

Pneumothorax as a complication of laparoscopic inguinal hernia repair

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Abstract. Pneumothorax was identified as a complication of endoscopic hernia repair in two patients with insufflation pressures of 15 mmHg and operating times exceeding 2 h. These patients also showed intraoperative perturbations in both oxygen saturation and end-tidal CO₂ production. A prospective study was undertaken to determine whether similar complications would arise if preperitoneal insufflation pressures were limited to 10 mmHg. Postoperative chest x-rays were obtained on all patients to check for pneumothoraces, even clinically occult ones. Fifty patients were studied, with average operating times of 67 min. No patient demonstrated any hemodynamic or ventilatory changes, and none had any evidence of pneumothorax on x-ray. We conclude that these complications were not present when insufflation pressure was maintained at 10 mmHg and that routine x-ray is not warranted. Larger randomized trials of insufflation pressures are needed.

Key words: Pneumothorax — Laparoscopy — Inguinal herniorrhaphy

Successful surgical correction of inguinal hernias has been possible since the late 19th century [1]. Endoscopic extraperitoneal herniorrhaphy (EPPH) has also been well described [4, 7, 13] and is considered an excellent alternative to the traditional open procedure [11]. While complications can arise in both techniques, however, pneumothorax is unique to the endoscopic approach. This study discusses the etiology, treatment, and prevention of this condition, as well as the necessity of routine postoperative chest x-rays.

Materials and methods

Two sentinel cases involving dramatic ventilation abnormalities were identified at our institution in early 1995. Details follow.

Case report 1

A 38-year-old male, ASA I, was admitted for elective bilateral inguinal hernia repair by endoscopic extraperitoneal technique. The induction of anesthesia was uneventful. At the onset of surgery, O₂ saturation (SO₂) was 97%, blood pressure was 130/70, heart rate was 80, and end-tidal carbon dioxide (ETCO₂) was 36 mmHg. At the completion of the case, the patient desaturated to 84% and the ETCO₂ increased to 48 mmHg. A chest x-ray obtained in the operating room revealed bilateral pneumothoraces as well as pneumomediastinum. The patient remained intubated for 20 min, at which time a repeat x-ray showed a decrease in the extent of the pneumothoraces. He was extubated, and a third x-ray done in the recovery room showed complete resolution of the pneumothoraces. The patient was admitted to the hospital for observation and discharged 24 h later. The duration of the procedure was 135 min, and the insufflation pressure within the preperitoneal space was 15 mmHg.

Case report 2

A 40-year-old male, ASA II, was admitted for elective repair of bilateral hernias using the endoscopic extraperitoneal technique. Anesthetic induction was uneventful. At the onset of surgery, SO₂ was 99%, blood pressure 140/80, heart rate 80, and ETCO₂ 27 mmHg. The preperitoneal working space was maintained at a pressure of 15 mmHg. As the case progressed, ETCO₂ rose steadily and reached a peak of 49 mmHg. SO₂ at this time was 92%. The patient was noted to have massive subcutaneous emphysema, and a postoperative chest x-ray revealed pneumomediastinum and a 50% right pneumothorax. He was observed for 3 h in the recovery room, after which a repeat chest x-ray showed resolution of the pneumothorax. He was admitted overnight for observation and discharged the next morning. The duration of surgery was 145 min.

The respiratory abnormalities described in the two cases above are presented graphically in Fig. 1. Both patients were young male nonsmokers without any evidence of pulmonary disease. There was also no evidence of diaphragmatic or hiatal hernia. No break in the peritoneum was noted during either procedure. The recognition that pneumothorax occurred in these two patients with preperitoneal insufflation pressures of 15 mmHg prompted a prospective study involving 50 consecutive patients whose pressures were set at 10 mmHg. The study was performed between July 1 and December 31, 1995. A total of 56 type II and III Nyhus-classified hernias were repaired. Patients ranged in age from 18 to 75 years (median 42). There were six bilateral hernias. The endoscopic extraperitoneal approach previously described by us was used exclusively [5]. All patients received the same type of anesthesia. The following measurements were recorded intra- and postoperatively (where applicable): end-tidal CO₂, oxygen saturation, blood pressure, and heart rate. A postoperative chest x-ray was performed in all patients.

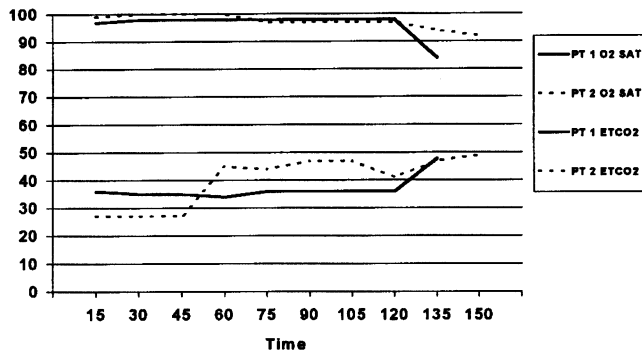


Fig. 1. Ventilatory changes in two cases of pneumothorax during EEPH.

Results

In this prospective study, 50 consecutive patients underwent successful EEPH with an average operating time of 67 min. There was no mortality and no morbidity. No patient demonstrated any significant fluctuation in either ET/CO₂ or SO₂ intraoperatively, and none exhibited any postoperative decompensation in SO₂. Vital signs were likewise stable both intra- and postoperatively. Of the 50 patients, eight experienced episodes of vomiting and retching in the recovery room. Postoperative chest x-rays showed no evidence of pneumothorax or of pneumomediastinum. There was no postoperative subcutaneous emphysema. All patients were seen by the operating surgeon at 1, 3, and 6 weeks postoperatively, and were without complications or recurrence.

Discussion

Pneumothorax is a known complication of laparoscopic surgery [2, 6, 10, 12]. Suspected etiologies include increased intra-abdominal pressure as a result of vomiting or retching [3], direct diaphragmatic injury, an infiltration of insufflated gas between the pleural or pericardial sacs, and spontaneous rupture of a preexisting bulla. It is also reported that in certain individuals potential channels exist between the peritoneal cavity and the pleural or pericardial sacs [9]. Another hypothesis postulates that gas may enter the retroperitoneal space and then migrate along tissue planes into the mediastinum or pleural spaces [12].

Pneumothorax has not been previously reported during EEPH. However, a recent article in the anesthesia literature [8] describes endoscopic extraperitoneal hernia repair having been complicated by a sudden increase in ET/CO₂ and the development of massive subcutaneous emphysema without hemodynamic instability. This was felt to be due in part to insufflation pressures that were kept between 14 and 18 mmHg.

In both cases we have reported here, pressures of 15 mmHg were maintained. In addition, both operating times exceeded 2 h, whereas no operation in the prospective group exceeded 90 min. In the prospective patients whose insufflation pressures were not allowed to exceed 10 mmHg there were no hemodynamic or ventilatory fluctuations intra- or postoperatively, and postoperative chest x-rays showed no pneumothoraces. It is our premise that pneumothorax as a complication of EEPH is most likely related to high insufflation pressures, as well as, possibly, to the length of the procedure. A larger randomized trial of insufflation pressures would help to clarify this issue, particularly since operating times cannot be controlled. We can conclude with greater certainty, however, that changes should not be anticipated in either SO₂ or ET/CO₂ when pressures are maintained at 10 mmHg or less, and that routine postoperative chest x-ray should be considered needless. If pneumothorax does develop, conservative treatment with monitoring of SO₂ is all that is indicated; the condition can be expected to resolve without the placement of a chest tube.

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