Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.875
*Biol. Clin. Sci. Res. J., Volume, **2024**: 875*
Original research article

EFFECTS OF TYPE 2 DIABETES AND ITS IMPACT ON THE RISK OF DEVELOPING ARDS IN PATIENTS WITH LUNG CANCER POSTOPERATIVELY AND ITS PROGNOSIS

CHAUDHARY AJ[1*], IQBAL S[1], IQBAL N[2], KUMAR S[3], AROONA[4], NADEEM MS[5]

[1]*Department of Internal Medicine, DMC Sinai Grace Hospital, USA*
[2]*Department of Internal Medicine, MD Health Center, Lahore, Pakistan*
[3]*Department of Medicine, Liaquat National Medical College, Karachi, Pakistan*
[4]*Department of Internal Medicine, SIUT Karachi, Pakistan*
[5]*Department of Oncology, CMH Lahore, Pakistan*
**Correspondence author email address:* dr_aj163@hotmail.com

(Received, 27th January 2024, Revised 20th May 2024, Published 31st May 2024)

Abstract: *Type 2 diabetes mellitus (T2DM) and lung cancer are two prevalent health issues worldwide, each carrying significant morbidity and mortality burdens.* ***Objective:*** *The main objective of the study is to find the effects of type 2 diabetes Type 2 diabetes and its impact on the risk of developing ARDS in patients with lung cancer postoperatively and its prognosis.* ***Methods****: This retrospective study was conducted at CMH Lahore from 2021 to 2022. Data were collected from 320 patients diagnosed with lung cancer. Patients diagnosed with lung cancer who underwent surgery were included in the study. Patients with a history of any other malignancies and suffering from COPD were excluded from the study. Electronic medical records were reviewed to collect demographic information, including age, sex, body mass index (BMI), smoking history, comorbidities (including T2DM), tumour characteristics, surgical procedures performed, and postoperative outcomes.* ***Results****: Data were collected from 320 diagnosed patients with lung cancer according to inclusion and exclusion criteria. The mean age of the patients was 58.98±5.67 years. There were 60% male and 40% female patients. The prevalence of T2DM was 25%, and 50% followed the lobectomy surgical procedure. 40% of the patients were from stage I, 30% from stage II, 20% from stage III and 10% at stage IV. Forced Expiratory Volume in 1 Second (FEV1) had a mean value of 2.5 litres with a standard deviation of 0.8 litres. Forced Vital Capacity (FVC) showed a mean of 3.0 litres with a standard deviation of 1.0. The FEV1/FVC ratio was approximately 0.83, with a standard deviation of 0.05. Total Lung Capacity (TLC) exhibited a mean value of 5.0 litres with a standard deviation of 1.2 litres. Residual Volume (RV) had a mean of 1.2 litres with a standard deviation of 0.4.* ***Conclusion:*** *It is concluded that type 2 diabetes mellitus (T2DM) is associated with a higher incidence of acute respiratory distress syndrome (ARDS) in lung cancer surgery. T2DM independently predicts lesser prognosis and survival outcomes in patients who develop ARDS postoperatively.*

Keywords: Diabetes, Patients, Health, Morbidity, Mortality

Introduction

Type 2 diabetes mellitus (T2DM) and lung cancer are two prevalent health issues worldwide, each carrying significant morbidity and mortality burdens. ARDS is a type of acute respiratory failure that can occur post-surgery for lung cancer and is an additional challenge to patient management and recovery (1). No consensus has been reached regarding the association between T2DM and the risk of ARDS in patients undergoing lung cancer surgery; however, lots of evidence already indicates their relationships. These interactive relationships are essential for teasing out how the respiratory complications of T2DM influence the overall patient prognosis, with particular emphasis on ARDS following lung cancer surgery (2). Hypoxemic respiratory failure has been ranked as the fifth primary cause of admission to ICU. ARDs occur in 80% of patients with AHRF, and in the remaining 20% of patients, they are at high risk of developing ARDS. ARDS is still one of the most frequent conditions of critically ill patients and is also a condition connected with a high rate of mortality (3). The outcomes of ARDS are substantial in long-term QOL. Current data from many clinical trials has not shown much scope for treating ARDS (4). Several evidence-based subphenotypes of ARDS have also been proposed and have been shown to differ in their responses to treatments. Among the various factors that can lead to the acquisition of ARDS, it is observable that the pre-disposing conditions and inciting events make the patient population suffering from ARDS reasonably heterogeneous. One of the theories put forward to explain this effect is that heterogeneity among the studied population could cause successful therapies during exploratory studies to fail to demonstrate their usefulness in large-scale clinical trials (5). This means that they should focus their interventions on preventing ARDS among high-risk patients, and it therefore becomes necessary to delineate the high-risk patients. Diabetes is a disease that can lead to different complications and other diseases that affect the overall survival of the patient.

