

# Opaque Hemithorax: Clinical, Histological and Radiological Assessment of 30 Cases at a Tertiary Care Hospital- A Preliminary Study

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## ABSTRACT

**Background:** Whitening out of half of the lung field on a chest X-ray is known as opacification of a hemithorax, and its presence usually indicates a significant disease in a patient. This study was done with an aim of finding different etiologies as the cause of complete opacification of a hemithorax on chest radiograph. **Materials and Methods:** An observational cross-sectional study of patients whose chest radiograph had opaque hemithorax was included and after clinical laboratory and advanced radiological - ultrasonography (USG) and computed tomography investigation of these patients the diagnosis responsible for the complete opacification of half the lung field in chest X-ray was recorded. **Results:** A total of 30 patients (23 males and 7 females) were enrolled for the study. Out of the 30 patients, 17 involved the left while 13 involved the right hemithorax. Fifteen patients had clear pleural effusion, 13 patients had mass with pleural effusion and 2 patients were postpneumonectomy cases. Mediastinal shift to contralateral side was seen in 18 out of 30 patients having opaque hemithorax. Eleven patients have biochemical features of tuberculosis. All 13 patients with mass and effusion were confirmed to have malignancy on histology. USG could detect malignancy in only ten cases. Chest pain was most frequent symptom and smoking or tobacco habit was associated with 14 cases. **Conclusion:** Plain pleural effusion was the most common etiology of opaque hemithorax in our study followed by mass with effusion. Among other rarer causes, only pneumonectomy was seen. For other rare causes that may present as opaque hemithorax larger study may be done.

**Key words:** Mass with effusion and pneumonectomy, opaque hemithorax, pleural effusion

## Introduction

Whitening out of half of the lung field on a chest X-ray is known as Opacification of a hemithorax. Complete opacification of a hemithorax indicates the presence of a significant disease, as there shall be loss of physiological functions on the involved side. The differential diagnosis of opaque hemithorax may include congenital anomalies, inflammatory and neoplastic disorders, and even postsurgical cause.<sup>[1]</sup> Complete opacification of a hemithorax seen on a

posterioranterior (PA) radiograph of chest usually indicates the presence of extensive disease. Although chest radiograph is a preliminary investigation, the diagnosis of these conditions requires further investigations to confirm the diagnosis. The exact diagnosis in earlier days were established using invasive procedures such as bronchography and pulmonary angiography, but with the advent of noninvasive imaging techniques, especially the computed tomography (CT) of the

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thorax, the exact diagnosis can now be established without these invasive procedures. Chest CT in such cases has now become the investigation of choice after chest radiograph.<sup>[2]</sup> With this background, we observed thirty cases of opaque hemithorax to study the prevalence of radiological and histological etiologies associated with it.

**Materials and Methods**

The present cross-sectional study was conducted in a tertiary care hospital in central Gujarat during January 2009–December 2011. Informed consent was taken from all the participants and study was approved by Institutional Review Board.

Thirty participants in the age range from 3 to 75 years of both genders were included in the study. Our inclusion criteria comprised cases suffering from chest pain. Preliminary chest screening/X-ray was carried out, and the patients with opaque hemithorax were admitted to the hospital for further clinical, laboratory, and radiological investigations. Clinically suspected cardiac disease patients and outdoor patient were excluded from the study. Demographic and physical parameters were noted. Participants were then subjected to radiological investigations like X-ray, ultrasonography (USG), and CT scan. On X-ray, PA view was taken and if indicated lateral view was also taken. USG of the chest was done by real-time ultrasound using (3.5–5 MHz) transducers. USG of the abdomen were also done to rule out metastasis in liver or adrenal gland. CT scan was done only in suspected cases of mass lesions extended up to the adrenal gland, in only 7 out of 30 cases. In 2 cases, bronchoscopy was done and in 13 cases of mass with effusion histology was done. Chest X-ray was studied in detail for additional parameters such as the side of thorax involved, presence of mediastinal shifts and if present, the side of this mediastinal shift, and the involvement of the contralateral lung. A single observer studied the chest radiographs for recording of the X-ray parameters to avoid interobserver variation in results. The data collected was entered into a Microsoft Excel sheet.

**Analysis of the data**

This collected data were analyzed and frequency distribution generated. GraphPad Prism software (version 6, GraphPad software Inc., CA, USA) was used for further analysis.

