Thorax Ct-Scan image and demographic factors of adenocarcinoma and squamous cell carcinoma

Imagen de tomografía computarizada del tórax y factores demográficos del adenocarcinoma y el carcinoma de células escamosas

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Abstract

Lung cancer is the leading cause of cancer death worldwide. As a result, CT scans are crucial in the detection and staging of lung cancer and patient follow-up after treatment. The objective of this study was to investigate the characteristics of lung adenocarcinoma and lung squamous cell carcinoma (SCC) and how they relate to demographic factors such as age, gender, and smoking history. This study uses thoracic CT-scan images to detect and stage lung cancer and monitor lung cancer patients after treatment. This research employed a cross-sectional descriptive-analytical approach. From July 2017 to December 2019, lung cancer patients underwent a chest CT scan at the Respira Lung Hospital's Radiology Installation in Yogyakarta, Indonesia. The indicators in this study included age, gender, and smoking history in adenocarcinoma or SCC patients. Data were collected through observation and documentation. The logistic regression test in SPSS 18 for Windows was used to analyze the data, with a p 0.05 threshold considered significant. The findings demonstrated that the relationship between chest CT-scan images and lung cancer detection and staging was significant, with a p-value of 0.05. Therefore, optimization of chest CT scan as a radiological modality can be used to determine the type of cytology or histology of lung cancer to improve diagnostic accuracy.

Keywords: CT-Scan, Thorax, Lung Cancer, Adenocarcinoma, Squamous Cell Carcinoma

Resumen

El cáncer de pulmón es la principal causa de muerte por cáncer en todo el mundo. Como resultado, las tomografías computarizadas son cruciales en la detección y estadificación del cáncer de pulmón, así como en el seguimiento del paciente después del tratamiento. El objetivo de este estudio fue investigar las características del adenocarcinoma de pulmón y el carcinoma de células escamosas (SCC) de pulmón y cómo se relacionan con factores demográficos como la edad, el sexo y el historial de tabaquismo. Este estudio utiliza imágenes de tomografía computarizada torácica para detectar y estadificar el cáncer de pulmón, así como para monitorear a los pacientes con cáncer de pulmón después del tratamiento. Esta investigación empleó un enfoque transversal descriptivo-analítico. Desde julio de 2017 hasta diciembre de 2019, los pacientes con cáncer de pulmón se sometieron a una tomografía computarizada de tórax en la instalación de radiología del Respira Lung Hospital en Yogyakarta, Indonesia. Los indicadores de este estudio incluyeron la edad, el sexo y los antecedentes de tabaquismo en pacientes con adenocarcinoma o SCC. Los datos se recopilaron a través de la observación y la documentación. Para el análisis de los datos se utilizó la prueba de regresión logística en SPSS 18 para Windows, considerándose significativo un umbral de p 0,05. Los hallazgos demostraron que la relación entre las imágenes de tomografía computarizada de tórax y la detección y estadificación del cáncer de pulmón fue significativa, con un valor de p de 0,05. Por lo tanto, la optimización de la tomografía computarizada de tórax como modalidad radiológica se puede utilizar para determinar el tipo de citología o histología del cáncer de pulmón para mejorar la precisión diagnóstica.

Palabras clave: tomografía computarizada, tórax, cáncer de pulmón, adenocarcinoma, carcinoma de células escamosas

Introduction

Lung cancer is a type of cancer that affects the respiratory system. It is the leading cause of cancer-related death in the world. According to reports, one-third of all cancer deaths in men are caused by lung cancer[1-3]. In 2015, the United States accounted for 27% of lung cancer deaths, while the European Union accounted for 20% in 2016.[11] Based on biology, therapy, and prognosis, the World Health Organization (WHO) divides lung cancer into two types: Non-Small Cell Lung Carcinoma (NSCLC) and Small Cell Lung Carcinoma (SCLC). NSCLC accounts for approximately 80-85 percent of all lung cancers[4,5]. This type is then classified into squamous cell carcinoma and non-squamous cell carcinoma[6-8].

According to WHO data, lung cancer is the most prevalent cancer type in men and the fifth most common cancer type in women in Indonesia. A high number of smokers in Indonesia lead to lung cancer, one of the significant health problems[9]. The most prevalent etiology of lung cancer is long-term exposure to tobacco smoke[10,11]. It causes 80-90% lung cancer in smokers and around 10-15% in nonsmokers[12]. A previous study also found hundreds of carcinogens in tobacco smoke.

