Superior to X-ray in its simplest form, or to CT.\(^2\) Since the introduction of technetium-99m phosphates in 1971,\(^3\) scintigraphy has become a reliable method to detect bone lesions, and has been shown to be far superior to X-ray in its simplest form, or to CT.\(^2\) The bone is made up of minute, 50 to 400 angstrom size, hydroxyapatite crystals consisting of calcium, phosphate, and hydroxyl ions. The main difference between X-ray and scintigraphic techniques is that the former detects local bone calcium content and the latter indicates local calcium turnover rate. Irrespective of the cause, normal bone response is to repair the damage. It takes a long time to cause nearly 30% loss of local calcium before the difference between the lesion and normal bone becomes obvious on X-ray, where as the increased calcium turnover rate at the local site of injury begins almost immediately, as early as 24 hours after injury. Because of slow calcium loss, only about 50 to 60% of bone lesions may be seen on routine bone X-ray.\(^1\) A stress fracture seen with scintigraphy may never become positive on an X-ray if there is not enough demineralization around the lesion. Because of its dependence on increased calcium turnover rate, bone scan maintains a very high sensitivity for both benign and malignant lesions except in case of multiple myeloma, where calcium turnover rate remains very low, resulting in a false-negative bone scan.

Although the distribution pattern of bone lesions may help to identify the aetiology of a few of the benign and malignant lesions in human neuroblastoma xenograft involve osteoclast recruitment and are made up of minute, 50 to 400 angstrom size, hydroxyapatite crystals consisting of calcium, phosphate, and hydroxyl ions. The main difference between X-ray and scintigraphic techniques is that the former detects local bone calcium content and the latter indicates local calcium turnover rate. Irrespective of the cause, normal bone response is to repair the damage. It takes a long time to cause nearly 30% loss of local calcium before the difference between the lesion and normal bone becomes obvious on X-ray, where as the increased calcium turnover rate at the local site of injury begins almost immediately, as early as 24 hours after injury. Because of slow calcium loss, only about 50 to 60% of bone lesions may be seen on routine bone X-ray. A stress fracture seen with scintigraphy may never become positive on an X-ray if there is not enough demineralization around the lesion. Because of its dependence on increased calcium turnover rate, bone scan maintains a very high sensitivity for both benign and malignant lesions except in case of multiple myeloma, where calcium turnover rate remains very low, resulting in a false-negative bone scan.

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**References**


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**Figure 2:** (a) showing increased Tc99m-MDP uptake over, eighth thoracic to fourth lumbar vertebra (arrow 2 and 3). Primary tumour in the right adrenal gland is showing increased tracer accumulation (arrow 1). (b) Corresponding slice of I-131-MIBG scan does not show any tracer accumulation over the corresponding sites (shown by arrow 2-3). Only the primary tumour in the right adrenal gland is showing increased tracer accumulation (arrow 1) about the current trend of replacing bone scan with a MIBG scan.\(^2\) Based on our findings, it could be recommended that Tc99m-MDP bone scan should remain a part of routine assessment of patients with neuroblastoma.

**Neuroblastoma: Role of bone imaging**

Since the introduction of technetium-99m phosphates in 1971 by Subramanian et al, scintigraphy has become a reliable method to detect bone lesions, and has been shown to be far superior to X-ray in its simplest form, or to CT.\(^2\) The bone is made up of minute, 50 to 400 angstrom size, hydroxyapatite crystals consisting of calcium, phosphate, and hydroxyl ions. The main difference between X-ray and scintigraphic techniques is that the former detects local bone calcium content and the latter indicates local calcium turnover rate. Irrespective of the cause, normal bone response is to repair the damage. It takes a long time to cause nearly 30% loss of local calcium before the difference between the lesion and normal bone becomes obvious on X-ray, where as the increased calcium turnover rate at the local site of injury begins almost immediately, as early as 24 hours after injury. Because of slow calcium loss, only about 50 to 60% of bone lesions may be seen on routine bone X-ray. A stress fracture seen with scintigraphy may never become positive on an X-ray if there is not enough demineralization around the lesion. Because of its dependence on increased calcium turnover rate, bone scan maintains a very high sensitivity for both benign and malignant lesions except in case of multiple myeloma, where calcium turnover rate remains very low, resulting in a false-negative bone scan.

Although the distribution pattern of bone lesions may help to identify the aetiology of a few of the benign and malignant
lesions, for example, Pagets disease or metastatic prostate cancer, scintigraphy, in general, lacks specificity. It cannot differentiate benign from malignant bone lesion in most cases, especially when there are only one or two bone lesions in the beginning. In patients with two or more primary malignancies, i.e. breast and lung in women or lung and prostate in men, scintigraphy fails to identify the source of bone malignancy. This is true also for X-ray, CT and MRI. Investigators have been working for more than 30 years to identify the technique that will provide specific information. Radio-labelled monoclonal antibodies were thought to provide such information, but they have so far failed to meet the expectations. There is interest in using receptor-specific small peptides that would overcome the disadvantages of the development of antihuman antibodies against monoclonal antibodies (HAMA).

In this issue of the journal, Barai et al\textsuperscript{4} studied the second most common malignancy of children, neuroblastoma, using radiiodine I-131 labelled metaiodobenzylguanidine (I-131 MIBG). Neuroblastomas arise from the neural crest tissue, 50% from the adrenal medulla, 25% from abdominal sympathetic ganglia, 15% from the posterior mediastinum, and the rest from other regions of the body.\textsuperscript{5} Scintigraphy is based upon the fact that norepinephrine is present in a high concentration in the neural tissue. Ganglion-blocking drug, guanethidine, structurally resembles norepinephrine.

I-131 MIBG which enters the neuroendocrine cells is stored in the catecholamine vesicles. Barai et al studied 57 children with neuroblastoma and compared detection of bone lesions with both I-131 MIBG and Tc-99m Methylene diphosphonate (Tc-99m MDP). At presentation, they found 11 positive bone scans with Tc-99m MDP and 7 positive with I-131-MIBG. On follow-up, Tc-99 MDP scan was positive in 14 as against 9 positive with I-131- MIBG. These results were very similar to a previous report by Gordon et al\textsuperscript{7} using I-123-MIBG, but different from those of Shulkin et al\textsuperscript{8} with I-131 MIBG. It is not clear if these results reflect the effect of dose difference, low dose with I-131 MIBG and high dose with Tc-99m MDP or the difference in the biological behaviour of the bone lesions. I suspect that the latter is the case. Since biopsy of all the positive lesions was not done, one has to assume that all Tc-99m MDP positive lesions were in fact all neuroblastoma. What if, only concordant I-131 MIBG positive and Tc-99m positive lesions were neuroblastoma, and positive Tc-99m MDP and negative I-131 MIBG were not neuroblastoma on biopsy? The primary goal of I-131 MIBG imaging should be to identify those Tc-99m MDP positive bone lesions as neuroblastoma in deciding an appropriate therapeutic strategy for the child.

**References**