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RESEARCH ARTICLE

ROLE OF MULTI-DETECTOR COMPUTED TOMOGRAPHY IN EVALUATION OF LUNG ANOMALIES

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Abstract

Aim: Theaimofthisstudyisthe role of multidetector computed tomography in evaluation of lung anomalies patient inNIMSHospital,Jaipur,Rajasthan.

Methods: Itwasanobservationaldescriptivestudy.Atotalof262patientsfrom thedepartmentofRadio-diagnosisandImaging,NIMSHospital,Jaipur,wereselected and scan was takenat different technical factors.

Result:In this study, the age group of the patients ranged between 15 to 90 years with mean age of patient were 55.6 years; the majority of the patients were in age group 56 to 60years (12.5%). There were 62.21% male patients and 36.5% femalesOut of 262 patients selected for the study, 109 (69) were males and (40) were females. The outcome shows that out of two groups, males'group were the most affected from pleural effusionas compared to females' group.

Conclusion: Pleural effusion was the most common interstitial lung disease observed in our study. Our Study proved that there is a better consideration, specificity and perfection of CT in assessment of Lung anomalies as evident by significant correlation of CT with final diagnosis with p value of less than 0.004

Introduction:-

Lung disease refers to several types of diseases or disorders that prevent the lungs from functioning properly. Lung disease can affect respiratory function, or the ability to breathe, and pulmonary function, which is how well lungs work. There are many different lung diseases, some of which are caused by bacterial, viral, or fungal infections. Other lung diseases are associated with environmental factors, including asthma, mesothelioma, and lung cancer. Chronic lower respiratory diseases are a set of conditions that includes chronic obstructive pulmonary disease (COPD), emphysema, and chronic bronchitis. Together, chronic lower respiratory diseases are a leading cause of death in all over world. Respiratory diseases such as asthma and COPD involve a narrowing or blockage of airways that reduce air flow . In other lung conditions–such as pulmonary fibrosis , a lung tissue scarring that can be caused by different factors, and pneumonia, a bacterial or viral infection in which air sacs fill with fluid–the lungs have reduced ability to hold air. Lung cancer is a disease caused by the abnormal growth of cells. Though most lung

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cancer starts in the lungs, some cases start in other parts of the body and spread to the lungs. The two main types of lung cancer—small cell and non-small cell—grow and spread in different ways, and each type may be treated differently. Cigarette smoking is the overall leading cause of lung cancer. Breathing secondhand smoke can also increase a person's chance of developing the disease. Other environmental factors linked to lung disease include asbestos, radon gas, air pollution, and chemicals such as uranium, beryllium, vinyl chloride, and arsenic.

Most common lung diseases.

1. Asthma
2. Chronic obstructive pulmonary disease (COPD)
3. Chronic bronchitis
4. Emphysema
5. tuberculosis

asthmais becoming a more prevalent disease since the early 1990s. From 1982 to 1992, the rate of asthma jumped from 34.7 to 49.4 per thousand.[1]

The prevalence of asthma in the USA is around 8%.[2] There also have been some mixed trends around the world where different countries have either had increasing cases or have been stagnant.[3] In children, asthma is presented predominantly in males until the age of 20, where the disease equally prevalent. Differences in childhood can be due to atopy, or because boys have a reduced airway size compared to girls.[4] There is a family history component of asthma, as well. However, the genes responsible for inheriting asthma remain unidentified. There are mechanisms of the phenotype of asthma that has a strong correlation of being inherited, but the mechanism is more complex, as asthma does not follow a Mendelian pattern. Asthma is most likely transmitted by multiple genes, with some variation of locus heterogeneity and polygenic inheritance leading to asthma expression being multifaceted. Atopy or IgE antibodies attack specific antigens or pollutants, which can contribute to the disease.[5] Enhanced IgE response to environmental factors such as house dust mites, animal allergens, mold, farm animals, have contributed to sensitize asthma exacerbating its symptoms and attributing to increased airway reactivity. The reason being is that there is increased exposure to these allergens, but less data is available on the causality. Air pollution and the causation of asthma are also less clear; however, there is a relationship with smoking and the increased risk of asthma.[6] Interestingly enough, obesity showed a positive linear relationship between asthma and increased BMI.[7] More research needs to be done to have a clearer picture of the multifactorial disease.

Mechanism

There are two phases of an asthma exacerbation, which include the early phase and late phase. The early phase is initiated by IgE antibodies that are sensitized and released by plasma cells. These antibodies respond to certain triggers in the environment, such as the risk factors listed above. IgE antibodies then bind to high-affinity mast cells and basophils. When a pollutant or risk factor gets inhaled, the mast cells release cytokines and eventually de-granulate. Released from mast cells are histamine, prostaglandins, and leukotrienes. These cells, in turn, contract the smooth muscle and cause airway tightening.[8] T- lymphocytes play an integral role where they produce a series of interleukins (IL-4, IL-5, IL-13) and GM-CSF, which aid in communication with other cells and sustain inflammation. IL-3 and IL-5 help eosinophils and basophils survive. IL-13 attributes to remodeling, fibrosis, and hyperplasia.[9] Within the next several hours, the late phase occurs, which eosinophils, basophils, neutrophils, and helper and memory T-cells all localize to the lungs as well, which perform bronchoconstriction and cause inflammation. Mast cells also play an essential role in bringing the late phase reactants to the inflamed sites.[10] It is critical to recognize both of these two mechanisms to target therapy and relieve both bronchoconstriction and inflammation, depending on the severity of the disease. Interestingly, those with a thicker airway over time have longer disease duration, due to a narrower airway.[11] As a result of inflammation and bronchoconstriction, there is an intermittent airflow obstruction, resulting in increased work of breathing.

