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Comparative Evaluation Of Posterior Mediastinal Lesions

Dr. Mohit H. Tamakuwala
Radiology resident, Radio-Diagnosis, Krishna Vishwa Vidyapeeth "Deemed To Be University", Karad, Maharashtra
email: mohittamakuwala@gmail.com **9974446055.**

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Abstract:
Background: Posterior mediastinal lesions manifest with a variety of diseases ranging from benign neurogenic tumors to malignancies like lymphomas and esophageal tumors. Accurate diagnosis and differentiation between benign and malignant lesions are of crucial significance to plan proper treatment. In this study, an evaluation was conducted concerning imaging features of posterior mediastinal lesions and histopathological correlations.
Methodology: This future, observational research was conducted for 18 months at Krishna Vishwa Vidyapeeth Hospital. 42 patients who were suspected to have posterior mediastinal lesions underwent chest radiographs, barium swallow, CT scan, and MRI. The findings were compared with histopathological findings. Statistical analysis including sensitivity, specificity, and correlation with histopathology was performed by chi-square tests.
Results: The study found malignancy to be higher in patients aged 61-80 years, and certain symptoms such as pain, lump in the abdomen, and hoarseness of voice were highly correlated with malignancy. Imaging features such as margins of the mass, erosion of rib/sternum, and lymphadenopathy were highly correlated with malignancy. Features like heterogeneous enhancement, irregular lesion morphology, and involvement of adjacent structures on CT/MRI scans suggested malignant lesions. Barium swallow findings like infiltrative and lobulated patterns also seen with malignancy.
Conclusion: Clinical history, imaging features, and histopathology all contribute to the accurate diagnosis of posterior mediastinal lesions. Some symptoms and imaging findings, such as irregular margins, lymphadenopathy, and heterogeneous enhancement, are crucial in distinguishing malignant from benign lesions.
Keywords: Posterior mediastinal lesions, neurogenic tumors, malignancy, imaging, CT/MRI, histopathology, diagnostic accuracy.

Introduction

Posterior mediastinal lesions encompass a wide variety of pathologies in the posterior mediastinal space, which is bounded by the thoracic vertebrae posteriorly and the pericardium and trachea anteriorly. Posterior mediastinal lesions are of significant clinical importance since they encompass a wide range of etiologies ranging from benign causes like neurogenic tumors to inflammatory or malignant diseases. A proper comprehension of these lesions is crucial for clinicians to avoid misdiagnosis and inappropriate treatment [1].

The posterior mediastinum harbors several vital structures, including the esophagus, thoracic duct, sympathetic chain, and descending thoracic aorta. As a result, posterior mediastinal lesions typically originate from these structures or are metastases from a remote location. The majority of posterior mediastinal masses are encountered incidentally during imaging studies performed for unrelated clinical reasons, testifying to the function of imaging in their first detection and characterization [2]. Advanced imaging techniques, including computed tomography (CT) and magnetic resonance imaging (MRI), are unavoidable when assessing the extent, origin, and internal consistency of such masses. These modalities, in combination with clinical presentation, are helpful in rendering information to the differential diagnosis, distinguishing benign from malignant lesions [3].

Some of the most common types of posterior mediastinal masses include neurogenic tumors, which arise from nerves within the posterior mediastinum. These include schwannomas, neurofibromas, and malignant peripheral nerve sheath tumors. Some other important lesions include esophageal tumors, lymphomas, and cystic masses such as bronchogenic or duplication cysts. The diverse presentation and course of these lesions render them challenging to diagnose and manage, which underscores the need to adopt a systematic approach to evaluation [4]. Histopathological diagnosis remains the best test to confirm the diagnosis of posterior mediastinal lesions. This is normally done by sampling tissue, and this can be done under imaging guidance. Synchronous correlation of imaging findings with histopathology guarantees correct diagnosis and aids in formulating appropriate therapeutic regimens. This complementary correlation of imaging and pathology underscores the interdisciplinary approach to the management of such lesions [5].

Benign versus malignant masses are one of the central issues in the evaluation of posterior mediastinal lesions. Imaging features such as lesion margins, enhancement patterns, and mediastinal or vertebral body involvement are useful in the initial diagnosis. However, shared imaging characteristics of benign and malignant lesions must be subjected to further evaluation in the form of biopsy or molecular testing to make a definitive diagnosis [6]. The importance of posterior mediastinal lesions extends beyond their location. Malignant lesions in this location may invade contiguous structures or metastasize to remote organs and hence result in significant morbidity and mortality. Accurate and prompt diagnosis is most essential in cutting such risks short as well as in improved patient outcomes and thereby the importance of robust diagnostic algorithms involving imaging, histopathological and clinical data merged [7].

