Postoperative Respiratory Complications

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Epidemiology

The incidence of postoperative pulmonary complications (PRC) it is recently considered to be up to 5% [1]. In the high-risk group, the incidence may reach or even exceed 20% [2]. The mortality associated with PRC can be ranged 10-25% [3]. Fleischman et al found that the incidence of PRC was higher than perioperative cardiac events, considered to be a common postoperative problem [4]. Other authors reported that PRC is associated with a high morbidity profile [5].

Pathophysiology

The pathophysiological changes depend on the interactions between anesthesia, surgical site, and preexisting diseases. Anesthesia impairs the breathing pattern through central nervous system depression. Decreased functional residual capacity, until being less than closing capacity, may predispose for atelectasis formation. After the atelectasis formation, impaired pulmonary gas exchange may develop, progressing till respiratory failure occurs [6].

During anesthesia the muscles' tonus is reduced and the intraabdominal pressure due to viscera can reduce lung capacities as well. By the other side in a supine anesthetized patient, the posterior areas alveoli become less ventilated but the blood flow remains unchanged [7]. This process can explain possible ventilation-perfusion mismatch producing hypoxemia, atelectasis, and pneumonia.

The respiratory muscles are also inactive due to muscle relaxants and positive end- expiratory pressure during mechanical ventilation. Postoperative pain and surgical incision are responsible for respiratory muscle inactivity as well.

Smoking damages ciliated epithelium increases bronchial hyperactivity, increases mucus secretion, and small airways obstruction. All the preexisting disease can exacerbate PRC, especially pulmonary diseases, prolonged mechanical ventilation, and prolonged hospitalization. So optimizing the patient preoperatively is a crucial step to prevent PRC.

Risk Factors

Several risk factors for PRC are recently identified [8]. Generally risk factors are patient related or surgical related. The patient related risk factors for PRC include congestive heart failure, ASA class 2 and more, advanced age, chronick obstructive pulmonary disease, weight loss, smoking, gastroesophageal reflux, alcohol use, diabetes mellitus, obesity, obstructive sleep apnea, hypertension, cancer, liver disease, and pulmonary hypertension. The surgical related risk factors include thoracic and upper abdominal surgery, prolonged procedures (more than 3 hours), emergency surgery, massive transfusion, and prolonged hospitalization.

Protective Techniques

Preoperative optimization of preexisting pulmonary diseases is the first serious step. It is recently reported that chest physiotherapy seems to improve the patient’s respiratory function and decreases PRC [9]. Optimizing asthmatic patient includes chronic use of medications (aminophylline, corticosteroids, inhalator beta-adrenergic agonists and muscarinic antagonists). The patients suffering from obstructive pulmonary disease should have a detailed bronchodilatation therapy before surgery, often achieving maximal doses [10]. Smoking cessation is another important step but needs to be taken at least 4 weeks before elective surgery.

Anesthetic techniques are responsibility of the anesthesiologist. Avoiding bronchospasm and bronchial hyperactivity can be realized by adequate anesthesia depth. If possible the muscle relaxants must be avoided because of histamine release and deteriorating effects on respiratory muscles. Mechanical ventilation using low Tidal volume and moderate levels of PEEP can reduce PRC, pulmonary infections, and atelectasis (1).

An interesting debate is going on fluid therapy. Regarding minor surgery there is no significant difference between liberal and restrictive fluid management [11] but liberal fluid management seems to increase the PRC incidence in major surgery and in high-risk patients [12,13]. The use of colloids seems to be safer than crystalloids. Crystalloids solutions are administered in large quantities, distribute rapidly in extravascular space, and often are associated with tissue edema and hyperchloremic acidosis. Several studies have reported a possible colloids’ effect on modulating the inflammatory response to prevent the development of lung injury after shock [14,15].

Postoperative continuous positive airway pressure (CPAP) seems to be an effective method to reduce PRC. CPAP is especially useful for the patient that cannot breathe deeply after being extubated. Several authors had shown a significant reduction of PRC when CPAP was applied [16].
Gastric decompression is another effective method. Nasogastric tube may increase the likelihood of gastric aspiration and ventilator associated pneumonia, but decompressing the stomach can help for maintaining saturation, oxygenation, and ventilatory capacities. As a conclusion nasogastric tube must be used very carefully and with the right indication.

It is recently [17] reported that laparoscopy seems to be more effective that open surgery. Thoracic epidural analgesia is another issue. Aggressively treating postoperative pain can reduce PRC by encouraging deep breaths early mobilization of the patient. PRC are reduced by 30% as Li et al stated [18].

Transfusion of blood and blood components is a daily practice in intensive care units and in anesthesia. Several complications are reported but two of these are respiratory-related; transfusion-related acute lung injury (TRALI) and transfusion-associated circulatory overload (TACO). TRALI has an estimated incidence of 1.12% per unit transfused blood [17], increasing morbidity and mortality [19]. TRALI is characterized as onset of respiratory distress/failure within 6 hours after the plasma containing blood components. It is more frequently faced in septic, cardiac surgery, and intensive care units [19,20]. TACO often happens after high volume of blood transfusion. It is characterized by hypertension, increased left atrial pressure, pulmonary infiltrates, and increased brain natriuretic peptide. Taking present the risks-benefits ratio, minimizing blood and blood components transfusion, and having a detailed transfusion protocol may guarantee less complications [21].

Conclusions

PRC are as common as cardiac complications. Several factors are evidenced as risk factors: age, preexisting disease, smoking, diabetes, surgical site, sleep apnea, and pulmonary hypertension. The strategies for risk reduction include preoperative medical optimization, CPAP, selectively gastric decompression, laparoscopic approach, thoracic epidural analgesia, smoking cessation 4 weeks before surgery, and using low Tidal Volume combined with moderate PEEP during mechanical ventilation.

References