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ORIGINAL ARTICLE

Ultrasound Guided Percutaneous Biopsy of Suspected Peripheral Lung Cancers: Impact of Present Smoking Trends

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Abstract

Background: While CT guided tissue sampling is considered gold standard in almost all lung pathologies, US guided sampling can be performed in peripheral lung lesions abutting pleura making them ultrasonographically approachable with benefit of non-exposure to x-rays and contrast agents. Smoking is one of the common variables associated with lung malignancies and current study evaluates the impact of changing trends in smoking habits. **Aims/Objectives**: To find the histopathological outcomes in patients of peripheral lung lesions and to describe the demographic variables and their association with malignant outcomes. **Study Design:** Retrospective study. **Material and Methods:** Retrospective data from a total of 242 patients was collected who were subjected to US-guided biopsy of peripheral lung lesions measuring >2 cm using 18G biopsy needles. Demographic variables were inspected. Histopathological outcomes were categorised into benign and malignant with subcategorisation. **Results:** Benign pathology was found in 20.24% (n = 49) cases and malignant in 74.38% (n = 180). 75% (p-value = 0.03) of male and 73.52% (p-value = 0.00) female smokers developed malignancy. Number of malignant cases increased with increased number of pack years among both genders (p-value = 0.028). Statistically significant difference was also found among males and females for cigarettes and tobacco consumption (p-value = 0.03 and 0.04 respectively) and alcohol consumption (p-value = 0.00) with malignant outcome. Squamous cell carcinoma was the most common malignant outcome with 39.6% cases, followed by adenocarcinoma (22.31%). **Conclusion:** Ultrasound guided lung biopsy is effective and diagnostic for peripheral lung lesions of adequate sizes. The differences observed in exposure types and risk patterns suggest the need for targeted awareness and screening strategies.

Key Words

Smoking, Lung Carcinoma, Lung Biopsy, Smokers

Introduction

Lung cancer is leading cause of cancer linked deaths worldwide among both men and women [1]. Smoking in various forms has long been incriminated with cancer development, particularly lung cancers[2]. In 2022, number of tobacco product users aged ≥ 15 years in India was approximately 253.0 million people placing the country at second globally and first in the WHO South-East Asia Region[3]. While CT guided transthoracic needle biopsy is considered gold standard minimally invasive tissue sampling method in majority of lung pathologies, ultrasound guided sampling can be employed in peripheral lesions abutting the pleura with benefit of non-exposure to ionizing radiation and contrast agents[4,5]. Primary objective of the study was to determine the histopathological outcomes (benign vs malignant) in patients presenting with peripheral lung lesions. Secondary objective: To describe the

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demographic variables (age distribution, gender, smoking status) and their association with malignant outcomes in patients with peripheral lung lesions.

Material and Methods

This Retrospective study was conducted in the Department of Radiodiagnosis and Department of Respiratory Medicine of Government Medical College, Jammu. Retrospective data of patients with peripheral lung lesions that was collected for 2 years (October 2022 - September 2024) was analyzed.

Inclusion Criteria:

- Age ≥ 18 years
- Both males and females
- Newly diagnosed peripheral lung lesion >2 cm on imaging
- Underwent US-guided biopsy with 18G needle within study period
- Complete clinical and histopathological data available

Exclusion Criteria:

- Age <18 years
- Prior thoracic surgery
- Previously diagnosed or currently treated pulmonary lesions
- Incomplete biopsy or inadequate tissue sample
- Contraindications to US-guided biopsy

Information of personal habits in the records was collected pertaining to smoking habits. Among smokers, type of smoking was categorized as -cigarettes, traditional bidis, tobacco/gutka, household/passive smoking and others (like vaping, e-cigarettes etc.). Smoking duration was calculated as pack years for smokers (number of cigarette packs smoked per day multiplied by number of smoked years, assuming one cigarette pack equal to 20 cigarettes). Demographic data was also collected including place of residence (rural, urban), dietary habits (vegetarian, non-vegetarians), alcohol consumption (non-alcoholic, former alcoholic, current alcoholic) and activity (sedentary hours <8 hours and >8 hours). Histopathological outcomes were recorded and categorized into benign and malignant with subcategorization.

Statistical Analyses: The data collected was entered in Microsoft excel. The qualitative data was presented as percentages. Chi-square test was used to find association between peripheral lung malignancies and smoking habits. $p<0.05$ was considered to be statistically significant.