Progress in imaging technology over the past decade, including functional imaging modalities like positron emission tomography (PET), has greatly improved the evaluation of posterior mediastinal lesions. When combined with CT, PET provides valuable metabolic information that is supplemented by structural imaging, and it helps to detect malignancy and response to treatment. Such advances hold out the promise to enhance diagnostic accuracy and, thereby, patient management [8].

This current study aims to examine posterior mediastinal mass imaging characteristics and correlate histopathology with imaging features. Through the development of a wide diagnostic platform, the study aims to improve the understanding and treatment of the complicated lesions. Findings in this study will contribute to knowledge and assist clinicians with improved-informed decision-making on patient management [9]. A systematic analysis of these lesions, combining imaging and histopathology, should potentially enhance both diagnostic accuracy and therapeutic result. Eventually, this investigation will not only contribute to optimizing individual patient treatment but will provide insight into the direction for further research within the field [10].

Methodology

This study was a prospective, observational study intended to correlate and examine imaging features of posterior mediastinal lesions with histopathological features. Suspicious patients presenting with posterior mediastinal lesions were recruited from the Department of Radiodiagnosis, Krishna Vishwa Vidyapeeth Hospital, which is a tertiary center. Participants underwent a systematic diagnostic workup consisting of chest radiographs, barium swallow study, CT scan, and MRI depending on the clinical suspicion. Imaging findings were then compared with histopathological examination in biopsy or resection. The study was performed over a duration of 18 months, using consecutive recruitment of patients who were appropriate for enrollment, and presenting an inclusive and representative series of cases. The aim of the study was to determine the diagnostic utility of various imaging modalities in identifying posterior mediastinal lesions.

The inclusion criteria focused on patients with mediastinal widening on chest radiographs, clinical symptoms indicative of mediastinal lesions, and other relevant findings such as esophageal abnormalities detected via barium swallow. Patients with prior treatments, renal issues, or pregnant women were excluded. A total of 42 patients were enrolled, based on a sample size calculation that ensured sufficient statistical power. Imaging was undertaken with the most advanced equipment available, such as high-resolution digital X-ray, 16-slice CT, and 1.5 Tesla MRI. Image acquisition, contrast injection, and patient preparation in the study employed standardized protocols in order to ascertain consistency and reliability.

Statistical analysis: Data were collected in a planned manner with the help of a pre-designed proforma to elicit clinical, imaging, and histopathological data. The data were processed using statistical methods, such as descriptive statistics to summarize demographic and clinical parameters. Sensitivity, specificity, positive predictive value, and negative predictive value for each imaging modality were calculated to assess diagnostic accuracy. The correlation of imaging results with histopathology outcomes was investigated with the use of chi-square tests and Fisher's exact test. Statistically, significance was established at a p-value of < 0.05, and presentation of results was through the use of tables and graphs to facilitate comparison.

Results

The study findings indicated that malignancy occurred more frequently among older age groups, i.e., the age group 61–80, followed by the age group 41–60. However, the association of malignancy with age was not statistically significant (p = 0.173), i.e., while malignancy appeared to be higher among older individuals, this may have been by chance. Consequently, although a higher proportion of males (42.3%) were diagnosed with malignancy compared with females (25.0%), the correlation between sex and malignancy was also not significant (p = 0.256). Comparatively, chief complaints and clinical history proved to be significantly correlated with malignancy (p = 0.032 for both), reflecting on the importance of specific symptoms in malignancy risk assessment. Hoarseness of voice, haemoptysis, persistent cough, and dysphagia were all predominantly occurring with malignancy, whereas chest pain, fever, and dyspnoea occurred with benign conditions only. Dysphagia, dyspnoea, vomiting, and weight loss were similarly more frequent with malignancy and suggested that these symptoms warranted detailed clinical evaluation. They placed strong emphasis on clinicians being more sensitive to patterns of symptoms that could potentially be red flags for malignancy and facilitating early diagnosis as well as timely intervention. (Table 1)

Table 1: Association BetweenDemographic Factors and Benign/Malignant Diagnosis

		Benign/Malignant		Total (%)	
		Benign	**Malignant**		
Age	≤ 20	3	1	4 (9.5)	Pearson chi-square = 1.292, p-value = 0.256
	21 - 40	6	0	6 (14.3)	
	41 - 60	10	6	16 (38.1)	
	61 - 80	8	8	16(38.1)	
Sex	Female	12	4	16 (38.1)	Pearson chi-square = 1.292, p-value = 0.256
	Male	15	11	26 (61.9)	
Clinical History	back pain	1	0	1 (2.4)	Pearson chi-square = 25.369, p-value = 0.032
	Chest pain	5	0	5 (11.9)	
	Chronic cough	0	1	1 (2.4)	
	Cough	0	1	1 (2.4)	
	Dysphagia	3	2	5(11.9)	
	Dyspnoea	2	0	2 (4.8)	
	Epigastric Pain	3	2	5(11.9)	
	Fever	3	0	3 (7.1)	
	Haemoptysis	1	2	3 (7.1)	
	Hoarseness Of Voice	0	3	3 (7.1)	