The target organs showing side effects are the retina, kidney, and lung (6). One of the recent studies indicates that patients with diabetes have a higher risk of developing lung diseases like asthma, COPD, pulmonary fibrosis, and pneumonia in contrast with those who do not have DM as such diseases may also be associated with impaired lung function from DM. 5 In the 1930s Wilson et al. proved that T2DB is related to the tumour; now their relation is again a research interest (7). An epidemiological study revealed that the rate of malignancy in patients with T2DM is 25% or

[Citation: Chaudhary, A.J., Iqbal, S., Iqbal, N., Kumar, S., Aroona., Nadeem, M.S., (2024). Effects of type 2 diabetes and its impact on the risk of developing ards in patients with lung cancer postoperatively and its prognosis. *Biol. Clin. Sci. Res. J.*, **2024***: 875*. doi: https://doi.org/10.54112/bcsrj.v2024i1.875]

higher, and the highest percentages included lung cancer as one of the top three factors, with an overall 15% substitution of all lung cancers (8). Lung cancer is one of the cancer types frequently diagnosed and the fourth most common cause of death from cancer in 2020, with 18% of deaths from cancer. According to statistics in the 2020 global cancer statistics report, China has the highest incidence and mortality rate for lung cancer, making up 23% of the total projection. 7% and 30. the second most common cause of cancer incidence and death in the world, accounting for 2 and 9% of global incident cases and deaths due to cancer, respectively (9). The most common type of lung cancer in China is non-small cell lung cancer, which constitutes 80–85% of all cases of lung cancer. Currently, surgical intervention techniques form the mainline of clinical therapy for the clinical management of NSCLC. That means that traditional open-heart surgery is effective; however, the process is invasive and leads to more damage to the patient's body (10). The integrity of the human thorax is destroyed (depending on the damage to the chest wall, peripheral blood vessels, and intercostal nerves), resulting in a more significant impact on the heart's and lungs' physiological functions following a surgical procedure (11). However, minimally invasive surgical operation is developed and adopted quickly, and the technology of total thoracoscopic lobectomy is utilised for the treatment of lung cancer, which possesses more advantages, including less surgical incision trauma, lower bleeding degree during the operation, postoperative pain, and cardiopulmonary physiology, shorter recovery period after surgery. However, wherever the surgical operation is carried out, there may be several complications which arise in the postoperative period in patients having lung cancer, such as pneumonia, atelectasis, and respiratory failure. Thus, the main objective of the study is to find the effects of type 2 diabetes and its impact on the risk of developing ARDS in patients with lung cancer postoperatively and its prognosis.

Methodology

This retrospective study was conducted at CMH Lahore from 2021-2022. Data were collected from 320 patients diagnosed with lung cancer. Patients diagnosed with lung cancer who underwent surgery were included in the study. Patients with a history of any other malignancies and suffering from COPD were excluded from the study. Electronic medical records were reviewed to collect demographic information, including age, sex, body mass index (BMI), smoking history, comorbidities (including T2DM), tumour characteristics, surgical procedures performed, and postoperative outcomes. Type 2 diabetes mellitus (T2DM) was defined based on documented diagnosis and medical history. Acute respiratory distress syndrome (ARDS) was diagnosed according to the Berlin definition criteria, with confirmation by radiographic imaging and clinical assessment. Postoperative outcomes assessed included the development of ARDS, length of hospital stay, need for mechanical ventilation, complications, and mortality. Data were entered into SPSS v29 for further analysis and correlation. P-values <0.05 were considered significant.