Despite advances in examination methods for diagnosing and treating lung cancer, the prognosis remains poor. So far, the stadium, tumor metastasis, sex, loss of body weight, performance status, and changes in molecular parameters have been identified as prognostic factors for lung cancer[1,13,14]. Therefore, an easy and effective prognostic assessment tool for lung cancer is necessary to determine the therapeutic strategy needed[15,16].

The computed tomography scan (CT scan) is essential for diagnosing and staging lung cancer and monitoring patients with bronchogenic carcinoma after treatment. This is because the prominent prognostic factor of survival in lung cancer is the tumor. Accordingly, accurate staging of bronchogenic carcinoma is essential for choosing the therapy and determining the patient's prognosis relating to the stadium[17-19]. Furthermore, computed tomography is a standard imaging modality used for evaluating bronchogenic carcinoma[20]. Therefore, recognizing lung cancer in the early stage will be very beneficial for patients[12]. Moreover, establishing the diagnosis enables patients to have a better quality of life in the course of the disease through incurable disease[21-23].

The most common type of lung cancer is Adenocarcinoma. The prevalence ranges from 35 to 50 percent of all lung cancers. The CT scan shows around solitary nodule with irregular borders due to parenchymal invasion along with a fibrotic response[9]. Approximately 75% of lung adenocarcinomas are located in the periphery of the lung, mainly in the superior lobe. In the early stages, adenocarcinoma lesions can appear through the blood and lymph vessels without showing clinical symptoms until distant metastases occur. The researchers wanted to see how the characteristics of lung adenocarcinoma and lung squamous cell carcinoma (SCC) connect to demographic factors such as age, gender, and smoking history. This study employs thoracic CT-scan images for lung cancer detection and staging and post-treatment follow-up for lung cancer patients.

Methods

This study used a cross-sectional descriptive-analytical method. This study involved lung cancer patients who underwent a chest CT scan at the Radiology Installation of the Respira Lung Hospital, Yogyakarta, Indonesia, from July 2017 to December 2019. The indicators in this study included age, gender, and smoking history in adenocarcinoma or SCC patients. Data was obtained using observation and documentation. The consecutive Sampling technique was used for sampling. We evaluated the chest CT scan and histologic examination of all subjects who met our inclusion criteria.

Data were analyzed by logistic regression test using SPSS 18 for windows with the condition that p <0.05 was considered significant. Data results are presented in numbers and percentages for categorical data, while numerical data is presented in mean±SD. Bivariate analysis was used to compare findings between chest CT scans and demographic characteristics. By comparing lung adenocarcinoma and SCC using logistic regression test. All data were statistically analyzed using SPSS 18 for Windows, with a significance level of p0.05.

The age, gender, and smoking history of patients with Adenocarcinoma and squamous cell carcinoma in the study are shown in Table 1.

Table 1. Distribution of research indicators

Characteristic	Adenocarcinoman%		Squamous cell carcinoman%		p
Age					0.024
31-40 y.o.	2	2.0%	2	4.3%	
41-50 y.o.	2	4.0%	6	13.0%	
51-60 y.o.	23	46.0%	11	23.9%	
61-70 y.o.	10	20.0%	14	30.4%	
71-80 y.o.	7	14.0%	12	26.1%	
>80 y.o.	7	14.0%	1	2.2%	
Sex					0.097
Male	26	52.0%	32	69.6%	
Female	24	48.0%	14	30.4%	
Smoking					0.005
Yes	26	52.0%	9	19.6%	
No	24	48.0%	37	80.4%	

According to table 1, 96 lung cancer patients took part in the study. Fifty (52.08%) of them had lung adenocarcinoma, and the remaining (47.92%) suffered from lung squamous cell carcinoma. There were no significant differences regarding age (p=0.024) and sex (p=0.097) between lung adenocarcinoma and lung squamous cell carcinoma patients. Most of the subjects were in the lung adenocarci-

noma and SCC group who were over 50 years old. Despite the fact that males were more affected by these two forms of lung cancer than females, fisher's exact test revealed no significant difference (p=0.097). With a statistically significant difference (p=0.005), subjects with a history of smoking were more numerous in the SCC group (n=37) than in the lung adenocarcinoma group (n=26).

