DOI: 10.18410/jebmh/2015/761

REVIEW ARTICLE

OBLITERATION OF COSTOPHRENIC ANGTE IN A PLAIN X-RAY CHEST

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HOW TO CITE THIS ARTICLE:
R. Ramakrishna, P. V. Kalyan Kumar. "Obliteration of Costophrenic Angte in a Plain X-Ray Chest". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 35, August 31, 2015; Page: 5499-5509, DOI: 10.18410/jebmh/2015/761

ABSTRACT: Obliteration of Costophrenicangle can be a pleural effusion in a majority of cases but other causes of mediastinal masses, aortic aneurysm, postpneumonectomy, lung and pleural masses and consolidation and collapse of the lung can cause shadows mimicking pleural effusion. It is always essential to take the help of lateral and decubitus films, ultrasonography of chest and CT scan chest to come to a proper diagnosis. Inadvertent pleural aspiration basing on chest x-ray PA alone can have disastrous consequences

KEYWORDS: Costophrenic angle, Chest x-ray PA, Pleural effusion, Pleural and pulmonary mass, Aortic aneurysm.

INTRODUCTION: Costophrenic angle is located on posterior and lateral side of the lower chest wall where diaphragm meets lower rib cage. Costophrenic angle is observed on plain X-ray on right and left side. The angle is observed as a downward indentation between the left or right diaphragm and adjacent chest wall. Under normal circumstances, an extremely small part of each lung touches the costophrenic angle. Normal costophrenic angle measures approximately 30 degrees.

Costophrenic angle blunting is a radiological finding or diagnosis. Word Costo is used to describe disease related to ribs and phrenic word is used to describe disease close to diaphragm. The acute angle between rib and diaphragm is considered normal when angle is less than 30 degree and blunt when angle is more than 30 degree. Angle becomes blunt in patients suffering with pleural effusion.[1,2]

Normal Causes of Costophrenic Angle Blunting Causes Include:

- Pleural effusion - Collection of fluid outside lung between lung and chest wall. Costophrenic Angle Blunting is seen more often in individuals with Pleural Effusion. Pleural effusion is the accumulation of fluid in space surrounding the lungs, which can be due to some type of infection of the lungs.
- Pleural abscess- Abscess when localized within posterior and lateral plural space causes blunting of costophrenic angle on X-Ray.
- Haemothorax- Bleeding disorder or trauma may cause bleeding within pleural space and result in blunting of costophrenic angle
- Pulmonary Embolism- Pleural effusion is often caused by pulmonary embolism

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Radiographic Appearances: Plain film: Chest x-rays are the most commonly used examination to assess for presence of a pleural effusion, however it should be noted that on a routine erect chest x-ray as much as 250-600 ml of fluid is required before it becomes evident.[2] A lateral decubitus film is most sensitive, able to identify even a small amount of fluid. At the other extreme, supine films can mask large quantities of fluid.[1,2,3]

Chest X-Ray lateral decubitus: A lateral decubitus film (obtained with the patient lying on either side, effusion side down, with a cross table shoot through technique) can visualize small amounts of fluid layering against the dependent parietal pleura.

CXR (erect): Both PA and AP erect films are insensitive to small amounts of fluid. Features include

1. Blunting of the costophrenic angle
2. Blunting of the cardiophrenic angle
3. Fluid within the horizontal or oblique fissures
4. Eventually a meniscus will be seen, on frontal films seen laterally and gently sloping medially (note: if a hydro-pneumothorax is present, no such meniscus will be visible)
5. With large volume effusions, mediastinal shift occurs away from the effusion (note: if coexistent collapse dominates then mediastinal shift may occur towards the effusion)
6. Lateral films are able to identify a smaller amount of fluid as the costophrenic angles are deepest posteriorly.

A subpulmoniceffusion may be seen when there is previously established pulmonary disease, but can also be encountered in normal lungs. It can be difficult to identify on frontal radiographs. They are more common on the right, and usually unilateral. The following features are helpful.

- Right: peak of the hemidiaphragm is shifted laterally
- Left: increased distance between lower lobe air and gastric air bubble
- A lateral decubitus film is again ideal.