Ethical Considerations: The study was conducted after taking approval from institutional ethical committee of GMC Jammu (IEC/GMCJ/2025/2414 dated 15-11-2025).

Results

Among 242 patients (140 males and 102 females), biopsy specimens were diagnostic in 94.63% (n = 229) of cases and inconclusive in 5.37% (n = 13). Benign pathology was found in 20.24% (n = 49) cases and malignant in 74.38% (n = 180). Most of the patients had more than a single symptom with majority presenting with chronic cough (221) followed by weight loss (198). Other chief complaints included hemoptysis (143), shortness of breath (64), chest pain (87), fever (34), generalized weakness (222). Three patients reported facial swelling. One patient was incidentally diagnosed with lung lesion who in fact presented with acute chest trauma.

Among males, 66.4% (93/140) gave history of smoking tobacco. 75% (105/140) of the male patients had malignant peripheral lung lesions. A statistically significant association was found between history of smoking and malignant lesions in the lungs among males. ($p = 0.03$) (Table 1A).

Table 1B depicts that out of 102 females, 75 (73.52%) had malignant lesion on histopathology. Among female patients 76.4% (78/102) had history of smoking. A statistically significant ($p = 0.00$) association was found between history of smoking and development of peripheral lung lesions in females.

Table 2A shows that among males who developed malignant lesions, maximum cases were in the age group of 45-55 years (48.57%) followed by those in the age group of 35 to 45 years (23.80%). In contrast, maximum cases in those with non-malignant lesions were seen in 35 to 45 years age group (28.57%) followed by 45-55 years age group (25.71%). This difference was not found to be statistically significant ($p = 0.10$).

Table 2B shows that among females who developed malignant lesions, maximum cases were in the age group of 35-45 years (54.66%) whereas among those with non-malignant lesions, maximum were found in 45 to 55 years age group (29.62%). This difference was found to be statistically significant ($p = 0.10$). Among the 93 male smokers and 78 female smokers, 80.64% and 83.33% respectively had developed malignant peripheral lung lesions.

Table 3 gives the pack years for smokers and development of lung cancer in both genders. It was seen that as the pack years increase, the percentage of smokers developing lung cancer also increased among male and female patients but this association was found to be statistically significant only among males ($p = 0.00$). Gender wise comparison of malignant cases with pack years of smoking showed that of those malignant cases who had smoked 20-30 pack years, 67.56% were females

Table 1A: Association of Smoking with Malignancy Among Male Patients of Peripheral Lung Lesions.

Variable	Malignant No. (%)	Non-malignant No. (%)	Total No. (%)	χ^2	p
Smoker	75 (71.4%)	18 (51.4%)	93(66.4%)	4.70	0.03*
Non-Smoker	30 (28.5%)	17 (48.5%)	47 (33.5%)		
Total	105(100)	35(100)	140(100)		

$p<0.05$

Table 1B: Association of Smoking with Malignancy Among Female Patients of Peripheral Lung Lesions.

Variable	Malignant No. (%)	Non-malignant No. (%)	Total No. (%)	X^2	p
Smoker	65 (86.6%)	13 (48.1%)	78 (76.4%)	16.37	0.000
Non-Smoker	10 (13.3%)	14 (51.9%)	24 (23.5%)		
Total	75(100)	27(100)	102(100)		

*p<0.05

Table 2A: Age wise distribution of male patients and its association with malignant peripheral lung lesions.

Age group (in years)	Malignant cases No. (%) N=105	Non-malignant cases No. (%) N=35	Total cases No. (%) N=140
25-35	5(50)	5(50)	10(100)
35-45	25(71.4)	10 (28.57)	35(100)
45-55	51(85)	9 (15)	60(100)
55-65	14(70)	6 (30)	20(100)
65-75	10(66.6)	5(33.3)	15(100)

$X^2=7.5$ $p=0.10$

Table 2B: Age wise distribution of female patients and its association with malignant peripheral lung lesions.

Age Group (in years) in Females	Malignant cases No. (%) N=75	Non-Malignant Cases No. (%) N=27	Total cases No. (%) N=102
25-35	3(37.5)	5(62.5)	8(100)
35-45	41(87.2)	6(12.76)	47(100)
45-55	12(60)	8(40)	20(100)
55-65	12(70.5)	5(29.41)	17(100)
65-75	7(70)	3(30)	10(100)

$X^2=11.89$ $p=0.01$

Table 3: Association between malignant cases and smoking pack years among male and female patients of peripheral lung disease.