**Results**

A total of thirty cases were considered in this study that finally presented with complete opaque hemithorax. There were 23 males and 7 female patients with age range 3–70 years. The primary complaint of all thirty patients with opaque hemithorax was a cough and chest pain. This was followed by weight loss, dyspnea, fever, and hemoptysis. Hemoptysis was the least frequently presenting complaint in this study group. Smokeless or smoking tobacco habit was present

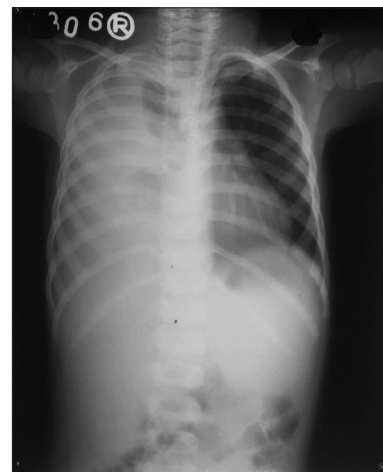
in 14 (46.66%) out of 30 cases. Smokeless means chewing tobacco, betel nut, etc., and smoking tobacco means bidi, hukka, and cigarette smoking. Four radiological categories in which thirty cases classified were anechoic clear pleural effusion (11 cases), echogenic pleural effusion (4 cases), mass with effusion (13 cases), and pneumonectomy (2 cases). Out 15 cases of effusion, 2 patients (13.4%) in pediatric age group showed the presence of *Staphylococcus aureus* culture. Biochemistry of remaining 13 patients (86.6%) showed tuberculous nature only. Out of 13 cases of mass with effusion, 2 cases (15.36%) were diagnosed to have endobronchial masses and rest 11 cases (84.6%) were of lung carcinomas.

Table 1 shows the frequency of occurrence of plain effusion, mass with effusion and patients with pneumonectomy. Plain effusion was more prevalent on the right side whereas, mass with effusion was more prevalent on the left side.

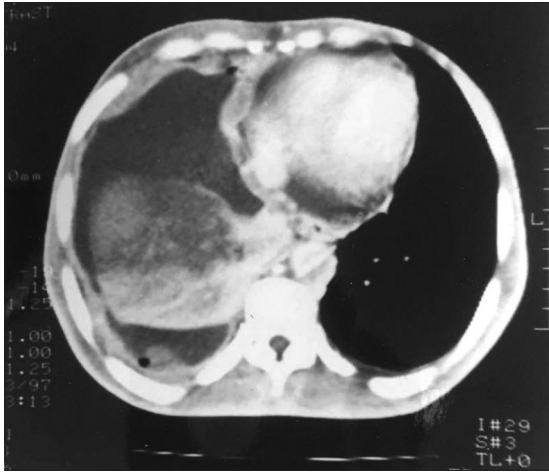
Mediastinal shift was on the same side on 11 occasions, opposite side on 18 occasions and central in one case. Out of 15 plain effusion cases, all 15 showed mediastinal shift to opposite side whereas out of 13 cases of mass with effusion; mediastinal shift was observed on same side in 9 cases, opposite side in

**Table 1: Side-wise frequency distribution of opaque hemithorax in thirty cases under study**

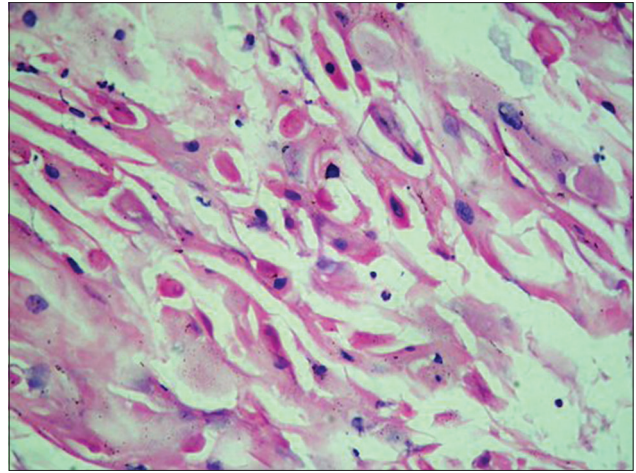
Radiological observation of opaque hemithorax	Side of opaque hemithorax (%)		Total (%)
	Left side	Right side	
Plain effusion	5 (33.33)	10 (66.66)	15 (50)
Mass with effusion	10 (76.92)	3 (23.08)	13 (43.33)
Patient with pneumonectomy	2 (100)	Nil	2 (1.66)
<b>Total</b>	<b>17 (56.66)</b>	<b>13 (43.33)</b>	<b>30 (100)</b>



