Gallium Scan Predicts Activity Of Diffuse Parenchymal Lung Disease

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Citation

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Abstract

The first step in the evaluation of diffuse parenchymal lung disease (DPLD) should be to establish its activity. The currently accepted parameters are clinical, changes in lung physiology, computerized tomographic (CT) appearance, and lung biopsy. Gallium 67 scintigraphy has been felt to be controversial.
We reviewed 17 cases of DPLD and documented gallium 67 scan results with evidence of activity as reflected by 10% change in pulmonary function tests, evidence of alveolitis on CT and cellular proliferation on lung biopsies.
Fourteen cases had positive Gallium scans and active DPLD (true positives), one had positive scan and active DPLD (false positive), and one had negative scan and active DPLD (false negative), and one had a negative scintigraphy and no evidence of activity (true negative).
The sensitivity of the gallium 67 scan was 93%, the specificity was 50%, the positive predictive value was 93%, negative predictive value was 50%, the likelihood ratio for positive was 1.86, and the negative likelihood was 0.13.
Gallium scan results were also correlated with a clinical, radiological, physiological, pathological score (CRPP), yielded a p value of 0.058.
We conclude that the gallium67 scintigraphy is a useful method to establish inflammatory activity in DPLD.

ABBREVIATIONS

Diffuse parenchymal lung disease (DPLD), computerized tomography (CT), pulmonary function tests (PFT's), clinical, radiological, physiological, pathological (CRPP) score, Interstitial Lung Diseases (ILD), Idiopathic Pulmonary Fibrosis (IPF), British Thoracic Society (BTS), Cryptogenic fibrosing alveolitis (CFA), polimorphonuclears cells (PMNs),

INTRODUCTION

Diffuse parenchymal lung disease (DPLD) is a common denominator term given to a heterogeneous group of clinical entities that can cause mainly dyspnea and hypoxemia. It does not only affect the interstitium but also the alveolar space and sometimes it may even involve the airways. The first step in the evaluation of DPLD should be to establish its activity. The currently accepted parameters are clinical grounds, changes in lung physiology, computerized tomography (CT) appearance, and lung biopsy. However clinical grounds are somewhat subjective; the chest-X-rays have low sensitivity (j) (p); pulmonary function tests (PFT's) have a limited reproducibility, but a proportion of patients have preserved lung volumes or airflow obstruction, such abnormalities should not lead to the exclusion for a diagnosis of DPLD (k) (p); CT Scan of the chest is better than plain radiographs, clinicians are significantly more likely to determine the correct diagnosis for DPLD, the extent of the disease, and the optimal site for biopsy, but its interpretation requires special training and yet the reading may be somewhat subjective (l) (p).. Histopathologically, the lungs of patients with DPLD can show from predominantly inflammatory pattern with little or no fibrosis (alveolitis), to predominantly fibrotic pattern or no inflammation. Lung biopsy is the goal standard, but it depends on type, size, and site of the sample, some DPLDs show overlapping histological features (m), (p) and repetitive lung biopsy is not feasible (s). It is important to determine the status of a particular patient on this spectrum.; Gallium 67 scintigraphy has been felt to be controversial despite that in 1969 it was described as a good marker in inflammatory lesions © (e) Gallium scan has become increasingly used to evaluate the presence of alveolitis in DPLD and to stage the disease process (n) (q) due to the fact that the concentration of gallium in the lung is normally low, making abnormal uptake of gallium easily recognizable (o). We decided to study the ability of Gallium-67 scanning to predict alveolitis

by means of correlating with a correlated clinical, radiological, physiological, pathological (CRPP) score.

METHODS

A retrospective review of cases referred to the Pulmonary Clinic of University of Texas M. D. Anderson Cancer Center with Diffuse Parenchymal Lung Disease and have had Gallium-67 Scan, CT Scan of the Chest, PFT's and lung biopsy.

