

RESEARCH ARTICLE

Blunt Esophageal Injury and Importance of Early Diagnosis: A National Trauma Data Bank Analysis

¹Mario F Gomez, ²Antonio Marttos, ³Nicholas Namias, ⁴Gerd D Pust

ABSTRACT

Objective: Blunt esophageal trauma is a rare entity. The aim of this study is to examine current management strategies, and determine risk factors associated with complications and mortality in the National Trauma Data Bank (NTDB).

Materials and methods: Using the NTDB from 2012, we identified adult patients who suffered blunt esophageal trauma. Patients were categorized undergoing early vs delayed management of esophageal injuries. Data collected included age, injury severity score (ISS), abbreviated injury score, length of stay, ventilation days, systolic blood pressure (SBP), time to procedure, comorbidities, esophageal-related procedures, complications, and disposition. Univariate and multivariable analysis were conducted to identify significant predictors of complications and mortality.

Results: We identified 160 adult patients with blunt esophageal injuries in the NTDB, of which 78 patients (49%) had data on specific management of the esophageal injury. Forty-five patients (58%) underwent early operative management and 33 (42%) had delayed operative management. Of patients in the early group, 31 (63%) had primary repair, 11 (24.4%) esophageal graft, and 3 (6.6%) esophageal tube placement. In the delayed operative group, 4 (12%) had primary repair, 14 (42%) esophageal graft, 10 (30%) esophageal tube placement, and 5 (15%) had drainage. Early diagnosis was associated with a higher definitive primary repair rate. Mortality was similar between both groups (15.5 and 24.4%, $p = 0.336$). The delayed group was associated with increased risk of pulmonary complications. Both groups were similar in age, gender, and race. Significant predictors of esophageal-related complications were Abbreviated Injury Scale (AIS) ≥ 3 and ISS.

Conclusion: Although rare, high index of suspicion for early detection of blunt esophageal injury must be maintained. Early operative management was associated with an increased rate of primary repair of the injury and decreased pulmonary complications.

Keywords: Blunt trauma, Esophageal trauma, Outcomes, Primary suture.

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RESUMEN

Objetivo: El trauma esofágico cerrado es una entidad quirúrgica poco común. El objetivo de este estudio es analizar información y datos nacionales sobre trauma esofágico, examinar las estrategias de manejo y determinar los factores de riesgo asociados con las complicaciones y la mortalidad en el National Trauma Data Bank (NTDB).

Material y métodos Estudio retrospectivo, usando información del NTDB de 2012, identificamos pacientes adultos que sufrieron traumatismo esofágico cerrado. Los pacientes se clasificaron de acuerdo a manejo temprano versus tardío de las lesiones esofágicas. Los datos recopilados incluyeron edad, puntaje de severidad de la lesión, puntaje de lesión abreviado, duración de la estadía, días en ventilación artificial y presión arterial sistólica, tiempo hasta el procedimiento, comorbilidades, procedimientos relacionados con el esófago, complicaciones y disposición. Se realizaron análisis univariados y multivariados para identificar predictores significativos de complicaciones y mortalidad.

Resultados: Identificamos 160 pacientes adultos con lesiones esofágicas contusas en la NTDB, de los cuales 78 pacientes (49%) tenían datos sobre el tratamiento específico de la lesión esofágica. 45 pacientes (58%) se sometieron a un tratamiento quirúrgico temprano y 33 (42%) tuvieron un manejo quirúrgico retrasado. De los pacientes en el grupo inicial, 31 (63%) tenían reparación primaria, 11 (24.4%) injerto esofágico y 3 (6.6%) colocación de tubo esofágico. En el grupo operatorio tardío, 4 (12%) tuvieron reparación primaria, 14 (42%) injerto esofágico, 10 (30%) colocación de tubo esofágico y 5 (15%) tuvieron drenaje. El diagnóstico precoz se asoció con una mayor tasa de reparación primaria definitiva. La mortalidad fue similar entre ambos grupos (15.5% y 24.4% $p = 0.336$). El grupo correspondiente a manejo tardío se asoció con un mayor riesgo de complicaciones pulmonares. Ambos grupos eran similares en edad, sexo y raza. Predictores significativos de complicaciones relacionadas con el esófago fueron el puntaje de lesión abreviada (AIS) ≥ 3 y el puntaje de severidad de lesión (ISS).

Conclusión: Aunque es poco común, se debe mantener especial atención para la detección temprana de la lesión esofágica contusa. El manejo quirúrgico temprano se asoció con una mayor tasa de reparación primaria de la lesión y disminución de las complicaciones pulmonares.