CXR (supine): Large amounts of fluid can be present on supine films with minimal imaging changes, as the fluid is dependent and collects posteriorly. There is no meniscus and only a veil-like increased density of the Haemothorax may be visible. It is therefore especially difficult to identify similar sized bilateral effusions as the density of the lungs will be similar.

Ultrasound: Ultrasound allows the detection of small amounts of pleural locular fluid, with positive identification of amounts as small as 3 to 5 ml that cannot be identified by x-rays, which is only capable of detecting volumes above 50 ml of liquid. Contrary to the radiological method, ultrasound allows an easy differentiation of pleural locular liquid and thickened pleura and it`s efficient in pinpointing thoracocentesis, even in small fluid collections

The ultrasound image of pleural effusion is characterized by an echo-free space between the visceral and parietal pleura. Septations (if seen) in the pleural fluid may indicate tuberculous pathology.

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Ultrasound can also be used to enable percutaneous diagnostic or therapeutic drainage (thoracocentesis).

CT scanning is excellent at detecting small amounts of fluid and is also often able to identify the underlying intrathoracic causes (e.g. malignant pleural effusions or primary lung neoplasms as well as subdiaphragmatic diseases (e.g. subdiaphragmatic abscess).

In addition CT can also help distinguish between a pleural effusion and a pleural empyema.

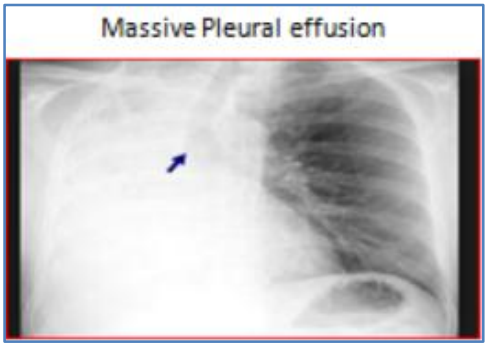

Fig. 1: Shows Pleural effusion on the right side

Fig. 2: shows Left sided Pleural effusion

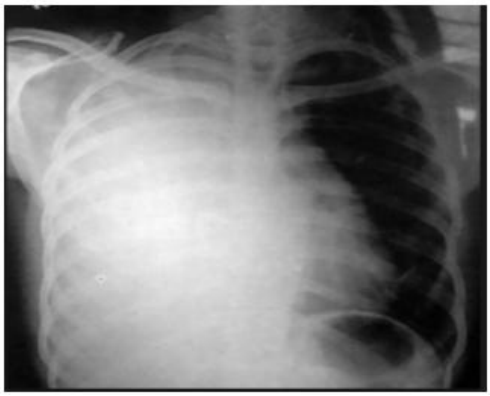

Fig. 3: A rare mediastinaltumour resembling massive pleural effusion[4]

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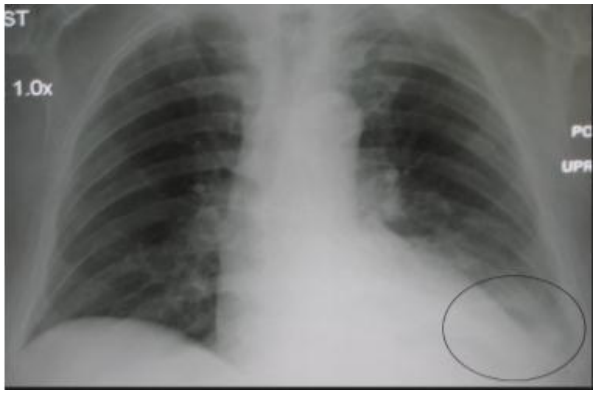

