and the fact that all of our patients had penetrating trauma. Our trauma center is situated in an inner city setting away from major highways and thus we receive a lower ratio of blunt trauma patients requiring operative intervention.

The current ACS protocols require an anesthesiologist as part of trauma activation. Beginning in January 2011, the St. Barnabas Anesthesiology Department began to send two anesthetists to each trauma. Prior to January 2011, it was the policy to send only one anesthetist to a trauma activation. The presence of an experienced anesthetist for airway management is essential with patients requiring ERT. When more than one anesthetist is available during an ERT, the team has anesthetist support for obtaining large bore venous access as well assisting in resuscitation. In our study, eight (8) patients had both anesthesia presence and a resuscitation team. Of these eight (8) patients, six (6) patients survived for a survival rate of 75%.-Each patient has staff dedicated to resuscitation and having an understanding for end points of resuscitation with anesthesia. This allows for stream-lining of transfusion of blood products and fluids without interruption or delay in the ERT, allowing the trauma team to focus on operative repair.

## CONCLUSION

In patients requiring ERT that are correctly selected for the procedure, their chance of survival is multifactorial. Transport of patients requiring ERT should be focused on minimizing transit time and reducing field intervention. Therefore, protocols for patients with penetrating chest injury should be focused on transit time. Experienced anesthesiologists in the trauma bay with adequate staffing to resuscitate the patient is also essential to survival. Both reduced transit time and increased trauma staffing has been shown to improve patient survival in our patient population.

## BIBLIOGRAPHY

Asensio JA, Roldan G, et al. 2001 Cardiac Trauma *J Trauma* 3:69-77  
 Keller D, Kulp H, et al. 2013 Life after near death: Long-outcomes of emergency department thoracotomy survivors *Acute Care Surgery* 74:1315-1320  
 Passos EM, Engels PT, et al. 2012 Societal Costs of Inappropriate Emergency Department Thoracotomy *J Am Col Surg*. 214:18-26  
 Rhee PM, Acosta J, et al. 2000 Survival after emergency department thoracotomy *J Am Col Surg*. 190:288-298  
 Hunt PA, Greaves I, et al. 2005 Emergency Thoracotomy in Thoracic Trauma *International J of the Care of the Injured* 37:1-19  
 Edens JW, Beekley AC, et al. 2009 Longterm outcomes after combat casualty EDT *J Am Col Surg*. 209:188-197  
 Powell DW, Moore EE, et al. 2004 Is Emergency Department Resuscitative Thoracotomy Futile Care for the Critically Injured Patient Required Prehospital Cardiopulmonary Resuscitation *J Am Col Surg* 199:211-215  
 Seamon MJ, Fisher CA, et al. 2007 Prehospital procedures before emergency department thoracotomy: “scoop and run” saves lives *J Trauma* 63:113-120