

Retrospective Evaluation of Patients with a Diagnosis of Primary Lung Cancer Who Underwent Resection with One-Lung Ventilation

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ABSTRACT

Objective: Lung cancer is still the leading cause of cancer-related death and the incidence continues to increase. The development of one-lung ventilation (OLV) techniques has provided new surgical alternatives. The aim of this study was to investigate the demographic characteristics, anesthetic approaches, and factors that affected the prognosis of patients who underwent OLV in the treatment of lung cancer.

Methods: With the approval of the ethics committee, the records of 114 patients who underwent a lobectomy or pneumonectomy with OLV for primary lung cancer were retrospectively reviewed. The age; sex; American Society of Anesthesiologists (ASA) score; comorbid diseases; operation type; complications; the quantity of fluid and blood given; the preoperative, peroperative, and postoperative hemogram and blood gas values; and the rate of postoperative transfer to the intensive care unit (ICU) were investigated.

Results: The mean age of the patients was 56.35±12.42 years; 89 (78%) were male and 25 (22%) were female. It was observed that 75 (65.8%) of the patients were smokers. An ASA classification of I-II was seen in 59 patients (51.75%), and an ASA classification of III-IV was noted in 55 patients (48.25%). Hypertension, diabetes mellitus, and chronic obstructive pulmonary disease were the most commonly seen comorbid diseases. The number of patients who received ICU care was 29 (25.43%). Of the admitted patients, 19 (65.5%) were ASA III-IV and 10 (34.5%) were ASA I-II; 19 (65.5%) were intubated and 10 (34.5%) were extubated. In all, 97 (85%) cases were a lobectomy and 17 (15%) cases were pneumonectomy. Twenty (20.6%) of the lobectomy patients and 9 (52.9%) of the pneumonectomy patients were taken to the ICU. It was determined that the age, comorbidities, ASA score, and complications were greater in the ICU patients, as well as the duration of anesthesia and OLV. There were a total of 10 (8%) cases with prolonged air leak, bronchopleural fistula, hemorrhage, or pulmonary edema complications.

Conclusion: It was concluded that a careful preoperative evaluation, surgical and anesthetic approach, and postoperative care are important to minimize the risk factors and improve the prognosis of thoracic surgery patients. These include bringing the lung function to the best possible state and assessing patient age, ASA score, comorbid diseases, operation type and anesthetic applications.

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Submitted: 17.01.2018
Accepted: 20.02.2018

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Keywords: Anesthesia; one-lung ventilation; primary lung cancer.

INTRODUCTION

An increase in the incidence of noncardiac thoracic surgery has been observed in parallel with the increased incidence of lung cancer, the progression of surgical procedures, the increased use of double lumen tubing and bronchial blockers, and the development of one-lung ventilation (OLV) techniques.^[1] In previous years, the surgical indications for pulmonary surgery were most often tuberculosis and empyema; however, the more recent surgical indications are mainly malignancies, followed by chest trauma, esophageal and mediastinal disease, pulmonary abscess, and bronchiectasis.^[2]

Lung cancer constitutes 12% to 16% of cases of all types of cancer, and 18% to 28% of all cancer-related deaths.^[3] Increased rates of smoking and greater air pollution in the 21st century have contributed greatly to these rates. According to the World Health Organization, worldwide, lung cancer is the most frequent cause of death among men, and the second most frequent cause among women.^[4] Previously, lung cancer was most frequently seen in the sixth decade of life; currently, it is observed most often at 70 to 74 years of age.^[5] Age, gender, pulmonary function, comorbid disease, ventilation performance state of the patient, stage and type of tumor, molecular biological factors, type of operation, and duration of anesthesia are all factors that affect prognosis.^[6]

The aim of this study was to investigate the demographic characteristics of patients, the anesthetic approach, longevity, admission to the intensive care unit (ICU), and other factors affecting the prognosis.

MATERIAL AND METHODS

The records of 114 patients who underwent an elective lobectomy or pneumonectomy with OLV for lung cancer in the clinic of thoracic surgery were retrospectively examined after obtaining approval from the ethics committee. Age; gender; smoking habit; American Society of Anesthesiologists (ASA) score; comorbid diseases; type and laterality of surgery; anesthesia applied; duration of OLV; quantity of fluid and units of blood transfused; complications; pre-, per-, and postoperative hemogram results and blood gas values; and the rate, cause, and ventilation state (intubated-extubated) of patients transferred postoperatively to the ICU were investigated, and average values were calculated. IBM SPSS Statistics 24 (IBM Corp., Armonk, NY, USA) was used to perform the statistical analysis. $P < 0.05$ was accepted as the level of statistical significance. Categorical values were expressed as percentages and analyzed using multiple regression analysis.

