Late onset of subcutaneous emphysema following laparoscopic procedures

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Citation

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Abstract

Laparoscopic surgical procedures are increasingly being applied to treat intraperitoneal abnormalities. These minimally invasive techniques offer decreased postoperative pain and length of hospitalization. However, these procedures are not without potential morbidity. Herein, we describe a patient treated with laparoscopic cholecystectomy, whose case was complicated with late onset of subcutaneous emphysema. The subcutaneous emphysema was a late event, occurring during the 6th postopeatve day, and this is the first such description in the literature (to our knowledge). The patient was treated conservatively, until elimination of clinical manifestations. Increased operative time, high intra-abdominal CO₂ pressure, trocar-related factors and Nissen fundoplication have been related with the onset of subcutaneous emphysema. Usually, no intervention is needed for similar, uncomplicated cases.

INTRODUCTION

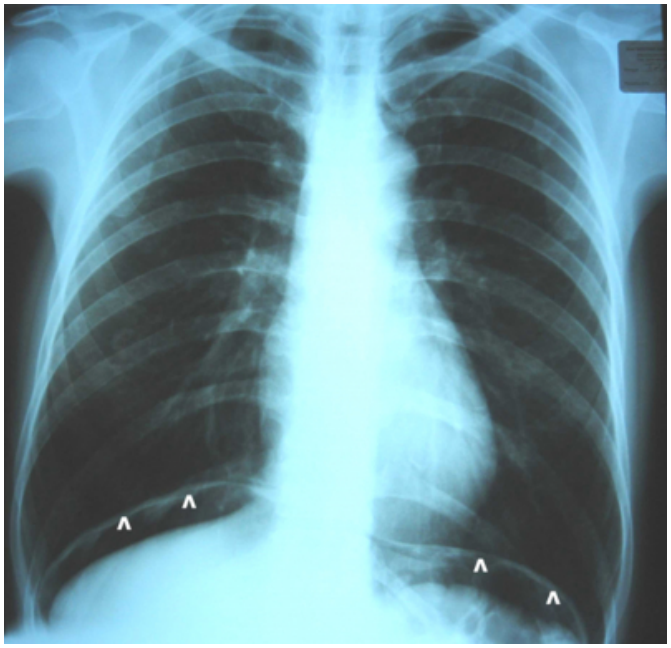
Laparoscopic surgery is being performed in many surgical facilities and is growing in popularity. It has evolved from a diagnostic tool to a method of performing complex surgical procedures. [1] Laparoscopic operations are considered relatively safe and non-invasive; however, there exists a small but important risk of developing complications related to insufflation with carbon dioxide (CO_2) gas. [2] These include, among others, hypercarbia, subcutaneous emphysema, pneumothorax, and pneumomediastinum. This report illustrates the management of a patient with a delayed development of subcutaneous emphysema, without pneumothorax/pneumomediastinum or hypercarbia, which presented on the 6 th postoperative day. To our knowledge, this delayed manifestation has not been reported previously.

CASE REPORT

A 54-year-old woman with an unremarkable medical history was admitted to the operation room for surgical treatment of symptomatic cholelithiasis. Pneumoperitoneum was induced with CO_2 insufflation, using the Hassan technique, at a pressure of 12mmHg. Three more trocars were placed along the right subcostal region. The surgery was uneventful, except for the increment of the duration (70 minutes), because of the presence of many inflammatory adhesions. No drainage was used, and after completion of the cholecystectomy, the pneumoperitoneum was released via the periumbilical port, after removal of the trocars inserted at superior midline and lateral sites. During the perioperative period, oxygen saturation remained stable between 98% and 100%. There was no increase in peak inspiratory airway pressure, no wheezing on physical examination and no subcutaneous emphysema. The patient was discharged on the next day, free of any clinical evidence of a complication. On the 6 th postoperative day, the patient complained of the descriptive crepitation of subcutaneous emphysema, located on the right upper abdominal quadrant. Chest and abdominal X-rays were done, which demonstrated sub-diaphragmatic presence of gas, without pneumothorax or pneumomediastinum (Figure 1). The patient was treated conservatively, until full compromise of clinical manifestations after 15 days.

Figure 1

Figure 1: Chest X-ray on the 6 postoperative day. Presence of an adequate quantity of intraperitoneal gas is depicted, but without pneumothorax or pneumomediastinum



DISCUSSION

Laparoscopic surgery has been associated with significantly less abdominal trauma and postoperative pain. It has, therefore, been a technique broadly used in the treatment of a variety of intra-abdominal abnormalities that had been treated previously with open surgical techniques. [3] Laparoscopic procedures, however, are not free of morbidity and predispose to a variety of unique complications not encountered at open laparotomy.