COPD

Chronic obstructive pulmonary disease (COPD) is a poorly reversible disease of the lungs that is one of the major causes of morbidity and mortality worldwide. In the United States, it is the fourth leading cause of death after heart disease, cancer, and Cerebrovascular disease.[12,13] Contrary to the trends for other major chronic diseases in the United States, the prevalence of and mortality from COPD have continued to rise.[14] the death rates doubled between 1970 and 2002,[15]and for the first time in 2000, mortality figures for women surpassed those for men.[16]In the United States, 12 million patients are currently diagnosed with COPD, but there is believed to be at least an equal number of individuals with impaired lung function suggestive of COPD who are undiagnosed.[17] Given that the majority of COPD cases are caused by smoking, it is primarily a preventable disease.

Most patients with COPD are middle-aged or elderly. In 2000, 16 million office visits were attributed to COPD-related conditions.[18] with the caseload expected to increase with the aging of the population. There is no cure for COPD. True breakthroughs in treatment, particularly disease-modifying agents, have been elusive. The only strategy known to reduce the incidence of the disease is smoking cessation. Healthcare costs associated with COPD are approaching $18 billion and $14 billion in direct and indirect costs, respectively. [19] Hospitalizations, which often Inpatient mortality from acute exacerbation is 10% by some estimates.[20]and nearly 60% at 1 year for patients older than 65 years of age.[21]

Despite these disturbing figures, COPD remains largely unrecognized as a public health problem. To increase awareness of COPD, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) was launched in 1997, as a collaboration of the National Heart, Lung, and Blood Institute, the National Institutes of Health, and the World Health Organization, to disseminate information on causes of COPD and issue management guidelines.[22]Further multidisciplinary efforts involving government, healthcare workers, and public health officials are needed to reduce the disease burden of COPD, which comprises not only economic and healthcare system costs but also losses to patients and families from progressive disability and impaired quality of life.

Risk Factors

Cigarette smoking is the principal risk factor for COPD. However, approximately 1 of 6 Americans with COPD has never smoked. Occupational and environmental exposures to chemical fumes, dusts, and other lung irritants account for 10% to 20% of cases. Individuals with a history of severe lung infections in childhood are more likely to develop COPD. [23] Alpha-1 antitrypsin deficiency is a rare cause of COPD but should be suspected in persons in whom emphysema develops before the age of 40 or those who lack the common risk factors.

Pulmonary Emphysema

A progressive lung disease is a form of chronic obstructive pulmonary disease (COPD). The Global Initiative for chronic obstructive lung disease (GOLD) has defined COPD as "a common, preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases."[24][25][26]

COPD is the third leading cause of death in the United States and the fourth leading cause of death worldwide. The World Health Organization (WHO) estimates suggest that it will rise to be the third most common cause of death worldwide by 2020. COPD includes patients with chronic bronchitis and emphysema. Although identified as separate entities, most patients with COPD have features of both. COPD often coexists with co morbidities, which affect the disease course.

Emphysema is primarily a pathological diagnosis that affects the air spaces distal to the terminal bronchiole. It is characterized by abnormal permanent enlargement of lung air spaces with the destruction of their walls without any fibrosis and destruction of lung parenchyma with loss of elasticity.

Etiology

Emphysema is caused by chronic and significant exposure to noxious gases, of which cigarette smoking remains the most common cause, and 80% to 90% of patients with COPD are cigarette smokers identified, with 10% to 15% smokers developing COPD. However, in smokers, the symptoms also depend on the intensity of smoking, years of exposure, and baseline lung function. Oms usually begin after at least 20 packs per year of tobacco exposure.[27][28]

Biomass fuels and other environmental pollutants such as sulfur dioxide and particulate matter are recognized as an important cause in developing countries affecting women and children greatly. A rare hereditary autosomal recessive disease, alpha one antitrypsin deficiency, can also lead to emphysema and liver abnormalities. However, it only contributes to 1% to 2% of cases of COPD. It is a proven risk factor and can present with pan-acinar bibasilar emphysema early in life.

Other etiological factors are passive smoking, lung infections, and allergies. Moreover, low birth weight as a newborn makes one more prone to develop COPD later

Epidemiology
Emphysema, as a part of COPD, is an illness that affects a large number of people worldwide. In 2016, the Global Burden of Disease Study reported a prevalence of 251 million cases of COPD globally. Around 90% of COPD deaths occur in low and middle-income countries.[29][30]

The prevalence of emphysema in the United States is approximately 14 million, which includes 14% white male smokers and 3% white male nonsmokers. The prevalence is slightly less for white female smokers and African Americans. These patient groups tend to develop emphysema after less exposure time than other patient populations.

It is slowly increasing in incidence primarily due to the increase in cigarette smoking and environmental pollution. Another contributing factor is decreasing mortality from other causes such as cardiovascular and infectious diseases. Genetic factors also play a significant role in determining the possibility of airflow limitation in patients.

Emphysema severity is significantly higher in the coal worker pneumoconiosis, and this is independent of smoking status.

Evaluation
Emphysema is a pathological diagnosis. Accordingly, routine laboratory and radiographic studies are not indicated.

Pulmonary function testing (PFT), particularly spirometry, is the mainstay of diagnosis. A post-bronchodilator test may be done in those with abnormal values. COPD is only partially reversible or irreversible with a bronchodilator, and post-bronchodilator FEV1/FVC is less than 0.07, which is diagnostic.[31][32][33][34]

GOLD staging based on the severity of airflow limitation is as follows:
- Mild with FEV1 greater or equal to 80% predicted
- Moderate with FEV1 less than 80% predicted
- Severe with FEV1 less than 50% predicted
- Very severe with FEV1 less than 30% predicted

The lung volume measurements indicative of air trapping in emphysema reveal increased residual volume and total lung capacity. Diffusing capacity for carbon monoxide is reduced due to the emphysematous destruction of the alveolar-capillary pulmonary membrane.

