

RISK ASSESSMENT AND PREVENTION OF PERIOPERATIVE PULMONARY COMPLICATIONS

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Summary

The incidence rate of pulmonary complications in the immediate postoperative period of non-cardiac surgery equals the incidence rate of cardiovascular complications. Patients undergoing surgery in the upper abdomen or any major abdominal operation are at the greatest risk. Exacerbation of chronic lung disease, respiratory failure, development of atelectasis and pneumonia are the most common and the most significant pulmonary complications in the early postoperative period. Patient's health status, preoperative preparation and the type of surgery are the factors playing the leading role in the incidence of these complications. Prolonged hospitalization, increased treatment costs and longer recovery are additional significant issues requiring the routine introduction of procedures to reduce the incidence rate of perioperative pulmonary complications.

KEY WORDS: *pulmonary complications, perioperative period, abdominal surgery, risk factors*

PROCJENA RIZIKA I PREVENCIJA PLUĆNIH KOMPLIKACIJA U PERIOPERACIJSKOM PERIODU

Sažetak

Učestalost plućnih komplikacija u neposrednom poslijeoperacijskom periodu nakon nekardijalnih operacija jednaka je pojavnosti komplikacija od strane kardiovaskularnog sustava. Najvećem riziku izloženi su bolesnici nakon kirurških zahvata u gornjem abdomenu ili drugih velikih operacija u trbušnoj šupljini. Egzacerbacija kronične plućne bolesti, respiratorna insuficijencija, razvoj atelektaza i posljedičnih pneumonija najčešće su i najznačajnije plućne komplikacije u ranom postoperacijskom periodu. Zdravstveni status bolesnika, prijeoperacijska priprema te vrsta kirurškog postupka glavni su čimbenici pojavnosti ovih komplikacija. Prolongiranje bolničkog liječenja, povećanje troškova i dugotrajniji oporavak su dodatni značajni problemi koji nam nameću potrebu za rutinskim uvođenjem postupaka kojim ćemo smanjiti učestalost plućnih komplikacija u perioperacijskom periodu.

KLJUČNE RIJEČI: *plućne komplikacije, perioperacijski period, abdominalne operacije, čimbenici rizika*

INTRODUCTION

The incidence rate of perioperative pulmonary complications following any major abdominal surgery is rather high. The risk is particularly high in patients over 70 years of age with a type of restrictive or obstructive pulmonary disease, or any associated disease of other organ systems.

The development of these complications can be anticipated, and their incidence rate can be significantly reduced by using preventive therapeutic procedures and choosing less invasive surgical and appropriate anesthetic techniques. The risk assessment and resulting preventive actions are indispensable for the management of surgical patients.

Strategy for reducing the incidence rate of postoperative pulmonary complications takes two steps:

1. Risk assessment for developing complications
2. Risk reduction procedures

Risk assessment for developing complications

The risk assessment for developing pulmonary complications based on clinical examination and appropriate diagnostic tests is the first step to patient's care. The risk factors can be divided into two basic categories:

- patient-dependent risk factors
- risk factors related to the type and location of surgical procedure

Patient-related risk factors

Risk factors for developing pulmonary complications in surgical patients are related to patient general health status, and also to patient's habits (smoking, alcohol consumption, etc.). The most significant among myriad of risk factors include:

1. Age – A series of studies show the incidence rate is higher in patients over 60 years of age, especially in those over 70.
2. Chronic lung diseases, dyspnea at rest or during slight effort – especially COPD, unlike restrictive pulmonary disease that shows less risk except in cases of severe restriction of the pulmonary parenchyma.
3. Smoking – significantly increases risk and encouraging the patient to stop smoking reduces the incidence rate of complications in elective surgery
4. Congestive heart disease – associated with a high incidence rate of respiratory failure and complications
5. Patient ASA status >II
6. Both abrupt weight loss and excess weight, neurological disorders, diabetes mellitus

Surgical procedure-related risk factors

Many studies have shown that procedures performed for the purpose of surgical treatment significantly influence both the speed and quality of patient recovery and possible occurrence of pulmonary complications.