Results

Characteristics of CT scan

Table 2 shows the findings of the study's observation on the CT scan characteristics of Adenocarcinoma and squamous cell carcinoma.

Table 2. The CT scan characteristics of Adenocarcinoma and squamous cell carcinoma

Characteristic	Adenocarcinoma (%)			Squamous Cell Carcinoman (%)	p
Mass size					0.035
Diameter ≤ 3 cm	1	2.0%	0	0.0%	
Diameter 3-7 cm	28	56.0%	15	32.6%	
Diameter >7 cm	21	42.0%	31	67.4%	
Mass anatomical site					0.069
Upper lobe of the right lung	19	38.0%	29	63.0%	
Lower lobe of the right lung	5	10.0%	5	10.9%	
Upper lobe of the left lung	17	34.0%	8	17.4%	
The lower lobe of the left lung	9	18.0%	4	8.7%	
Mass Location					0.099
Central	17	34.0%	24	52.2%	
Peripheral	33	66.0%	22	47.8%	
Different lobe nodule					0.024
Absent	38	76.0%	43	93.5%	
Present	12	24.0%	3	6.5%	
Mass margin					0.101
Well-defined	21	42.0%	11	23.9%	
Ill-defined	10	20.0%	8	58.7%	
Speculated	19	38.0%	27	84.8%	
Air bronchogram/cavity					0.129
Absent	39	78.0%	39	10.9%	
Present	11	22.0%	5	4.3%	
Cavity	0	0.0%	2	4.3%	
Mass enhancement					0.227
Absent	0	0.0%	2	4.3%	
Present	50	100%	44	95.7%	
Vascular involvement					0.301
Absent	32	64.0%	24	52.2%	
Present	18	36.0%	22	47.8%	
Lymphadenopathy					0.118
N0	3	6.0%	0	0.0%	
N1	22	44.0%	12	26.0%	
N2	11	22.0%	17	37.0%	
N3	14	28.0%	17	37.0%	
Pleural effusion in the tumour side					0.576
Absent	23	46.0%	21	45.7%	
Present	27	54.0%	25	54.3%	
Lung metastasis					0.016
Absent	28	56.0%	37	80.4%	
Present	22	44.0%	9	19.6%	
Tumour stadium					0.096
I A	0	0.0%	0	0.0%	
I B	0	0.0%	0	0.0%	
II A	0	0.0%	0	0.0%	
II B	4	8.0%	0	0.0%	
III A	5	10.0%	4	8.7%	
III B	3	6.0%	7	15.2%	
III C	1	2.0%	3	6.5%	
IV A	36	72.0%	28	60.9%	
IV B	1	2.0%	4	8.7%	

According to table 2, there were significant variations in mass size (p=0.035), different lobe nodules (p=0.024), and the occurrence of metastasis (p=0.016) between two types of non-small cell lung malignancies, Adenocarcinoma, and squamous cell carcinoma. Most subjects in adenocarcinoma group had the mass size of 3 - 7 cm (n=28; 56.0%), while those in squamous cell carcinoma their mass size was > 7 cm in diameter (n=31; 67.4%). Different lobe nodule was more common in adenocarcinoma (n=12; 24.0%) than in squamous cell carcinoma (n=3; 6.5%). Lung metastasis was observed more in subjects with Adenocarcinoma (n=22; 44.0%) than those with squamous cell carcinoma (n=9; 19.6%). No significant differences were found between the Adenocarcinoma and squamous cell carcinoma groups. regarding the anatomical location of the mass (p=0.069), mass location (p=0.099), mass margin (0.101), air bronchogram (0.129), mass increase (0.227), vascular involvement (0.301), lymphadenopathy (0.118), pleural effusion in mass side (0.576), and tumor stage (0.096).

Observation of Adenocarcinoma

The results of observations of Adenocarcinoma in the study can be seen in Figures 1, 2, 3, and 4.