A chest x-ray is only helpful in diagnosis if emphysema is severe, but it is usually the first step when suspecting COPD to rule out other causes. Destruction of alveoli and air trapping causes hyperinflation of the lungs with flattening of the diaphragm, and the heart appears elongated and tubular in shape.

Arterial blood gases are usually not required in mild to moderate COPD. It is done when oxygen saturation goes below 92% or when an assessment of hypercapnia is needed in severe airflow obstruction.

Complications
Patients suffering from emphysema are prone to develop various complications, some of which are life-threatening. Following are some most frequently encountered complications of emphysema:
- Respiratory insufficiency or failure
- Pneumonia
- Pneumothorax
- Chronic atelectasis
- Corpulmonale
- Interstitial emphysema
- Recurrent respiratory tract infections
- Respiratory acidosis, hypoxia, and coma

Lung Cancer
Lung cancer or bronchogenic carcinoma refers to tumors originating in the lung parenchyma or within the bronchi. It is one of the leading causes of cancer-related deaths in the United States. Since 1987, lung cancer has been responsible for more deaths in women than breast cancer. It is estimated that there are 225,000 new cases of lung cancer in the United States annually, and approximately 160,000 people die because of lung cancer. It is interesting

to note that lung cancer was a relatively rare disease at the beginning of the 20th century. Its dramatic rise in later decades is mostly attributable to the increase in smoking among both males and females.[35][36] Etiology

Smoking is the most common cause of lung cancer. It is estimated that 90% of lung cancer cases are attributable to smoking.The risk is highest in males who smoke. The risk is further compounded with exposure to other carcinogens, such as asbestos. There is no correlation between lung cancer and the number of packs smoked per year due to the complex interplay between smoking and environmental and genetic factors. The risk of lung cancer secondary to passive smoking increases by 20 to 30%.[37] Other factors include radiation for non-lung cancer treatment, especially non-Hodgkin's lymphoma and breast cancer.[38] Exposure to metals such as chromium, nickel, arsenic, and polycyclic aromatic hydrocarbons is also associated with lung cancer. Lung diseases like idiopathic pulmonary fibrosis increase the risk of lung cancer independent of smoking.[39]

Asbestos and radon are established risk factors for lung cancer as well. Asbestos exposure, particularly occupational exposure, increases the risk for lung cancer in a dose-dependent manner but varies according to the type of asbestos fiber. Non occupational asbestos exposure risk is less defined. However, the United States Environmental Protection Agency (EPA) has set standards for low-level acceptable non occupational asbestos exposure, stating that the health risk to occupants of a building in which asbestos is undisturbed without respirable particles is not significant.[40] Radon exposure in uranium miners was associated with a small but significant risk of lung cancer.[41] Radon has also been shown to accumulate in homes as a decay product of uranium and radium. A meta-analysis of European studies reported appreciable hazards from residential radon, particularly for smokers, and was responsible for approximately 2% of all deaths from lung cancer in Europe.

Epidemiology

Lung cancer is the most commonly diagnosed cancer worldwide, accounting for approximately 12.4% of all cancers diagnosed worldwide, and is the leading cause of cancer-related deaths.[42] The American Cancer Society estimates an annual incidence of more than 234,000 new lung cancer cases and over 154,000 lung cancer-associated deaths in the United States.[42] According to the Global Cancer Statistics report from 2020, lung cancer remained the leading cause of cancer death worldwide, with an estimated 1.8 million deaths.[43]

Historically, the lung cancer epidemic seems to involve the developed world only. Recent data suggest that the incidence of lung cancer is dramatically rising, with nearly half of new cases, 49.9%, diagnosed in the underdeveloped world.[44] In the United States, mortality is high in men compared to women. Overall, there is no racial difference in the incidence of lung cancer, but the age-adjusted mortality rate is higher in African American males than their Caucasian counterparts. No such distinction exists between women.

History and Physical

No specific signs and symptoms exist for lung cancer. Most patients already have advanced disease at the time of presentation. Lung cancer symptoms occur due to local effects of the tumor, such as cough due to bronchial compression by the tumor due to distant metastasis, stroke-like symptoms secondary to brain metastasis, paraneoplastic syndrome, and kidney stones due to persistent hypercalcemia.[45]

These symptoms, however, may be primarily due to lung cancer or due to underlying bronchopulmonary disease.

Pleural involvement in lung cancer can manifest as pleural thickening/nodules or a malignant pleural effusion. During the course of their illness, approximately 10 to 15% of patients with lung cancer will have a malignant pleural effusion, with some showing a unilateral pleural effusion as the only presenting feature.[46] Bronchogenic carcinoma with associated ipsilateral malignant pleural effusion is considered unresectable; however, it must be noted that not all pleural effusions in patients with lung cancer are malignant.[47] A benign pleural effusion may occur due to lymphatic obstruction, post-obstructive pneumonitis, or atelectasis. If two consecutive cytology specimens are negative for malignancy in patients with bronchogenic carcinoma, surgical thoracoscopy or medical fluoroscopy is recommended to evaluate the pleural space before surgical resection of a primary lesion.[48] Medical Fluoroscopy has a sensitivity of greater than 90% for detecting malignancy when present in patients with bronchogenic carcinomas.[49]

Superior vena cava syndrome with dilated neck veins, edema of the face, neck, and upper extremities, and a plethoric appearance is a common feature of small cell lung cancer. It might be the primary presentation of the

disease. The chest radiograph will show widening of the mediastinum or a right hilar mass.[50] As stated above, lung cancers in the superior sulcus present as Pancoast syndrome. This presents as shoulder pain, Horner syndrome, and evidence of bony destruction, with atrophy of hand muscles.