Palabras clave: trauma esofágico, trauma cerrado, sutura primaria, resultados

¹⁻⁴Trauma Surgeon

¹⁻⁴Department of Surgery, University of Miami, Miami, Florida USA; Ryder Trauma Center, Miami, Florida, USA

Corresponding Author: Mario F Gomez, Trauma Surgeon Department of Surgery, University of Miami, Miami, Florida USA; Ryder Trauma Center, Miami, Florida, USA, Phone: 3476221458, e-mail: mfgomez1229@gmail.com

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INTRODUCTION

Traumatic esophageal injury is a rare entity that carries a relatively high morbidity and mortality, even in high-volume trauma centers. Most traumatic esophageal injuries are due to penetrating neck injuries, with an incidence of less than 10%.^{1,2} The incidence of blunt esophageal trauma in the literature is reported as 0.001%.^{1,3,4} The diagnosis is often difficult because patients have few specific symptoms on presentation. The clinical presentation varies based on location of the injury, size of perforation, degree of contamination, and presence of associated injury.^{2,5} Pain is the most common symptom (71%) followed by fever (51%), dyspnea (24%), and crepitus in 22%.^{1,2,6} Additionally, symptoms of associated injuries may mask the aforementioned symptoms, which leads to a delay in diagnosis contributing to the increase morbidity and mortality associated with esophageal injury.

Since the overall prevalence of esophageal injury remains low, previous studies have mainly focused on evaluating the risk of morbidity and mortality associated with penetrating esophageal injury. Asensio et al⁷ published the largest multicenter study constituting 405 patients with penetrating esophageal injuries during 10.5 years to assess the impact of time to diagnosis and treatment on the morbidity and mortality on patients with esophageal injuries. A recent study evaluated data from the NTDB comprising 227 patients with penetrating esophageal injuries aimed to determine risk factors associated with esophageal-related complications and mortality.^{1,7} Although the two aforementioned studies have dealt specifically with penetrating esophageal injuries, there is a paucity of data evaluating blunt esophageal injury and its associated morbidity and mortality. As the largest aggregate of trauma data, the NTDB allows for analysis of treatment and outcomes of uncommon injuries, such as blunt esophageal injury. The aim of this study is to examine current management strategies and determine risk factors associated with complications and mortality in blunt esophageal trauma in the NTDB.

MATERIALS AND METHODS

The NTDB was queried to identify all patients aged 18 years and older who sustained traumatic esophageal injury, using the International Classification of Disease, 9th Revision code (ICD-9 codes 862.22) for 2012. Patients with iatrogenic esophageal perforation, penetrating esophageal injury, and with missing data of interest were excluded from the final analysis.

Variables extracted from the NTDB included demographics, comorbidities, mechanism of injury, AIS, length

of stay (LOS), and vital signs in the emergency department. In addition, treatment modalities and timing of surgical procedure (early *vs* delayed >24 hours) were abstracted.

Categorical values were reported as percentages, while continuous variables were reported as median. Univariate analysis was performed to identify difference between outcomes in the group of interest. A logistic regression was used to identify independent predictors of mortality. The accuracy of the test is calculated using the area under the curve with 95% confidence interval. Values with $p < 0.5$ were considered significant. Statistical analysis was performed using Statistical Package for the Social Sciences for Windows.

RESULTS

During the study period, a total of 160 patients were identified from the NTDB as having a blunt esophageal injury. Due to missing data, 83 patients (51.8%) were excluded from the analysis, leaving the final study population of 78 patients. Motor vehicle collisions, seen in 58 patients (74%), were the most common mechanism of injury, followed by pedestrian hit by car in 17% and falls were involved in 9% of cases (Table 1).

Patients with an esophageal injury were more likely to be males 45.5%, with median age of 49 years, and 50% were over the age of 50 years. On admission, 27% were identified as being hypotensive (SBP < 90), and a Glasgow Coma Scale of <9 was seen in 25.6% of cases. These patients had a median ISS of 24, with 73% having an ISS of >15. Associated severe head, chest, abdomen were documented in 31, 83.3, and 37.2% of patients respectively. Patients with blunt esophageal injury were grouped into having an early (<24 hours) *vs* delayed (>24 hours) surgical intervention. Early surgical intervention occurred in 57.6%, with 73.3% more likely to have an ISS >15, and an associated severe chest trauma of 97.8% (Table 1).