Fig. 4: Obliteration of CP angle due to pneumonia

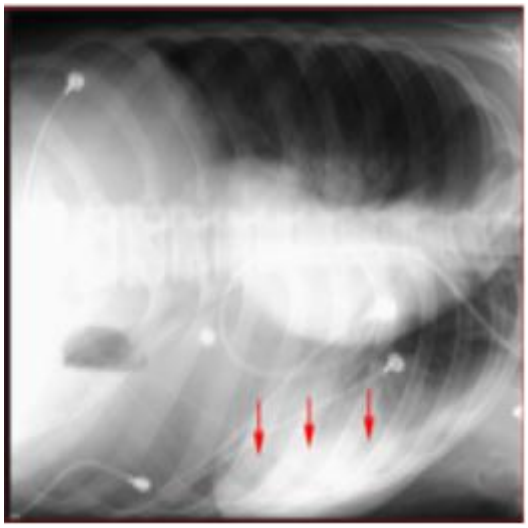

Fig. 5: Lateral decubitus film

Fig. 6: Right sided encysted effusion

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Pleural fluid can accumulate in isolation between the lung base and diaphragm. This is known as a subpulmonic effusion and presents a more difficult diagnostic challenge. When a chest X-ray is reported by a radiologist as "normal", there is potential for embarrassment when that slightly elevated-looking diaphragm turns out to be a large subpulmonic effusion. The radiographer can help prevent such embarrassment with the selective application of the decubitus chest projection on patients with suspected subpulmonic effusion. In subpulmonic effusions there is obliteration of intra-pulmonary blood vessels seen below the level of diaphragmatic dome.[5]

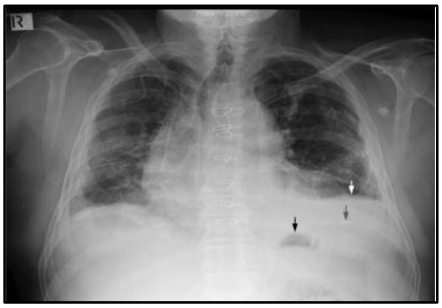

Fig. 7: Subdiaphragmatic Pleural effusion

Subdiaphragmatic effusion can be identified by 1. abnormally large distance between fundus of stomach and dome of diaphragm 2. Abrupt termination of vascular shadows at the level of diaphragm 3. Blunting of affected CP angle in the PA. 4. Pseudo diaphragm can appear to peak more laterally 5. Pseudodiaphragm can appear more horizontal medially 5. Crowding of lung parenchyma on the affected side.

A blunt costophrenic (CP) angle in chest radiographs is known as a sign of pleural effusion, but is also observed in pulmonary emphysema. However, healthy young adult subjects with a blunt CP angle were often encountered in company annual medical examinations.[6] Stable patients showing blunted CP angles identified during routine checkup in industries are likely to have low small airway functions with chest symptoms.[6]

Costophrenic angle can be obliterated by collapse of middle and lower lobes and massive cardiomegaly and pericardial effusions.[7,8]

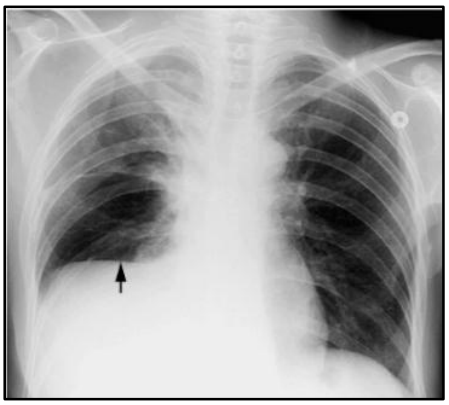

Fig. 8: Sub diaphragmatic effusion on right side[9]

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Figure 9 and 10: Obliterated CP angle in a 40 year old male patient who had a left pneumonectomy. The opacity on left side is due to the displacement of heart posteriorly and laterally. The apex beat in this patient was felt in the left infrascapular are.