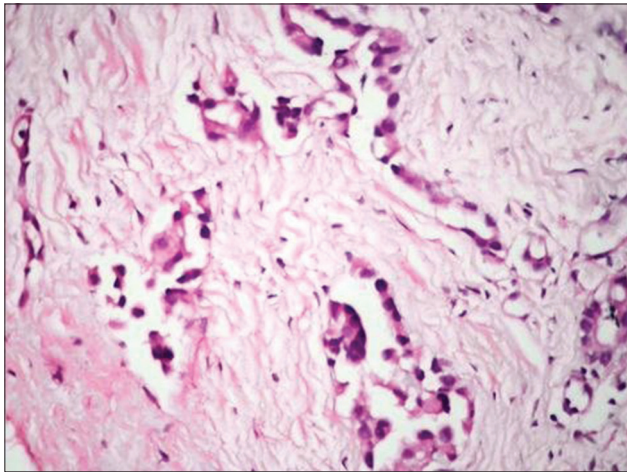
**Figure 1:** Posterioranterior chest radiograph showing opaque hemithorax on the right side with trachea more or less centrally placed. Left lung fields appear clear. The mediastinum is shifted to the left side in a patient with tuberculous pleural effusion



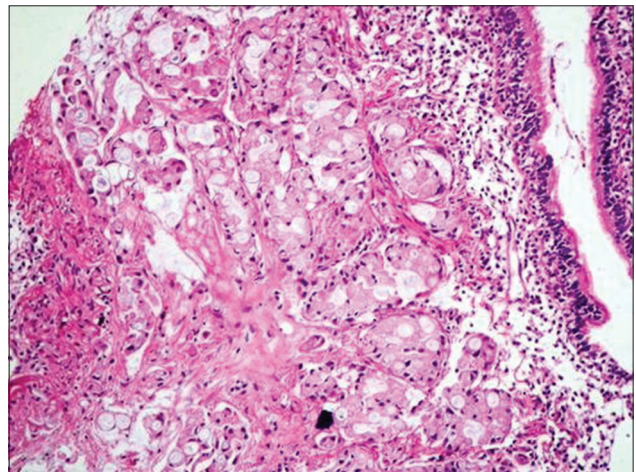
**Figure 2:** Contrast enhanced axial computed tomography scan image of the chest showing heterogeneous enhancing oval-shaped mass lesion involving the right lung. There is irregular pleural thickening with nodularity and pleural effusion in a histologically proven case of squamous cell carcinoma of the lung



**Figure 3:** Squamous cell carcinoma of the lung showing pearls of squamous cells with heavy keratinization. Dysmorphic and dyskeratotic cells are seen (H and E, x40)



**Figure 4:** Mesothelioma of the lung showing strands and nests of tumor cells surrounded by desmoplastic stroma. The individual cells show hyperchromatic nuclei and high nucleocytoplasmic ratio (H and E, x40)



**Figure 5:** Adenocarcinoma showing tumor cells with moderately abundant cytoplasm with clearing indicative of mucin accumulation. The nucleus is pushed to periphery (H and E, x20)

3 cases, and central in 1 case. In 2 pneumonectomy cases, shift was on same side. Transthoracic mediastinal herniations were seen in only 2 cases. No rib destruction and calcification was observed in any case. Freely moving septa were seen in only 17 patients on USG. Associated dynamic signs or “SWIRL” signs of collapsed lung was seen in almost 23 cases of effusion. Out of 13 cases of mass with effusion only 10 (76.92%) were detected on USG. Histologically 13 cases were differentiated as squamous cell carcinoma 7 (53.84%), adenocarcinoma 2 (15.38%), small cell carcinoma 2 (15.38%), nonsmall cell carcinoma 1 (7.69%), and mesenchymal sarcoma 1 (7.69%). Associated metastasis was evident on CT scan of 6 out of 13 cases. Metastasis was observed in adrenal gland in 3 out of 6 cases and then 1 each in neck nodes, skeletal muscle, and liver. Images 1, 2, 3, 4, and 5 shows radiograph of opaque hemithorax with pleural effusion, CT chest, squamous cell

carcinoma lung, mesothelioma lung, and adenocarcinoma lung, respectively.

There were five deaths of patients under study; one with pneumonectomy and rest four with mass lesion.

