Chapter 169
Empowering the Physicians with Radioisotopes in Clinically Challenging Situations

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INTRODUCTION

Physiology is the basis of medicine. Nuclear medicine deals with imaging human physiology.

These simple facts will provide instant clarity in the physician's mind when it comes to dealing with clinically challenging situations.

A cardiologist occasionally misses thyrotoxicosis as a cause of high output cardiac failure; a gastroenterologist could miss pericardial effusion as a cause of hepatomegaly. These conditions are more commonly picked up at the bedside by a physician with clinical acumen:

- Pyrexia of unknown origin
- Gradual onset dementia
- Stunted growth
- Vague aches and pain/unexplained hip pain
- Do you want to excise that lung nodule?
- Typical angina with normal coronaries

These are only a few of many challenging situations enumerated herein:

Having worked up a febrile patient for more than 1 week (total duration of fever lasting more than 3 weeks), a useful tool is (fluorodeoxyglucose positron emission tomography) FDG PET/computed tomography (CT) scan. F18-FDG is a short-lived radiotracer that localized in areas of abnormal metabolic activity. Thus, focus of infection as well as hidden neoplasm (lymphomas) may be unmasked using this method. It has been documented that a normal size lymph node may show abnormal metabolic activity in cases of lymphoma. Histological evaluation of such nodes helps in early diagnosis and treatment of this entity. Major limitations to its usage are cost and availability (though now there are 70 PET/CT centers in India).

Patients with frontal lobe ataxia, amnesia and incontinence may be dismissed as progressive dementia/multi-infarct dementia and a treatable entity such as normal pressure hydrocephalus may be missed. Cerebrospinal fluid (CSF) cisternography involves administration of radiotracer in the CSF space via lumbar puncture technique. Images are acquired at 1 hour, 4 hours and 24 hours. Persistence of tracer activity in the lateral ventricles is a sign of normal pressure hydrocephalus and can be effectively treated with ventriculoperitoneal shunt.

Stunted growth could result from metabolic conditions. Recurrent fractures of the vertebrae because of metabolic bone disease may also result in the same. An important mnemonic to be remembered is disease of psychic moans, abdominal groans, psychic moans, bones and recurrent renal stones that occurs in primary hyperparathyroidism. Technetium-Sestamibi scan will effectively document an adenoma in the parathyroid gland.

Vague ache and pain is one symptom that a physician finds difficult to deal with. Most of the investigations turn out to be normal. There are certain treatable conditions that can be effectively diagnosed with radiotracers. Whole body bone scan often shows hot spots in areas of pathology. One must be aware of the fact that not all hot spots on bone scan are related to malignancy. As a matter of fact, most of the hot spots seen on bone scan are because of benign conditions. Many a times, these skeletal lesions are because of tuberculosis, sarcoidosis and brucellosis. Bone scan is a very sensitive method to localize the site of affection. Its specificity is limited and hence, histology must be done from the affected site.

Unexplained hip pain could be related to bone infarcts in sickle cell crisis. Bone scan may show photon deficiency in the early phase. Later in the course of disease, there is increased osteoblastic activity that shows as increased tracer uptake.

An asymptomatic lung nodule is a cause of concern especially when a previous fine needle aspiration is inconclusive. Should you have them excised? A simple decision making tool is FDG scan. More than 50% of hypermetabolic solitary lung nodules will be malignant. Hence, the test of choice is FDG PET/CT scan. Absence of metabolic activity within such nodules can qualify for conservative management. A word of caution must be mentioned here. Bronchioalveolar neoplasm (that comprises 1% of all lung neoplasm) may be falsely negative on PET scan.

Typical angina pectoris with normal coronaries can occur in vasospastic angina. However, in absence of vasospastic disease, such pain is related to flush occlusion of a branch of coronary artery that can be completely missed on an angiogram. Stress myocardial perfusion imaging provides an objective evidence of territory of ischemia.

Finally patients presenting with hypertension, uncontrolled diabetes, hypercalcemia and/or a combination of factors may turn out to be having multiple endocrine neoplasia syndrome. With the introduction of 99m-Technetium-Hynic-TOC (tyrosine octreotide receptor scan), entities such as pheochromocytoma, neuroblastoma, carcinoid tumors can be easily diagnosed.

Please note that the “eyes do not see what the mind does not know”. Hence, a judicious approach to any patient without a settled diagnosis cannot be overemphasized.

Physicians are still reluctant to offer radioactive iodine therapy to unmarried women/women in fertile age group. Literature is replete with data that emphasizes the safety of radioiodine in this subgroup.
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About 4–6 months of contraception must be advised following radioiodine therapy in fertile woman desirous of conception. Oligoarticular inflammatory arthritis can be effectively treated by radiation synovectomy. Low dose beta emitting radionuclides such as 90-Yttrium colloid, 186-Rhenium colloid are readily available, though cost remains a major limiting factor in its usage.

Medullary carcinoma of thyroid can now be treated with Lutetium labeled tyrosine octreotide, a molecule that has affinity for primitive neuroendocrine allied group of tumors. Thus, updating the current trends in nuclear medicine will empower the physicians to tackle clinically challenging situations.