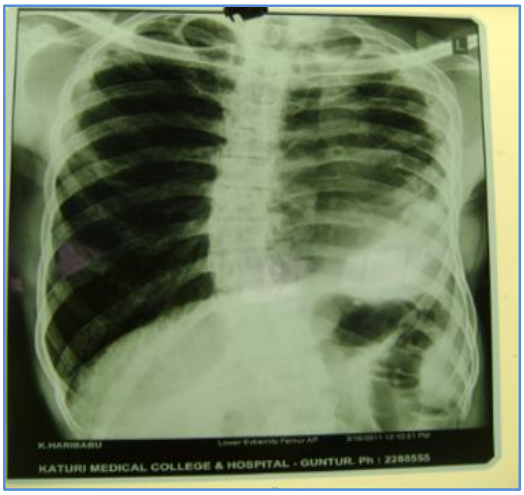

Fig. 9: CT scan of the chest in the same patient

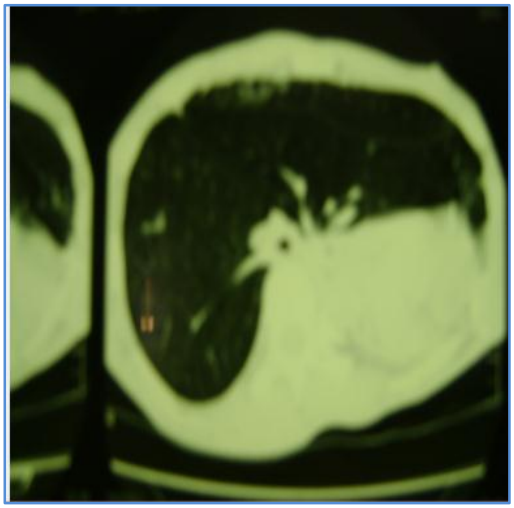

Fig. 10: CT Chest of the same patient with left Pneumonectomy for bronchiectasis with herniation of right lung anteriorly

After lobectomy changes in the pulmonary and extrapulmonary structures follow. Variations in the normal anatomy of bronchi, vessels and fissure occur.[10]

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Fig. 11: Right Lower lobe Consolidation with obliteration of right CP angle

Fig. 12: Pleural Fibrosis

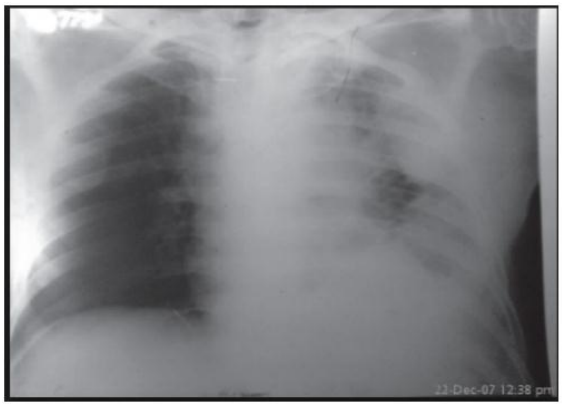

Fig. 13: Pulmonary and nodal multiple myeloma with a pleural effusion mimicking bronchogenic carcinoma[1]

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Figure 14, 15, 16: 80 year old female came to our tertiary care centre OPD with symptoms of recent onset of shortness of breath. Chest X Ray is s/o opacification of left lung with a preliminary diagnosis of left sided massive pleural effusion CT scan showed massive aortic aneurysm with clot, which compression of the left lung and small pleural fluid on the left side. The aneurysm was threatening to rupture medially in to the trachea and so the idea of bronchoscopy was withdrawn.

Fig. 14

Fig. 15

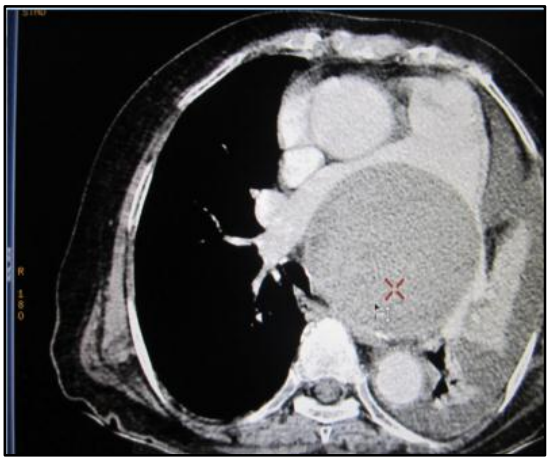

Fig. 16: CT scan of same patient

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Figure 17: Blunted CP angle in emphysema with flattened domes of diaphragm Blunting of costo phrenic angles can occur in previous inflammation or chronic obstructive pulmonary disease. If a film is obtained with the patient lying on opposite side the blunting will disappear if it is because of fluid.[11]