Results of Gallium we reported as positive or negative. Radiographic Score was based on CT Chest appearance: 1 = Alveolitis (Ground glass) and 0 = Fibrosis.

Physiology Score: 1 = 10% in Total lung capacity (TLC) or Diffusion of CO2 (DLCO2), 0 = No change.

Pathologic Score: 1 = Cellularity, 0 = Fibrosis

Clinic Radiological Physiologic Pathologic Score CPRR + Summa of Rad + Physiologic + Pathologic score using an aseptic technique the ETTs were removed from 55 patients from the intensive care unit (ICU) at University of Texas M. D. Anderson Cancer Center.

RESULTS

Seventeen patients were included in the study. The Gallium scan was positive in 15 of them. The sensitivity of the Gallium-67 was 93%, the specificity was 50%, of the positive predictive value was 1.86 and for negative 0.13. The correlation of Gallium Scan with the scores as shown in the figures.

We had fourteen cases Gallium Scan positive and active DPLD (true positive), one had positive scan and no evidence of activity (false positive), one had negative scan and active DPLD (false negative), and one had negative scintigraphy and no evidence of activity (true negative). The sensitivity of the gallium 67 scan was 93%, the specificity was 50%, the positive predictive value was 93%, the negative predictive value was 50%, the likelihood ratio for positive was 1.86, and the negative likelihood ratio was 0.13.

Gallium scan results were also correlated with a clinical, radiological, physiological, pathological (CRPP) score, yielding a p value of 0.058.

DISCUSSION

Gallium has been prejudiced to be unable to predict the clinical course or prognosis in Interstitial Lung Diseases (ILD) such Sarcoidosis and Idiopathic Pulmonary Fibrosis (IPF), the British Thoracic Society (BTS) care committee (p) conclude that the pulmonary parenchyma may be positive in a wide range of DPLDs and, in this context gallium scanning is not helpful, furthermore serial gallium scans are not useful as monitors of disease in Cryptogenic fibrosing alveolitis (CFA); although Vanderstappen et al ® described that the gallium-67 scanning is useful in the management of CFA and hypersensitivity pneumonitis.

Others have found that there was a strong correlation between the intensity of gallium uptake in pulmonary parenchyma and the detection rate of granuloma. Line et al (b) evaluated the extent and relative activity of the inflammatory process using gallium-67, they correlationated the gallium scan with the degree of interstitial cellularity and the degree of alveolar cellularity, Lavender (i) observed that gallium-67 could concentrate in the area of active inflammation and could be used as the tracer of activity. In fact, in Sarcoidosis, Tuberculosis, and Bronchocarcinoma gallium scan has been proven to be very useful in predicting disease activity(a) (f). The biodistribution of the radionuclides of gallium shows an affinity for malignancies and inflammatory process, but it is affected by sex hormone status, age, lactation, radiotherapy, chemotherapy (c) (f) and steroid treatment (g).

The physical and chemical characteristics of Gallium are similar to ferrum, it combines with the lactoferrin of inflammatory cells, most likely taken up by activated alveolar macrophages or polimorphonuclears cells (PMNs) the areas of inflammation, and the uptake may be a marker of alveolitis (a) (b). This is supported by the finding of a better correlation of gallium uptake with the extent of inflammation on open lung biopsy (d) (h) . Although it is nonspecific, it is very sensitive marker for the presence of inflammation, but it depends on the number of leukocytes, so it is not sensitive in leukopenic patients (q)

These observations indicate that the intensity of gallium uptake reflects mainly the degree of granuloma formation in the lung, -and gallium scintigraphy may be an indicator for predicting the degree of activity of pulmonary disease; Siemsen et al (f) observed that in the earlier stages, the inflammatory process is best followed by 67Gallium citrate scanning, It is observed that the presence of activity decreased after using steroids, these changes correlated well with clinical improvements (a).