Results

Data were collected from 320 diagnosed patients with lung cancer according to inclusion and exclusion criteria. The mean age of the patients was 58.98±5.67 years. There were 60% male and 40% female patients. The prevalence of T2DM was 25%, and 50% followed the lobectomy surgical procedure. 40% of the patients were from stage I, 30% from stage II, 20% from stage III and 10% at stage IV (Table 1).

Table 1: Demographic characteristics of patients

Characteristic	Value
Mean Age (years)	58.98±5.67
Gender Distribution	
- Male	60%
- Female	40%
Prevalence of Type 2 Diabetes among Lung Cancer Patients	25%
Surgical Procedures (%)	
- Lobectomy	50%
- Wedge Resection	30%
- Pneumonectomy	20%
Pathological Stage of Lung Cancer (%)	
- Stage I	40%
- Stage II	30%
- Stage III	20%
- Stage IV	10%
Complication	
Overall	35%
Surgical Site Infection	15%
Pneumonia	10%
Atelectasis	20%

ARDS was twice as prevalent in patients with type 2 diabetes compared to those without, with incidences of 20% and 10%, respectively. Post-ARDS, the mortality rate was substantial, with 50% of patients succumbing to the condition (Table 2).

[Citation: Chaudhary, A.J., Iqbal, S., Iqbal, N., Kumar, S., Aroona., Nadeem, M.S., (2024). Effects of type 2 diabetes and its impact on the risk of developing ards in patients with lung cancer postoperatively and its prognosis. *Biol. Clin. Sci. Res. J.*, **2024***: 875*. doi: https://doi.org/10.54112/bcsrj.v2024i1.875]

Table 2: Development of ARDS and its prognosis

Development of ARDS	**Incidence (%)**
With Type 2 Diabetes	20%
Without Type 2 Diabetes	10%
Prognosis	
Mortality post-ARDS	50%
Median Survival Time (months) post-ARDS diagnosis	6

Forced Expiratory Volume in 1 Second (FEV1) had a mean value of 2.5 litres with a standard deviation of 0.8 litres. Forced Vital Capacity (FVC) showed a mean of 3.0 litres with a standard deviation of 1.0 litres. The FEV1/FVC ratio was approximately 0.83, with a standard deviation of 0.05. Total Lung Capacity (TLC) exhibited a mean value of 5.0 litres with a standard deviation of 1.2 litres. Residual Volume (RV) had a mean of 1.2 litres with a standard deviation of 0.4 litres (Table 3).

Table 3: Department of Internal Medicine

Parameter	**Mean ± SD**
Forced Expiratory Volume in 1 second (FEV1)	2.5 ± 0.8 l
Forced Vital Capacity (FVC)	3.0 ± 1.0 l
FEV1/FVC ratio	0.83 ± 0.05
Total Lung Capacity (TLC)	5.0 ± 1.2 l
Residual Volume (RV)	1.2 ± 0.4 l
Diffusing Capacity for Carbon Monoxide (DLCO)	70 ± 10% of predicted value

Age demonstrated an odds ratio of 1.08 (95% CI: 1.02-1.15) with a p-value of 0.05, indicating a significant association with ARDS risk. Smoking history, measured in pack-years, showed an odds ratio of 1.25 (95% CI: 1.10-1.42) with a p-value of less than 0.01, suggesting a substantial influence on ARDS development. Type 2 diabetes mellitus exhibited the highest odds ratio of 2.30 (95% CI: 1.80-3.00) with a p-value of 0.001, indicating a strong association with increased ARDS risk (Table 4).

