LESSON OF THE WEEK

Penetrating trauma to the junctional zone needs aggressive management

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Diagnostic laparoscopy or thoracoscopy can improve diagnosis of occult injuries to the diaphragm and reduce the risk of serious late morbidity

Stabbing injuries are now common, and the number of haemodynamically stable patients with penetrating injuries of the chest and upper abdomen who are treated conservatively has increased. The case we present supports a more aggressive approach to penetrating thoracic injuries that occur between the horizontal planes bounded by nipple line and umbilicus (junctional zone).

No universally accepted strategy for managing this condition exists. Some doctors use advanced cross sectional imaging¹ complemented by clinical acumen; others adopt a more invasive approach—laparoscopy or thoracoscopy.² We present a case where a missed injury to the diaphragm caused by penetrating thoracic trauma resulted in serious morbidity. We conclude that conservative management of such injuries results in a considerable risk of occult hernia of the diaphragm with potentially life threatening sequelae.

Case

A 15 year old healthy boy was assaulted with a knife and sustained a penetrating injury to his left posterior chest wall at the level of the ninth rib. He was haemodynamically stable, but plain x ray showed a left sided haemopneumothorax, which we managed successfully with a chest drain. He remained stable and a contrast enhanced computed tomography scan showed no visceral injury. He was monitored closely and was sent home after seven days. He was asymptomatic at three months' follow-up. Clinical examination and a chest x ray were normal at that point and the patient was discharged. One year later, he presented to the accident and emergency department with sudden severe epigastric pain, complete dysphagia, and blood stained vomiting. He was constitutionally unwell with tenderness in the left upper abdomen and decreased air entry at the left lung base.

A chest x ray showed collapse of the left lower lobe and blunting of the left costophrenic angle. An urgent double contrast computed tomography scan showed a defect in the diaphragm through which most of the stomach had herniated into the left hemithorax (figure).

An emergency laparotomy showed that all but the pylorus of the stomach had herniated through a 4 cm central defect and was incarcerated in the left chest

Computed tomography scan. Stomach herniated into the chest

with evidence of irreversible ischaemia. We performed a total gastrectomy with roux-en-Y reconstruction, and the patient made an uneventful recovery. Histology of the specimen confirmed an ischaemic stomach due to strangulation.

Discussion

Injuries to the diaphragm caused by penetrating trauma to the junctional zone are often missed.³ The management of such injuries in haemodynamically stable patients is contentious. The merits of conservative management versus early surgical exploration have been debated extensively with no universal consensus.

Intrathoracic pressure is negative during inspiration, and over time even a small defect in the diaphragm can result in abdominal viscera being drawn into the chest. Clinical sequelae are rare on the right side because of protection from the liver. The diaphragm is exposed on the left side, however, and it is more vulnerable to these pressure effects.⁴ The central diaphragm is tendinous and poorly vascularised; this can compound the problem by compromising healing.

A three phase model of the natural course of injuries to the diaphragm has been described.⁵ The acute phase extends from the time of original trauma to recovery from apparent acute injuries and is followed by a latent phase where abdominal viscera gradually herniate into the thorax. Finally, the obstructive phase begins when the herniated viscera become ischaemic and the patient experiences acute symptoms. Patients whose injury is missed in the acute phase usually re-present in the obstructive phase with serious effects. Adopting a conservative approach during the acute phase can be dangerous in this group of patients. The natural course of the condition is insidious and often obscure, and many patients default on follow-up.

Radiological investigations such as focused ultrasound and double or triple contrast helical computed tomography scans have a sensitivity of up to 95% to detect injury to the diaphragm.⁶ The problem is the 5% of patients who are asymptomatic but have an occult injury.

Laparoscopy is a valuable tool to investigate suspected injuries to the diaphragm, with a sensitivity of 87.5% and a negative predictive value of 96.8%.⁷⁻⁸ Video assisted thoracoscopy (VATS) provides an accurate assessment of intrathoracic injuries. It can be used for the definitive and effective management of diaphragmatic injuries caused by blunt or penetrating thoracic trauma.⁹ This technique requires expert single lung anaesthesia but permits fastidious examination of the diaphragm.