Metastasis from lung cancer to bone is frequently symptomatic, and patients may present with bone pain at the site of metastasis in the setting of elevated serum alkaline phosphatase and hypercalcemia. Up to 20% of the patients with non-small cell lung cancer may have bone pain secondary to metastasis on initial presentation. [51] whereas the percentage is as high as 30 to 40% in patients with small-cell lung cancer.[52] Imaging usually reveals osteolytic lesions with vertebral bodies as the most common site of metastasis. Adrenal metastases also occur in lung cancer, but they are rarely symptomatic and are usually seen on staging. However, not all adrenal lesions are malignant lesions, and positron emission tomography (PET) scanning is recommended to differentiate benign from malignant adrenal lesions.[53] Brain metastasis is another common feature of lung cancer in small cell lung cancers (SCLC) and non-small cell lung cancers (NSCLC). In SCLC, brain metastases may be present in as high as 20 to 30% of the patients at diagnosis.[54] Other common sites of metastases in lung cancer include the liver, which is usually only symptomatic in advanced disease.

Evaluation

Lung cancer is the leading cause of death in both men and women. NSCLC accounts for 85% of diagnosed lung cancer cases in the United States.[37] The overall goal is a timely diagnosis and accurate staging. As per the American College of Chest Physicians (ACCP) guidelines, the initial evaluation should be complete within six weeks in patients with tolerable symptoms and no complications. Only 26% and 8% of cancers are diagnosed at stages I and II, respectively, whereas 28% and 38% are diagnosed at stages III and IV respectively. Therefore, curative surgery is an option for only a minority of patients.

Pleural Effusion

Pleural effusion is the accumulation of fluid in between the parietal and visceral pleura, called pleural cavity. It can occur by itself or can be the result of surrounding parenchymal disease like infection, malignancy or inflammatory conditions. Pleural effusion is one of the major causes of pulmonary mortality and morbidity. [55][56][57]

All healthy humans have a small amount of pleural fluid that lubricates the space and facilitates normal lung movements during respiration. This delicate balance of fluid is maintained by the oncotic and hydrostatic pressure and the lymphatic drainage; disturbances in any one of these systems can lead to a build-up of pleural fluid.

Etiology

Pleural fluid is classified as a transudate or exudate based on modified Light's criteria. Pleural fluid is considered an exudative effusion if at least one of the criteria are met. [58][59]

1. Pleural fluid protein/serum protein ratio more than 0.5
2. Pleural fluid lactate dehydrogenase (LDH)/serum LDH ratio of more than 0.6
3. Pleural fluid LDH is more than two-thirds of the upper limits of normal laboratory value for serum LDH.

Common causes of transudates include conditions which alter the hydrostatic or oncotic pressures in the pleural space like congestive left heart failure, nephrotic syndrome, and liver cirrhosis, hypoalbuminemia leading to malnutrition and with the initiation of peritoneal dialysis.

Common causes of exudates include pulmonary infections like pneumonia or tuberculosis, malignancy, inflammatory disorders like pancreatitis, lupus, rheumatoid arthritis, post-cardiac injury syndrome, chylothorax (due to lymphatic obstruction), hemothorax (blood in pleural space) and benign asbestos pleural effusion.

Some of the less common causes of pleural effusion are a pulmonary embolism which can be exudate or transudate, drug-induced (e.g., methotrexate, amiodarone, phenytoin, dasatinib, usually exudate), post-radiotherapy (exudate), esophageal rupture (exudate) and ovarian hyperstimulation syndrome (exudate).

Epidemiology

Pleural effusion is the most common disease among all the pleural disease and affects 1.5 million patients per year in the United States. A wide variety of diseases can present with pleural effusions like diseases primarily involving the lung like pneumonia, asbestos exposure, primarily systemic diseases like lupus, rheumatoid arthritis, or maybe

the pleural manifestation of diseases which primarily affect other organs like congestive heart failure, pancreatitis, or diseases local to the pleura like pleural infections and mesothelioma.[60]

Pathophysiology

In the normal healthy adult, the pleural cavity has minimal fluid which acts a lubricant for the two pleural surfaces. The amount of pleural fluid is around at 0.1 ml/kg to 0.3 ml/kg and is constantly exchanged. Pleural fluid originates from the vasculature of parietal pleura surfaces and is absorbed back by lymphatics in the dependent diaphragmatic and mediastinal surfaces of parietal pleura. Hydrostatic pressure from the systemic vessels that supply the parietal pleura is thought to drive the interstitial fluid into the pleural space and hence has lower protein content than serum. Accumulation of excess fluid can occur if there is excessive production or decreased absorption or both overwhelming the normal homeostatic mechanism. If pleural effusion is mainly due to Mechanisms that lead to pleural effusion mainly due to increased hydrostatic pressure are usually transudative, and leading to pleural effusion have altered the balance between hydrostatic and oncotic pressures (usually transudates), increased mesothelial and capillary permeability (usually exudates) or impaired lymphatic drainage.[61][62]

History and Physical

A patient with pleural effusion can be asymptomatic or can present with exertional breathlessness depending on the impairment of thoracic excursion. Patient with active pleural inflammation called pleurisy complains of sharp, severe, localized crescendo/ decrescendo pain with breathing or a cough. When the effusion develops, pain can subside, falsely implying an improvement in condition. Constant pain is also a hallmark of malignant diseases like mesothelioma. Depending on the cause of effusion, the patient can also complain of a cough, fever and systemic symptoms.

The physical examination can be subtle. In large effusion, there will be the fullness of intercostal spaces, and dullness on percussion on that side. Auscultation reveals decreased breath sounds and decreased tactile and vocal fremitus. Egophony is most pronounced at the superior aspect of the effusion.

Pleural rub, often mistaken for coarse crackles can be heard during active pleurisy without any effusion.