Figure 1. Adenocarcinoma with mass in the lung periphery and unusual interstitial pneumonia

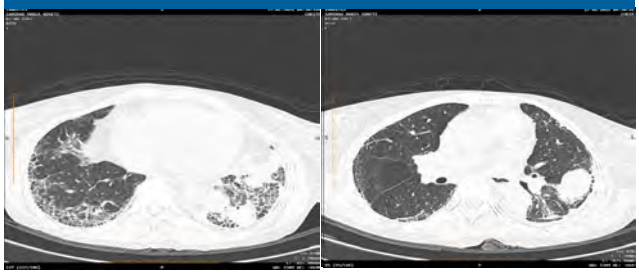


Figure 2. Adenocarcinoma with mass and infected bullae

Figure 3. Squamous cell carcinoma with mass and paraseptal emphysema in the superior lobe

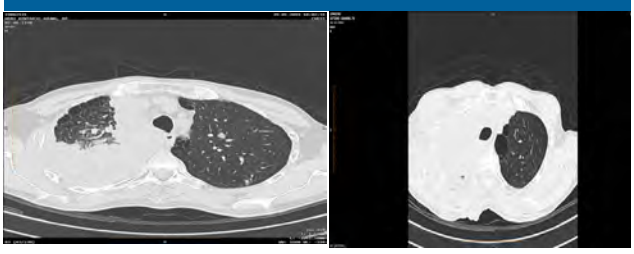
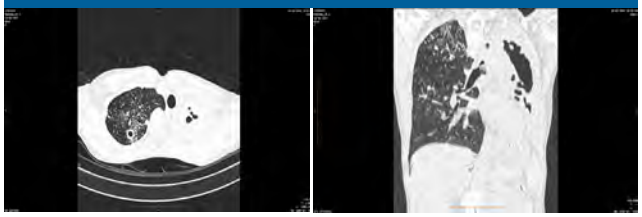


Figure 4. Squamous cell carcinoma with lung TB



Discussion

The characteristics of lung adenocarcinoma and lung squamous cell carcinoma (SCC) detected in thorax CT scans, and their correlations to demographic parameters such as age, gender, and smoking history are investigated in this study. There were 50 patients with lung adenocarcinoma and 46 lung SSCC patients during the study period. Small cell lung cancer (SCLC) and non-small cell lung carcinoma (NSCLC) are the two most common kinds of lung cancer (NSCLC). Histopathologic ally NSCLC is classified into Adenocarcinoma and squamous cell carcinoma[24-26]. Adenocarcinomas are mucin-forming and usually arise from the fibrotic tissue of the lung, and squamous cell carcinomas show polygonal cells with intercellular bridges[27].

Lung cancer is diagnosed in more than 60% of cases before 65. When they were diagnosed with lung cancer, most of our study participants were over the age of 50, with stage IV A being the most prevalent cancer stage. Lung cancer in its early stages has no clinical symptoms[28]. However, lung cancer signs and symptoms commonly occur at the advanced stage[19]. As a result, patients frequently receive a delayed diagnosis, resulting in a dismal prognosis.

The stage of the disease mostly controls lung cancer prognosis. Thoracic complications kill roughly 75% of squamous cell carcinoma patients and nearly 40% of Adenocarcinoma and large cell carcinoma patients[13]. The life expectancy of patients with metastatic lung cancer ranges from 6 months to a year[5]. It is based on the patient's performance on the Karnofsky scale, the severity of the disease, and weight loss in the previous six months.[18] This study concluded that lung metastasis was more common in subjects with Adenocarcinoma (44%) than squamous cell carcinoma (19.6%).

Smoking is one of many factors that can put people at risk for lung cancer[6,10]. Lung cancer is responsible for 80% of lung cancer in men and 50% of lung cancer in women. Most subjects in this study are smokers. This study demonstrated that smoking was more common in squamous cell carcinoma patients (80.4%) than in Adenocarcinoma (52.0%). The risk of lung cancer is 20 times higher in smokers than that of nonsmokers.

A Lung CT scan is one of the imaging modalities for diagnosing and evaluating various lung abnormalities. It can also guide therapy plans, including prescribing, surgery, or radiation[2]. Thorax CT scan is better than thorax X-ray in diagnosing lung mass as it can determine the size, location, and growth of lung cancer and identify lymph node enlargement[7]. Lung cancer may present in various radiological features. It generally appears as hilar or perihilar mass, large mass (>4 cm), apical mass, multiple mass, atelectasis, pneumonia appearance, cavity, and mediastinal lymphadenopathy.

