

Elderly Prone to Traumatic Stress Neck Fractures

Occult sacral fractures show up on a bone scan after 24 hours and resemble a butterfly or Honda car logo.

BY DAMIAN McNAMARA
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MIAMI BEACH — The cervical injuries and vertebral insufficiency stress fractures that follow traumatic injury in elderly patients present special diagnostic challenges, Dr. Richard H. Daffner said at a symposium on emergency radiology sponsored by Baptist Health South Florida.

Decreased vision and hearing, diminished motor skills, slower reaction times, and multiple comorbidities disproportionately affect patients 65 years and older, he explained.

“What complicates this, particularly because falls are the biggest source of injury and trauma to the elderly, is fractures—which can contribute significantly to their ultimate demise,” said Dr. Daffner, director of musculoskeletal, trauma, and emergency radiology, Allegheny General Hospital, Pittsburgh.

Emergency physicians are most likely to encounter cervical fractures and vertebral insufficiency stress fractures in the

elderly trauma patient. The majority of cervical fractures in the elderly tend to cluster at the C1 and C2 level, Dr. Daffner said. Hyperextension injury is the leading cause of a C2 fracture. “As you get older, your neck tends to be stiffer, but the C1-C2 region remains the most mobile,” he explained.

Dr. Daffner and his colleagues studied 231 elderly patients with a total of 274 cervical injuries. They found that 119 of these injuries (43%) were at C2. In contrast, among the 749 participants in the study who were younger than 65 years with a total of 870 cervical injuries, 221 injuries (25%) occurred at C2.

Dens fractures “can be quite subtle” on a radiograph, Dr. Daffner said. “You see it much better on computed tomography—a slight shift of bone forward around C2.”

A hyperextension injury is often devastating, Dr. Daffner said. “A wide vertebral disk space [on radiograph] is the hallmark sign, and it’s never normal in the elderly population.” Patients with a wide disk space should undergo magnetic resonance

imaging immediately to determine the extent of injury, he suggested. The injury can be associated with development of edema, osteophytes impinging on the spinal cord, and neurologic compromise.

Insufficiency stress fractures are common in the elderly and are very site-specific for a particular activity, Dr. Daffner said. The sacrum and pelvis are most commonly involved, but the fractures also occur at the femoral neck and tibial plateau. “The diagnosis is not often considered by the clinician—

some of these seniors are very active.” Failure to identify these fractures early can lead to progressive disability, a longer healing time, and a fracture that becomes distracted.

An occult fracture can be detected with a bone scan if the injury is more than 24 hours old, Dr. Daffner said. On a bone scan, a butterfly pattern (which can also be described as resembling a Honda car logo) is highly suggestive of a sacral stress fracture.

Radiographs are less useful but sometimes show some osteopenia. Computed tomography is useful if there is an occult fracture in the spine. Computed tomography is also the procedure of choice for pelvic stress fractures.

However, magnetic resonance imaging is recommended for fractures in the peripheral skeleton. “A complete MR study is not needed—we often do coronal and axial images” in less than half an hour in most cases, he said. “MRI is very useful early on when a patient comes in right away complaining of pain.”

Many patients who have an insufficiency stress fracture have bone compromised by osteoporosis and/or a history of malignancy.

“One of the keys to differentiating a malignancy versus a stress fracture is a stress fracture tends to be linear and occurs in the vertical plane, up and down, whereas malignancies tend to be globular,” Dr. Daffner said. ■

The majority of cervical fractures in the elderly tend to cluster at the C1 and C2 level, the part of the neck that remains most mobile with age.

Tolerable Upper Intake Level for Vitamin D Called Too Low

BY JEFF EVANS
Senior Writer

ARLINGTON, VA. — The currently recommended tolerable upper intake level of vitamin D is too low and is hindering clinical research efforts to determine a more accurate optimal intake of the vitamin, said Reinhold Vieth, Ph.D., at a conference sponsored by the American Society for Bone and Mineral Research.

Preliminary research and case reports on the use of high doses of vitamin D suggest that the tolerable upper intake level (UL) could be much higher than it now is, yet some researchers think that higher doses will cause hypercalcemic toxicity, according to Dr. Vieth, director of the bone and mineral laboratory at Mount Sinai Hospital, Toronto.

The lowest adverse-event level for vitamin D intake was established at 3,800 IU/day based on a 1984 study in which six patients developed hypercalcemia at that level. In the same study, a dosage of 2,400 IU/day of vitamin D resulted in a statistically significant increase in serum calcium levels but was not regarded as hypercalcemic and was considered safe. But because of an uncertainty factor of about 400 IU/day, the UL—defined as the highest level of daily vitamin D intake likely to pose no risk of adverse effects in almost all individuals in the general population—became 2,000 IU/day (50 mcg/day), Dr. Vieth said (J. Am. Diet. Assoc. 1998;98:699-706).

