

Emergency Nuclear Medicine

There is now increasing role and contribution of 'Diagnostic Imaging' in the management of critically ill patients arriving at emergency department (ED) in off-hours of the day. Emergency radiology is now 24 × 7 active and busy facilities in many postgraduate teaching, tertiary-care government and large modern corporate hospitals. The emergency imaging facilities have moved in the vicinity of ED for logistic reasons so as to provide timely scanning and instant reporting so as to provide effective healthcare in these critically ill patients, where time is the crucial factor between diagnosis and institution of therapy. Till the last decade, X-ray was the commonest radiological procedure done in emergency situations, but now it has been replaced by CT scan. CT and ultrasonography (USG) are the two most common imaging investigations ordered from accident and emergency units of large hospitals.

Nuclear medicine is highly sensitive functional imaging modality which has ability to diagnose disease at an early stage by detecting organ function impairment. This is known fact that functional impairment precedes the morphological abnormality well in advance in the disease course. There are many radionuclide scans which have shown proven clinical efficacy for various emergency clinical indications. Hepatobiliary scan has high diagnostic accuracy in diagnosing acute cholecystitis. Intervention with morphine injection has provided the faster diagnosis by shortening the imaging window. But fact of the matter is how many of us are actually comfortable in injecting morphine for a diagnostic scan. Hepatobiliary scan is specific for localization of bile leak in post-trauma and postsurgical cases. Even liver colloid and DMSA renal scans are being used in some centers to evaluate blunt abdominal trauma for diagnosing hepatic and renal contusions, lacerations and pedicle injuries respectively. However, this indication of blunt abdominal trauma is largely replaced by ultrasound and contrast-enhanced CT (CECT).

^{99m}Tc-labeled RBCs scan is very useful noninvasive technique to localize obscure lower gastrointestinal hemorrhage. But this modality has been criticized for localizing bleeder to an 'approximate abdominal quadrant' rather than 'exact bowel loop'. Moreover, ^{99m}Tc- RBC GI bleed scan is not suitable for

acutely bleeding and hemodynamically unstable patients; where immediate intervention with diagnostic arteriography with coiling of culprit vessel at the same sitting becomes the life-saving therapeutic procedure. However, newer generation SPECT-CT cameras have shown promise for more accurately localization of involved bowel segment. Therefore, this investigation can be reserved for vitally stable patients where we have sufficient time at our disposal to investigate the patient. Such patients are therefore admitted to the wards for evaluation of lower GI hemorrhage rather than ED. A negative GI bleed scan may obviate the need for emergency arteriography and these patients are reported have good prognosis.

Testicular isotope scanning with ^{99m}Tc-pertechnetate can differentiate acute epididymoorchitis (conservative management) with testicular torsion to be managed surgically in acute scrotal pain with its high sensitivity (90-100%) and specificity (89-98%). But Doppler sonography remains first choice for evaluation of acute scrotum in ED due to easy availability, rapid diagnosis, identification of incidental findings and lack of ionization radiation. Nevertheless, testicular isotope scan is still requested in cases of equivocal ultrasound studies instead of going for exploratory surgery.

Till recently, V/Q scan was the most common nuclear medicine investigation performed on emergency basis to diagnose pulmonary embolism (PE). Now the requests for emergency V/Q scan or lung perfusion scan *per se* have reduced noticeably. CT pulmonary angiography (CTPA) has essentially replaced it as first-line test for diagnosis of PE.

But this time-honored investigation has some inherent advantages which can not be overlooked. It has been reported to have high negative predictive value and therefore a normal lung perfusion scan practically rules out PE with 98% confidence. V/Q scan should be preferably done in young women of reproductive age group where the concern is to minimize breast radiation exposure and to reduce fetal exposure of both radiation as well as iodinated contrast during pregnancy. In patients with known hypersensitivity to contrast, diabetes and renal failure, V/Q scan is safe modality to diagnose PE.

Chest pain is the commonest symptoms for which patients seek medical care in ED. Chest pain remains the most common presenting symptoms of acute coronary syndrome (ACS). Majority of patients with clinical suspicion of ACS has to undergo unnecessary costly admission in coronary care units (CCU) for the sake of observation in view of lack of laboratory

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evidence of sustained myocardial injury. Up to half patients admitted in ED are eventually found to have noncardiac chest pain. Approximately 10% of patients are also inappropriately sent home due to unrecognized and undiagnosed myocardial infarction and are at a greater risk. Therefore a faster and more definitive diagnosis of ACS is required to avoid unnecessary hospitalization and to prevent inappropriate discharges due to misdiagnosis.

In this clinical situation, acute resting myocardial perfusion imaging (MPI) can be used effectively to triage. Acute resting MPI becomes abnormal and shows perfusion defect in ACS instantaneously at the moment myocardial flow is impaired after plaque rupture and coronary artery occlusion. Acute resting MPI reported to have high sensitivity and high negative predictive value ($> 99\%$). In patient with clinical suspicion of ACS with normal ECG and normal values of early cardiac biomarkers, if acute rest MPI is normal then this patient can be safely discharged. In spite of high level of evidence (ERASE trial) in favor of acute rest MPI, this modality is most underutilized in emergency clinical practice. Moreover, we need to have low-cost

mobile small cameras to facilitate this service directly to ED or CCUs. Shifting a critically ill patient in Nuclear Medicine Department remains worrisome for intensivists.

Overall, it appears as if we are losing ground on the front of providing emergency nuclear medicine services. There are definitively logistic, technical and human resource constrains before us but the most important fact is that we need to change our attitude of working for fixed office hours (9 am to 5 pm job). We need to reach and provide timely help to our clinical colleagues and patients, when it matters the most i.e., at the time emergency and crisis.

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