Squamous cell carcinoma is commonly found in the central lung area characterized by endobronchial obstructive lesions showing the presence of hilar or perihilar mass. Atelectasis and obstructive pneumonitis emerge due to bronchial obstruction[29-31]. Squamous cell carcinoma is primarily encountered in one-third of the lung periphery in cavitated mass with a thick wall. An air-fluid level can accompany it.[29] Its size ranges from 2 to 10 cm in diameter. Thorax CT scan findings of our study subjects with squamous cell carcinoma demonstrated that 67.4% had a mass measure of >7cm, 52.2% of the masses were located in the central lung, and only 4.2% had cavitated mass.

Adenocarcinoma is the most common type of lung cancer. Its incidence reaches 35 - 50% of all lung cancers. About 75% of lung adenocarcinomas are located in the lung periphery, mainly in the superior lobe. Still, they are commonly found in lungs with local fibrotic tissue or previous chronic interstitial fibrosis. Subpleural mass is seen as a thin linear lesion which is the extent of pleura.[27] An air bronchogram is observed in the nodule, and central necrosis may also appear, but the cavitated lesion is uncommon.[30] In the early stage, adenocarcinoma lesions may appear through blood vessels and lymph without showing any clinical symptoms until distant metastasis occurs. The thorax CT scan findings in this study revealed that 66 % of lung adenocarcinomas in the subjects were located in the lung periphery and none of them had cavitated lesions.

Conclusions

Overall, the present study aimed to analyze the features of lung adenocarcinoma and lung squamous cell carcinoma (SCC) and how they relate to demographic factors such as age, gender, and smoking history. The study utilized thoracic CT-scan images to detect and stage lung cancer and monitor lung cancer patients after treatment. Based on the results acquired, patients with lung cancer treated at Respira Lung Hospital in Yogyakarta, Indonesia, had CT scans that revealed substantial differences between lung adenocarcinoma and lung squamous cell carcinoma. Patients with squamous cell carcinoma have a bigger tumor mass than those with Adenocarcinoma. Patients with Adenocarcinoma have more lobe nodules and lung metastases than those with squamous cell carcinoma. Patients with squamous cell carcinoma are more likely to have a smoking history than those with Adenocarcinoma. Optimizing chest CT scan as a radiological modality can determine the type of cytology or histology of lung cancer to improve diagnostic accuracy.

However, several constraints may be present in this study. This is a single-center study so the sample size is limited, and the outcomes cannot be generalized. The patients' data on the medical record, CT scan imaging, and anatomical pathology results were not documented well, thus limiting our sample recruitment. Future studies must be able to overcome these limitations.

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Reference

1. Lakhani DA, Chen SC, Antic S, Muterspaugh A, Cook C, Liu N, Shujat H, Jouan S, Winston B, Fields K, Wenstrup J. Establishing a cohort and a biorepository to identify biomarkers for early detection of lung cancer: the Nashville Lung Cancer Screening Trial Cohort. Annals of the American Thoracic Society. 2021 Jul;18(7):1227-34.

2. Liu H, Jing B, Han W, Long Z, Mo X, Li H. A comparative texture analysis based on NECT and CECT images to differentiate lung adenocarcinoma from squamous cell carcinoma. Journal of medical systems. 2019 Mar;43(3):1-8.

3. Gu K, Lee HY, Lee K, Choi JY, Woo SY, Sohn I, Kim HK, Choi YS, Kim J, Zo JI, Shim YM. Integrated evaluation of clinical, pathological and radiological prognostic factors in squamous cell carcinoma of the lung. PLoS One. 2019 Oct 4;14(10):e0223298.

4. Wang J, Gao R, Huo Y, Bao S, Xiong Y, Antic SL, Osterman TJ, Massion PP, Landman BA. Lung cancer detection using co-learning from chest CT images and clinical demographics. InMedical Imaging 2019: Image Processing 2019 Mar 15 (Vol. 10949, pp. 365-371). SPIE.

5. Squires MH, Gower N, Benbow JH, Donahue EE, Bohl CE, Prabhu RS, Hill JS, Salo JC. PET imaging and rate of pathologic complete response in esophageal squamous cell carcinoma. Annals of Surgical Oncology. 2022 Feb;29(2):1327-33.

