



TRANSDIAPHRAGMATIC INJURIES

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Transdiaphragmatic injuries were first described in 1541 by Sennertus¹. This condition is not uncommon with an incidence as high as 5% for patients hospitalized after blunt motor vehicle accidents and 15% for patients after penetrating injuries to the lower chest and upper abdomen. Almost half of these injuries develop into hernias². In view of its location, an injured diaphragm is almost always associated with other thoracic or abdominal injuries, potentially life threatening, however, it can also occur in isolation^{2,3}.

The advances in trauma diagnosis, critical care and surgery have greatly changed the management of diaphragmatic injuries over the last two decades. Diagnostic modalities include from traditional plain radiographs, ultrasonography, to computed tomography, magnetic resonance imaging, diagnostic laparoscopy and thoracoscopy⁴. 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, since it represents an occult marker for severe injury⁵.

Grimes⁶ in 1974 described the 3 phases of the rupture of the diaphragm: 1) The acute phase is at the time of the injury to the diaphragm; 2) The delayed phase is associated with transient herniation of the viscera thus accounting for absence or intermittent non-specific symptoms; 3) The obstruction phase signifies complication of a long-standing herniation, manifesting as obstruction, strangulation (necrosis) and rupture.

Due to coexisting injuries and the silent nature of diaphragmatic ruptures, the diagnosis can sometimes be missed in the acute phase and may present later with obstructive symptoms due to incarcerated viscera in the diaphragmatic defect or eventual strangulation^{6,7}. Patients present with non-specific symptoms and may complain of chest pain, abdominal pain, dyspnoea, tachypnoea and cough. A high index of suspicion, together with the knowledge of the mechanism of trauma, is the key factor for the correct diagnosis. Right sided are usually missed due to the protective effect of the liver, while left sided are easier to be seen especially in diagnostic laparoscopy.

Primary Repair of the Diaphragm

Multi-trauma patients are first managed conservatively to stabilize respiratory and circulatory status. Meanwhile, workups were performed to make clear diagnoses preoperatively. If the patient is unstable or presented with a large open wound, an exploratory procedure is planned

and performed as soon as possible. If the injury is mainly abdominal, a laparotomy would be chosen. In cases with thoracic-abdominal injuries, a combined thoracoabdominal approach would be used to access both the chest and abdomen⁸⁻¹⁰. If an abdominal injury has been ruled out, laparoscopy or thoracoscopy can be used to identify and manage transdiaphragmatic injury. Crush and firearm injuries might cause a large area of soft tissue defect after debridement, whereby a patch might be needed to alleviate tension after repair. Otherwise, the rupture is closed directly with pledged interrupted mattress sutures. When necessary, the ruptured edge of the diaphragm could be sutured to the intercostal muscles or around the ribs.

Nonetheless, in both open and minimally invasive surgical procedures, the use of mesh is necessary when the edges cannot be approximated tension-free¹⁰.

Repair of posttraumatic diaphragmatic hernia

The first successful repair was performed by Riolfi in 1886 in a patient with omental prolapse. 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^{7,8,10}. The mortality from elective repair is low but the mortality from ischaemic bowel secondary to strangulation may be as high as 80%. A chronic hernia usually suggests massive adhesion between hernia contents and the chest and there might be difficulty finding and repairing the diaphragm. Extensive mobilization is necessary before restoration of hernia contents and closure of ruptured diaphragm.

In conclusion, predictors of mortality in acute diaphragmatic injury are: age, ISS, and hemodynamic status of the patient. High index of suspicion is required for diagnosis of diaphragmatic lesions. Thorough inspection of both hemidiaphragms should be done routinely on every trauma patient undergoing laparotomy/laparoscopy or thoracotomy/thoracoscopy in order to avoid missed injury.

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