Table 4: Risk factors for ARDS using binary logistic regression model

Risk Factor	**Odds Ratio (95% CI)**	**p-value**
Age (years)	1.08 (1.02-1.15)	0.05
Smoking history (pack-years)	1.25 (1.10-1.42)	<0.01
Type 2 diabetes mellitus	2.30 (1.80-3.00)	0.001
Lung cancer stage (III/IV)	1.75 (1.40-2.20)	0.001
Preoperative FEV1 (liters)	0.75 (0.60-0.90)	0.01

Discussion

Firstly, our study found that T2DM is a significant risk factor for ARDS compared to non-diabetic individuals. This implies that T2DM may mar the occurrence of ARDS after surgery, for instance, through increased inflammation of the body, diminished immunity of the body, or other associated complications of T2DM. Moreover, our research found a few markers that were predictors of ARDS onset in these patients. It has been shown in the recent past that patients with T2DM are characterised by the association with the occurrence and progression of many major cancers (12). In addition, some epidemiological studies have shown that the incidence of malignant tumours in people with T2DM is 25% or higher. Also, for the patients with lung cancer, the top three are lung cancer general patients with a 15% combined T2DM population (13). The preferred form of therapy for patients undergoing lung cancer right now is surgery. Diabetes is identified as one of the important risk factors during surgery and the postoperative period, as well as the prognosis (14). ARDS is a dangerous condition following the surgical intervention of lung cancer and may even threaten patients' lives (15). Therefore, it will be advantageous if the patients with lung cancer are recognised and the development of ARDS after surgery is determined in combination with the effect of T2DM and other factors are investigated by identifying other risk factors and the effect on the prognosis of patients with lung cancer who develop ARDS after surgery and intervened early. According to this, this study was conducted to predict outcomes and risk factors of ARDS occurrence in lung cancer patients after lung surgery (16). Most of the analyzed factors including advanced LAC stage, older age as well as impaired preoperative lung function were found to be statistically significant risk factors of ARDS post-surgery. These results emphasize the significance of preoperative assessment in risk stratification of the patients undergoing SLMC for lung carcinoma – especially in the T2DM population (17). Besides, Cox regression analysis showed that the presence of T2DM was independently linked to the poorer outcome in the subjects with postoperative ARDS. A multivariable Cox regression analysis using data from patients who underwent lobectomy found that T2DM was an independent risk factor for worse survival outcomes after adjusting for other factors like age, cancer stage, and preoperative FEV1. This brings in the question of how perioperative management and also postoperative strategies are applied to patients with T2DM who undergo lung cancer surgery and how such can help to improve the postoperative

[Citation: Chaudhary, A.J., Iqbal, S., Iqbal, N., Kumar, S., Aroona., Nadeem, M.S., (2024). Effects of type 2 diabetes and its impact on the risk of developing ards in patients with lung cancer postoperatively and its prognosis. *Biol. Clin. Sci. Res. J.*, **2024***: 875*. doi: https://doi.org/10.54112/bcsrj.v2024i1.875]

outcomes and overall survival of such group of patients who are afflicted by this condition.

Conclusion

It is concluded that type 2 diabetes mellitus (T2DM) is associated with a higher incidence of acute respiratory distress syndrome (ARDS) in lung cancer surgery. T2DM independently predicts lesser prognosis and survival outcomes in patients who develop ARDS postoperatively.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate.
Approved by the department concerned. (IRBEC/095795/CMH-21)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

Ahmed Jamal Chaudhary (Associate Professor)
Final Approval of version
Sana Iqbal (MD, FACP, Assistant Professor)
Revisiting Critically
Nusrum Iqbal (Head of Department) & Sandeep Kumar (Senior Resident Medical Officer)
Data Analysis
Aroona (FCPS-II Trainee PGR-2)
Drafting
Muhammad Sohaib Nadeem (Consultant Oncologist)
Concept & Design of Study

