Editorial

Laparoscopy induced pneumothorax

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Pneumothorax is the clinical entity, which is characterized by abnormal collection of air or gases in the pleural space that seperates the lung from the chest wall and may interfere with normal breathing.

Pneumothoraces can be caused either by trauma to the chest, or as a complication of medical practice. More specifically, pneumothorax can be induced as a result of surgical intervention and laparoscopic procedures. The typical symptoms of pneumothorax are among others chest pain and shortness of breath.

Laparoscopy is a surgical technique, which becomes more and more popular. Pneumothorax is a known complication of laparoscopic abdominal surgery (1). It is most commonly a complication of procedures that include laparoscopic mobilization of the esophagus in procedures such as fundoplication. In general every laparoscopic procedure that contains dissection of the esophageal hiatus affects the parietal pleura and more specifically the left side (2).

The risk factors that have been correlated with pneumothorax development during laparoscopic surgery are operative times more than 200 min, positive end tidal CO_2 >50 mmHg, and operator inexperience (3-5). Detection of intraoperative pneumothorax is crucial and can be accomplished in several ways, with the most evident being the direct visualization of the entry point into left parietal pleura and visualization of the lung. The problem is that the entry point is not always obvious, and the only evidence of intraoperative pneumothorax may be paradoxical ballooning of the hemidiaphragm on the affected side or changes in respiratory dynamics as they are measured by the anaesthetist (3). The respiratory changes that occur as a result of pneumothorax are decrease of total lung capacity that is a result of decreased compliance, increased airway pressure and increase in CO_2 that cause an increase in the end tidal CO_2, which can be used as a primary indication of laparoscopy caused pneumothorax. Additionally, hypoxygonemia and hemodynamic changes can be seen (6). Other signs of intraoperative pneumothorax are jugular venous distention, especially in tension pneumothorax, hypotension, absent breath sounds, bulging diaphragm and expanding subcutaneous emphysema (7).

According to Ludemann *et al.*, changes in the electrocardiograph (ECG) pattern and more specifically in the amplitude of the QRS complex in the anterior precordial leads may be a very sensitive marker of pneumothorax (6). An experimental approach on pneumothorax was performed by Ludemann *et al.* in which pneumothorax was caused in animal models (sheep) showed that with the use of ECG reliable detection of pneumothorax size <100 mL was possible (6). The idea of this experiment was based on the fact that when a gas is introduced into the thorax, it assumes a most apical position, directly below the anterior precordial positions used for the 12-lead ECG recording. Additionally, the poor conductance of the introduced gas reduces the electrical recording of the ECG, leading to the fact that

the most evident changes are seen in the largest electrical component of the ECG, the QRS complex (6).

Clinical laparoscopic surgery includes the use of gases such as He and CO_2 (8). The problem is that the use of CO_2 for the creation of pneumoperitoneum can cause metabolic derangement; on the contrary with He pneumoperitoneum. The difference is a result of the fact that He is not absorbed. The intraoperative CO_2 pneumothorax is well tolerated in the clinical setting and it usually does not demand invasive techniques for its therapy, perhaps due to its ability to be absorbed (1). He pneumothorax, on the other hand requires a more aggressive approach in its therapy, because He is not absorbed. It is possible that the mechanism of He gas absorption from the thorax is simple diffusion, and this procedure requires many hours or even days in order to be completely resoluted. In these cases simple aspiration of the hemithorax is the therapy of choice, because it is efficient for the reduction of the gas volume and this treatment should be undertaken even in the asymptomatic patient (1).

The potential causes of intraoperative pneumothorax are simple gas diffusion, congenital defects and iatrogenic. More specifically, the congenital defects are para-aortic or para-caval spaces, inguinal space that can lead to pneumothorax via retroperitoneum, congenital patent diaphragmatic foramen. As far as iatrogenic causes are concerned these could be multiple including hiatal dissection with pleural or esophageal tears, barotrauma after bullae or emphysematous bleb rupture, trauma or tear of the diaphragm, central line placement or even trocar sites and pulmonary infarct (7-21).

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