RESULTS

The mean age of the patients who underwent a lobectomy or a pneumonectomy with the indication of lung cancer was 56.35 ± 12.42 years, and the age groups are shown in Table I. The study population consisted of 89 males (78%) and 25 females (22%): a male/female ratio of 3.5/1. Seventy-five (65.8%) patients were smokers. In all, 59 patients (51.75%) were in ASA class I-II and 55 (48.25%) were classified as ASA III-IV. A total of 31 patients had 1 comorbidity (27.19%), 24 (21.05%) had 2, 5 (4.38%) had 3, 1 (0.87%) had 4, and 1 (0.87%) had 5 comorbidities. The most frequently seen concomitant disease was hypertension (HT) in 37 patients (32.45%), followed by chronic obstructive pulmonary disease (COPD) in 29 (25.43%), diabetes mellitus (DM) in 20 (17.5%), and congestive heart disease in 10 (8.77%) patients.

Review of patient files in which no premedication was administered revealed that, after standard monitoring, anesthesia was induced with 2mg/kg propofol, 2 μ g/kg fentanyl, and 0.6 mg/kg rocuronium. In female patients, a 37-F double-lumen was used for endobronchial intubation, and a 39-F double-lumen tube was used for male patients. A mixture of oxygen+air+sevoflurane was used to maintain anesthesia, and arterial and central vein catheterization was applied in all cases.

In this OLV study group, 60 patients (52.63%) underwent a left lobectomy and 37 (32.45%) a right lobectomy, while a left pneumonectomy was performed for 8 (7.01%) and a right pneumonectomy for 9 (7.89%). Of a total of 29 patients who were admitted to the ICU, 8 had undergone a left lobectomy (27.5%), 12 a right lobectomy (41.37%), 4 a left pneumonectomy (13.79%), and 5 a right pneumonectomy (17.24%). When the data of the 114 study participants were analyzed, it was determined that 20 of 97 (20.61%) patients who underwent a lobectomy and 9 of 17 (52.94%) who underwent a pneumonectomy were admitted to the ICU, indicating that a greater percentage of pneumonectomy patients were admitted to the ICU ($p=0.02$).

Table I. Age groups of the patients

| Age group (years) | n | % |
|-------------------|-----|-------|
| 20–29 | 6 | 5.3 |
| 30–39 | 4 | 3.5 |
| 40–49 | 18 | 15.8 |
| 50–59 | 34 | 29.8 |
| 60–69 | 37 | 32.5 |
| 70–79 | 15 | 13.2 |
| Total | 114 | 100.0 |

Table 2. Type of surgery and status of patients admitted to the intensive care unit

| | Left lobectomy | | Right lobectomy | | Left pneumonectomy | | Right pneumonectomy | |
|------------------|----------------|-------|-----------------|-------|--------------------|------|---------------------|-------|
| | n | % | n | % | n | % | n | % |
| Type of surgery | 60 | 52.63 | 37 | 32.45 | 8 | 7.01 | 9 | 7.89 |
| Admission to ICU | 8 | 13.33 | 12 | 32.43 | 4 | 50 | 5 | 55.55 |
| Intubated | 5 | 62.5 | 9 | 75 | 2 | 50 | 3 | 60 |
| Extubated | 3 | 37.5 | 3 | 25 | 2 | 50 | 2 | 40 |

ICU: Intensive care unit.

Table 3. Relationship between various parameters and intensive care unit admission

| Parameter | Correlation coefficient (R) | P |
|------------------------|-----------------------------|--------|
| Intubated/extubated | 0.766 | 0.000* |
| Age | 0.179 | 0.029* |
| Gender | 0.031 | 0.371 |
| Smoking | 0.003 | 0.486 |
| Comorbidity | 0.252 | 0.003* |
| ASA class | 0.193 | 0.02* |
| Type of surgery | 0.192 | 0.02* |
| Duration of anesthesia | 0.215 | 0.011* |
| Duration of OLV | 0.265 | 0.002* |
| Transfusion | 0.013 | 0.445 |
| Complication | 0.170 | 0.035* |

ASA: American Society of Anesthesiologists; OLV: One-lung ventilation.

In all, 19 intubated and 10 extubated cases were admitted to the ICU ($p=0.000$). The type and laterality of the surgery and the ventilation state (intubated or extubated) of the patients that were admitted to the ICU is provided in Table 2. The indications for ICU admission were prolonged operative time, excessive bleeding and extensive blood transfusion, acute respiratory insufficiency, higher ASA scores, and the need for close monitoring following major surgery. Of the 19 intubated patients, 10 had profuse bleeding (52.63%), 5 had prolonged surgery (26.31%), and 4 had acute respiratory insufficiency (21.05%). Among the 10 extubated cases admitted to ICU, 5 were due to profuse bleeding (50%), 2 were a result of prolonged surgery (20%), and 3 were ASA III-IV patients admitted for close monitoring (30%).