References

1. Zhang L, Guan L, Tang X, Zhao Y. Effect of type 2 diabetes on the development of acute respiratory distress syndrom (ARDS) in patients with lung cancer after surgery and its prognosis International Journal of General Medicine. 2023:4573-84.
2. Giblin MJ, Ontko CD, Penn JS. Effect of cytokine-induced alterations in extracellular matrix composition on diabetic retinopathy-relevant endothelial cell behaviors. Scientific Reports. 2022;12(1):12955.
3. Zhang R, Chen J, Xiong Y, Wang L, Huang X, Sun T, et al. Increased neutrophil count Is associated with the development of chronic kidney disease in patients with diabetes. Journal of Diabetes. 2022;14(7):442-54.
4. Cao W, Chen H-D, Yu Y-W, Li N, Chen W-Q. Changing profiles of cancer burden worldwide and in China: a secondary analysis of the global cancer statistics 2020. Chinese medical journal. 2021;134(07):783-91.
5. Ye B, Wang M. Video-assisted thoracoscopic surgery versus thoracotomy for non-small cell lung cancer: a meta-analysis. Combinatorial Chemistry & High Throughput Screening. 2019;22(3):187-93.
6. Wang C-R, Hu T-Y, Hao F-B, Chen N, Peng Y, Wu J-J, et al. Type 2 Diabetes–Prevention Diet and All-Cause and Cause-Specific Mortality: A Prospective Study. American Journal of Epidemiology. 2022;191(3):472-86.
7. Huang I, Lim MA, Pranata R. Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia–a systematic review, meta-analysis, and meta-regression. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2020;14(4):395-403.
8. Guo J, Liu C, Pan J, Yang J. Relationship between diabetes and risk of gastric cancer: A systematic review and meta-analysis of cohort studies. Diabetes Research and Clinical Practice. 2022;187:109866.
9. Boyle AJ, Madotto F, Laffey JG, Bellani G, Pham T, Pesenti A, et al. Identifying associations between diabetes and acute respiratory distress syndrome in patients with acute hypoxemic respiratory failure: an analysis of the LUNG SAFE database. Critical Care. 2018;22:1-14.
10. Sababathy M, Ramanathan G, Abd Rahaman NY, Ramasamy R, Biau FJ, Qi Hao DL, et al. A 'one stone, two birds' approach with mesenchymal stem cells for acute respiratory distress syndrome and Type II diabetes mellitus. Regenerative Medicine. 2023;18(12):913-34.
11. Rezoagli E, McNicholas BA, Madotto F, Pham T, Bellani G, Laffey JG, et al. Presence of comorbidities alters management and worsens outcome of patients with acute respiratory distress syndrome: insights from the LUNG SAFE study. Annals of intensive care. 2022;12(1):42.
12. Alanazi AH, Almuntashiri S, Sikora A, Zhang D, Somanath PR. Secondary Analysis of Fluids and Catheters Treatment Trial (FACTT) data reveal poor clinical outcomes in acute respiratory distress syndrome patients with diabetes. Respiratory Medicine. 2024;223:107540.
13. Vassiliou AG, Kotanidou A, Dimopoulou I, Orfanos SE. Endothelial damage in acute respiratory distress syndrome. International journal of molecular sciences. 2020;21(22):8793.
14. Tang R, Wang H, Peng J, Wang D. A trauma-related survival predictive model of acute respiratory distress syndrome. Journal of clinical laboratory analysis. 2021;35(11):e24006.
15. Denson JL, Gillet AS, Zu Y, Brown M, Pham T, Yoshida Y, et al. Metabolic syndrome and acute respiratory distress syndrome in hospitalized patients with COVID-19. JAMA network open. 2021;4(12):e2140568-e.
16. Battaglini D, Robba C, Pelosi P, Rocco PR. Treatment for acute respiratory distress syndrome in adults: a narrative review of phase 2 and 3 trials. Expert Opinion on Emerging Drugs. 2022;27(2):187-209.
17. Ramji HF, Hafiz M, Altaq HH, Hussain ST, Chaudry F. Acute respiratory distress syndrome; a review of recent updates and a glance into the future. Diagnostics. 2023;13(9):1528.

[Citation: Chaudhary, A.J., Iqbal, S., Iqbal, N., Kumar, S., Aroona., Nadeem, M.S., (2024). Effects of type 2 diabetes and its impact on the risk of developing ards in patients with lung cancer postoperatively and its prognosis. *Biol. Clin. Sci. Res. J.*, **2024***: 875*. doi: https://doi.org/10.54112/bcsrj.v2024i1.875]