As pleural effusion is the result of varied disease, history and physical examination should also be focused on the underlying pulmonary or systemic cause of the effusion. For example, in congestive heart failure (CHF), examine for jugular venous distension, S3, and pedal edema, in cirrhosis leading to hepatic hydrothorax, look for ascites and other stigmata of liver disease.

Evaluation

Chest radiographs are useful to confirm the presence of effusion. The findings of effusion vary with amount of effusion. On an upright posteroanterior (PA) view, minimum 200ml of fluid is required to obliterate the costophrenic angle, called the meniscus sign of a pleural effusion. However, in a lateral view, 50 ml of fluid can be diagnosed with this sign. Ultrasound of chest is more sensitive and useful for diagnosis of pleural effusion and also helps in planning thoracentesis. All unilateral effusion in adults needs thoracentesis to determine the cause of pleural fluid. This is also known to improve the patient's symptoms and facilitate recovery.[63][64][65]

Determining whether the fluid is an exudate or transudate narrows the differential. However, Light’s criteria should be interpreted in the clinical context since it misdiagnoses 20% of transudates as exudative. An example would be a patient who has been chronically diuresis for heart failure can increase the pleural fluid protein level and can be classified as an exudate.

Commonly performed tests on the pleural fluid to determine etiology are a measurement of fluid pH, fluid protein, albumin and LDH, fluid glucose, fluid triglyceride, fluid cell count differential, fluid gram stain and culture, and fluid cytology. Exudates are characterized by elevated protein, elevated LDH and decreased glucose. Pleural fluid LDH greater than 1000 U/L may be seen in tuberculosis, lymphoma, and empyema. Low pH (pH less than 7.2) indicates complex pleural effusion in the setting of pneumonia, and almost always requires chest tube insertion for drainage. Other causes for low pH may be an esophageal rupture and rheumatoid arthritis.
Fluid cell counts in transudates show predominantly mesothelial cells. In parapneumonic effusions, lupus pleuritis, and acute pancreatitis, there is neutrophilic predominance in cell counts. Some causes of lymphocyte-predominant effusions include malignancy, lymphoma, tuberculosis, sarcoid, chronic rheumatoid pleural effusion, and

malignancy. Eosinophilia in pleural effusion is rare and usually in the presence of air (Pneumothorax), blood (hemothorax), a parasitic disease, or drug-induced effusion.

The presence of organisms by gram stain or culture leads to a diagnosis of empyema and necessitates a chest tube for drainage of pus. Cytology is necessary for determining the presence of malignant cells in the pleural fluid. The sensitivity of pleural fluid cytology in the presence of malignant effusion in the first thoracentesis is around 60%, and the yield increases with further attempts, approaching 95% by three samples on different days. However, if a malignant effusion is strongly suspected and cytology is negative, then medical thoracoscopy with pleural biopsy can be performed after two to three thoracenteses to obtain a diagnosis.

Other tests that can be performed on the pleural fluid to determine etiology include adenosine deaminase (ADA) which, when elevated is suspicious for tuberculosis in areas of high prevalence of tuberculosis. In esophageal rupture, the presence of amylase in pleural fluid is diagnostic. In heart failure, an elevated NT-proBNP level may be seen in pleural fluid. The presence of more than 110 mg/dL of triglycerides in the pleural fluid indicates a chylothorax. Pleural fluid is usually straw-colored, and if it is milky white, then a chylothorax should be suspected. Diagnosis of hemothorax can be made if the pleural fluid hematocrit is more than 0.5 times that of serum hematocrit.

The chest x-ray may reveal mediastinal shift to the contralateral chest cavity. There may also be displacement of the trachea towards the ipsilateral side if the bronchus is obstructed. Ct scan is useful to determine the cause like a malignancy.

Differential Diagnosis

- Congestive heart failure
- Injury to the diaphragm
- Diaphragmatic paralysis
- Malignant mesothelioma
- Pneumonia
- Atelectasis

Staging

Current guidelines on the management of Pleural effusions

- Use of bedside ultrasound improves success rates and reduce the risk of Pneumothorax during aspiration
- Ultrasound can detect pleural fluid sequestrations
- Always send fluid for biochemistry, culture, and cytology
- Use light's criteria to distinguish exudate from transudate
- Lymphocyte predominant effusions are usually due to heart failure, malignancy, and TB
- Check pH when aspirating pleural effusions
- Do not inject air or local anesthetic into the sample as this may alter the pH of the fluid
- If pH is less than 7.2, drainage of the fluid is recommended
- Malignant effusions can be detected on cytology (40-60%)
- CT scan is recommended when complete removal of pleural fluid is not possible
- Thoracoscopy can be used to make a diagnosis of malignancy
- Routine flexible bronchoscopy is not recommended for pleural effusions

Prognosis

The prognosis depends on the cause of the pleural effusion. Benign effusions can be cured but if the cause is a malignancy, the prognosis is very poor. Another feature of pleural effusions is recurrence which can also occur with benign disorders like lupus, uremia, and rheumatoid arthritis. If the pleural effusion is not drained it can lead to dyspnea and even an empyema.