Procedures most commonly correlated with the development of these complications are as follows:

1. Type of surgery – aortal surgery, chest surgery, abdominal surgery, and upper abdominal surgery in particular
2. Duration of surgery – operations that take over two hours
3. Emergency surgical procedures
4. Anesthesia technique
5. Transfusion of blood or blood-based products – more than 4 units of blood
6. Postoperative pain

Diagnostic procedures for risk assessment

Preoperative preparations include physical examination, laboratory and x-ray tests, and, depending on comorbidity, additional specialist exams to evaluate and assess the risk of any surgical procedure. Tests for the purpose of evaluating pulmonary status of the surgical patient and assessing the risk of developing pulmonary complications include as follows:

1. Spirometry – is routinely performed in patients with chronic pulmonary disease. In a series of studies, spirometry has been shown to be a poor predictor of these complications. However, it provides an important insight into the functional status of patients with obstructive pulmonary disease, non-treated patients in particular, or it shows the therapy efficacy or reversibility of changes in the lungs.
2. Lung x-ray – is a routine test with its predictive value being more significant in heart than in lung patients; changes in lung parenchyma that can be seen in the elderly do not have a higher prognostic value for the development of pulmonary complications.
3. Laboratory tests – blood urea (>7.5mmol/l) and albumin (<35-39g/l) levels have been shown to be an important predictor for the development of pulmonary complications.
4. Blood gas analysis, or PCO₂ levels (>45mm Hg) indicate a high probability of pulmonary complications development or mortality. The PO₂ level of <50 mmHg is a contraindication for elective surgery. At the same time, both test results are a sim-

ple indicator of success of performed therapeutic procedures.

5. Microbiological analysis of the oropharyngeal mucosa is not a routine test during the preoperative preparation of patients; clinical trials, however, confirm that pulmonary infections in operated patients usually originate from the oral cavity.

Procedures for reducing pulmonary complications

After assessing the risk of developing pulmonary complications, steps for minimalizing their occurrence are to be taken. Preventive procedures are required in patients with chronic obstructive pulmonary disease (COPD) or patients undergoing surgeries associated with a high percentage of pulmonary complications. They are to be started in the preoperative, and continued during the operative and postoperative period. Such treatment necessarily requires a multidisciplinary approach that, besides the anesthesiologist and surgeon, includes also other specialties (internal medicine specialist, cardiologist, pulmonologist, neurologist, physical medicine specialist).

Preoperative period

In this period, any procedures to improve the pulmonary function, or pulmonary expansions are involved. According to clinical research studies that are currently available, there are no reliable techniques for respiratory function recovery, although any of the techniques or their combination may be considered beneficial.

1. Routine mechanical cleansing of the oral cavity and two-day disinfection of the mouth and nose with chlorhexidine is performed to reduce the frequency of pulmonary infections that develop due to bacterial translocation during intubation or other manipulations in the oral and nasal cavity.
2. In COPD patients, physical therapy aimed at respiratory muscles strengthening, secretion mobilization, cough stimulation, postural drainage, breathing exercises, inhalatory and, when required, antibiotic therapy, bronchodilator aerosol therapy, high dose corticosteroid administration

that are to be gradually reduced in the postoperative period. Antibiotic therapy in case of infected sputum takes about ten days and for this period, the elective procedure should be cancelled.

3. Abstinence from smoking for a minimum of two months before any elective surgery. Smoking cessation immediately before the procedure may result in increased secretion and the development of respiratory complications.

Intraoperative procedures

During this period, both the surgical and anesthesia techniques should be tailored to the patient.

1. Anesthesia procedures to reduce the possibility of developing pulmonary complications during general anesthesia include bronchodilator administration during the induction of anesthesia. The administration of lower FiO_2 in the inspiratory air mixture, exclusion of nitrogen oxide, administration of short-acting muscle relaxant agents, administration of PEEP (risk of barotrauma) and small-volume ventilation (6-7ml/kg) are required during surgery.
2. Regional anesthesia techniques, delivered independently or in combination with general anesthesia with reduced administration of anesthetics, relaxants, and local anesthetic positive effects on the cardiocirculatory stability and reduced bronchial reactivity, as well as a reduced need for postoperative mechanical ventilation can produce favorable effects on the postoperative recovery and the occurrence of pulmonary complications.
3. The placement of nasogastric tube is indicated only in case of selective gastric decompression.
4. Less invasive surgical methods (laparoscopic surgeries) to spare muscles of the abdominal wall and diaphragm are to be chosen, and a surgical technique developed and improved to shorten the duration of surgery and to reduce the frequency of pulmonary complications.

Postoperative procedures

The following procedures are only a continuation of the preventive measures already taken:

1. Good postoperative analgesia techniques, primarily those for continuation analgesia or PCA, either intravenous or epidural, enable balanced deep breathing and painless cough
2. Accelerated patient mobilization: sitting, getting up, as well as physical and respiratory therapy
3. Early enteral or combination of enteral and parenteral diet enriched with glutamines, vitamins, selenium and other micronutrients,
4. Oxygenotherapy, bronchodilators and corticosteroid therapy.

CONCLUSION

The routine assessment of risks for developing postoperative pulmonary complications and the implementation of preventive procedures to lower their incidence rate in patients at risk, reduce postoperative mortality and morbidity. A further follow-up of therapeutic value of any procedures as well as the evaluation of diagnostic

tests in relation to their predictive value for the development of pulmonary complications are required.

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