

POST-OPERATIVE CHEST X-RAY FINDINGS AND TEMPORAL LUNG CHANGES IN RELATION TO ANAESTHESIA METHOD PERFORMED DURING OPEN-HEART SURGERIES WITH CARDIOPULMONARY BYPASS

Gediminas Mačys¹, Viktorija Vasiukevičiūtė¹, Tadas Lenkutis²

¹*Faculty of Medicine, Lithuanian University of Health Sciences, Kaunas, Lithuania,*

²*Department of Anaesthesiology and Intensive Care Unit, Lithuanian University of Health Sciences, Kaunas, Lithuania*

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Summary

Aim. To evaluate and assess the role of anaesthesia type in the development of lung X-ray changes after open-heart surgery.

Methods. This is a retrospective study. During the period of 2019 11–2021 06, 287 patients underwent open-heart surgery with general anaesthesia (GA) (230 patients) or thoracic epidural analgesia with general anaesthesia (TEA + GA) (57 patients). We have collected data of patients' X-rays that were performed on the first and the fifth day after the surgery.

Results. There is a statistically significant relation that patients who received TEA + GA developed more changes of venous stasis ($p < 0.05$) in lungs X-ray on the first day post-surgery. Other findings revealed that following surgery, all the chest X-ray changes were detected more frequent in patients who had GA vs. TEA + GA performed. Nevertheless, these results didn't show statistical significance ($p > 0.05$).

Conclusions. The study reveals that there is a difference between anaesthesia method used for the development of abnormal pulmonary X-ray findings. The study shows that people who received TEA + GA were more prone to developing venous stasis post-surgery.

Introduction

During the postoperative period, pulmonary system complications are a leading cause of morbidity and mortality [1, 2]. Following open cardiac surgery, pulmonary complications

account for approximately 15.08% with a mortality rate of 18.5% among patients who developed respiratory system complications [3]. Atelectasis, infiltration, pleural effusion, and venous stasis are one of the most common pulmonary complications.

All anaesthetics have influence on pulmonary functions, either directly or indirectly through their impacts on other systems [4]. The studies show that thoracic epidural analgesia with general anaesthesia (TEA + GA) provides better analgesia [5] and is associated with fewer incidences of postoperative respiratory failure in comparison with general anaesthesia (GA) alone [6, 7].

The use of anaesthetic, particularly maintenance drugs such as propofol or barbiturates, can disturb the balance of immunological markers, which can lead to post-operative respiratory complications [8]. Following open-heart surgery, atelectasis and pleural effusion are common complications [9]. According to the studies, pulmonary atelectasis is a frequent discovery in people who underwent anaesthesia, as it affects from 85% to 90% of healthy adults [4,10]. Until present day there are not enough data published that compares these two types of anaesthesia methods and its relations with pulmonary complications. This study strives to compare two different patient groups who had TEA + GA and GA alone and determine the post-operative chest X-ray changes.

Aim of the study – to determine and assess the role of anaesthesia type in the development of lung X-ray changes after open-heart surgery.

Material and methods

Beginning from November 2019 to June 2021 at the Cardiac, Thoracic and Vascular Surgery Department of the Lithuanian University of Health Sciences Kaunas Clinics,

287 patients (209 men and 78 women) underwent open-heart surgery with general anaesthesia (GA) or thoracic epidural analgesia with general anaesthesia (TEA + GA) and normothermic cardiopulmonary bypass. GA was performed to 230 people, while TEA + GA was performed to 57. These two patient groups represent the object of the present study. All patients post-operatively had two follow-up chest X-rays. The first one was done after the first day post-surgery, and the second one – on the fifth day post-operation. Patients affected by chronic obstructive pulmonary disease (COPD), operated in emergency, or needing a redo operation were excluded from the study.

The study was approved by the Lithuanian University of Health Sciences Bioethics Centre. The study is retrospective one. All the collected data was anonymous. To analyse the data, we used SPSS 28.0 statistical software. The chi-square (χ^2) test was used to analyse differences between the variables. All p values less than 0.05 were considered statistically significant.

Results

We have collected data about 287 open-heart operations with normothermic cardiopulmonary bypass. The means of evaluated data about key points of performed surgeries are visible in Table 1.

The X-rays taken on the first and the fifth day post-surgery were assessed. The analysed X-rays revealed venous stasis in 135, atelectasis in 18, infiltration in 43, and pleural effusion in 143 patients on the first day following surgery. Patients who received TEA + GA compared to patients who had only GA had more complications of venous stasis (59.6% vs. 43.9%) and pleural effusion (52.6% vs. 49.1%). The ones who had GA in contrast to those who received TEA + GA, had more complications of infiltration (7.4% vs. 1.8%) and atelectasis (17.0% vs. 7.0%). There is a statistically signifi-

cant relation that patients who received TEA + GA developed more complications of venous stasis ($p < 0.05$) on the first day post-surgery. However, other complications' development on the first day following surgery and anaesthesia method chosen didn't showed a statistical significance.

On the fifth day following surgery, X-rays revealed venous stasis in 98 patients, atelectasis in 21, infiltration in 47 patients, and pleural effusion in 132 patients. On the fifth day after the surgery, all the complications were detected more frequent in patients who had GA instead of TEA + GA performed: venous stasis (35.7% vs. 28.1%), atelectasis (7.4% vs. 7.0%), infiltration (17.8% vs. 10.5%) and pleural effusion (46.1% vs. 45.6%). Nevertheless, these results didn't show statistical significance ($p > 0.05$).

