

# Blunt Trauma Diaphragm Injury in Children: An Analysis of the National Trauma Data Bank

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## Introduction

### Background

- Trauma is the **leading cause of mortality and morbidity in children** ages 1 through 18<sup>1-3</sup>
- Its **associated injuries** continue to be the prevailing reason for death in the pediatric population
- Approximately **9.2 million injured children** visit the emergency department in U.S. hospitals annually<sup>4</sup>
- Diaphragm injury is rare in both pediatric and adult populations, and it remains **one of the most commonly missed diagnoses of trauma**

### Why does this matter?

- It is **important to diagnose and treat TDR early** because it can lead to intestinal strangulation, sepsis and death<sup>5</sup>
- Current literature includes **only case reports and institutional series**; this limits our ability to generalize those findings

## Purpose

Estimate the frequency of blunt TDR in pediatric trauma

Describe the most common mechanisms of injury

Describe the patient outcomes after blunt TDR

## Method

### Research Design

- Retrospective Study
- National Trauma Data Bank (NTDB) from 2007-2017
- 6 million cases from 900 hospitals

### Inclusion Criteria

- Age between 0 and 18 years
- Blunt Injuries
- Patient with diagnosis of TDR

### Analysis

- Frequency and descriptive statistics
- t-test, linear progression, and cross-tabulation

## Results

### Characteristics of Patients with Blunt TDR

- A total of **88 pediatric patients** were identified with blunt TDR
- The mean age was **12 years**
- Males** account for 72% of the patients
- Caucasian** accounts for 64% of the patients, **Black or African American** accounts for 19%, and **other race** accounts for 11%
- The most common mechanism of injury was **motor vehicle accident** (65%), followed by **fall** (25%)

Table 1. Diagnostic Procedures on Patients with Blunt TDR

	Percent	Frequency
<b>Abdomen</b>		
Laparotomy	51.14	45
Computerized Tomography (CT)	30.68	27
Ultrasound	11.36	10
Laparoscopy	9.09	8
X-ray	2.27	2
<b>Thorax</b>		
Computerized Tomography (CT)	26.14	23
X-ray	11.36	10
Thoracotomy	11.36	10
<b>Head, Neck, Face</b>		
Computerized Tomography (CT)	35.23	31
Magnetic Resonance Imaging	3.41	3
X-ray	1.14	1
Electroencephalogram	1.14	1
<b>Extremities</b>		
X-ray	15.91	14
Magnetic Resonance Imaging	2.27	2
<b>Heart</b>		
Ultrasound	5.68	5
Magnetic Resonance Imaging	1.14	1
<b>Spine</b>		
Magnetic Resonance Imaging	3.41	3
X-ray	1.14	1



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## Results Cont'd

Table 2. Associated Injuries of Patients with Blunt TDR

Associated Injuries	Percent	Frequency
<b>Fractures</b>		
Fracture of Spine and Rib	48.86	43
Fracture of Extremities	28.41	25
Fracture of Skull	17.05	15
<b>Head and Neck Injuries</b>		
Intracranial Injury	22.73	20
Injury to Nerves and Spinal Cord	5.68	5
<b>Thoracic Injuries</b>		
Lung Injury	42.05	37
Pneumohemothorax	28.41	25
Hemothorax	18.18	16
Pneumothorax	7.95	7
Esophagus Injury	3.41	3
Heart Injury	3.41	3
Other Non-specific Thoracic Injury	2.27	2
<b>Abdominal Injuries</b>		
Liver Injury	37.5	33
Spleen Injury	32.95	29
Kidney Injury	21.59	19
Large Bowel Injury	20.45	18
Other Non-specific Abdominal Injury	17.05	15
Small Bowel Injury	13.64	12
Stomach Injury	5.68	5
Pancreas Injury	4.55	4
Adrenal Gland Injury	3.41	3