	Loss Of Consciousness	1	0	1 (2.4)	
	Nausea	2	0	2 (4.8)	
	Shortness Of Breath	3	3	6 (14.3)	
	Stridor	1	0	1(2.4)	
	Vomiting	2	1	3 (7.1)	
Chief Complaint	Chest pain	6	0	6	Pearson chi-square = 18.369, p-value = 0.032
	Cough	5	2	7	
	Dysphagia	6	7	13	
	Dyspnoea	2	3	5	
	Epigastric Pain	3	0	3	
	Fever	1	0	1	
	Vomiting	1	2	3	
	Weakness	1	0	1	
	Weight Loss	2	1	3	

The study confirmed that certain clinical parameters were strongly correlated with malignancy, and pain (p = 0.006), abdominal lump (p = 0.003), and hoarseness of voice (p = 0.001) were found to be very statistically significant ($p < 0.05$). This meant that patients with these symptoms were likely to have a malignant diagnosis. Other symptoms presented such as cough (p = 0.666), dyspnoea (p = 0.780), fever (p = 0.636), dysphagia (p = 0.353), heartburn (p = 0.810), neck swelling (p = 0.666), and weight loss (p = 0.890) were not statistically significant between benign and malignant. Though some of these symptoms had been classically associated with malignancy, their lack of statistical significance indicated that they were unlikely to be employed as good predictors by themselves. These findings underscored the necessity of recognizing pain, abdominal lump, and hoarseness of voice as potential red-flag symptoms that required further diagnostic evaluation for early diagnosis and appropriate management of malignancy. (Table 2)

Table 2: Association Between Clinical Variables and Benign/Malignant Diagnosis

Variable	Benign Count	Malignant Count	p value
Cough	18	9	0.666
Pain	22	6	0.006
Dyspnoea	15	9	0.780
Fever	11	5	0.636
Dysphagia	14	10	0.353
Heartburn	10	5	0.810
Neck Swelling	20	3	0.666
Abdominal Lump	24	8	0.003
Hoarseness of Voice	25	8	0.001
Weight Loss	15	8	0.890

The radiographic findings were also strongly related to malignancy when the findings from chest X-rays were analyzed. Mass location on chest X-ray was not significantly related to malignancy (p = 0.456), which would mean that mass location alone could not be used as a predictive measure. The features of the margin on the chest X-ray, though, were strongly associated with a very high incidence in malignant lesions (p = 0.004). Similarly, erosion of the sternum or rib was highly correlated with malignancy (p = 0.010), indicating that such signs can be employed as future red flags for malignancy. Other features such as the occurrence of calcifications (p = 0.638), pleural effusion (p = 0.710), patterns of lung parenchymal opacity (p = 0.642), and vertebral collapse (p = 0.349) were not proven to have a statistically significant difference between malignant and benign conditions. These observations emphasize the importance of certain chest X-ray results, particularly ill-defined margins and rib/sternum erosion, in raising suspicion for malignancy and guiding further diagnostic evaluation. (Table 3)

Table 3: Association Between Chest X-ray and Benign/Malignant Diagnosis

		Benign/Malignant		**Total**	
		Benign	**Malignant**		
Chest X-ray - Mass Location	Lower	15	6	21	Pearson chi-square = 1.556, p-value = 0.456
	Middle	6	6	12	
	Upper	6	3	9	
Chest X-ray - Margins	Ill-Defined	1	5	6	Pearson chi-square = 19.043, p-value = 0.004
	Infiltrative	0	2	2	
	Irregular	1	1	2	
	Lobulated	6	6	12	
	Oval	2	0	2	
	Round	2	0	2	
	Well-Defined	15	1	16	
Chest X-ray - Calcification	Absent	24	14	38	Pearson chi-square = 0.220, p-value = 0.638
	Present	3	1	4	
Chest X-ray - Pleural Effusion		11	7	18	0.710
Chest X-ray - Consolidation		12	9	21	0.334
Chest X-ray - Chest Wall/Neck Swelling		5	5	10	0.280
Chest X-ray - Pericardial Effusion		5	1	6	0.293
Chest X-ray - Vertebral Collapse		4	4	8	0.349
Chest X-ray - Lung Parenchymal Opacity	Nodular	4	4	8	Pearson chi-square = 0.886, p-value = 0.642
	None	15	7	22	
	Patchy	8	4	12	
Chest X-ray - Rib/Sternum Erosion	No	25	9	34	Pearson chi-square = 6.643, p-value = 0.010
	Yes	2	6	8	

