Reviewing the value of 99mTc-HMPAO-labeled leukocyte in patients with infectious diseases with special focus in infectious endocarditis

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Abstract:

Objective: There is an increased interest in autologous radiolabeled leukocytes because the 2015 update in the European Society of Cardiology infectious endocarditis guideline. Our objectives were to review the role of 99mTc-HMPAO labeled leukocytes scintigraphy in infection and inflammation identification and localization. To review the process of patient preparation, radiopharmaceutical and leukocytes labeling presenting some pearls and pitfalls. To identify the equipments needed for tracer labeling and quality control. To emphasize the accuracy and dosimetric advantages related to other radiopharmaceuticals. To illustrate the normal physiological biodistribution and the procedure applications. To describe the possible sources of false positive, false negative and confusion factors.

Method: The EANM, SNMMI and IAEA guidelines and the publications between 1995 and 2017 in the SCIELO and PUBMED databases were reviewed and, together with the authors experience, they were used to identify best practices and risk factors. The ICRP and IAEA publications were used as fundamentals for dosimetric comparison. Patients images from the participants centers were collected to demonstrate the main tracer applications.

Results: The 99mTcHMPAO is the most indicated non-positron radiopharmaceutical for the majority of infection and inflamation scintigraphy applications once it has better accuracy and delivers less radiation dose to the patient. A recent study of 99mTc- HMPAO SPECT/CT estimated a sensitivity of 90% and a specificity of 100% for diagnostic of infective endocarditis. The effective dose (mSv/MBq), efective dose for standard activity (mSv), critical organ and its dose (mSv) are respectively: 99mTc- HMPAO (0,017; 6,29; spleen; 55,5), 99mTc-coloidal sulfur (0,014; 5,18; spleen; 28,5); 111 In leukocytes (0,59; 10,9; spleen; 101,7), 67Ga (0,12; 22,2; bone; 107,3 mGy). In contrast the labeling is laborious demanding a relatively long time of handling of potentially contaminated blood. The technologist knowledge and the experience are a relevant factor. Care must be taken to maintain the leukocytes integrity. The 99mTc-HMPAO labeled leukocytes should be reinjected to the patient as soon as possible, with a maximum of one hour, avoiding radiation effects over the labeled cells and radiopharmaceutical degradation. The simultaneous handling of samples from more than one patient is not recommended because of cross contamination. Additionally to the usual equipments of nuclear medicine centers, a centrifuge and a laminar flow hood are needed. A flowchart of labeling, quality control, patient preparation and imaging was proposed. Imaging examples of osteomyelitis, diabetic foot, prosthesis and bowel infection, fever of unknown origin and endocarditis were presented.

Conclusion: The 99mTc-HMPAO labeled leukocytes scintigraphy is a time consuming and complex procedure, but training, education and optimization makes this procedure viable with proven benefits of the patients.