

FIVE YEARS EXPERIENCE OF TRAUMATIC DIAPHRAGMATIC INJURY.

Manzoor Ahmad, A.Baseer, M.Abid, F.K.Ismail, M.Imran, Kaleemullah, S.Z.A. Shah, A. Bilal

Department of Cardiothoracic Surgery, Post Graduate Medical Institute, Lady Reading Hospital, Peshawar

ABSTRACT

OBJECTIVE: To describe the clinical presentation, diagnosis, associated injuries and management of patients presenting with traumatic diaphragmatic injuries at Cardiothoracic unit, Post Graduate Medical Institute, Lady Reading Hospital Peshawar.

STUDY DESIGN: Retrospective descriptive study.

PLACE AND DURATION OF STUDY: Cardiothoracic unit, Post Graduate Medical Institute, Lady Reading Hospital Peshawar, from January 2006 to December 2010.

METHODOLOGY: 56 patients diagnosed with traumatic diaphragmatic injuries were retrospectively analyzed in Cardiothoracic unit, Post Graduate Medical Institute, Lady Reading Hospital Peshawar, from January 2006 to December 2010. Most patients were diagnosed with plain x-ray chest and x-ray chest with naso gastric tube in situ. Ultrasonography, computerized tomography and contrast studies were also used. The studied variables included patients' demographics, clinical presentation, type of injury, associated injuries, management and outcome.

RESULTS: Out of these 56 patients 40 (71.4%) were male and 16 (28.6%) female. The age ranged from 12 to 68 years with mean age of 31.7 years. The 56 patients included 42 with blunt diaphragmatic rupture and 14 patients who had a penetrating injury of the diaphragm. The anatomic distribution of injury to the diaphragm included 50 left-sided injuries and 6 right-sided injuries. Out of 42 blunt diaphragmatic rupture cases, 40 (95%) cases occurred on the left side and 2 (5%) on the right side. The penetrating injuries were left sided in 10 patients (71%) and right sided, in 4 (29%) cases. The penetrating injuries included 8 stab wounds, 5 gunshot wounds and 1 iatrogenic injury from a chest tube. The blunt injuries included 16 motor vehicle accidents, 10 pedestrians struck by motor vehicles, 12 with a history of fall, and 4 patients with bomb blast injuries. Six patients were asymptomatic, chest pain was present in 45 patients, 20 patients had abdominal pain, 34 patients had dyspnea, 42 patients complained of frequent vomiting, 28 patients were tachypnoeic, and 18 patients had cough. In these 56 patients, the diagnosis of diaphragmatic hernia was made before surgery in 51 patients (91%) and during surgery in 5 (9%). Most patients in our study had associated injuries like head injuries 8, rib fractures 8, pulmonary contusion or laceration 8, long bone fractures 6, gastrointestinal injuries 4, liver and spleen injury 1 each and 7 patients with having polytrauma. 17 patients were had no associated injuries.

Surgery was performed in all cases. In 32 patients emergency surgery was performed and in 24 patients elective surgery was performed. In 40 patients the approach was thoracic and in 12 patients' laparotomy was also performed along with thoracotomy, and in 4 patients only laparotomy was done, primary repair with non-absorbable sutures was done in 49 patients and polypropylene mesh patches was used in 7 patients.

Two (3.6%) patients died, one with associated head injury and one with bomb blast liver injury. Morbidity was 3(5.3%) with minor wound infection 2 patients and one patient developed recurrence.

CONCLUSION: The recognition of diaphragmatic rupture is important because of the frequency and severity of associated injuries. The difficulties in reaching the diagnosis require an aggressive search in patients at risk.

KEY WORDS: Diaphragmatic injury, Trauma, Associated injuries, Thoracic.

CORRESPONDENCE

Dr. Manzoor Ahmad,
Department of Cardiothoracic Surgery,
Post Graduate Medical Institute,
Lady Reading Hospital, Peshawar

INTRODUCTION

Traumatic rupture of the diaphragm is an uncommon condition. It occurs in 0.8 to 5% of patients admitted to hospital with thoraco-abdominal trauma. The etiologic factors are blunt trauma (for example, in motor vehicle accidents) and penetrating trauma¹. Diaphragmatic rupture with abdominal organ herniation was first

described by Sennertus in 1541^{2,3}. Diaphragmatic injury is a recognized consequence of high velocity blunt and penetrating trauma to the abdomen and chest rather than from a trivial fall³. These patients usually have multi system injuries because of the large force required to rupture the diaphragm⁴. Grimes in 1974⁵ described the 3 phases of the rupture of the diaphragm. The acute phase is at the time of the injury to the diaphragm. The delayed phase is associated with transient herniation of the viscera thus accounting for absence or intermittent non specific symptoms. The obstruction phase signifies complication of a long standing herniation, manifesting as obstruction, strangulation and rupture³. Patients present with non specific symptoms and may complain of chest pain, abdominal pain, dyspnoea, tachypnoea and cough⁶. A high index of suspicion, together with the knowledge of the mechanism of trauma, is the key factor for the correct diagnosis⁷.