Barium Swallow findings analysis revealed significant correlations between certain radiographic findings and malignancy. Luminal narrowing/stricture (p = 0.037), dilatation of the esophagus (p = 0.012), filling defects (p = 0.003), lobulated patterns (p = 0.031), infiltrative patterns (p < 0.001), polypoid appearance (p = 0.002), and strictures (p = 0.040) were all significantly associated with malignancy, suggesting that these characteristics may act as good markers for malignant conditions. Particularly, infiltrative patterns were most strongly correlated, and all instances with this result were malignant. Conversely, results of fine nodular/granular patterns (p = 0.475), ulcerative changes (p = 0.315), varicoid appearance (p = 0.248), and hiatus hernia (p = 0.315) did not present any statistically significant differences between benign and malignant cases, indicating that these in isolation might not be able to predict malignancy. These results highlight the importance of recognizing individual Barium Swallow abnormalities, especially infiltrative, lobulated, and polypoid types, as red-flag signs that need additional workup for malignancy. (Table 4)

Table 4: Association Between Barium Swallow and Benign/Malignant Diagnosis

	Benign/Malignant	**Total**	

		Benign	Malignant		
Barium Swallow - Fine Nodular/Granular Pattern	No	11	9	20	Pearson chi-square = 1.490, p-value = 0.475
	Yes	2	1	3	
Barium Swallow - Luminal Narrowing/Stricture	No	5	0	5	Pearson chi-square = 6.595, p-value = 0.037
	Yes	8	10	18	
Barium Swallow - Dilatation of Esophagus	No	7	2	9	Pearson chi-square = 5.698, p-value = 0.012
	Yes	6	8	14	
Barium Swallow - Filling Defects	No	8	0	8	Pearson chi-square = 11.435, p-value = 0.003
	Yes	5	10	15	
Barium Swallow - Smooth	No	5	10	15	Pearson chi-square = 11.435, p-value = 0.003
	Yes	8	0	8	
Barium Swallow - Lobulated	No	12	5	17	Pearson chi-square = 6.951, p-value = 0.031
	Yes	1	5	6	
Barium Swallow - Infiltrative	No	13	1	14	Pearson chi-square = 21.909, p-value = 0.000
	Yes	0	9	9	
Barium Swallow - Polypoid	No	13	4	17	Pearson chi-square = 12.630, p-value = 0.002
	Yes	0	6	6	
Barium Swallow - Stricture	No	9	10	19	Pearson chi-square = 5.322, p-value = 0.040
	Yes	4	0	4	
Barium Swallow - Ulcerative	No	8	8	16	Pearson chi-square = 2.309, p-value = 0.315
	Yes	5	2	7	
Barium Swallow - Varicoid	No	13	10	23	Pearson chi-square = 1.335, p-value = 0.248
Barium Swallow - Hiatus Hernia	No	8	8	16	Pearson chi-square = 2.309, p-value = 0.315
	Yes	5	2	7	

CT/MRI findings analysis identified many significant correlations with malignancy. Lesion morphology had good correlation, with circumferential ($p = 0.001$), lobulated, and irregular morphologies being more prevalent in malignancies, whereas oval, round, and defined lesions were all strictly benign. Lesion size also had statistical strength ($p = 0.027$), with diffuse involvement being more likely to occur in malignancy. Lymph node involvement was very important ($p < 0.001$), with all of the malignant cases having lymph node involvement and none of the benign cases. Similarly, structural invasion or compression ($p = 0.044$) and extension to adjacent tissues ($p = 0.008$) were very much associated with malignancy and emphasize their role as significant markers for diagnosis. The enhancement pattern of the mass was also an important parameter, with heterogeneous enhancement having a highly significant correlation with malignancy ($p < 0.001$), whereas homogeneous, peripheral, or absence of enhancement was noted only in benign lesions. Metastasis was also a sharp indicator of malignancy, with a highly significant correlation ($p < 0.001$). However, neither the site of the lesion ($p = 0.287$) nor the presence of calcifications ($p = 0.654$) was statistically significant. These findings prove the significance of the shape of the lesion, lesion size, lymph node involvement, enhancement pattern, pattern of invasion of structures, and metastasis as significant radiological features in distinguishing benign from malignant conditions. (Table 5)