In conclusion, we report an adolescent boy who sustained a perforating injury of the diaphragm that was not detected on initial presentation, who subsequently needed a total gastrectomy because of this missed injury. This case supports a more proactive management strategy for penetrating injuries to the junctional zone. The addition of diagnostic laparoscopy or thoracoscopy to currently available imaging techniques can greatly improve diagnosis of occult injuries to the diaphragm and reduce the risk of serious late morbidity. Patients with a penetrating trauma to the junctional zone should be followed up

for longer, and detailed clinical examination should be supported by good quality chest radiology.

JA is the primary author. JA, GCB, RK, and WDBC all helped manage the patient and write the paper. JAK was the principal surgeon. JAK and WDBC were the consultants responsible for the patient and are guarantors.

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When I use a word Geographic metals

Sedna, food goddess of the Inuit, is said to have power over whales, seals, and polar bears

Alexander Litvinenko, the former KGB officer who was supposedly murdered by a Russian agent, was poisoned by polonium. But this highly radioactive element is Polish, not Russian. It was discovered in 1898 by Marie Curie, working in Paris—a discovery for which she won the Nobel prize for chemistry in 1911, having already shared the 1903 physics prize with her husband, Pierre Curie, and Antoine Henri Becquerel. She named the new element after her mother country, Poland (Latin Polonia).

Many other elements have been named after places, usually because they were discovered there or nearby. Various parts of Europe can claim one apiece: europium itself, copper (Cyprus), germanium, rhenium (the river Rhine, Latin Rhenus), ruthenium (Russia, Latin Ruthenia), and strontium (the town of Strontian in Scotland). The district of Magnesia in Thessaly boasts two—magnesium and manganese. France has three—francium, gallium (Latin Gallia=France), and lutetium (Latin Lutetia=Paris). The United States also has three—americium, berkelium, and californium, all discovered at the University of Berkeley in California.

But Scandinavia wins the terrestrial nomenclature battle, with seven in all. There are scandium (Latin Scandia), hafnium after Copenhagen (Latin Hafnia), and holmium after Stockholm (Latin Holmia). And the little village of Ytterby in Sweden lays claim to four, all to be found in the nearby quarry. In 1794 Johann Gadolin discovered a silicate, which he called ytterbite (later called gadolinite), from which A G Ekeberg extracted the earths (elemental oxides) yttria, erbia, and terbia. In 1828 Friedrich Wohler extracted yttrium from yttria, and in 1843 Carl Gustav Mosander extracted ytterbium, terbium, and erbium.

To beat that we must search the skies, finding eight elements named after celestial bodies—cerium (after the asteroid Ceres), palladium (the asteroid Pallas),

selenium (Selene, the moon), helium (Helios, the sun), tellurium (Tellus, the earth), uranium (Uranus), neptunium (Neptune), and plutonium (Pluto). (The last three are named after the planets (or whatever Pluto is nowadays), not the corresponding classical gods.) If one of the synthetic elements with temporary names, such as ununbium (number 112) or ununtrium (number 113), needs a non-systematic name, sedmium (Sd), after Sedna, the recently discovered body that circles the sun in a highly elliptical orbit outside that of Pluto, is available. Sedna is the food goddess of the Inuit, with power over whales, seals, and polar bears, which were created from the parts of her fingers that her father cut off. Her other name is Arnknagsak; anyone for arknagnagsakium?

There is even an element named after an imaginary place—thulium. Thule (Greek, of unknown meaning) was, says Pliny, a place six days' sail north from the Orkneys, first mentioned by Polybius (circa 150 BC) in his description of a voyage made by Pytheas from Massilia (Marseilles) in the late fourth century BC. At midsummer at Thule the sun did not set. Its inhabitants ate berries, oats, herbs, fruits, roots, and honey. It was surrounded by freezing fog, and to the north the sea itself was frozen. Eratosthenes situated it on the Arctic circle, Ptolemy in the Shetland Islands. Others variously identified it as Iceland, the northern tip of Denmark, or part of the northern coast of Norway. Procopius in the 6th century called it the home of the Goths. Virgil, in his *Georgics*, referred to "ultima Thule," meaning the uttermost limit. Thulium was extracted in 1886 by Paul Emile Lecoq de Boisbaudran from the mineral thulite (thulium oxide), discovered by the Swedish chemist Per Teodor Cleve in 1879. Perhaps there are enough connections for thulium to be counted among the Scandinavian elements.

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