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Radionuclide Bone Scan: How Useful in Cervical Spine Trauma?

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A sensitive method of measuring bone activity is the radionuclide bone scan. A diphosphonate ester compound, labeled with technetium 99m, is injected intravenously. The half-life distribution of these tracers from the vascular to the extravascular spaces is two to four minutes. By three hours time, about 35 percent of the tracer has been excreted by the kidney, 30-40 percent has been absorbed by bone, 10-15 percent is in other tissues, and about 5 percent remains in the blood.

Photons of energy are given off by the tracer and are recorded by a gamma camera. Newer systems allow a larger field of view so that whole body scans are able to provide excellent images and may be preferable to limited regional studies for practical reasons.

Scintigraphy, a more formal name for bone scanning, using technetium 99m methylene diphosphonate (MDP) will reveal a variety of non-osseous disorders, including neoplastic, hormonal, inflammatory, ischemic, traumatic, and excretory. Soft tissue Tc99m MDP uptake can be observed in benign conditions, such as tumoral calcinosis or myositis ossificans, and in malignant conditions, such as sarcomas, adenocarcinomas, and metastases. Moreover, tissue damage (which may be due to inflammation, physical injury, or infection), generally results in localized hyperemia, edema, or calcium (and hemosiderin) deposition. These can also be visualized with scintigraphy.¹

For deeper structures, single photon emission computed tomography (SPECT) can produce increased image contrast and improve spacial resolution.² Limitations to imaging the cervical spine with SPECT include decreased resolution, as a result of the relatively low bone mass of the cervical spine, and the relatively large radius of rotation necessitated by the mass of the shoulders. Despite such limitations, a recent report reveals the usefulness of cervical SPECT in trauma cases; the authors were able to make the diagnosis of occult fractures not seen with conventional plain film, demonstrate periosteal injury, differentiate radiographic

abnormalities from healed fractures, and identify active posttraumatic osteoarthritis superimposed on chronic degenerative disease.³ Their proposed algorithm for the diagnosis of cervical spine injury after trauma is presented in Figure 1.

Figure 1		Neck Trauma		
		Cervical spine series		
			--Unstable--	
Negative fracture				Positive acute fracture
		Positive DDD(?) fracture		
Persistent pain		Flexion/extension films		CT
		Stable		
		Persistent pain		Neurosurgery
SPECT		SPECT		
Positive	Negative	Positive	Negative	
				Consider Bone
				SPECT
Consider CT, immobilization	Conservative treatment	CT	Conservative treatment	

SPECT appears to be a promising method for the evaluation of mild traumatic brain injuries (MTBI).

Measuring regional cerebral blood flow (rCBF), Nedd et al.⁴ compared the results of the SPECT study with

CT findings and found intraparenchymal abnormalities with SPECT in 87.5 percent vs. only 37.5 percent with CT. Areas of involvement were larger in the SPECT studies and contrecoup lesions were detected more often with SPECT. All patients with skull fractures had normal CT (brain) scans in this series, whereas 43.7 percent had rCBF abnormalities on SPECT.

In a similar comparative study,⁵ this time for low back pain, SPECT was shown to be superior to both plain film radiology and CT in the identification of lesions. Eighty percent of the SPECT visualized lesions were seen on CT, but only 37 percent were seen on plain film studies. Another report suggests that SPECT may be more likely than CT to correlate with clinical findings in cases of spondylosis.⁶

About 90 percent of fractures will appear normal on bone scan within two years. They can be detected within hours of injury in the majority of cases. The occasional exception to this rule is in hip fractures in the elderly.

In many cases, bone scan can detect bone injuries which are too subtle for plain film radiography or CT -- modalities that detect fracture on the basis of absolute loss of bone crystal. Below is the list of the conditions detectable with scintigraphy.

Conditions Detectable with Radionuclide Imaging:

1. Avulsion fractures

2. Stress fractures

3. Shin splints

4. Insufficiency fractures

5. Bone bruises (focal periosteal, cartilaginous, subchondral, or interosseous trauma)

6. Pars defects

7. Osteonecrosis

8. Plantar fasciitis

9. Muscle Injuries

10. Tendinitis

11. Bursitis

12. Frostbite

13. Electrical burns

14. Child abuse

15. Chronic radiation injury

16. Osteomyelitis

17. Reflex sympathetic dystrophy

18. Osteoarthritis and other arthritides (including those affecting the TM joint)

19. Osteochondroses

20. Osteochondroses

21. CA
22. Discitis

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