CONCLUSIONS

This study showed that 67Ga-citrate scan may serve as a

study complementary to chest radiography because it indicates the extent, localization, and degree of activity of the inflammatory disease with greater accuracy than do the radiographic studies. It also permits the physicians to follow progression of the disease or response to treatment and possible to detect disseminated interstitial disease not visualized on radiographs.

Because Gallium scan is noninvasive, simple to perform, and widely available, it should prove useful to stage the activity of DPLD and to make decisions regarding therapy directed against the alveolitis component of the disease.

We conclude that gallium 67 scintigraphy is a useful method to establish inflammatory activity in DPLD.

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References

1. Jin S, Wang G, Zhu M. Galliu-67 scanning of alveolitis in idiopathic pulmonary fibrosis and sarcoidosis. Chin Med J 1996; 109(7):519-521.
2. Line B, Fulmer J, Reynolds H, et al. Gallium-67 citrate in the staging of idiopathic fibrosis: Correlation and physiologic and morphologic features and bronchoalveolar lavage. Am Rev Respir Dis 1978; 118(2): 355-365.
3. Hayes R. The medical use of Gallium Radionuclides: A brief history with some comments. Semin Nucl Med 1978; 8: 183-191.
4. Noble. Textbook of Primary Care Medicine.
5. Staab E, McCartney W. Role of Gallium 67 in inflammatory disease. Semin Nucl Med 1978; 8: 219-234.
6. Siemsen J, Grebe S, Waxman A. The use of Gallium-67 in Pulmonary disorders. Semin Nucl Med 1978; 8: 235-249.
7. Waxman A, Beldon J, Richli W, et al. Steroid-induced suppression of gallium uptake in tumors of the central nervous system. Semin Nucl Med 1978; 19: 480-482.
8. Niden A, Mishkin F, Khurana M, et al. Gallium-67 citrate lung scans in interstitial lung disease. Chest 1976; 69: 266-268
9. Lavender P, Lower J, Barker J, et al: Gallium-67 citrate scanning in neoplastic and inflammatory lesions. Br J Radial 1971; 44 (521): 360.
10. Epler G, McLoud T, Gaensler E, et al. Normal chest roentgenograms in chronic diffuse infiltrative lung disease. N Engl J Med 1978; 298: 935-939.
11. Myre M, Allard S, Bernard C, et al. Clinical, functional and pathological correspondence in early stage idiopathic pulmonary fibrosis: evidence for small airway obstruction. Respiration 1988; 53: 174-186.
12. Padley S, Hansell D, Flower C, et al. Comparative accuracy of high resolution computed tomography and chest radiography in the diagnosis of chronic diffuse infiltrative lung disease. Clin Radiol 1991; 44: 222-226.
13. Smith C, Moser K. Management for interstitial lung disease. Chest 1989; 95: 676-678.
14. Bisson G, Lamoureux G, Begin R. Quantitative gallium 67 lung scan to assess the inflammatory activity in the pneumoconiosis. Semin Nucl Med 1987; 17(1): 72-80.
15. Bekerman C, Hoffer P, Bitran J, et al. Gallium-67 citrate imaging studies of the lung. Semin Nucl Med 1980; 10(3): 286-301.
16. British Thoracic Society: Standards of Care Committee. The Diagnosis, assessment, and treatment of Diffuse Parenchymal Lung Disease in adults. Thorax 1999; 54(S): S1-S30.
17. Miller J, Lee S, Lao R, et al. Comparison of Thallium-201 and Gallium-67 citrate Scintigraphy in the diagnose of pulmonary disease. Chest 1995; 107(2): 440-446.
18. Vanderstappen M, Mornex J, Lahneche B, et al. Gallium-67 scanning in the staging of cryptogenetic fibrosing alvelitis and hypersensitivity pneumonitis. Eur Resp J 1988; 1(6): 517-522.
19. Fulmer J, Von Gal E, Roberts W, et al. Morphologic-physiologic correlates of the severity of fibrosis in idiopathic pulmonary fibrosis. J Clin Invest 1979; 63: 665-676.

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