6. Alvarez-Jimenez C, Sandino AA, Prasanna P, Gupta A, Viswanath SE, Romero E. Identifying cross-scale associations between radiomic and pathomic signatures of non-small cell lung cancer subtypes: preliminary results. Cancers. 2020 Dec;12(12):3663.

7. Wang SW, Chan LP, Wang LF, Wu CW, Lin SH, Huang TY, Lee KW. Secondary primary malignancy in patients with head and neck squamous cell carcinoma: 27-year experience from the perspective of diagnostic tools. Plos one. 2022 Feb 15;17(2):e0263773.

8. Messerli M, Kotasidis F, Burger IA, Ferraro DA, Muehlematter UJ, Weyermann C, Kenkel D, von Schulthess GK, Kaufmann PA, Huellner MW. Impact of different image reconstructions on PET quantification in non-small cell lung cancer: a comparison of Adenocarcinoma and squamous cell carcinoma. The British Journal of Radiology. 2019

Apr;92(1096):20180792.

9. Tongbai T, McDermott S, Kiranantawat N, Muse VV, Wu CC, Shepard JA, Gilman MD. Non-diagnostic CT-guided percutaneous needle biopsy of the lung: predictive factors and final diagnoses. Korean Journal of Radiology. 2019 Nov 1;20(11):1515-26.

10. Xu K, Yang H, Ma W, Fan L, Sun B, Wang Z, Al-Hurani MF, Schmid RA, Yao F. Neoadjuvant immunotherapy facilitates resection of surgically-challenging lung squamous cell cancer. Journal of Thoracic Disease. 2021 Dec;13(12):6816.

11. Alexandru L, Thibault V, Vincent D, Marguerite M, Clarisse E, Guillaume P. P151 NEVER SMOKER WITH ESOPHAGEAL SQUAMOUS-CELL CARCINOMA: DIFFERENT DEMOGRAPHICS BUT COMPARABLE SUVIVAL. Diseases of the Esophagus. 2019 Nov;32(Supplement_2):doz092-151.

12. Chalian H, McAdams HP, Lee Y, Duan F, Wu Y, Khoshpouri P, Patz Jr EF. Mediastinal lymphadenopathy in the National Lung Screening Trial (NLST) is associated with interval lung cancer. Radiology. 2022 Mar;302(3):684-92.

13. Atchley WT, Alvarez C, Saxena-Beem S, Schwartz TA, Ishizawar RC, Patel KP, Rivera MP. Immune Checkpoint Inhibitor-Related Pneumonitis in Lung Cancer: Real-World Incidence, Risk Factors, and Management Practices Across Six Health Care Centers in North Carolina. Chest. 2021 Aug 1;160(2):731-42.

14. Hida T, Hata A, Lu J, Valtchinov VI, Hino T, Nishino M, Honda H, Tomiyama N, Christiani DC, Hatabu H. Interstitial lung abnormalities in patients with stage I non-small cell lung cancer are associated with shorter overall survival: the Boston lung cancer study. Cancer Imaging. 2021 Dec;21(1):1-7.

15. Lantuejoul LR, Toffart AC, Ghelfi J, Decaens T, Hilleret MN, Brichon PY, Stefanov O, Jankowski A, Reymond E, Ferretti GR. Liver transplantation-associated lung cancer in smokers: Results of an early CT detection program. Journal of Liver Transplantation. 2022 Jan 1;5:100050.

16. Shahid M, Ateeli H. METASTATIC CAVITARY ADENOCARCINOMA OF THE LUNG IN A PATIENT WITH RECENT AGGRESSIVE SQUAMOUS CELL CARCINOMA OF THE CHEST WALL. Chest. 2019 Oct 1;156(4):A699.

17. Chauhan A, Chanda A, Kaur P, Soni A, Sehgal S, Khurana A, Verma Y, Parkash O. P30. 06 Outcome Differences Amongst Histopathological Variants of Non Small Cell Lung Cancer Treated With Palliative Radiotherapy. Journal of Thoracic Oncology. 2021 Mar 1;16(3):S396.