Of the patients admitted to the ICU, 10 were classified as ASA I-II (34.5%) and 19 were ASA III-IV (65.5%). A statistically significant difference was determined with respect to ASA category and ICU admission ($p=0.02$).

The mean duration of anesthesia, surgery, and OLV was 293.85 ± 103.00 , 272.76 ± 102.52 and 200.39 ± 82.66 min-

utes, respectively. The mean quantity of blood loss and fluid transfusion was 527.63 ± 506.42 mL and 2506 ± 1268.96 mL, respectively. A total of 48 patients (42%) underwent transfusion.

The postoperative complication of a prolonged air leak was seen in 4 patients (40%), bronchopleural fistula was observed in 2 (20%), there was bleeding in 3 (30%), and pulmonary edema occurred in 1 (10%). A statistically significant correlation was observed between admission to ICU and age, gender, comorbidities, ASA classification, type of surgery, anesthesia, duration of OLV, and perioperative and postoperative complications ($p<0.05$) (Table 3).

DISCUSSION

Despite developments in the diagnosis, staging, and treatment of lung cancer, it has a high mortality rate. Increased exposure to harmful industrial and environmental factors, and an increased percentage of the aging population are contributors to mortality.

As in the rest of the world, in our country, critical patient care and monitoring are performed in the ICU. These hospital units have the highest mortality rates, as it is there that patients with very serious clinical manifestations are seen and invasive interventions are most intensively applied.^[7] In Turkey, various mortality rates have been reported for ICUs: Ceylan et al.:^[8] 40.2%, Ursavaş et al.:^[9] 38.4%, and Günel et al.:^[10] 43.6%. Boussat et al.^[11] detected a much higher mortality rate (66%) among primary lung cancer patients who had been admitted to the ICU.^[11] Since mortality rates are the most reliable determinant of ICU performance, we examined admissions to the ICU as a factor affecting the mortality rate.

In their study of 1155 cases of lung cancer, Tammemagi et al.^[12] observed that age and smoking were important factors affecting survival, and they estimated that each 10-year increase in age increased mortality at a rate of nearly 40%. Sigel et al.^[13] performed a large-scale study encompassing 27,859 lung cancer patients and found that 20% were aged <60, 32% were 61–69, 37% were 70–79, and

11% were >80 years of age. Similarly, we found that 29.8% of our patients were aged 50–59 years, 32.5% were 60–69, and 13.2% were 70–79. We also observed a correlation between age and admission to the ICU, and had comparable results for the age groups of 60–69 and 70–74 years, which had the highest risk for mortality.^[14]

Sağiroğlu et al.^[15] retrospectively screened the records of 100 patients who had undergone lobectomy for lung cancer, and they did not determine any correlation between gender, smoking, and mortality. Similarly, we did not find a statistically significant correlation between these parameters and admission to the ICU, which can be a determinative factor in the prognosis of these cases, while some studies have reported an impact on mortality related to gender and smoking.^[16]

The patient's general health status, comorbidities, and protection of the intact lung from the effects of collapse, secretion, and blood require extreme care when applying thoracic anesthesia.^[17] Comorbidities may be important prognostic determinants in lung cancer. Marcus et al.^[18] investigated the effects of concomitant diseases on lung cancer mortality and reported that the severity of concomitant diseases increased the risk of mortality. They found that most frequently, chronic lung disease, DM, metastatic tumor, and acute myocardial infarction were observed as comorbidities. Our results also demonstrated that there was a higher ASA score, and a greater number of concomitant diseases, specifically HT, COPD, DM, and congestive heart failure were seen in patients admitted to the ICU.

Lee et al.^[19] compared lung cancer patients who had undergone bronchoplastic lobectomy and pneumonectomy and found a higher perioperative mortality rate but comparable complication rates in pneumonectomy cases.^[19] Similarly, 20 (20.61%) lobectomy patients and 9 (52.94%) pneumonectomy patients in our study were admitted to the ICU.

In thoracic surgery, OLV ensures the safety of the patient, improves the surgeon's field of vision, and increases the quality of the surgery. However the potential development of hypoxemia should not be forgotten with a prolonged procedure.^[17] In their study, Sağiroğlu et al.^[15] determined a mean duration of anesthesia and surgery of 218.81 ± 81 and 185.8 ± 61.47 minutes, respectively. They reported a duration of anesthesia of ≥ 4 hours in 41% of their cases.

