Conclusion

Bernard's views on scientific method and on the demarcation of science are of even greater interest than his important discoveries in experimental physiology. To be profitable an experiment should be planned to demonstrate the truth or falsehood of a particular theory, but when analysing the results the scientist must be completely unpredisposed by his own views on the theory. He must apply completely different attitudes of mind to the planning and to the interpretation of the experiment, a difficult precept which Bernard succeeded in following. He emphasized also that one must not ignore the unexpected but note it for possible future investigations. Above all the scientist must be aware of his own limitations and of the limitations of the science which he practises. Observing these precepts, Claude Bernard was a great scientist.

REFERENCES

Delayed pneumoperitoneum following traumatic haemopneumothorax

A case report

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Summary

An unusual case of delayed pneumoperitoneum following a penetrating wound of the chest is presented. The mechanism of pneumoperitoneum, the diagnostic dilemma of injury to the abdomen in penetrating wounds of the lower chest, and the alternative methods used in achieving early diagnosis of diaphragmatic penetration are discussed.

The common practice of classifying penetrating wounds as either thoracic or abdominal is unfortunate. It is recognized that the diaphragm extends as high as the 4th intercostal space during expiration. In penetrating injuries of the lower chest the domelike anatomical configuration of the diaphragm predisposes it as well as other intraperitoneal structures to concurrent injury. Abdominal symptoms and signs in patients with wounds of the lower chest are difficult to interpret. Injury to the lower intercostal nerves can cause pain and muscular spasm where they are distributed in the abdominal wall. Irritation of the diaphragmatic pleura by blood might also cause epigastric pain. The surgeon is therefore often faced with a dilemma in deciding whether abdominal surgery is required.

The diagnostic problems of an unusual case of delayed pneumoperitoneum following a stab wound in the lower chest wall are reported.

Case report

A 30-year-old man was admitted to hospital with a stab wound in the right 6th intercostal space in the posterior axillary line. He was afebrile and haemodynamically stable. Auscultation revealed decreased air entry on the right side of the chest. There was no clinical evidence of tension pneumothorax. The abdomen was soft and non-tender. A chest radiograph showed a large haemopneumothorax with a total collapse of the right lung. There was no shift of the midline structures and no free air under the diaphragm. Abdominal radiographs were negative.

A thoracostomy tube was inserted in the right 5th intercostal space in the midaxillary line; 500 ml of blood was drained immediately. In the following 24 hours small amounts of blood
continued to drain from the tube, and there were no abdominal signs or symptoms during this period. The thoracostomy tube was accidentally disconnected from the underwater seal approximately 32 hours after admission. Within 2 hours the patient began complaining of severe upper abdominal pain. Examination revealed tachycardia, abdominal tenderness and guarding. A radiograph showed the presence of a large pneumoperitoneum. At laparotomy a small amount of free intraperitoneal blood and a small tear in the dome on the right side of the diaphragm were found. The postoperative course was uneventful.

Discussion

Pneumoperitoneum is an impressive clinical finding which usually suggests perforation of an intraperitoneal hollow viscus. This is the case in over 90% of patients in whom signs of peritoneal irritation are present. Madura et al.4 reviewed unusual causes of spontaneous pneumoperitoneum and suggested that, when constitutional and abdominal findings were absent, the source of the free air was not a ruptured hollow viscus and conservative management alone would be sufficient.

Pneumoperitoneum associated with pneumothorax in an injured patient is alarming and suggests diaphragmatic penetration with injury to the abdominal contents. Normally the intraperitoneal pressure exceeds the intrathoracic pressure during both inspiration and expiration.7 Pneumothorax with or without surgical emphysema should therefore not be associated with pneumoperitoneum even in the presence of diaphragmatic rupture. Also, patients with tension pneumothorax do not frequently develop this complication, either because of prompt treatment or inadequate build-up of intrapleural pressure.8

Only 3 reports of post-traumatic pneumothorax associated with pneumoperitoneum could be found in the English literature.9-11 Krausz and Manny8 described 2 patients with traumatic pneumothorax who developed pneumoperitoneum 5 and 8 days after injury. Mechanical ventilation using positive end-expiratory pressure was implicated as the cause of the pneumoperitoneum. Air escaped from ruptured alveoli along adjacent vessels into the mediastinum, then along peri­oesophageal tissues into the retroperitoneum and finally into the peritoneal cavity. Andrew and Milne9 described 2 patients with multiple injuries including pneumothorax who developed pneumoperitoneum several days after admission to hospital. In both cases this was associated with mechanical ventilation. Five similar cases were reported by Glauser and Bartlett.12 Kazarian et al.13 noted that practically all cases of abdominal penetration by stab wounds needing surgery become obvious within 12 hours of admission to hospital. Delayed symptoms and signs therefore suggest an unusual lesion and the delayed finding in our case caused a dilemma. Accidental disconnection of the thoracostomy tube led to an increase in intrapleural pressure, allowing air and blood into the peritoneal cavity, thus causing pneumoperitoneum and peritoneal irritation.

In about 20% of patients with penetrating thoracic injuries the abdomen has also been pierced.10,11 Petersen and Sheldon12 advocate routine abdominal exploration for stab wounds of the chest below the 5th intercostal space; this policy resulted in a 21% negative laparotomy rate. Bull and Mathewson,13 following a similar policy, reported that 27% of the penetrating wounds they explored had not entered the peritoneum.

Danto et al.,14 basing their diagnoses in penetrating wounds of the chest on clinical signs only, had a 30.8% negative abdominal exploration rate. When peritoneal lavage was added to the evaluation of injured patients, the negative laparotomy rate fell to 7.7%.

Talbert et al.2 evaluated peritoneal lavage in 51 patients with penetrating wounds of the thorax at or below the 4th intercostal space. There was a 22% incidence of diaphragmatic penetration and/or intra-abdominal injury. Lavage here had a sensitivity value of 91% and a specificity of 98%.

Jones et al.15 performed routine emergency thoracoscopy under local anaesthesia on 36 patients with haemothorax. The entrance wound was below the 5th intercostal space in 12 patients. In 50% of these, thoracoscopy showed that the diaphragm was injured. In 4 patients with suspected intra-abdominal injuries because of the low path of the weapon and abdominal tenderness, exploratory laparotomy was avoided after examination of the diaphragm by thoracoscopy, a safe and accurate procedure.16,16 Jones et al.15 also described its usefulness in avoiding unnecessary thoracoscopy, in stopping bleeding from injured intercostal arteries by diathermy, and in the evacuation of clots from the pleural space, thus avoiding a possible need for decortication.

Peritoneal lavage and thoracoscopy can therefore increase the possibility of identifying diaphragmatic penetration and intra-abdominal injury and minimize negative explorations.

REFERENCES