Role of Simultaneous Bone & 99mTc HMPAO Labeled WBC Scanning in Diagnosis of Bone And Soft Tissue Infections.

Thesis

Submitted for the fulfillment of the ***M.D***.
In nuclear medicine

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Rational and background:

Although our understanding of microorganisms has advanced significantly and antimicrobial therapy has become increasingly available, bone and soft tissue infections remain a major cause of patient morbidity. (1)

Nuclear medicine plays an important role in the evaluation of patients suspected of harboring bone and soft tissue infections.
Although ^{99m}Tc- methylene diphosphonate (***MDP***), ***^{67}Ga-citrate*** are extremely useful, labelled leukocyte imaging is the current radionuclide gold standard for imaging most infections in immunocompetent patients. (2)

The development of methods to radiolabel inflammatory cells that migrate to sites of infection was a significant milestone in the evolution of radionuclide techniques for imaging infection. Although a variety of in vitro leukocyte-labelling techniques have been used, the most commonly used procedures make use of the lipophilic compounds ^{111}-ln-oxyquinoline and ***^{99m}Tc-HMPAO.*** (3)
Uptake of labeled leukocytes is dependent on intact chemotaxis (movement of the cells in response to chemical stimuli), the number and types of cells labeled, and the cellular component of a particular inflammatory response.(4) The majority of leukocytes labelled are neutrophils, and hence the procedure is identifying neutrophil-mediated inflammatory processes, such as bacterial infections. (5)

The labeling of leukocytes technique has been advented in ***NEMROCK*** center for first time in Egypt for evaluation of infection with the aid of ***IAEA***.

Aim of the work

To evaluate the role of ***Tc-99m HMPAO***-labelled WBCs and bone scintigraphy as a combined technique in Nuclear Medicine unit of ***NEMROCK*** center to improve specificity in diagnosis of bone and soft tissue infections.

Materials and methods

50 patients are going to be included in the study

Inclusion Criteria:

* Patients above 12 years old and of any sex.
* Any patient with suspicious acute bone or soft tissue infection
* Any patient with previous prosthesis for follow-up to exclude or prove infection.

Exclusion Criteria:

* Any patients with suspicious AIDS or HIV virus.
* Any patients with vertebral osteomyelitis.

Patient evaluation:

Comparison between skeletal scanning, as well ^{99mTc} ***HMPAO WBCs*** scanning or combined method to exclude or prove infection.

Techniques used:

Triple phase bone scan in the usual dose (15-20 mCi) $^{Tc\text{-}99m}$ **MDP** with early dynamic and blood pool scans (vascular phase) and late osseous phase after 3 hours, using a dual head gamma camera equipped with low energy parallel hole collimator. Acquisitions were performed with single energy window for a 15% energy window centred at 140 KeV for the Tc-***99m MDP***. Occasionally additional simultaneous co-registration of localised detailed images was also performed using 256 x 256 matrix

size. Therefore, 2 separate images are displayed (one for ^{99mTc} ***HMPAO*** & another for ^{99mTc} ***MDP***). This is followed by fusion of the 2 displayed images after proper manipulation with the use of variable multiplication factor that yield to satisfactory fused image for proper localization.

^{Tc99m} ***HMPAO*** labelled WBCs, where 30-40 ml of patient's blood are going to be processed in the laminar flow laboratory, then imaging will be commenced at 2, 4 and 24 hours post injection.

End points:

All patients will be evaluated by each method (Triple phase Bone Scan, Tc labelled WBCs) and combined method with calculation of sensitivity, specificity and accuracy to assess bone and soft tissue infections.

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بروتوكول الدكتوراه في الطب النووي

دور مسح العظام المتزامن مع المسح الكلي بأستخدام التكنشيوم المعنون HMPAO على كرات الدم البيضاء فى تشخيص حالات التهابات العظام و الأ نسجة الرخوة 0

رسالة مقدمة توطئة للحصول على درجة الدكتوراه

مقدمه من

طبيب / أسامه على رجب

بكالوريوس الطب و الجراحة- ماجستير الطب النووي
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2007

Abstract

Aim of the study: To evaluate the role of Tc-99m HMPAO-labelled WBCs and bone scintigraphy as a **combined** technique to improve specificity in diagnosis of bone and soft tissue infections.

Materials and Methods: This study included 65 sites suspected to have bone infection were included. Patients were divided into two major groups; Group A: 16 sites with current endo-prosthesis; Group B: 49 sites with no prosthesis.

Images of labeled leukocyte were acquired at 3 different time points after the injection of the labeled leukocytes: 30 min, 2 h, and 4 h. Also all patients had triple phase bone scan.

Results: The overall sensitivity for bone scan for detection of osteomyelitis was 100 % but it had a very low overall specificity of only 6.4%. The reported overall sensitivity, specificity and accuracy for Labeled WBCs were 91.1 %, 93.5% and 92.3% respectively.

^{99m}Tc-HMPAO labeled WBCs showed better sensitivity, specificity and accuracy in the group with prostheses reaching 100%, 91.6% and 93.7 % respectively. Whereas, the sensitivity, specificity and accuracy of the triple phase bone scan were 100%, 7.6%, and 31.25% respectively.

In the group with no prosthesis, the sensitivity, specificity and accuracy of the labeled WBCs modality were 90 %, 94.7%, and 91.8% respectively. While the sensitivity, specificity and accuracy of the triple phase bone scan were 100%, 5.2% and 63.2% respectively.

Conclusion: 99mTc-HMPAO-leukocyte appears to be an effective and sensitive and ^{the} most accurate modalities that it is superior to triple phase bone scan in assessment of ^{bone} infection that help the patients to avoid unnecessary invasive diagnostic and therapeutic procedures.

Key Words: bone infection; radionuclide imaging; ^{99m}Tc-labeled leukocytes; HMPAO

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List of figures