Kürkçüoğlu et al.^[20] analyzed the duration of anesthesia in cases operated on for lung cancer and reported a duration of anesthesia, surgery, and OLV of 297.56 ± 95 , 233.72 ± 84 , and 209.52 ± 85 minutes, respectively. They reported a longer duration in cases of pneumonectomy. Consistent with these studies, we determined a mean duration of anesthesia, surgery, and OLV of 293.85 ± 103.00 , 272.76 ± 102.52 , and 200.39 ± 82.66 minutes, respectively,

and longer durations for pneumonectomy patients. We also found a statistically significant correlation between such prolongation and the admission of the patients to the ICU.

CONCLUSION

We think that age, ASA score, comorbid diseases, type of surgery, duration of anesthesia, and the procedure performed have an effect on the prognosis of patients with lung cancer. The minimization of risk factors determined during the preoperative evaluation, the optimization of pulmonary function, a careful surgical and anesthetic approach, and postoperative care are important prognostic factors.

Ethics Committee Approval

Ethics committee approved.

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: G.A., B.E.Ç., Ç.A.Ö.; Design: G.A., F.D.G., B.E.Ç., E.E.C., R.D.; Data collection &/or processing: G.A., Ç.A.Ö.; Analysis and/or interpretation: G.A., Ç.A.Ö., B.E.Ç., E.E.C.; Literature search: G.A., B.E.Ç., F.D.G.; Writing: G.A., B.E.Ç.; Critical review: G.A., B.E.Ç., R.D.

Conflict of Interest

None declared.

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Primer Akciğer Kanseri Tanısında Tek Akciğer Ventilasyonu İle Rezeksiyon Uygulanan Hastaların Geriye Dönük Olarak Değerlendirilmesi

Amaç: Tek akciğer ventilasyon (TAV) tekniklerinin gelişmesi ile, kansere bağlı ölümlerde ilk sırada olan ve görülme sıklığı giderek artan akciğer kanserlerinin cerrahisine olanak sağlanmıştır. Çalışmada, akciğer kanseri nedeniyle TAV uygulanarak ameliyat edilen hastaların demografik özellikleri, anestezi yaklaşımı, prognozu etkileyecek faktörlerin araştırılması amaçlanmıştır.

Gereç ve Yöntem: Etik komite izini alınarak primer akciğer kanseri nedeniyle TAV uygulanarak lobektomi veya pnömonektomi yapılan 114 hastanın kayıtları geriye dönük olarak incelendi. Olguların yaş, cinsiyet, ASA skoru, ek sistemik hastalıkları, operasyon tipi, komplikasyonlar, kanama, verilen sıvı ve kan miktarı, ameliyat öncesi, ameliyat sırasında ve sonrasında hemogram ve kan gazı değerleri, ameliyat sonrası yoğun bakıma ünitesine (YBÜ) transport oranı incelenip ortalamaları alındı.

Bulgular: Hastaların yaş ortalaması 56.35 ± 12.42 yıl olup 89'u (%78) erkek, 25'i (%22) kadın idi. Olgularımızın 75'inin (%65.8) sigara kullanım öyküsü olduğu gözlemlendi. Hastaların 59'unun (%51.75) ASA I-II, 55'inin (%48.25) ASA III-IV ve en çok eşlik eden hastalığın hipertansiyon, diabetes mellitus ve kronik obstrüktif akciğer hastalığı olduğu saptandı. YBÜ'ye alınan hasta sayısı 29 (%25.43) idi. Alınan hastaların 19'unun (%65.5) ASA III-IV, 10'unun (%34.5) ASA I-II olduğu, 19'unun (%65.5) entübe, 10'unun (%34.5) ise ekstübe olduğu belirlendi. Doksan yedi (%85) olguya lobektomi, 17 (%15) olguya pnömonektomi uygulandığı, lobektomi uygulanan hastaların 20'sinin (%20.6), pnömonektomi uygulananların ise dokuzunun (%52.9) YBÜ'ye alındığı gözlemlendi. YBÜ'ye alınan olguların yaşlarının, komorbidite, ASA skorları, komplikasyonların yüksek, anestezi ve TAV sürelerinin belirgin derecede uzun olduğu belirlendi. On (%8) olguda uzamış hava kaçağı, bronkoplevral fistül, kanama, akciğer ödemi komplikasyonları gözlemlendi.

Sonuç: Torasik cerrahi uygulanan hastaların prognozunda yaş, ASA skoru, komorbid hastalıklar, operasyon tipi ve anestezi uygulamalarının etkili olduğu, ameliyat öncesi değerlendirme ile saptanan risk faktörlerinin en aza indirilmesinin, akciğer fonksiyonlarının olası en iyi duruma getirilmesinin, dikkatli cerrahi ve anestezi yaklaşımının ve ameliyat sonrası bakımın önemli olduğu kanısına varıldı.

Anahtar Sözcükler: Anestezi; primer akciğer kanseri; tek akciğer ventilasyonu.