Discussion

The use of TEA + GA in patients undergoing open-heart surgery was mostly related with a lower risk of post-operative pulmonary problems, according to the findings of this retrospective study. Our findings showed that on the first day post-surgery venous stasis and pleural effusion were more prone to develop when using TEA + GA than GA alone. Nevertheless, observing the X-rays five days following the surgery revealed that GA has a greater impact on longer-term abnormal pulmonary X-ray findings.

There is currently little data on the role of anaesthesia method performed in relation to chest X-ray changes after open-heart surgeries. However, the analysis of this study reveals the potential correlation of mentioned aspects.

A review of various studies focuses on pre-operative risk factors to development of post-surgery pulmonary complications, for-instance, older age, pre-operative congestive heart failure, pre-operative arterial oxygenation, cough, and shortness of breath, along with low FEV1 and FVC volumes [11,12]. One of the most significant factors to pulmonary problems is a longer stay in hospital, early mobilization contributes to lowering the risk to complications [13]. Pain following open-heart surgery could be debilitating, leading to unwanted outcomes such as pulmonary complications [14]. In most study cases, TEA with GA relates to better post-surgery analgesia and lower risks of post-operative respiratory system complications, moreover it helps lowering inflammation [15,16]. Controversially, other study findings states that the addition of epidural anaesthesia to GA doesn't show any less risk in developing major medical complications or mortality rates in long-term and both anaesthesia methods are appropriate [17,18].

During the research, the main problem we encountered was that most of the open-heart surgeries in our investigated hospital were performed with GA only. This led to difficulties

Table 1. Statistical means of evaluated open-heart surgeries with normothermic cardiopulmonary bypass.

Variables	Means
Cardiopulmonary bypass (<i>minutes</i>)	89.32
Aortic compression time (<i>minutes</i>)	47.38
Total duration of anaesthesia (<i>hours:minutes</i>)	05:15
Artificial lung ventilation (<i>hours:minutes</i>)	07:55
Post-operative fluids therapy on the 1st day post-surgery (<i>milliliters</i>)	2478.9
The loss of blood on the 1st day post-surgery (<i>milliliters</i>)	433.4
Total days spent in hospital (<i>days</i>)	20.3

finding a sufficient number of patients who underwent surgery with TEA + GA. Better study results could be achieved if the same number of patients were in both groups of different anaesthesia strategies. Another downside of the study was that the data collected only compared post-operative chest X-ray changes with anaesthesia method performed. Additionally, the X-ray changes would be more important if they would reflect in the patient's anamnesis.

Our work could be a beneficial starting point for future studies. A more detailed, more patients and data-included study should be performed to compare these anaesthesia methods. It would be beneficial to carry out a study that compares post-operative X-ray findings with ongoing anamnesis and patient's vitals. Considering that pulmonary complications remain high morbidity complications and research must be done to lower the risks of this issue.

Conclusions

The study reveals that there is a difference between anaesthesia method used for the development of abnormal pulmonary X-ray findings. The study shows that people who received TEA + GA were more prone to developing venous stasis post-surgery.

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**POOPERACINIAI PAKITIMAI PLAUČIŲ
RENGENOGRAMOJE, PRIKLAUSOMAI NUO
ANESTEZIJOS METODO PASIRINKIMO
ATVIRŲ ŠIRDIES OPERACIJŲ SU DIRBTINE
KRAUJO APYTAKA METU**

G. Mačys, V. Vasiukevičiūtė, T. Lenkutis

Raktažodžiai: bendroji anestezija, aukšta krūtininė epidurinė analgezija, plaučių rentgenograma, atviros širdies operacijos.

Santrauka

Tikslas. Įvertinti anestezijos įtaką plaučių rentgenologiniams pokyčiams po atvirų širdies operacijų.

Metodai. Šis tyrimas yra retrospektyvinis. 2019 11–2021 06 287 pacientams buvo atliktos atviros širdies operacijos, taikant bendrąją anesteziją (BA) (230 pacientų) arba aukštą krūtininę epidurinę analgeziją su bendrąja anestezija (TEA + BA) (57 pacientai). Analizavome pirmąją ir penktąją dieną atliktas pooperacines pacientų plaučių rentgenogramas.

Rezultatai. Pacientams, kuriems buvo taikyta TEA + BA, pirmąją dieną po operacijos rastas statistiškai reikšmingas ryšys veninės stazės atsiradimui plaučių rentgenogramose ($p < 0,05$). Kiti tyrimo rezultatai parodė, kad pacientams, kuriems buvo taikyta BA, po operacijos plaučių komplikacijos buvo aptinkamos dažniau, lyginant su pacientais, kuriems atlikta TEA + BA. Šie rezultatai neparodė statistinio reikšmingumo ($p > 0,05$).

Išvados. Atvirų širdies operacijų metu pasirinktas anestezijos metodas turi įtakos plaučių rentgenologiniams pokyčiams po operacijos. Pacientai, kurie gavo TEA + BA, buvo labiau linkę į veninės stazės išsivystymą po operacijos.

Adresas susirašinėti: gediminas.macys96@gmail.com

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