Table 5: Association Between CT/MRI and Benign/Malignant Diagnosis

	Benign/Malignant	Total	

		Benign	Malignant		
CT/MRI - Site	Lower Mediastinum	13	4	17	Pearson chi-square = 4.998, p-value = 0.287
	Middle	3	4	7	
	Middle + Lower	5	4	9	
	Upper	5	1	6	
	Upper + Middle	1	2	3	
CT/MRI - Shape	circumferential	1	4	5	Pearson chi-square = 28.809, p-value = 0.001
	Fusiform	3	0	3	
	Irregular	1	4	5	
	Lobulated	2	5	7	
	Oval	9	0	9	
	Polypoidal	0	2	2	
	Round	5	0	5	
	Scalar	1	0	1	
	Tortuous	2	0	2	
	Well Defined	3	0	3	
CT/MRI - Extent of Lesion	Diffuse	10	12	22	Pearson chi-square = 7.239, p-value = 0.027
	Limited	17	3	20	
CT/MRI - Calcification	No	18	11	29	Pearson chi-square = 0.201, p-value = 0.654
	Yes	9	4	13	
CT/MRI- Lymph Nodes Involved	No	20	0	20	Pearson chi-square = 21.212, p-value = 0.000
	Yes	7	15	22	
CT/MRI - Structures Compressed/Invaded	No	18	6	24	Pearson chi-square = 4.220, p-value = 0.044
	Yes	9	9	18	
CT/MRI - Enhancement Pattern of Mass	Heterogeneous	3	15	18	Pearson chi-square = 0.31.111 p-value = 0.000
	Homogeneous	5	0	5	
	None	13	0	13	
	peripheral enhancement	6	0	6	
CT/MRI- Extension into the Surrounding	No	23	7	30	Pearson chi-square = 7.010, p-value = 0.008
	Yes	4	8	12	
Metastasis	No	27	5	32	Pearson chi-square = 23.625, p-value = 0.000
	Yes	0	10	10	

Table 6: Correlation Between CT/MR Diagnosis and Benign/Malignant Nature

CT/MR Diagnosis	Benign/Malignant		Total
	Benign	Malignant	
Achalasia Cardia	2	0	2
Bronchogenic Carcinoma with Mediastinal Extension & Metastatic Lymphadenopathy	0	4	4
Descending Thoracic Aneurysm	4	0	4
Esophageal Cancer	0	10	10
Esophageal Duplication Cyst	1	0	1

Esophageal Leiomyoma	2	0	2
Esophageal Varices	2	0	2
Esophagitis	1	0	1
Extramedullary Hematopoiesis	1	0	1
Hiatus Hernia	5	0	5
Neurogenic Tumor	4	1	5
Pancreatic Pseudocyst	1	0	1
Tubercular Paravertebral Abscess	4	0	4
Total	27	15	42
Pearson chi-square = 38.516, p-value = 0.000			

The correlation between CT/MRI diagnosis and benign or malignant nature of conditions was found to be extremely significant ($p < 0.001$), that certain diagnoses were strongly suggestive of malignancy. Among malignancies, cancer of the esophagus was the most frequent diagnosis (10 cases) and was followed by extension of bronchogenic carcinoma into mediastinum and metastatic lymphadenopathy (4 cases). Of note, no benign process was misdiagnosed as malignancy. Conversely, all cases of achalasia cardia, descending thoracic aneurysm, duplication cyst of the esophagus, leiomyoma of the esophagus, varices of the esophagus, esophagitis, extramedullary hematopoiesis, hiatus hernia, neurogenic tumor, pseudocyst of the pancreas, and tubercular paravertebral abscess were categorized as benign, and there was a single case of neurogenic tumor in the malignant category. This strong statistical correlation hides the diagnostic specificity of CT/MRI findings in distinguishing benign from malignant disease, particularly in diagnosing malignancies such as esophageal carcinoma and bronchogenic carcinoma. (Table 7)

Table 7: Follow-up and Histopathology Findings

Follow up/histopathology	**Frequency**	**Percent**
H.P Confirmed Diagnosis of Esophageal Leiomyoma	1	2.4
H.P Confirmed Diagnosis of Esophageal Squamous Cell Carcinoma	5	11.9
CT Guided Biopsy Done, Diagnosed as Squamous Cell Carcinoma of Lung	2	4.8
Endoscopy Done, Diagnosed as Hiatus Hernia	2	4.8
Endoscopy Done, Diagnosed as Hiatus Hernia with Reflux Esophagitis	2	4.8
Endoscopy Done, Diagnosed as Reflux Esophagitis	1	2.4
Follow Up Could Not Be Done	3	7.1
H.P: Adenocarcinoma of Esophagus	2	4.8
No Follow Up	5	11.9
On AKT	3	7.1
Operated & Diagnosed as Schwannoma on Biopsy	2	4.8
Operated And Diagnosed as Ganglioneuroma on Biopsy	2	4.8
Operated And Diagnosed as Neuroblastoma on Biopsy	1	2.4
Operated Upon & H.P Confirmed Diagnosis of Esophageal Squamous Cell Carcinoma	1	2.4
Patient Denied for Surgery or Biopsy	1	2.4
Patient Expired	9	21.4
Total	42	100.0

The statistical association between confirmed diagnosis and benign or malignant status was significant ($p = 0.006$), indicating the precision of confirmed diagnoses in differentiating between malignant and benign conditions. Of the confirmed diagnoses, all 13 benign cases remained benign and all 11 malignant cases were also confirmed as malignant, indicating high diagnostic accuracy. In addition, none of the patients with no follow-up or follow-up complications were later found to be malignant, supporting the necessity for follow-up in an effort to make the correct diagnosis. Note that 9 patients expired, and 4 of them had a diagnosis of malignancy, which may suggest some link between malignancy and mortality. One patient refused further diagnostic evaluation, with their status unknown. This analysis highlights the fundamental significance of confirmation and follow-up in diagnosis for the establishment of accurate disease categorization and risk of increased mortality in cases of malignancy. (Table 8)