Carbon dioxide (CO_2) is the most widely used gas for insufflation, due to its non-flammability, good patient tolerance, and high diffusability with subsequent rapid rate of bodily excretion. Laparoscopic operations are associated with complications consequent to gas insufflation, such as subcutaneous emphysema, pneumothorax, pneumomediastinum and hypercarbia. [4] Thus, it is important that physicians involved in the postoperative treatment of these patients be familiar with these complications, their natural history, and their management.

The incidence rates for subcutaneous emphysema during laparoscopy vary from 0.43% to 2.34%. [5] Incidence rates for pneumothorax and pneumomediastinum, which usually are accompanied by subcutaneous emphysema, have not been reported. Because these complications can go unrecognized, especially when they are diminished, the true incidence might be higher than expected. [6] The true incidence of subcutaneous emphysema, pneumothorax and pneumomediastinum is believed to be significantly higher, because many such complications go undetected. [7] Subcutaneous emphysema by itself usually requires conservative treatment. On the contrary, when it is accompanied by pneumothorax, pneumomediastinum or hypercarbia, more invasive therapy is generally needed, in order to avoid increment of morbidity and mortality rates. [8]

Several predisposition factors have been related with the manifestation of such complications. Length of operative procedure is the most easily identified risk factor for complications related to CO_2 insufflation. Operative time over 200 minutes predisposes patients to subcutaneous emphysema, pneumothorax, pneumomediastinum and hypercarbia. [9] CO_2 absorption is believed to correlate directly with operative time by many authors. The etiology of subcutaneous emphysema is most likely leakage of insufflated gas into the subcutaneous tissue. An increase in the number of surgical ports also increases the number of points of entry of CO_2 gas into the subcutaneous tissue. The use of six or more operative ports, independently of the size and location of insertion, is also accused of predisposing for gas-related complications. [10]

Other authors have shown a strong association between high $PETCO_2$ and subcutaneous emphysema. Subcutaneous emphysema caused by insufflation with CO_2 results in increased CO_2 absorption through subcutaneous tissues, leading potentially to a final outcome of hypercarbia and increased $PETCO_2$. [11] Thus, maximum end-tidal CO_2 of 50mmHg or greater is accounted as a possible early and indirect sign of growing subcutaneous emphysema, possibly with pneumothorax, or pneumomediastinum. [12] Several authors have established a link between preperitoneal insufflations and extensive retroperitoneal dissection with the development of subcutaneous emphysema and resultant hypercarbia. [6,13]

Operative procedures involving extended diaphragmatic manipulation, as Nissen fundoplication, have been related with the onset of subcutaneous emphysema, which is typically located at the thoracic region, and frequently accompanied by pneumothorax or pneumomediastinum. [14,15] Hassan technique is not related with higher rates of similar complications, and some believe that suturing of the insertion point of the fascia facilitates the efficacy of pneumoperitoneum evacuation. [16] On the contrary, elevated

intraperitoneal pressure of CO_2 (30mmHg or greater), is associated with CO_2 absorption through subcutaneous tissues and greater rates of gas related complications. [9,17]

In the case we treated, none of the aforementioned predisposing factors was occurring. Furthermore, the onset of subcutaneous emphysema was very late, exceeding any description in the literature known to us. One can only speculate that in this case the CO_2 was entrapped in the abdominal cavity for several days and finally was gradually insufflated into subcutaneous tissues after almost a week, in an incessive way that did not provoke hypercarbia, pneumothorax, or pneumomediastinum. Obviously, in this case, the pneumoperitoneum was not adequately released via the periumbilical port, a procedure which is generally used by us, and additional techniques should be applied as routine procedure. Although this is not officially reported from other authors, we believe that the lack of use of a drainage tube might have participated in the insufficient pneumoperitoneum evacuation in our patient, since drainages can offer a possible way out to a trapped, intraperitoneal quantity of air.

In conclusion, one can say that laparoscopic procedures carry a relatively short, but substantive risk of subcutaneous emphysema and other gas related complications. Patients must be examined circumstantially for such events during the intra- and post-operative period, and the pneumoperitoneum should be cautiously evacuated after the completion of surgical procedures. Generally, subcutaneous emphysema requires conservative therapy, but when its presence is concluded, the possibility of coexisting hypercarbia, pneumothorax or pneumomediastinum should be investigated, in order to avoid further morbidity and apply the congruent treatment.

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