Pack years for smokers	Male smokers	Malignant cases among males	Female smokers	Malignant cases among females
<20	5(100)	2(40)	3(100)	1 (33.33)
20-30	19(100)	12(63.15)	28(100)	25 (89.28)
30-40	48(100)	43(89.58)	32(100)	27 (84.37)
>40	21(100)	18(85.71)	15(100)	12 (80)
TOTAL	93(100)	75(80.64)	78(100)	65(83.33)
X^2	11.82		6.25	
P	0.00		0.09	

Table 4: Type of smoking habits and its association with gender of patients diagnosed with malignant peripheral lung lesions.

Type of Smoking	Males, N=93 No (%)	Females, N=78 No (%)	χ^2	p-value
Cigarette	25 (26.88%)	12 (15.38%)	3.30	0.03*
Bidi	45 (48.38%)	40 (51.28%)	0.14	0.70
Tobacco/Other Chewing	40 (43.01%)	22 (28.20%)	4.02	0.04*
Household/ Passive Smoking	10 (10.75%)	36 (46.15%)	27.04	0.00*
Others	5 (5.37%)	8 (10.25%)	1.43	0.23

Table 5: Associated demographic variables in patients with and without malignant peripheral lung lesions.

Variable	Malignant (N=180) No. (%)	Non-malignant (N=62) No. (%)	Total (N=242) No. (%)	χ^2	p-value
Residence	Urban 137 (76.11%) Rural 43 (23.88%)	51 (82.25%) 11 (17.74%)	188 (77.68%) 54 (22.3%)	1.005	0.31
Diet	Vegetarian 98 (54.4%) Non-vegetarian 82 (45.5%)	40 (64.5%) 22 (35.4%)	138 (57.02%) 104 (42.9%)	1.90	0.16
H/o Alcohol Consumption	Non Alcoholic 43 (23.3%) Former Alcoholic 76 (42.2%) Current Alcoholic 61 (33.8%)	25 (40.3%) 27 (43.5%) 10 (16.1%)	68 (28.0%) 103 (42.5%) 71 (29.3%)	9.40	0.00*
Sedentary Life	< 8 hrs 91 (50.5%) ≥ 8 hrs 89 (49.4%)	37 (59.6%) 25 (40.3%)	128 (55.2%) 114 (47.1%)	1.54	0.21

**p < 0.05 statistically significant*

and those who had smoked 30-40 and more that 40 pack years 61.42% and 60% were males. This difference in pack years of smoking among males and females was found to be statistically significant ($X^2 = 9.09$, p = 0.028). Among male patients, 43.01%, 48.38% and 26.88% had consumed tobacco, bidi and cigarette respectively, whereas among females, 46.15% were exposed to house hold/passive smoking, 51.38% had consumed Bidi and 15.38% had smoked cigarettes. Gender wise comparison of addictions among patients of malignant peripheral lung lesions showed statistically significant association for cigarettes, tobacco chewing and household/passive smoking (p = 0.03,0.04 and 0.00 resp). (Table 4).

Table 5 shows that there was a statistically significant difference in Alcohol consumption variables among cases with malignant and non-malignant peripheral lung lesions (p = 0.00). 33.88% and 42,22% patients with malignant lung lesions were current and former alcohol consumers respectively, whereas among those without malignant lesions, 16.1% and 43.5% were current and former alcoholics.Place of residence, type of diet, and sedentary habits did not show statistically significant difference (p = 0.31, 0.16 & 0.21 respectively) among the two groups.

Squamous cell carcinoma was the most common malignant outcome with 39.6% cases, followed by adenocarcinoma (22.31%) and large cell undifferentiated carcinoma (5.37%). Other less frequent malignancies include small cell carcinoma, metastasis, lymphoma, and malignant mesenchymal tumors. Tuberculosis was the most frequently noted benign condition with 8.67% cases followed by chronic infections (2.89%). Among female patients, adenocarcinoma was the most common malignant histological type while in male patients, squamous cell carcinoma predominated (Figure 1a and 1b).