Figures 1 and 2 shows radiological evidences of opaque hemithorax whereas Figures 3, 4 and 5 shows histological evidence of different malignancies observed in opaque hemithorax cases.

### Discussion

Different etiologies that may present as opaque hemithorax are agenesis of lung, lung aplasia, fibrotic lung disease, massive pleural fluid collections such as hydrothorax, pyothorax, hemothorax and chylothorax, malignancies, and lung collapse.<sup>[1]</sup> Out of above-mentioned causes, we

could only report three in the present study. For other rare causes, large sample sized studies are needed. These were plain effusion (15 cases), mass with effusion (13 cases) and pneumonectomy (2 cases).

Pleural effusion may be caused due to varied etiologies. Tuberculosis and malignancies are the two most common causes encountered in massive pleural effusions. Massive pleural effusions may result in contralateral mediastinal shift in approximately 15%–25% of cases.<sup>[3,4]</sup> This observation is very small as compared to our study where 60% cases of effusion showed contralateral shift. The observation may be attributed to very small sample size in our study. Porcel and Manuel had found that out of 766 patients of pleural effusion, 93 patients (12%) exhibited massive pleural effusions. Somewhat more than a half of large or massive pleural effusions (89 of 163 pleural effusions; 55%) were related to malignancies.<sup>[5]</sup> In another study, among massive effusions, malignancy was most frequent (38%).<sup>[6]</sup> In one series from Baltimore, 42% of 102 exudative pleural effusions were due to malignant disease.<sup>[7]</sup> In an epidemiologic study from the Czech Republic, malignancy accounted for 24% of all the pleural effusions.<sup>[8]</sup> In the present study, pleural effusion was the cause of opaque hemithorax in 28 patients, and among them, malignant pleural effusion was present in 13 (46.42%) patients. This observation regarding the prevalence of malignant pleural effusion is in agreement with the findings of Light *et al.*<sup>[7]</sup> and was not in agreement with remaining studies.<sup>[5,6,8]</sup> this may be attributed to smaller sample size in study population. Tuberculous pleural effusion (13; 46.42%), and *S. aureus* pleural effusion (2; 7.14%) were observed in the remaining 15 cases. In high prevalence countries, tuberculosis should always be suspected whenever a pleural effusion is detected, and it is still a leading cause of pleural effusion in developing countries.<sup>[1]</sup>

Based on clinical and demographic findings like age, history of smoking, signs and symptoms such as hemoptysis, hoarseness of voice, clubbing malignant pleural effusion may be suspected and investigated further to detect the underlying malignancy. Lung cancer is the leading cause of malignant pleural effusion.<sup>[9]</sup> When patients with lung cancer are first evaluated, approximately 15% have a pleural effusion.<sup>[10]</sup> During this disease, however, at least 50% of patients with disseminated lung cancer develop a pleural effusion. Pleural effusions may occur with all the cell types of lung carcinoma, but appear to be most frequent with adenocarcinoma.<sup>[11]</sup> Other malignancies such as lymphomas and malignant mesothelioma can also cause massive pleural effusion. In malignant mesothelioma, pleural effusion is found in approximately 75%–90% of patients.<sup>[3,4]</sup> In this study, pleural effusion was more prevalent in squamous cell carcinoma.

Another uncommon cause of opaque hemithorax can be, the chest radiograph obtained in patients who have undergone pneumonectomy, but this condition as a cause of unilateral complete opaque hemithorax can easily be detected from

the patient's history of surgery and also by the presence of postoperative skin scar over patient's chest.<sup>[2]</sup> We reported two cases of pneumonectomy in the present study.

In many cases, the position of mediastinum in opaque hemithorax helps in narrowing down the list of differential diagnosis on chest X-ray. Any space occupying etiology of one side of lung shifts the mediastinum to contralateral side. Other rarer causes seen as differential diagnoses for opaque hemithorax could not be found in patients in the present study. Therefore, to evaluate prevalence of rare diseases as a cause of opaque hemithorax, a large sample size is required.

## Conclusion

Present study revisits the etiologies of opaque hemithorax. In order of their occurrence, plain pleural effusion followed by mass with pleural effusion and then pneumonectomy were the common etiologies. Malignant pleural effusion was more prevalent followed by tuberculous pleural effusion in opaque hemithorax. Among rare causes pneumonectomy was reported.

## Limitations of study

Sample size remains a major drawback in this present study due to which rare causes could not be reported.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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