CT

Siemens Medical Systems introduced single-section helical computed tomography (CT) technology for clinical use in 1988. In 1992, Elscint created a dual-section helical scanner, the first and simplest multisection scanner. In the fall of 1998, several equipment manufacturers launched the next generation of multisection CT scanners. These units have four data acquisition systems connected to multidetector arrays to provide a “quad-section” CT scan, increasing the speed of data collection by a factor of four over conventional single-section helical CT scanners. In

addition, some of these scanners have gantry rotation speeds of two revolutions per second, twice the speed of most conventional helical scanners. These two improvements have combined to increase the scanning speed by a factor of eight over most conventional single-section helical CT scanners The benefits of quad-section CT relative to single-section helical CT are significant. The examination can be performed with thinner sections, leading to higher spatial resolution along the longitudinal axis of the patient. Scanning can be performed much faster, resulting in improved temporal resolution and reduced motion artifacts. Intravenously administered iodinated contrast material can be delivered at a faster rate, increasing contrast enhancement in the images. These factors combine to improve the spatial, temporal, and contrast resolution of the images, significantly increasing the diagnostic accuracy of the examination. The aim of this article is to introduce the technical principles of multisection CT and provide examples of clinical applications. The section on technical principles addresses detector rows, detector array design, selection of section thickness, and scanning speed. The section on clinical applications illustrates isotropic viewing, musculoskeletal applications, use of multiplanar reformation (MPR) in special situations, CT myelography, long coverage and multiphase studies, CT angiography, cardiac scoring, evaluation of brain perfusion, imaging of large patients, evaluation of acute chest pain or dyspnea, virtual endoscopy, and thin-section scanning with retrospective image fusing.[66]

Method And Material:-

Study Type:

An observational & correctional study was carried out in Department of Radio- diagnosis & Imaging NIMS Hospital, Jaipur, Rajasthan. Thisstudy was based “ROLE OF MULTI DETECTOR COMPUTED TOMOGRAPHY IN EVALUATION OF LUNG ANOLAMIES”.

Studydesign:

Thisstudywasdesignedtochecktheamountofpatient suffered bylung anomalies suggestedforMDCTatNIMSHospital,Jaipur,Rajasthan.

Studyarea:

CTscanroom5,DepartmentofRadio- diagnosis&Imaging,NIMSHospital,Jaipur,Rajasthan,INDIA.

Studyduration:

Thisobservational&cross-sectionalbasedstudywasconductedoutforthetimeperiodoftwelve monthsfromJuly2021toJuly2022atCollegeof ParamedicalTechnology,NIMSUniversity,Jaipur,Rajasthan,India.

Selectioncriteria

InclusionCriteria

1. Patients aged between 15-90
2. Patients who were willing to give written and informed consent
3. Males and females
4. Patients referred for HRCT CHEST

ExclusionCriteria

1. Patients not willing to give written and informed consent.
2. Patients not willing to give written and informed consent.
3. Patients having below 15 ages were excluded

Studypopulation

Thestudypopulationconsistedof262 lung anomaliespatientsreferredfor MDCTfromthedepartmentofRadio-DiagnosisandImaging,NIMSHospital,Jaipur

Methodofdatacollection:-

$n = Z^2 x\ p(1-p)$

d2

$n = 1.96^2 x 0.218 x 0.782$

0.05^2

= 262

n = sample size

z = 1.96

p = 0.218(prevalence rate)
d = 5% (margin of error)

After collection of data, data will be presented graphically.

Descriptive statistics like minimum, maximum, mean, standard deviation etc was calculated when P- value was less than 0.05 then it was considered as statistically significant.

All statistical analysis was performed in SPSS and Microsoft excel software

Detailed history including age, sex laterality, clinical picture including examination were properly recorded. Multi detector 128 slice ingenuity s. no 336210 having multiplanar and 3D reconstruction images with volumetric scan was used for detailed evaluation of lung anomalies The exposure factor used were 120kvp and 60mAs space was 3mm respectively.

Statistical analysis was done by using SPSS version 20 software. For general characteristics of the study population, descriptive analysis was performed Diagnostic statistical test such as sensitivity, specificity and accuracy of CT findings were calculated.

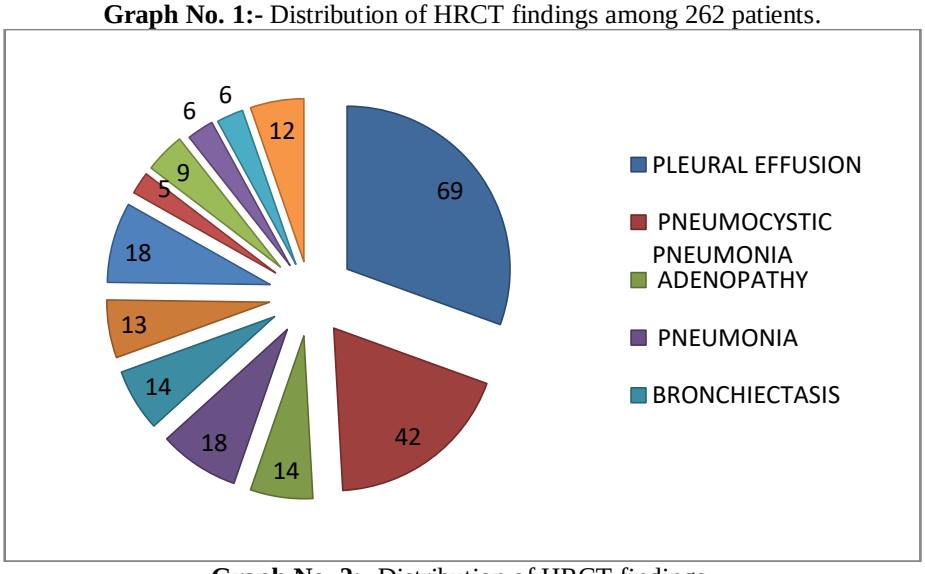
Result:-

In this study, the age group of the patients ranged between 15 to 90 years with mean age of patient were 55.6 years; the majority of the patients were in age group 56 to 60 years (12.5%). There were 62.21% male patients and 36.5% females

The most common presenting clinical feature was pleural effusion 41% of patients followed by the cough which was present in 55% of cases favour was present in 29% patients while skin thickening and arthralgia were seen in 4% of patients each. Weight loss and Raynaud's phenomena were seen in 6% each chest pain was present in 8% cases, and Haemoptysis was present in 8% patients.