Overall, mortality was not found to be significant between both surgical intervention groups (15.5 *vs* 24.2%, $p = 0.336$). Pulmonary complications were the most common complication, with a trend toward higher incidence in the delayed group. Acute respiratory distress syndrome (ARDS) occurred in 36.3% of patients (4.4 *vs* 36.3%, $p = 0.0004$) and pneumonia in 33.3% (11.1 *vs* 33.3%, $p = 0.016$). No significant differences were noted in terms of hospital length of stay, ventilator days, and incidence of surgical site infection (SSI), deep vein thrombosis/pulmonary embolism (DVT/PE), and urinary tract infection (UTI) (Table 2).

Patients in the early surgical intervention group were more likely to undergo primary suture repair of the

Table 1: Demographics and clinical data according to early vs delayed operative intervention

	Total (n = 78)	Early <24h (n = 45)	Delayed >24h (n = 33)	p-value
Age (years)	49 (50)	46 (48)	54.6 (55)	0.025
Age >50	39 (50%)	21 (46.6%)	18 (48.4%)	0.491
Male (%)	50 (64.1%)	34 (75.5%)	16 (35.5%)	0.013
Injury severity score	26.4 (24)	28.4 (29)	26 (24)	0.325
ISS >15	57 (73%)	33 (73.3%)	24 (72.7)	0.952
AIS head ≥3(%)	24 (31%)	13 (28.9%)	11 (33.3%)	0.674
AIS chest ≥3(%)	65 (83.3%)	44 (97.8%)	21 (63.6%)	0.00006
AIS abdominal ≥3 (%)	29 (37.2%)	15 (33.3%)	14 (42.4%)	0.971
AIS extremity ≥3 (%)	22 (28.2%)	16 (35.6%)	6 (18.2%)	0.015
MVC	58 (74%)	36 (80%)	22 (67)	0.907
Pedestrian hit car	13 (17%)	5 (11%)	8 (24)	0.124
Fall	7 (9%)	4 (9%)	3 (9)	0.751
Length of stay (days)	15 (9)	20.1 (9.5)	15 (9)	0.334113
Ventilator days	6.3 (5)	7.5 (4)	6.3 (5)	0.337019
SBP <90	22 (27%)	13 (28.3%)	9 (27.3%)	0.875
Glasgow coma scale <9	20 (25.6%)	9 (20%)	11 (33)	0.182

Table 2: Outcome comparison between early vs delayed intervention

	Total (n = 78)	Early (n = 45)	Delayed (n = 33)	p-value
Length of stay (days)	15 (9)	20.1 (9.5)	15 (9)	0.334113
Ventilator days	6.3 (5)	7.5 (4)	6.3 (5)	0.337019
Complications				
ARDS	14 (18%)	2 (4.4%)	12 (36.3%)	0.00004
PNA	16 (20%)	5 (11.1%)	11 (33.3%)	0.016
SSI	12 (16%)	8 (17.7%)	4 (12.1%)	0.493
DVT/PE	3 (3.8%)	2 (4.4%)	1 (3%)	0.748
UTI	7 (9%)	4 (8.8%)	3 (9%)	0.748
Mortality	15 (19%)	7 (15.5%)	8 (24.2%)	0.336

ARDS: Acute respiratory distress syndrome; PNA: Pneumonia; SSI: Surgical site infection; DVT/PE: Deep vein thrombosis/pulmonary embolism; UTI: Urinary tract infection

Table 3: Different operative strategies in early vs delayed interventions

	Early	Delayed	p-value
Primary suture (n = 33)	31 (68.8%)	4 (12.1%)	<0.0001
Esophageal graft (n = 18)	11 (24.4%)	14 (42.4)	0.092
Esophageal stent (n = 13)	3 (6.6%)	10 (30.3%)	0.005
Drainage (n = 15)	5 (11.1%)	5 (15.1%)	0.597

Table 4: Independent risk factor for mortality

	OR	95% CI for OR	p-value
AIS	1.5	0.25–9.79	0.05
ISS	1.7	0.3–10.1	0.059

OR: Odds ratio; CI: Confidence interval

esophageal injury (68.8 vs 12.1%, $p = <0.0001$), followed by esophageal graft placement (24.4%), esophageal stent (6.6%), and drainage procedure (11.1%). Patients in the delayed surgical intervention group were more likely to have esophageal graft placement (42.4%), and 30.3% had esophageal stent placement (30.3 vs. 6.6%, $p = 0.05$) (Table 3). Additionally, logistic regression analysis identified ISS >15 to be an independent predictor of mortality (Table 4).

