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Research Article

Considerations about Traumatic Diaphragmatic Rupture, case series and Review of Literature

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Abstract

Introduction: Diaphragmatic rupture following trauma is often associated and missed injury. Traumatic diaphragmatic rupture remains a diagnostic challenge, and associated injuries determine the outcome in those cases diagnosed early. Penetrating trauma with direct injury to the diaphragm is more common and accounts for about two-thirds of cases. The incidence of injury is 5% in the thoracic-abdominal trauma [1-3]. This report documents our experience of treating traumatic diaphragmatic rupture in our Level 1 University Trauma Center.

Methods: We retrospectively analyzed 18 patients diagnosed with traumatic diaphragmatic rupture was presented in the Emergency Department from January 2019 to June 2019 caused by blunt trauma in 8 and by penetrating trauma in 4 cases.

Results: In our study were included 11 patients, 10 (90.9%) males, and 1(9.1%) female. The average age is 48.5 years, we have the age group 17-60 years where we have 9 (81.8%) cases, The diagnosis was made by chest X-ray in 7(72.7%), thorax and upper abdominal computed tomography in 45.40% of cases. The most common injured organs were the spleen (54.50%), liver (36.40%), Big Blood Vessels (27.3%), and intestinal (9.10%). The mortality rate was 18%.

Conclusions: Early diagnosis and early surgical treatment determine successful management of TDR, with or without herniation of the abdominal organs. Penetrating trauma with direct injury to the diaphragm is more common. Traumatic injuries of the left side are more frequent, consequently, the most damaged organ is the spleen.

Keywords: Diaphragm; Intervention; Postsurgical complications; Rupture

Abbreviations: TDR: Traumatic Diaphragmatic Rupture; MVA: Motor Vehicle Accident; FfH: Fall from Hight; HwSo: Hit with Strong object; GSW: Gunshot Wound; SW: Stab Wound; STW: Sharp Tools Wound; PE; Pulmonary embolism; MOF: Multi Organ Failure; DIC: Disseminated Intra-vascular Coagulation; MRI: Magnetic ResonanceImaging; T: Computerized Tomography Scanner; DPL: Diagnostic Peritoneal Lavage; BI: Blast Injuries; BT: Blunt Trauma; PT: Penetrate Trauma; SBP: Systolic Blood Pressure; HR: Heart Rate; HdCo: Hemodynamic Condition; FAST: Focused Assessment with Sonography in Trauma; ICU: Intensive Care Unit; LOS: Length of Stay; TDI: Traumatic Diaphragmatic Injury; ED: Emergency Department; OM: Operative Management

Introduction

The Diaphragm is the main respiratory muscle and the second most important muscle after the heart, it is so important for the respiratory process that any disorder of its function or damage to it is vital to the body [2]. Diaphragmatic injuries are relatively rare and may be due to Blunt (abdominal or thoracic) trauma, penetrating trauma, or a combination of trauma [1]. TDR occurs in 5% of patients with thoracic-abdominal trauma and abdominal mass herniation occurs in 45-60% of patients. In recent decades, the treatment of TDR has moved significantly [3]. The incidence

of TDR has increased in recent years, parallel to the increase in the frequency of abdominal injuries, caused by MVA or occupational accidents [1-4]. In establishing a more accurate and rapid diagnosis in addition to evaluate the mechanism of injury, TDR requires careful evaluation of other diagnostic methods such as Chest x-ray, CT, MRI, [3] or even the use of laparoscopy and DPL [5]. The objectives of this article are: to identify epidemiological data, the mechanism of damage for both types of TDR, to evaluate pre-hospital management as an important element in the early diagnosis of diaphragmatic trauma or concomitant injuries, or the localization of the injury and the correlation between it and the time of intervention by comparing it with the data of the literature. to illustrate postoperative complications according to Clavien - Dindo classification and their distribution and correlation with ISS.