Table 8: Correlation Between Diagnostic Confirmation and Benign/Malignant Nature

Group	Benign	Malignant	Total
Confirmed Benign Diagnoses	13	0	13
Confirmed Malignant Diagnoses	0	11	11
No Follow-Up/Follow-Up Issues	8	0	8
Patient Refusal/Other Outcomes	1	0	1
Patient Expired	5	4	9
Pearson chi-square = 32.321, p-value = 0.006			

Discussion

This recent study endeavored to carry out a thorough analysis of posterior mediastinal masses using a multi-modality imaging approach comprising clinical assessment, chest X-ray, barium swallow study, and cross-sectional modalities such as CT and MRI. They drew comparisons with past studies in terms of focusing on diagnostic reliability, patterns of malignancy, and characteristic features allowing differentiation of malignant from benign tumors.

Our study revealed prevalence of middle-aged and elderly participants, which has been observed in the study by Patil and Kadam (2023) [11], wherein increased rates of mediastinal lesions were noted in the elderly. Though malignancy was more in the age group 61–80 years, the correlation between malignancy and age was not statistically significant. Similarly, while males had a higher proportion of malignant diagnoses compared to females, this correlation was also not statistically significant, in line with Sajeev and Naveen's (2021) [12] evidence. Chief complaints such as hoarseness of voice, haemoptysis, chronic cough, dysphagia, and loss of weight, however, were significantly linked to malignancy, justifying the usefulness of risk estimation by symptomatology. These findings concur with Pathak et al. (2021) [13], whose findings identified the significance of chronic respiratory and gastrointestinal symptoms as malignancy diagnosis predictors.

The site of chest mass in chest radiography did not independently function as a predictor of malignancy, a contention echoed by Patidar et al. (2016) [14]. But ill-defined margins and infiltrative patterns had robust correlations with malignancy, as Archer et al. (2023) [15] highlighted the importance of the margin of a lesion in malignancy differentiation. And erosion of the sternum or rib was significantly correlated with malignancy, just as Kocaturk et al. (2017) [16] highlighted. While all of these, including calcification, pleural effusion, and lung parenchymal opacity, failed to differentiate materially between benign and malignant disease, the identification of irregular margins and osseous involvement by chest X-ray does provide a valuable initial screening indicator, testifying to the value of radiography as an economic screening procedure.

Our experiences with barium swallow were that luminal narrowing, esophageal dilatation, filling defects, and infiltrative or lobulated contours were all strongly correlated with malignancy. These results are in agreement with those of Occhipinti et al. (2015) [17] and Sajeev and Naveen (2021) [12], who also showed that esophageal structural change on barium swallow was predictive of malignancy. Also, polypoid lesions were strongly correlated with malignancy, as noted in observations by Patidar et al. (2016) [14]. However, findings such as fine nodular pattern, ulcerative changes, and hiatus hernia did not effectively differentiate between malignant and benign conditions, and therefore highlighted the importance of correlation with other imaging modalities.

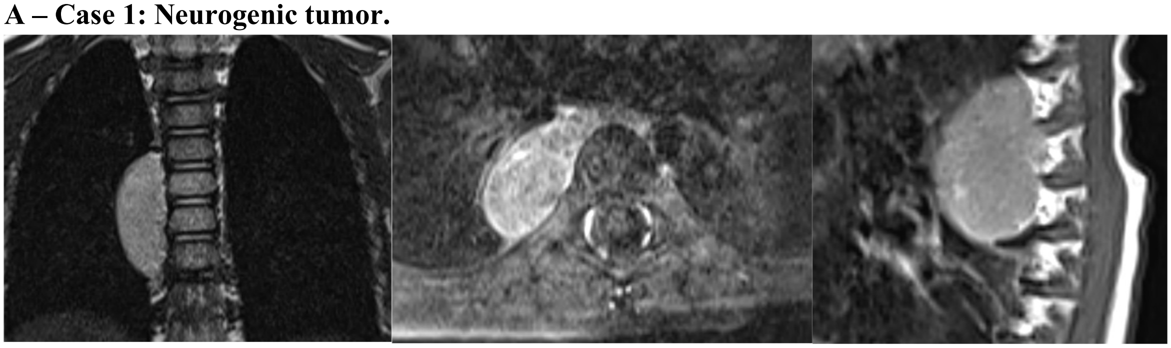
CT and MRI advanced imaging findings provided valuable diagnostic information. Lesion shape was the most significant determinant, being more likely to be malignant if circumferential, irregular, or lobulated, as also noted by Singh et al. (2019) [18] and Patil and Kadam (2023) [11]. Involvement of lymph nodes was most significantly associated with malignancy, as also noted by Sajeev and Naveen (2021) [12] and Pathak et al. (2021) [13], who emphasized its use in tumor staging. Structural invasion, heterogeneous enhancement, and metastasis were all equally valuable predictors of malignancy, in line with the research of Archer et al. (2023) [15] and Kulkarni et al. (2023) [19], which emphasized the value of cross-sectional imaging in determining the extent and aggressiveness of the lesion.