DISCUSSION

Blunt esophageal injury is uncommon and carries a high morbidity and mortality.⁸ Due to its low prevalence, there is a paucity of data, and most studies are mainly case reports. The purpose of this study was to examine a population of patients with traumatic blunt esophageal injury, specifically with regards to early vs delayed (>24 hours) surgical intervention and the associated management,

outcomes, and risk factors for mortality. The mortality rate between groups was not significant but there is tendency toward higher pulmonary complications in the delayed surgical group.

Traumatic esophageal injury is a rare entity due to the anatomical features of the esophagus; it is located deep in the posterior mediastinum and is protected by the thorax. However, once a perforation has occurred, subsequent infection and inflammation can rapidly lead to a critical condition.^{9,10} Adding to the complexity of diagnosing an esophageal injury is that most symptoms are subtle and can be masked by other injuries occurring due to the blunt trauma. Additionally, Mackler's triad associated with esophageal perforation may not always be present.^{6,11} The mechanism of esophageal perforation in blunt trauma can be due to direct crush damage, increase in intraluminal pressure secondary to an external force, and secondary damage due to associated fractures.^{2,12,13} In our study, 74% were involved in a motor vehicle collision, which is

in accordance with published case studies that esophageal perforation after blunt trauma requires a high external force. Beal et al¹¹ reported a case series of 96 cases, with the most common mechanism being motor vehicle trauma and 38% had esophageal-related complications.

Primary repair was the most commonly adopted surgical approach. Current recommendation is to expose mucosal layer, debridement of necrotic issue, and a tension-free repair. More extensive esophageal injury may require more aggressive approach, such as esophageal resection, drainage, or diversion.^{14,15-17} In our study, early surgical intervention was performed in 58% of patients who required an intervention and was associated with decreased complication rate. Current management guidelines advocate that early treatment is associated with improved outcomes, as there is decrease in spillage and inflammation.¹⁸ Asensio et al,⁷ in a retrospective multicenter study, found that delay in treatment was associated with a significant increase in complication rate and worse outcomes. A recent study involving 994 cases from the NTDB determined that early surgical intervention within the first 24 hours is associated with improved survival.⁸

Due to the rarity of blunt traumatic esophageal injury, limited data are available. For this reason, the NTDB was queried to obtain a large sample population. We excluded spontaneous, iatrogenic, and penetrating esophageal perforation focusing on blunt traumatic esophageal injury. The major weakness of our study is related to its retrospective nature and the fact that we only looked at the NTDB for the year of 2012, thus limiting our sample size. Additionally, a large patient population suffering from blunt esophageal injury had to be excluded due to missing data.

CONCLUSION

Although rare, a high index of suspicion for early detection of blunt esophageal injury must be maintained. Early surgical management was associated with increased rate of primary repair and decrease in associated pulmonary complications.

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INVITED COMMENTARY

**Blunt Esophageal Injury and Importance of Early Diagnosis:
A National Trauma Data Bank Analysis**

Esophageal trauma is rare and blunt trauma even more so. Therefore, any attempt to study this injury that carries high mortality and morbidity is worthwhile. This registry based study aims to assess the current management strategies and evaluate risk factors for failures.¹

The sample included 78 patients from one year (2012) with adequate data for analysis. The authors divided the material in two groups depending whether the repair was early or late (cut off 24 hours). About 60% underwent early surgery with majority undergoing primary repair. In the delayed group of 33 patients, only 4 patients (12%) had primary repair, whereas 42% had a graft, 30% a tube and 15% drainage only. There was no statistically significant difference in mortality (16% vs. 24%), but pulmonary complications were more common after delayed repair. Esophageal-specific and general trauma severity predicted mortality.

First the good news. We already knew that early diagnosis and treatment is better than delayed, and that primary repair is a good option when tissue conditions allow it. It is nice to see that confirmed even if not a spectacular finding. The statistical indifference in mortality might be explained by the small sample size. Too bad that the authors limited this study only to one year; they would have done a much better work in including more years, and the question is why in 2018 we need to see study 6 years old.?

Then the bad news, some of which the authors acknowledged. A registry-based small and old sample does not give relevant updated information. The authors could have done better! A large proportion of missing data questions the validity of the results. Finally, the authors list the complications in Table 2. Apparently there wasn't any leakages after primary repair, which is outstanding.

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Ari Leppäniemi
Abdominal Center
Meilahti Hospital
University of Helsinki
Finland