Although autopsy studies have revealed equal incidence of right and left diaphragmatic ruptures, ante-mortum study reports suggest 88-95% of diaphragmatic ruptures occurred on the left side³. Right sided ruptures are associated with high mortality and morbidity⁸ and thus the under diagnosis of right sided injuries may be due to greater pre-hospital mortality³.

To avoid missing traumatic diaphragmatic injuries, one must maintain a high index of suspicion based on the mechanism of injury. Recent advances in imaging technology must be incorporated into the diagnostic armamentarium and into decision making. Once diagnosed, management of traumatic diaphragmatic injuries focuses on ventilatory support, treatment of associated injuries and surgical repair of the diaphragmatic tear. Surgical treatment of long-standing post traumatic diaphragmatic rupture is the same as that applicable in diaphragmatic hernias⁹. The first successful repair was performed by Riolfi in 1886³. The surgical treatment usually performed includes hernia reduction, pleural drainage and repair of the diaphragmatic defect. This may be performed either through an open laparotomy or thoracotomy or through laparoscopy or thoracoscopy. The mortality from elective repair is low but the mortality from ischaemic bowel secondary to strangulation may be as high as 80%².

METHODOLOGY

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RESULTS

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DISCUSSION

Traumatic diaphragmatic injuries are a relatively rare accompaniment to torso trauma and are usually associated with other injuries especially when due to blunt trauma. Concentration on other injuries sustained and inconsistency of signs on imaging can often lead to a missed diagnosis of Traumatic diaphragmatic injuries and inspection of both domes of the diaphragm at thoracotomy and laparotomy for trauma is mandatory.

In a review of 56 cases, the injury was 4 times more common in males and usually occurred in the 3rd decade of life¹⁰. Blunt trauma was responsible for 75% of cases. Left-sided ruptures accounted for 89.3% of cases, 11.7% occurred on the right. The vast majority of traumatic diaphragmatic injuries seen in the UK are due to blunt trauma, mainly because of the relative rarity of penetrating stab and firearm injuries. There is a high incidence of associated injury, most commonly chest (43.9%), pelvic (40%), splenic (37.6%), and liver (25%). Visceral migration may occur in 33% of patients and the mortality can be as high as 17-19%^{10,11}. In our study, visceral migration was (30.4%) and chest injuries (30%). The mortality in our study was low (3.6%) as compared to 17-19%.

There is no single investigation that provides a reliable diagnosis of traumatic diaphragmatic injuries at initial presentation. Between 33-70% are diagnosed on initial CXR, but this figure decreases in patients who are intubated¹². CT scanning increases diagnostic sensitivity to 66%¹⁴. Magnetic resonance imaging, ultrasound¹³, upper gastrointestinal contrast studies, laparoscopy and thoracoscopy have all been used in the diagnosis of traumatic diaphragmatic injuries.

There are various surgical approaches for diaphragmatic hernia repair. In our study, mostly primary repair with non-absorbable sutures was performed, mesh was used in only seven patients. Mesh patches are widely used. Polytetrafluoroethylene (Gore-Tex), polyethylene terephthalate (Dacron) and polypropylene are the most common materials used in prosthetic patches to repair large diaphragmatic defects that are not amenable to primary repair. Recently, some authors have suggested the use of a newer biologic material which is composed of a sheet of collagen derived from porcine dermis¹⁵. However, there are cases in the literature reporting patch infection and hernia recurrence after the use of a mesh¹⁶, thus we believe that primary repair with non-absorbable sutures is the best alternative for diaphragm repair, as it reduces the risk of infection and is more cost effective.

The frequency and severity of associated injuries seen in the group of patients presented here were consistent with those in other reports. Numerous articles describe splenic rupture occurring in 15% to 35% of patients with blunt diaphragmatic rupture, followed closely by liver lacerations in 10% to 30%, pelvic fracture in 30% to 50%, and thoracic aortic tears in 3% to 10%. Thus, diaphragmatic rupture emerges as a unique entity that, on the one hand, is an accurate predictor of serious associated injuries but, on the other hand, is frequently occult and difficult to detect in itself. The complications encountered in the present series were consistent with those in other reports. Most authors cite a wide variety of infectious complications, including pneumonia, wound infections, and subphrenic or intra-abdominal abscesses. The lack of uniformity in the methods of reporting complications makes direct comparisons among series less meaningful.

The overall mortality rate reported in the present series was 3.6%. This result was in accordance with those of other series that range from 4.3% in a series of predominantly penetrating injuries to 37% in a series of blunt injuries with most authors reporting 20% to 25% mortality rates^{17,18,19,20,21}. Irreversible shock and head injury are most often cited as causes of intra-operative or early postoperative deaths. Sepsis and multisystem organ failure predominate as late causes of death.