Material and Method

Our study was retrospective, conducted within the period of January 2019 to June 2019. Our study included 11 patients who were presented at our University Hospital of Trauma. In our study, we were based on a few points that will make it easy: Grouping of patients by gender and age, from sort of trauma according to the trauma mechanism; in accordance with the time of hospitalization; under the transport mode; by ISS value; by the time of Surgery; with the accompanying damaged organs; to the postoperative complications; from the cause of death. Discrete data analysis (variables) were presented in absolute value and percentage.

Results

In our study were included 11 patients, 10(90.9%) males, and 1(9.1%) female. The average age is 48.5 years, we had most affected the age group 17-60 years where we have 9(81.8%) of cases. According to the etiology of TDR; 8(72.7%) cases were after PT, and 3(27.3%) cases from BT. Regarding the mechanism of injury, most of them were after penetrating injuries with 8(72.7%) cases, of which the most common were SW in 4(50.0%) cases, followed by GSW with 2(25.0%), while injuries with BI and with STW with one case. While after blunt injuries were 3(27.3%) cases, and 2(33.3%) cases after the Motor MVA and one case after the FfH. All trauma patients arrived at the hospital during the first 6 hours.

The patient's condition or HdCo in arrival based on the Allgower Formula (rate of SBP/HR) in most of cases were potentially risked in 6(55%) of cases, followed with hemodynamically stable in 4(36%) of cases and with hemorrhagic shock in one case. Most of trauma patients (64%) were transported with ambulance, and 36% of cases with private cars. The value of ISS at our patients had an average of 23.7. The performance of the examinations as part of the primary and secondary survey to do early diagnosis in diaphragm injury was Chest x-ray in 7(72.7%), Abdomen x-ray in 2(18.20%), CT in 5(45.40%), FAST in 6(54.50%) of cases. According to the side of diaphragm injuries, we have found the left side in 8(73%), and to right side in 3(27%) of cases. All cases had OM and the time of Surgery was in most of cases within the first 2 hours to 8(72, 7%), after 2-6 hours to 2(18.20%), and after 6 hours with one case (Table 1).

	Localisation / of Rupture		
Surgery Time	**Left Side**	**Right Side**	**Total**
0-2h	7(63.6%)	1(9.1%)	8(72.7%)
After 2-6h	1(9.1%)	1(9.1%)	2(18.2%)
After 6-24h	0(0%)	1(9.1%)	1(9.1%)
Total	8(72.7%)	3(27.3)	11(100%)

Table 1: Distribution of TDR in according the Surgery Time.

The accompanying injuries were as follows; Spleen in 6(54.5%), ribs in 5(45.50%), chest 4(45.5%), liver 4(36.5%), big blood vessels injury 2(18.20%), intestinal and pericardial injury in one case (Table 2).

Accompanying Injury	**References from Literature**	**Our Results**
Spleen	50%	54.50%
Ribs	47.20%	45.50%
Liver	38.60%	36.40%
Lungs	30.90%	27.3%
Big Blood Vessels	11.1%	18.20%
Intestinal	19.40%	9.10%
Pericardia	8.0%	9.10%

Table 2: Distribution of accompanying injuries in TDR.

During TDR treatment, it was also associated with other surgical procedures, with this distribution; Chest drainage at 9(90.9%) of cases; Liver suture in 3(36.4%) of cases; Splenectomy in 3(27.3%) of cases; Lien preservation in 1(9.1%) case, Primary Vascular Suture, Pericardial Suture and primary Stomach suture in one case. The recovery period was in most of the cases to 6(64%) in the surgical ward, and in 3(36%) of cases were treated in ICU. Evaluation of surgical wounds was per primam (not infected) in 9(82%) of cases and infected wounds in 2(18%) of cases. LOS in hospital was; more than 7 days in 10(90.0 %), and 0-1 day in one case; The distribution of Post-operative complications was:

Pleural Versament 36.4%, Sepsis 27.3%, Hemopneumothorax, Eventration, Biliary Fistula, Respiratory Acuteinsufficiency with one case. Mortality in our cases was 18%, while the time when it happened was one case during the surgery and one case after 72 hours. The causes of death, was result of fibrinolysis in one case, and PE in one case.