So, the most common indication of which HRCT chest was performed was pleural effusion present in 41% of cases, pneumocystis pneumonia 24% of patients. Adenopathy was present in 11% of patients. Pneumonia was present in 8% of the patients, bronchiectasis was present in 8% of the patients, Para septal emphysema was present in 8.3% followed by emphysema was present in 3.8% of the patients, atelectasis was present in 9% of the patients, COPD was present in 7.2% of the patients, pneumothorax was present in 3.8% of the patients, pulmonary fibrosis was present in 4.5% of the patients, cardiomegaly was present in 6.4% of the patients.

Graph No. 1:- Distribution of HRCT findings among 262 patients.



Graph No. 2:- Distribution of HRCT findings.

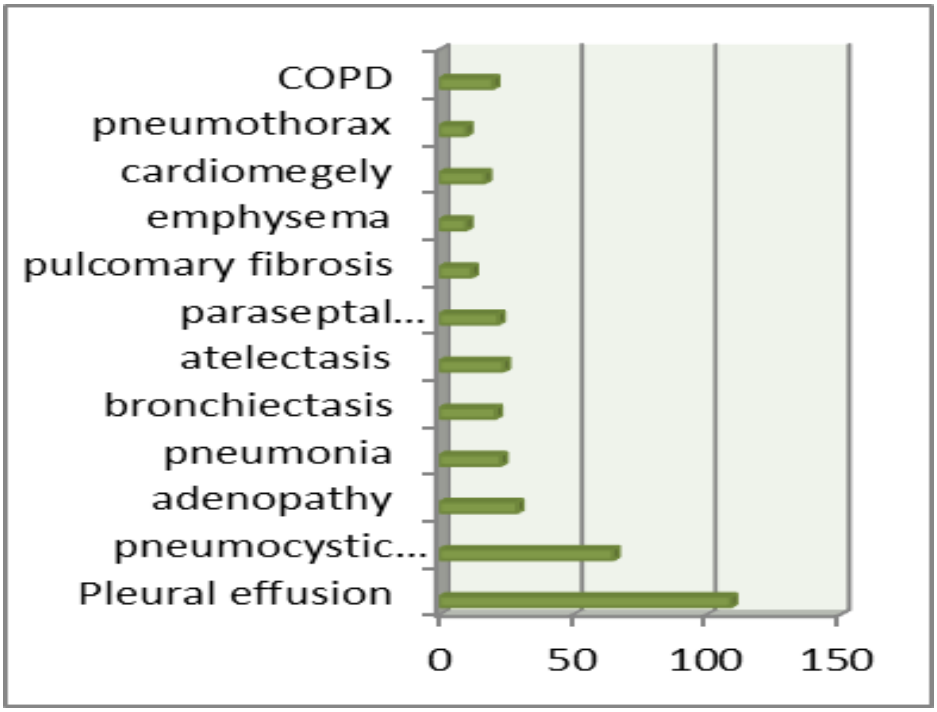


Table No 1: Distribution of HRCT findings among 262 patients.

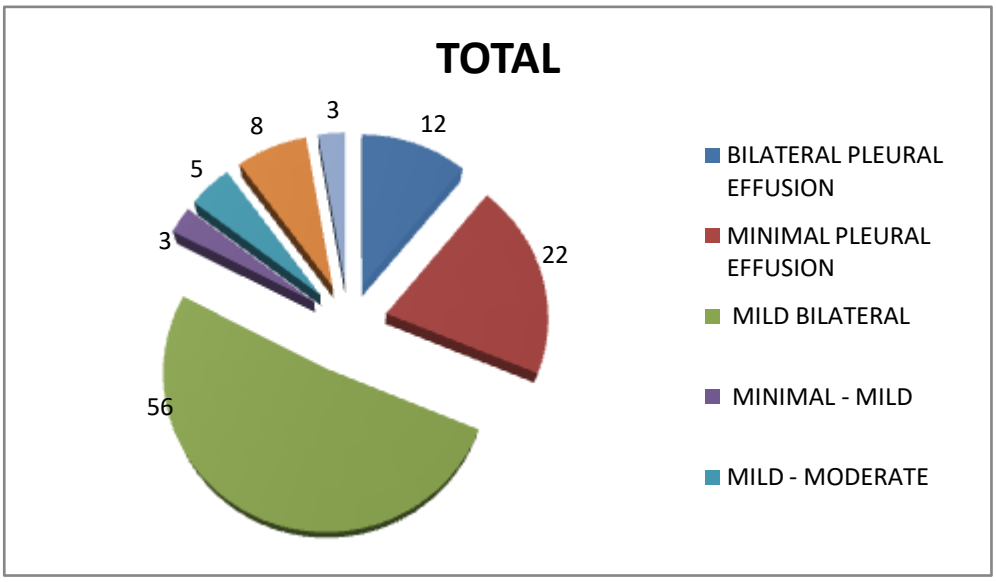
FINDINGS ON HRCT	M	F	TOTAL	P%
Pleural Effusion	69	40	109	41%
Pneumocystic Pneumonia	42	24	65	24%
Adenopathy	14	15	29	11%
Pneumonia	18	5	23	8.4%
Bronchiectasis	14	7	21	8%
Atelectasis	13	11	24	9%
Para septal Emphysematous	18	4	22	8.3%
Pulmonary Fibrosis	5	7	12	4.5%
Emphysema	9	1	10	3.8%
Cardiomegaly	6	11	17	6.4%
Pneumothorax	6	4	10	3.8%
COPD	12	8	20	7.6%

Pleural effusion was the most common indication on HRCT which was present in 109 patients (41%), in which 69 were males and 40 cases were females. Male group were the most effected group instead of females this is the common observation in our study.

Table No 2:- Distribution of pleural effusion among 109 out of 262 patients.