Research on the effects of vitamin D has been driven by the 2,000-IU/day UL rather than by a more careful dose-finding study of when toxicities begin to appear, he said.

There is no recommended dietary allowance (RDA) for vitamin D because

when RDAs were established in 1995, there was perceived to be not enough evidence to recommend one, so an adequate intake level was “guesstimated,” Dr. Vieth said.

Vitamin D and its metabolites are stored at their highest concentration in adipose tissue, but a roughly equal amount overall is stored in muscles, contrary to what has been published (Am. J. Clin. Nutr. 2004;80:1689S-96S). This leaves a large reservoir to store vitamin D. If one extrapolates a study of vitamin D toxicity in rats to humans, the highest dosage that did

not cause hypercalcemia was equivalent to 5,000 IU/kg per day; hypercalcemia began to occur when the serum 25-hydroxyvitamin D (25[OH]D) level reached an equivalent of 2,000 nmol/L (Arch. Biochem. Biophys. 1980;202:43-53).

“It’s one thing to say high doses of vitamin D are bad, but it’s also very important to recognize how high we are talking about. What dose are we talking about?” he asked. “At least in animals, these doses are way off the curve in terms of anything we’ve been talking about.”

Perhaps the best study of vitamin D toxicity in humans is a report of a family that stole a container from a shipping dock of what they thought was vegetable oil but was actually a concentrate of vitamin D that was for veterinary use, according to Dr. Vieth (Ann. Intern. Med. 1995;122:511-3). In the family, hypercalcemia began to occur at serum 25(OH)D levels that were

well above the reference range upper limit of 500 nmol/L; their serum 25(OH)D concentrations ranged from 847 nmol/L to 1,652 nmol/L.

Normally the vitamin D-binding protein binds more than 99% of all 1,25-dihydroxyvitamin D (1,25[OH]₂D) and only a “very small proportion” of vitamin D metabolites. But more than 1% of 1,25(OH)₂D was unbound from the binding protein in the family members and more of it was effectively displaced from the protein than normal because of the relatively high level of vitamin D metabo-

One investigator concluded that 1 mg/day or 40,000 IU/day of vitamin D₃ might be the threshold at which toxicity begins; below that no hypercalcemia occurred.

lites in the patients. The levels of total 1,25(OH)₂D were just high-normal in the family members, but most had a high level of unbound 1,25(OH)₂D. This suggests that the likely mechanism through which vitamin D causes toxicity is the displacement of 1,25(OH)₂D from vitamin D-binding protein, Dr. Vieth said.

The capacity of vitamin D-binding protein for all metabolites of vitamin D is 4,000-5,000 nmol/L, but when concentrations of 25(OH)D approach 1,000 nmol/L, vitamin D-binding protein cannot bind as much 1,25(OH)₂D, he said.

“One problem with the vitamin D nutrition story is that we start to think of it as a drug, something to be used in treatment.

Unlike any other drug I’m aware of, there’s never been a dose-finding study done,” said Dr. Vieth, who is also a professor in the departments of nutritional

sciences, pathology, and laboratory medicine at the University of Toronto.

In a preliminary study of 12 patients with active-phase multiple sclerosis, Dr. Vieth and his colleagues studied the safety of using up to 40,000 IU/day of vitamin D₃ in treatment. The dosage of vitamin D₃ in the study increased from 4,000 IU/day up to 40,000 IU/day during the course of the study.

Many of the patients had already been taking vitamin D supplements; they had baseline concentrations of 100 nmol/L of 25(OH)D. The patients also received about 1,000 mg/day of calcium phosphate.

“So if you’ve got a cohort that’s going to be susceptible to vitamin D toxicity in a phase I study, this is it,” he said.

No events of hypercalcemia and no change in urinary calcium levels have occurred. The investigators have received funding to extend the study.

With the results of his study and after a review of the literature, Dr. Vieth concluded that about 1 mg/day or 40,000 IU/day of vitamin D₃ might be the threshold at which toxicity begins.

But the actual UL for vitamin D should be about 10,000 IU/day, or 250 mcg/day, Dr. Vieth suggested. This is not an RDA, but it is a level not likely to cause harm in most individuals.

In support of a UL of 10,000 IU/day, Dr. Vieth noted that a colleague has used 1,250 mcg/day vitamin D₃ “for some time,” and induced 25(OH)D levels of up to 643 nmol/L without hypercalcemia. Others also have used vitamin D several times higher than the current upper limit of 2,000 IU/day. Sunshine also can safely provide a dose of 10,000 IU/day to an adult, he said. ■