Discussion

In our study, we included 11 patients, 9.1% female, and 90.9% male, whose average age was 48.5 years. These data are in line with those in the literature Hofmann, Sabine, et al [6], and the values being as follows: males 88.2%, females 11.8% and median age 46 years. We also have a match with age distribution. In our study we showed that 82% were in the 17- 60 years age group and 18% in the 61- 60 years age group, whereas in the literature Gwely, et al [5]. this distribution is described as 83

% for 17-60 years and 10.9% over 61 years. The most common etiology of TDR has penetrated injury to 8(73%) of cases, followed by blunt injury with 3 (27%) of cases. Even in this case, we have a concordance with the literature data where TP causes 73% of cases with TDR [7,8]. Zarour, et al. [8] report the largest single-institution series in the current literature of 773 patients with TDI over a 15-year period. The majority (73%) of these patients were penetrating trauma victims, and most were managed with laparotomy and direct suture repair of the injury.

Every patient with penetrating trauma should be examined for diaphragmatic damage. In terms of mechanism of injury, most of them were after penetrating injuries with 8(72.7%) cases, of which the most common were SW in 4(50.0%) cases, followed by GSW with 2(25.0%), while injuries with BI and with STW with one case. While after blunt injuries were 3 (27.3%) cases, and 2(33.3%) cases after the MVA and one case after FfH. All trauma patients arrived at the hospital during the first 6 hours. The time of hospitalization, which is an important point, turns out to be 100% in the first 6 hours. The shorter time to submit to ED means a shorter time to diagnose TDR, faster OM, fewer complications from the herniation, and ultimately a reduction in mortality and morbidity. The proximity of our Center with localization in 81.8% of cases and the proximity of national roads to hospitals are the reasons why we have this distribution. These results are in agreement with the literature, Beng Leong Lim, et al [2]. Tseng J, et al [9]. "The Allgower Formula or Shock Index is reported to carry significant prognostic value for trauma and other emergency cases admitted to the emergency department".

In our study the patient's condition or HdCo in arrival based on the Allgower Formula in most of the cases were potentially risked in 6(55%) of cases, followed with hemodynamically stable in 4 (36%) of cases and with hemorrhagic shock in one case. The ISS has a gravity injury rate of 23.7 for those diagnosed with TDR and values below 16 represent 3(27.3%) of cases, values from 16-26 represent 5(45.5%) of cases and those above 27 represent 3(27.3%) of cases. These results are consistent with recent years' studies from Gwely, et al [10]. According to the site of injuries, we have found: the left side in 7(73%) of cases and the right side in 27% of cases. Right diaphragmatic injuries, especially after BT, are relatively rare and have a relative loss/delay of diagnosis and consequently delayed surgical treatment [11]. Missed diagnosis of a large, right-sided diaphragmatic rupture with herniated liver and concomitant liver laceration after blunt trauma: consequences for delayed surgical repair. However, many authors believe that TDR right side is associated with higher mortality, so they remain undiagnosed while undergoing autopsy. [10,12,13]. Mortality in our cases was 18%, while the time when it happened was one case during the surgery and one case after 72 hours. The causes of death were result of fibrinolysis in one case, and PE in one case. The accompanying injuries were as follows; Spleen in 6(54.5%), ribs in 5(45.50%), chest 4 (45.5%), liver 4(36.5%), big blood vessels injury 2(18.20%), intestinal and pericardial injury in one case (Table 2). So, given the limited number of cases we had in the study, we find that we have a concordance with the literature data on the most frequent organ injuries: spleen, Liver, Lung [1,8]. The adult ISS, right from the patient's first presentation, is rightly proportional to either morbidity or mortality, and even postoperative complications are proportional to them [3]. Mortality in our study was 18% and survival was 82%. In the literature, mortality is described by 10% -35%, so we have a good agreement with our study [4,14-18].

Conclusion

Early diagnosis and early surgical treatment determine successful management of TDR, with or without herniation of the abdominal organs. Penetrating trauma with direct injury to the diaphragm is more common. Traumatic injuries of the left side are more frequent, consequently, the most damaged organ is the spleen.

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