Pleural Effusion	**M**	**F**	**T**
Bilateral Pleural Effusion	**8**	**4**	**12**
Minimal Pleural Effusion	**15**	**7**	**22**
Mild Bilateral	**34**	**22**	**56**
Minimal –mild	**2**	**1**	**3**
Mild –moderate	**5**	**0**	**5**
Moderate	**5**	**3**	**8**
Bilateral minimal-moderate	**0**	**3**	**3**

Graph No. 03:-



AGE
In this study, patients' ages were ranging from 15-90years.
Out of 262 patients, 50-56years age group contributemaximum of 33 patients

Age	No of patients
Less than 20yrs	**11**
20-40yrs	**57**
40-60yrs	**103**
>60	**91**

Table No 3:- Age distribution.

Sex
Out of 262 patients, study sample consists of 165 male and 97 female

Table No 4:- Gender distributions.

MALE	FEMALE
165	**97**

Discussion:-

As this Study proved that there is a better consideration, specificity and perfection of MDCT using High resolution computed tomography (HRCT) technique is considered the modality of choice of airway disease assessment as it shows presence, distribution, morphological type of diseases and associated findings as well, alsoPankajbadarkhe-patil et al in 2016. This study was hospital based prospective and descriptive.

The total 50 patients was studied based on inclusion and exclusion criteria which was referred from medicine department of institute having clinical suspicion of ILD. HRCT was done in all patients on 6 slice Siemens somatom CT scanner in supine position using standard HRCT protocol. Parenchymal abnormalities were was detected and categorized for specific diagnosis of ILD. They examined majority of the patients (n=25) was between the ages of 60-80 years (8 males and 17 females) the major complaints was progressive Dyspnea (n=48; 96%) and joint pain (N=22; 44%) related to connective tissue disorders followed by dry cough (n=37; 74%). The most common interstitial lung disease found on their study was usual interstitial pneumonia (n=18;36%) followed by nonspecific interstitial pneumonia (n=7;14%) and acute interstitial pneumonia (n=7; 14%)

Most commonly found associated risk factor with interstitial lung disease was connective tissue disorder (n=19 38%) followed by smoking (n=9; 18%) allergy (n=8; 16%) and least exposed history in three cases which include exposure to chemotherapy, radiotherapy and cost dust particles in coal mine.

The most commonly found pattern associated with interstitial lung disease was reticular opacity (n=37; 64%) followed by increased opacity (n=29; 58%) and decreased opacity (n=29; 58%) on HRCT. Most common specific HRCT findings on their study population was septal thickening (n=37; 64%) followed

AlthroughShadab Ahmad et al in (2020). In this study a total of 80 patients with restricted pulmonary functions and clinical suspicion of ILD was enrolled in their study. MDCT was using Siemens somatom force 384 slice multidetector computed tomography machine. Pattern anaylsis for reticular opacities, nodules and lung opacities was done to reach at a diagnosis. Final diagnosis was based on correlation of radiological and clinicopathological findings. Diagnostic efficacy of MDCT was evaluated in terms of sensitivity, specificity, positive protective value (PPV) negative predictive value (NPV) and accuracy for detection of ILD. In their study the mean age of patients was 58± 8.75years. majority was females (51.3%). History of chronic obstruction pulmonary diseases COPD, tuberculosis and bronchial asthma was revealed in 31 (38.8%), 26 (32.5%) and 16(20%) patients, respectively

Irshadmohi-ud-din bhat et al in (2016). This study was conducted in the department of Radio diagnosis and imaging, Govt medical college, Srinagar, on 50 patients presented with suspected diagnosis of ILD referred by chest disease hospital and medicine department of Govt medical college, Srinagar. In their study, the age of the patients ranged from 22 to 85 years with mean age of 53.5 years, the majority of the patients was in the age group 21-40 years (38%). There was 44% male patients and 56% female patients. The most common presenting clinical feature was dystnea on exertion present in 64% of cases. Fever was present in 24% patients while skin thickening and arthralgia was seen in 8% of patients each. Weight loos and Raynaud's pnhonemonenwere was seen in 6% of patients each. Chest pain was present in 2% cases, and hemoptysis was present in 8% patients.

Youssriah y. sabri et al. in 2018 they involved 62 patients and was referred to radiology department for MSCT of chest from the pulmonary department. They found that pulmonary bronchiectatisis distribution; with bilateral lesions were more common in 62.5% of patients, classified according to morphological type with the cylindrical bronchiectasis was the most common shape in 37.5% of case, classification according to bronchiectasis etiology, most of cases were post inflammatory in 42.2% of cases, followed by traction bronchiectasis in 34.4% of cases.

HRCT can play a major role in the assessment of patients who have diffuse lung anomalies. By eliminating superimposition of structures, CT allows for a better assessment of the type, distribution, and severity of parenchymal abnormalities than is possible with chest radiographs. HRCT currently has the best sensitivity and specificity of any imaging method for the assessment of focal and distribution of these abnormalities, HRCT often allows for a confident diagnosis to be made. Thus, HRCT is indicated in patients with suspected diffuse infiltrative lung anomalies who have normal or questionable radiographic findings.

Although in this present study it shows that among 262 patient 109 patients identified with pleural effusion from them 69 were male and 40 were female.

Thus, it has been clarified with this part of discussion that comprehensive evaluations of patient age, presenting symptoms, examination and computed tomography (CT) findings help us to diagnosis of lung anomalies.

Conclusion:-

Pleural effusion was the most common interstitial lung disease observed in our study. Our Study proved that there is a better consideration, specificity and perfection of CT in assessment of Lung anomalies as evident by significant correlation of CT with final diagnosis with p value of less than 0.004.

Thus, CT plays an important role in studying lung details, anomalies. Hence it can be said that the CT is preferable before definitive diagnosis and surgical procedures related as it gives guidance to the Radiologist and ultimately it will lead to the effective diagnosis, management treatment and prevention of complications of lung anomalies.

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