18. Kaiho T, Nakajima T, Iwasawa S, Yonemori Y, Yoshino I. ALK rearrangement adenocarcinoma with histological transformation to squamous cell carcinoma resistant to alectinib and ceritinib. OncoTargets and therapy. 2020;13:1557.

19. Opoka L, Szturmowicz M, Oniszh K, Korzybski D, Podgajny Z, Błasi-ska-Przerwa K, Szołkowska M, Bestry I. CT imaging features of thin-walled cavitary squamous cell lung cancer. Advances in Respiratory Medicine. 2019;87(2):114-7.

20. Lee J, Kim YK, Seo YY, Choi EK, Lee DS, Kim YS, Hong SH, Kang JH, Lee KY, Park JK, Sung SW. Clinical characteristics of false-positive lymph node on chest CT or PET-CT confirmed by endobronchial ultrasound-guided transbronchial needle aspiration in lung cancer. Tuberculosis and Respiratory Diseases. 2018 Oct 1;81(4):339-46.

21. Rehman A, Kashif M, Abunadi I, Ayesha N. Lung cancer detection and classification from chest CT scans using machine learning techniques. In2021 1st International Conference on Artificial Intelligence and Data Analytics (CAIDA) 2021 Apr 6 (pp. 101-104). IEEE.

22. Hong JH, Park S, Kim H, Goo JM, Park IK, Kang CH, Kim YT, Yoon SH. Volume and mass doubling time of lung adenocarcinoma according to WHO histologic classification. Korean journal of radiology. 2021 Mar;22(3):464.

23. Yue JY, Chen J, Zhou FM, Hu Y, Li MX, Wu QW, Han DM. CT-pathologic correlation in lung adenocarcinoma and squamous cell carcinoma. Medicine. 2018 Dec;97(50).

24. Tsubakimoto M, Yamashiro T, Tamashiro Y, Murayama S. Quantitative CT density histogram values and standardized uptake values of FDG-PET/CT with respiratory gating can distinguish solid adenocarcinomas from squamous cell carcinomas of the lung. European Journal of Radiology. 2018 Mar 1;100:108-15.

25. Liu B, Shiraga S, Mortenson MM, Lai J. Small cell lung carcinoma and synchronous rectal Adenocarcinoma and jejunal gastrointestinal stromal tumor present in a patient with history of laryngeal squamous cell carcinoma. Anticancer Research. 2020 Dec 1;40(12):7053-6.

26. Obayashi K, Shimizu K, Nakazawa S, Nagashima T, Yajima T, Kosaka T, Atsumi J, Kawatani N, Yazawa T, Kaira K, Mogi A. The impact of histology and ground-glass opacity component on volume doubling time in primary lung cancer. Journal of Thoracic Disease. 2018 Sep;10(9):5428.

27. Ullah A, Munagala R, Mishra P, Singh K, Kozman D, Mattox S, Keshavamurthy J, Patel N. Small cell carcinoma of the lung in a patient with previously treated synchronous Adenocarcinoma and squamous cell carcinoma. Lung India: Official Organ of Indian Chest Society. 2021 May;38(3):263.

28. Deng HY, Zeng M, Li G, Alai G, Luo J, Liu LX, Zhou Q, Lin YD. Lung adenocarcinoma has a higher risk of lymph node metastasis than squamous cell carcinoma: a propensity score-matched analysis. World journal of surgery. 2019 Mar;43(3):955-62.

29. Od EG, Od ÁM, MgSc AM, MgSc JV, Mgsc RV, Od JO, Od PP, MgSc CE, Zambrano AD, MgSc MD, Inv ZD. Nivel de estrés radicular en premolares superiores y presión ejercida en tejidos adyacentes: un modelo mecánico en 3D. Archivos Venezolanos de Farmacologia y Terapéutica. 2021;40(9):942-5.

30. Paredes FX, Enriquez EA, Peralvo MA. Safety and immunogenicity of vaccines against SARS-CoV-2. Archivos Venezolanos de Farmacologia y Terapéutica. 2021;40(9):946-52.

31. Zambrano AM, Díaz CE, Zamora EE, Laverde AJ, Adame FT, Ronda JR, Quintanilla SB, Uvidia VC. Salud mental de los pacientes con enfermedades crónicas durante la pandemia por COVID-19. Sindrome Cardiometabólico. 2020;10(1):20-4.