Table 3. Surgical Procedures on Patients with Blunt TDR

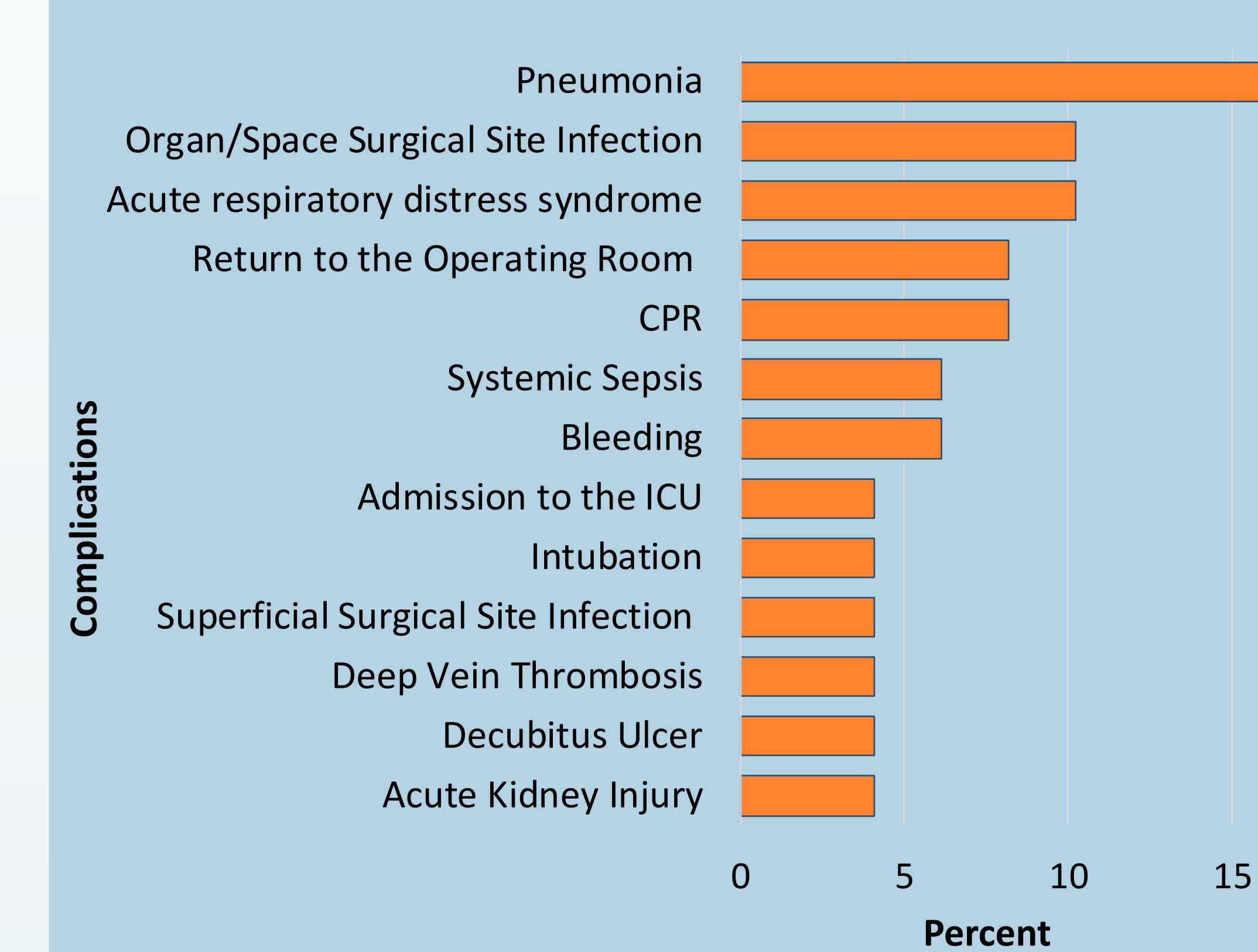
	Percent	Frequency
<b>Pleura</b>		
Intercostal Catheter for Drainage	64.77	57
<b>Diaphragm</b>		
Suture of Laceration	42.05	37
Non-Specified Repair	18.18	16
Repair of Hernia	7.95	7
<b>Small Intestine</b>		
Partial Resection	15.91	14
Anastomosis	5.68	5
Ileostomy and Enterostomy	5.68	5
Suture of Laceration	3.41	3
<b>Large Intestine</b>		
Suture of Laceration	11.36	10
Hemicolectomy and Transverse Colon Resection	10.23	9
Anastomosis	1.14	1
Colostomy	1.14	1
<b>Spleen</b>		
Total Splenectomy	14.77	13
Non-Specified Repair	1.14	1
<b>Stomach</b>		
Gastrostomy	7.95	7
Suture of Laceration	3.41	3
Gastroenterostomy Without Gastrostomy	2.27	2
Partial Gastrectomy	1.14	1

## Results Cont'd

### Injury Severity and Hospital Outcomes of Patients with Blunt TDR

- The overall injuries was rated as **severe** (ISS= 29.89)
- The average oxygen saturation was 92.1%
- Over half of the patients (70.5%) were **admitted to the ICU**
- The average ventilator days was 9
- The average hospital length of stay was 12.4
- Overall **mortality rate was 6%**

Figure 1. Complications of Patients with Blunt TDR



## Conclusion

- Blunt Traumatic diaphragm injury is associated with significant thoracoabdominal trauma and injuries to the thoracic cage, liver, or spleen**
- Any of these injuries should prompt trauma provider to the potential of diaphragm rupture
- Blunt TDR in children is uncommon but associated with **significant morbidity and mortality**
- Early diagnosis of TDR may mitigate potential adverse outcomes

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