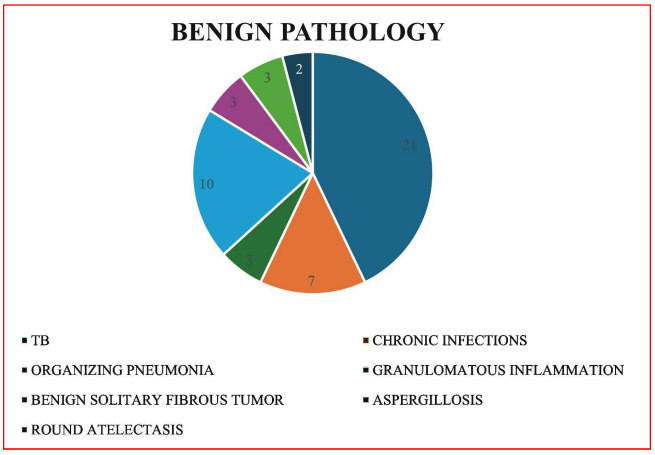

Figure 1a: Benign histological outcomes with tubercular infection being most common.

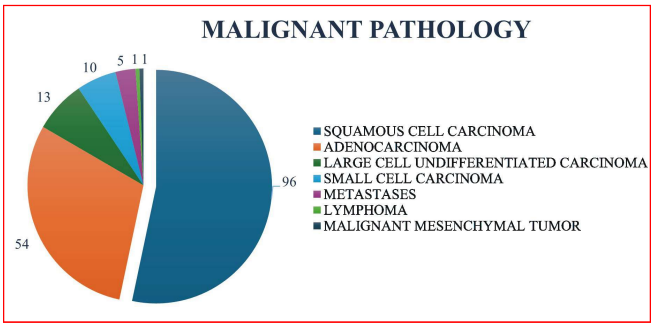

Figure 1b: Malignant histological outcomes with squamous cell carcinoma being most common.

Discussion

Established data estimates active smokers to have a 5 to 30 times increase in incidence of lung cancer compared with non-smokers[6,7]. This study underpins the strong association between smoking and malignant lung pathologies, consistent with long-standing global evidence.

Among both male and female participants, smokers exhibited a significantly higher frequency of malignancy compared to non-smokers (71.4% and 86.6%, respectively), echoing numerous previous studies, including the findings of Doll and Hill, who first reported the causal link between smoking and lung cancer in British doctors over six decades ago[2,8].

A notable gender difference was observed in the types of exposure. While cigarette and tobacco chewing were more prevalent among male smokers, passive or household smoke exposure was considerably higher among female patients, with 46.15% of malignant cases in females linked to second-hand smoke exposure (p = 0.00). This aligns with WHO reports emphasizing the health burden of passive smoking, particularly in countries like India with high household exposure[3]. As among non-smokers, prolonged passive home exposure tended to increase lung cancer risk, these results also underscore the need to consider indirect smoke exposure in female populations when assessing cancer risk[9,10].

Age distribution revealed mid-life peaks in malignancy incidence, with the 45–55 age group in males and 35–45 in females showing the highest malignancy rates (p = 0.001). Similar findings were summarised by Singh *et al*[11]. Increasing pack years were also strongly associated with malignancy (p = 0.028) confirming a dose-dependent relationship between active smoking and lung cancer development[12,13,14]. These findings indicate that mid-life individuals may be at a heightened risk of developing malignancies, possibly due to cumulative exposure to risk factors such as long-term smoking.

Several studies investigating relationship between alcohol consumption and lung cancer have found inconsistent results[15]. However, our study showed statistically significant difference in alcohol consumption variables (current and former alcoholics) among cases with malignant histopathological outcomes (p = 0.00).

Histopathologically, squamous cell carcinoma was the predominant malignancy overall (39.6%) and among males, while adenocarcinoma was more common in females. This distribution is in agreement with global trends, where squamous cell carcinoma remains strongly linked to active smoking[16,17]. In the study by Singh *et al*., adenocarcinoma was established as the dominant histologic type at present among smokers in India while in our study it followed as the second overall[11].

Ultrasound-guided biopsy demonstrated high diagnostic adequacy, with conclusive histopathology achieved in 94.63% of cases. Ultrasound offers a safe, radiation-free alternative for peripheral lung lesions, which this study successfully utilized in a real-world setting[5,18,19]. Lee MH *et al* and Jarmakani M *et al* also concluded considering US guidance for peripheral lung biopsies because it is safer, faster and possibly more accurate than CT guidance[20,21].

Conclusion

This study confirms a strong link between smoking (active and passive) and malignant peripheral lung lesions, with notable gender differences in exposure patterns. Increasing pack years further elevated malignancy risk, underscoring the need for early cessation and targeted awareness, especially for women with passive exposure. Ultrasound-guided biopsy remains a safe, radiation-free option for peripheral lesions.

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Conflict of Interest: Nil

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