Correlation analyses confirmed that while demographic factors such as age and sex were individually non-predictive of malignancy, clinical presentation and imaging characteristics were significant in differentiation. The combination of hoarseness of voice, haemoptysis, chronic cough, and dysphagia with malignancy concurred with Sajeev and Naveen (2021) [12] and Singh et al. (2019) [18]. In addition, chest X-ray features such as ill-defined margins and rib/sternum erosion were strongly predictive, as observed in Kocaturk et al. (2017) [16]. CT/MRI characteristics, particularly extent of diffuse lesion, lymphadenopathy, heterogeneity of enhancement, and structural invasion, were strongly correlated with malignancy, according to Pathak et al. (2021) [13] and Patil and Kadam (2023) [11]. The evidence highlights the requirement for an interdisciplinary diagnostic approach that combines clinical history, radiological evaluation, and histopathological confirmation.

The ultimate diagnoses were confirmed by histopathological examination, the most common malignant conditions being bronchogenic carcinoma and esophageal cancer. The high diagnostic accuracy reported in our study is in agreement with Singh et al. (2019) [18] and Archer et al. (2023) [15], who had excellent correlation between imaging diagnoses and histopathology. The follow-up information indicated that there was elevated mortality in malignancy cases, further pointing to the need for early treatment and diagnosis. Moreover, our study highlighted the necessity of follow-up because the absence of diagnostic proof or denial by the patient posed challenges to disease classification.

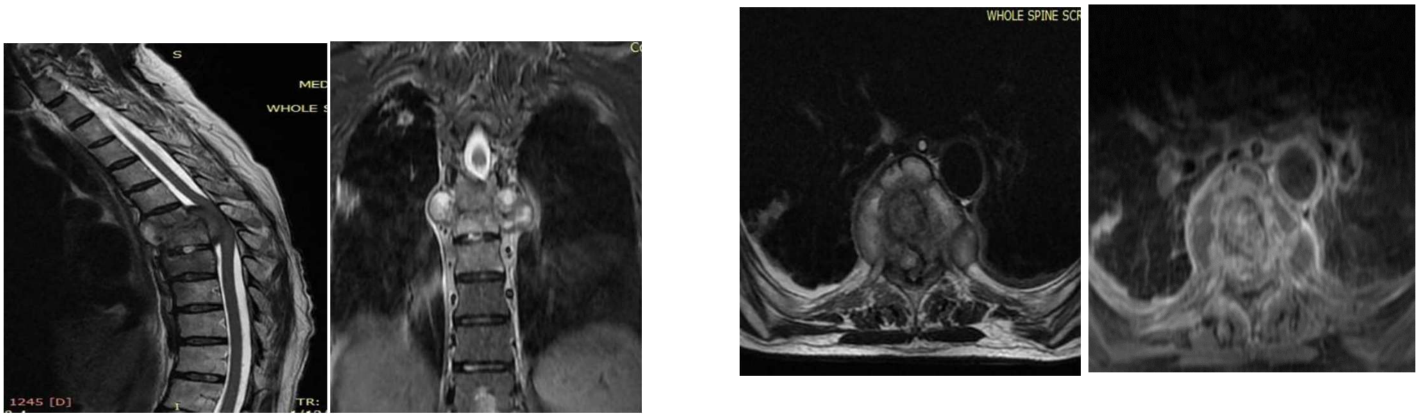
Radiological images:

A – Case 1: Neurogenic tumor.



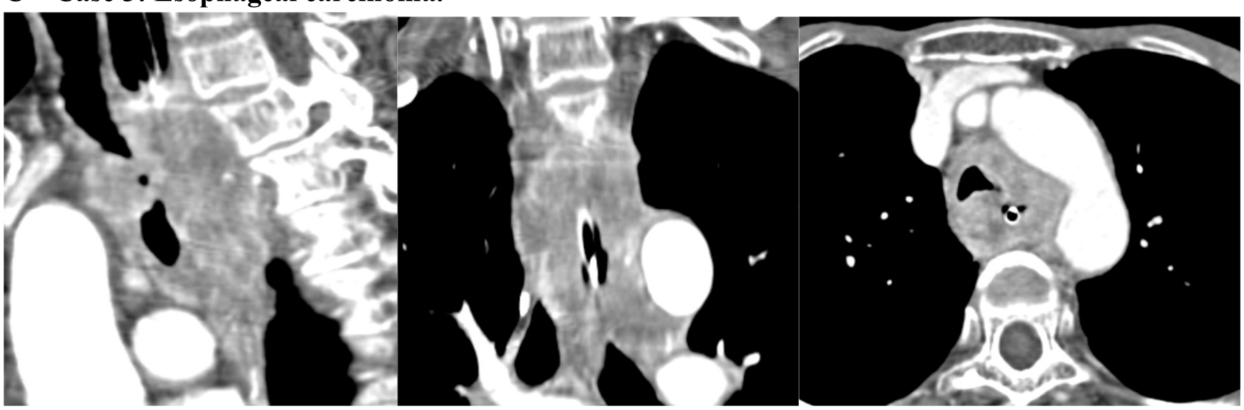
- Well-defined soft tissue density lesion in right paravertebral region extending from lower D4 to mid D8 level appearing isointense on T1WI and mildly hyperintense on T2WI/STIR; shows diffusion restriction and heterogeneous post-contrast enhancement. No evidence of extension into spinal canal seen.