Fig. 17: Blunted CP angle in Emphysema

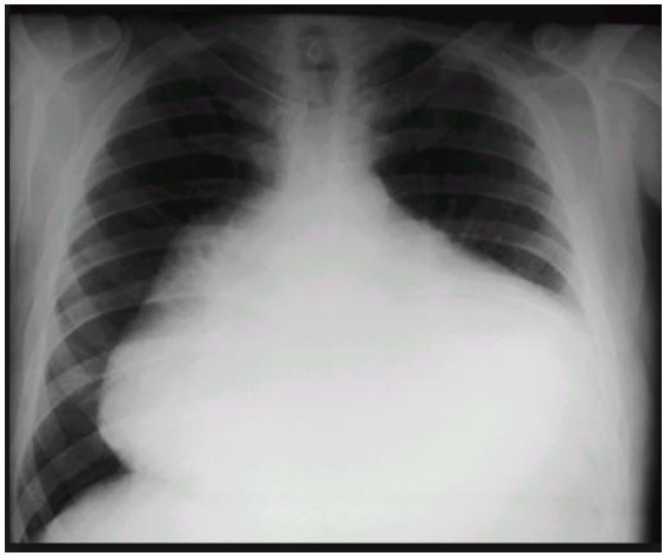

Fig. 18: Obliteration of CP angle in massive pericardial effusion

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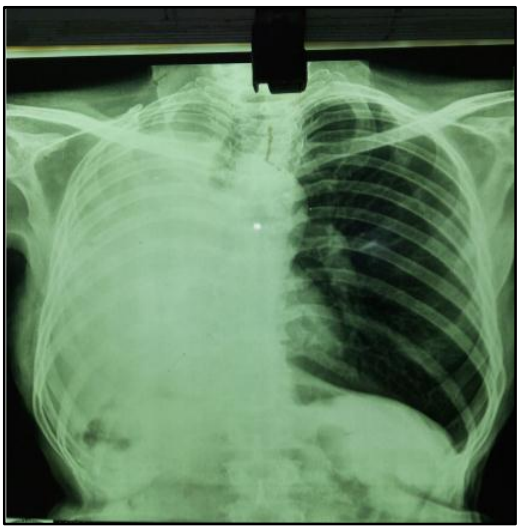

Figure 19

Figure 19: This is the X-ray of a 55 year old male patient with a long history of smoking. Patient came with acute breathlessness. X-Ray shows right sided opacity in the right lung with the diaphragmatic shadow obliterated, CP angle is not visible with mediastinal shift to right. The ultrasonography revealed underlying collapse and consolidation with minimal pleural effusion.

SUMMARY AND CONCLUSION: Obliteration of the CP angle is routinely seen in a plain X-ray chest. Most of the time it is indicative of pleural effusion of whatever aetiology. The other causes of obliterated Costophrenic angle can be pleural mass, pulmonary mass, pleural thickening resulting from old pleural effusions, pleural thickening, multiple myeloma from the rib cage, consolidation with or without collapse, subdiaphragmatic effusion or elevation of the dome secondary to hepatomegaly, amoebic liver abscess. In the two cases reported from our institution obliterated CP angle on the left side is because of the shadow of the heart shifted posteriorly and laterally because of left pneumonectomy. Another case reported from our institution is in an 80 year old female patient is because of massive aortic aneurysm threatening to rupture.

There is always a tendency on the part of a chest physician to aspirate basing on Chest X-Ray PA since lateral film, CT scan chest, ultrasound are not readily available in a rural setting. Many a time we are successful in aspirating fluid but in some cases like aortic aneurysm, pneumonectomy and vascular mediastinal tumour the consequences can be disastrous

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Date of Submission: 16/08/2015.
Date of Peer Review: 17/08/2015.
Date of Acceptance: 28/08/2015.
Date of Publishing: 31/08/2015.