CONCLUSION

Suspicion of diaphragmatic rupture in a patient with multiple trauma injuries contributes to an earlier

correct diagnosis. Early diagnosis is very important for appropriate surgical management, reducing the risks of visceral strangulation and its complications. Optimal treatment consists of early repair with careful attention given to associated injuries. The outcome is dependent almost entirely on the severity of these associated injuries. Primary repair with non-absorbable sutures remains the gold standard for the closure of small to moderate sized defects. Patients with large defects may require patch closure with a mesh, but these can carry risks.

REFERENCES

- 1) Rajesh S, Sabaratnam S, Alan JM, Amit KC. Traumatic rupture of diaphragm. *Ann Thorac Surg* 1995; 60:1444-9.
- 2) Christie DB 3rd, Chapman J, Wynne JL, Ashley DW: Delayed right sided diaphragmatic rupture and chronic herniation of unusual abdominal contents. *Journal of the American College of Surgeons* 2007, 204(1):176.
- 3) Goh BK, Wong AS, Tay KH, Hoe MN: Delayed presentation of a patient with a ruptured diaphragm complicated by gastric incarceration and perforation after apparently minor blunt trauma. *Canadian Journal of Emergency Medicine* 2004, 6(4):277-280.
- 4) Meyers BF, McCabe CJ: Traumatic diaphragmatic hernia. Occult marker of serious injury. *Ann Surg* 1993, 218(6):783-790.
- 5) Grimes OF: Traumatic injuries of the diaphragm. Diaphragmatic hernia. *Am J Surg* 1974, 128(2):175-181.
- 6) Shreck GL, Toalson TW: Delayed presentation of traumatic rupture of the diaphragm. *J Okla State Medical Association* 2003, 96(4):181-183.
- 7) Mintz Y, Easter DW, Izhar U, Edden Y, Talamini MA, Rivkind AI: Minimally invasive procedures for diagnosis of traumatic right diaphragmatic tears: a method for correct diagnosis in selected patients. *Am Surg* 2007, 73(4):388-392.
- 8) Kelly J, Condon E, Kirwan W, Redmond H: Post-traumatic tension faecopneumothorax in a young male: case report. *World Journal Emergency Surgery* 2008, 3:20.
- 9) DeBlasio R, Maione P, Avallone U, Rossi M, Pigna F, Napolitano C: Late posttraumatic diaphragmatic hernia. A clinical case report. *Minerva Chir* 1994, 49(5):481-487.
- 10) Shah R, Sabanathan S, Meams AJ, Choudhury AK. Traumatic rupture of diaphragm. *Ann Thorac Surg* 1995; 60: 1444-9.
- 11) Smithers BM, O'Loughlin B, Strong RW. Diagnosis of ruptured diaphragm following blunt trauma: results from 85 cases. *Aust N Z J Surg* 1991; 61: 73741.
- 12) Shapiro MJ, Heiberg E, Durham RM, Luchtefeld W, Mazuski JE. The unreliability of CT scans and initial chest radiographs in evaluating blunt trauma induced diaphragmatic rupture. *Clin Radiol* 1996; 51: 27-30.
- 13) Guth AA, Patcher HL, Kim U. Pitfalls in the diagnosis of blunt diaphragmatic injury. *Am J Surg* 1995; 170: 5-9.
- 14) Murray JG, Caoili E, Gruden JF, Evans SJ, Halvorsen Jr RA, Mackersie RC. Acute rupture of the diaphragm due to blunt trauma: diagnostic sensitivity and specificity of CT. *AJR Am J Roentgenol* 1996; 166: 1035-9.
- 15) Mitchell IC, Garcia NM, Barber R, Ahmad N, Hicks BA, Fisher AC. Permacol: a potential biologic patch alternative in congenital diaphragmatic hernia repair. *J Pediatr Surg*. 2008; 43:2161-64.
- 16) Bekdash B, Singh B, Lakhoo K. Recurrent late complications after congenital diaphragmatic hernia repair with prosthetic patches. A case series. *J Med Case Rep*. 2009; 3:7237.
- 17) Freeman T, Fischer RP. The inadequacy of peritoneal lavage in diagnosing acute diaphragmatic rupture. *J Trauma* 1976; 16:538-542.
- 18) Rodriguez-Morales G, Rodriguez A, Shatney CH. Acute rupture of the diaphragm in blunt trauma: analysis of 60 patients. *J Trauma* 1986; 26:438-444.
- 19) Truesdale PE, Phippen WG. Traumatic diaphragmatic hernia following war injuries. *N Engl J Med* 1935; 212:597-602.
- 20) Aronoff RJ, Reynolds J, Thal E. Evaluation of diaphragmatic injuries. *Am J Surg* 1982; 144:671-675.
- 21) Aronoff RJ, Reynolds J, Thal E. Evaluation of diaphragmatic injuries. *Am J Surg* 1982; 144:671-675.