B – Case 2: Tubercular paravertebral abscess.



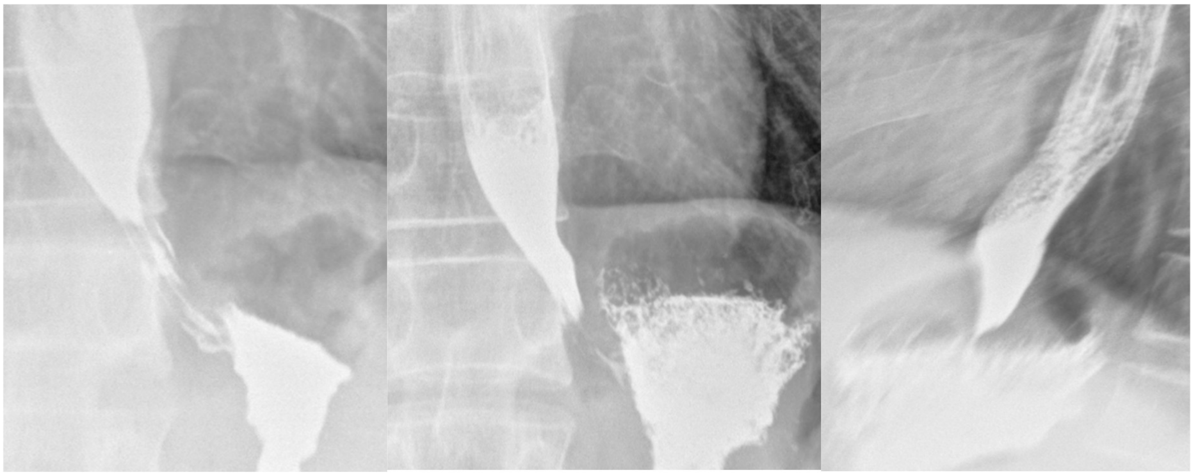
- Sagittal T2WI, coronal STIR, axial T2WI, axial T1+ C images showing altered signal intensities involving D6,D7 & D8 level with complete destruction of D6-D7 disc, with lobulated pre and para-vertebral collection with extension to epidural space and causing cord compression. Bilateral minimal pleural effusion noted.

C – Case 3: Esophageal carcinoma.



- Circumferential heterogeneously enhancing esophageal wall thickening (max thickness ~ 19 mm at the level of D4) noted for length of (~ 6-7 cm) in mid thoracic esophagus extending from D4 to D7 vertebral levels leading to significant luminal compromise with mild to moderate dilatation of proximal esophagus [Ryle’s tube is noted in situ passing through the esophageal growths segment].

D – Case 4: Achalasia cardia.



❖ Dilatation and stasis in esophagus with smooth tapering at the lower esophageal sphincter & narrowing at the gastro-esophageal junction with characteristic appearances of **bird beak sign or rat-tail sign.**

Conclusion

This study points out the diagnostic importance of a multimodal imaging technique in differentiating benign from malignant posterior mediastinal lesions. Comparisons with earlier studies emphasize the strength of chest radiography, barium swallow, and CT/MRI in lesion characterization. The findings stress the value of a systematic approach that includes clinical, radiologic, and histopathologic assessments to improve diagnostic performance and direct optimal patient management. Future studies should focus on larger sample sizes and prospective validation to further maximize imaging-based diagnosis protocols for mediastinal lesions.

Limitations and Future aspects

This study has a few drawbacks in the form of limited sample population, single institution study, and cross-sectional analysis, which limit generalizability and long-term outcome assessment. Retrospective design may create selection bias and heterogeneity of the image protocol and lack of standardized criteria will affect consistency of findings. No new imaging techniques like PET/CT or functional MRI were employed. Future research should be multi-center, prospective, with larger series, standardized imaging protocols, and newer methods like radiomics and AI-based analysis. Longitudinal follow-up of patient outcomes will improve diagnostic accuracy and individualized management strategies.

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