

Insufficiency fracture in normal pressure hydrocephalus – A case report

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ABSTRACT

Idiopathic normal pressure hydrocephalus (iNPH) is a progressive neurological disorder in the elderly, marked by gait disturbance, cognitive decline, and urinary incontinence. This case report describes a 77-year-old male with untreated iNPH who developed a spontaneous insufficiency fracture of the proximal femur without any history of trauma. Investigations revealed Vitamin D deficiency, secondary hyperparathyroidism, and early signs of chronic kidney disease, contributing to compromised bone health. Prolonged immobility due to iNPH likely exacerbated bone demineralization and muscle atrophy, increasing fracture risk. Surgical intervention was chosen over conservative management to facilitate early mobilization and prevent complications. This case underscores the need for heightened clinical vigilance for insufficiency fractures in cognitively impaired, immobile elderly patients and highlights the importance of proactive nutritional and metabolic bone health management in those with iNPH.

Key words: Bone fragility, Case report, Insufficiency fractures, Neurological complications, Normal pressure hydrocephalus

Normal pressure hydrocephalus (NPH) is a progressive syndrome of unknown cause characterized by the triad of gait disturbance, cognitive impairment, and urinary incontinence in the elderly, ventricular enlargement on neurological imaging, normal cerebrospinal fluid pressure, and improvement with shunt surgery [1]. It is subdivided into two subcategories, where in the first type, hydrocephalus develops after a known cause such as head trauma, subarachnoid hemorrhage, or stroke. In the second type, no known cause can be identified, known as idiopathic NPH (iNPH) [2]. Insufficiency fractures are caused by normal or physiological stress on weakened bone [3]. Older patients are at an increased risk of spontaneous insufficiency fractures due to associated conditions of osteopenia, osteoporosis, sarcopenia, and neuromotor degradation [4]. Fractures can occur spontaneously in this population during ambulation and transferring [3]. It is essential to prevent the occurrence of insufficiency fractures in the elderly population as it is closely associated with worsening daily activity levels, mortality, and increased medical costs [5,6]. In various population-based epidemiological studies across the globe, the incidence of NPH is estimated to range

from 0.3 to 3% among patients over 61 years of age [7]. Studies have previously shown that patients with iNPH may be susceptible to all fracture types due to falls [8].

We report this case to highlight a rare presentation of spontaneous insufficiency fracture in a patient with untreated iNPH. Although falls are a well-recognized cause of fractures in patients with iNPH, spontaneous insufficiency fractures without trauma are rarely reported. This case is unique because the fracture occurred in the absence of external injury in this patient who had been bed-bound for several years. The report underscores the interplay between immobility, metabolic bone disease, and fracture risk, and highlights the importance of vigilance for insufficiency fractures in cognitively impaired, immobile elderly patients, thereby contributing to clinical awareness and guiding preventive strategies in similar populations.

CASE REPORT

A 77-year-old gentleman presented to the outpatient department with a history of left leg pain associated with decreased movement in the same leg for 7 days. The patient's medical history listed hypertension, diabetes mellitus, and ischemic heart disease for the past 5 years,

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and he was compliant with home medications. He was a known smoker and alcoholic for the past 20 years. He had a history of smoking 8–9 cigarettes daily for 20 years and regular alcohol consumption (50–60 mL spirits/day) for 20 years. There was no history of fall or major trauma. He was bed-bound for the last 4 years due to NPH, which was diagnosed 4 years back, but he refused any form of treatment. He was admitted to the hospital for further evaluation and management.

On admission, the patient had a temperature of 37°C, pulse rate of 82/min, blood pressure of 128/76 mmHg, respiratory rate of 20/min, and oxygen saturation of 95% on room air. Clinical examination revealed generalized weakness, pain, and decreased movement of the left leg. No swelling or deformity was noted. There was no history of fever.

Routine investigations were sent, and an X-ray of the pelvis with both hips (anteroposterior view) was done, which revealed a displaced fracture of the proximal shaft of the left femur. X-ray of the femur (anteroposterior and left lateral view) showed a fracture of the left proximal femur (Fig. 1). No osteopenia was appreciated on the radiographs. The patient was asked again for any history of trivial trauma, but he could not recall any. As Vitamin D deficiency is highly prevalent in the Indian population, he was investigated for the same and found to have insufficient Vitamin D levels (28 ng/mL). He had low serum calcium levels (8.1 mg/dL) and increased parathyroid hormone levels (114 pg/mL). A bone density scan (dual-energy X-ray absorptiometry) was done to rule out osteoporosis and osteopenia, which showed a T score of -1.0 . Urea (51 mg/dL) and creatinine (1.6 mg/dL) values were slightly raised. A skeletal survey was done, and serum alkaline phosphatase levels were measured to be within normal range (70 mg/dL), thereby ruling out Paget's disease of the bone. Serum phosphate (2.9 mg/dL), C-reactive protein (2.4 mg/dL), and a complete blood count (hemoglobin – 9.2 g/dL, total leukocyte count – 10300 μ L, erythrocyte sedimentation rate – 26 mm in the 1st h) were done to rule out osteomyelitis. Serum protein electrophoresis was done to rule out any primary or metastatic bone malignancy, which showed hypoalbuminemia and the presence of M band (0.4 g/dL) in the beta-2 region. A bedside ultrasound of the whole abdomen was done, which showed Grade 1 fatty liver and raised cortical echogenicity in bilateral kidneys with maintained corticomedullary differentiation. A computed tomography scan of the brain was done, which showed features suspicious of NPH, mild diffuse cerebral atrophy, and chronic small vessel ischemic changes in bilateral periventricular white matter and bilateral centrum semiovale (Fig. 2). Family history of inherited bone disorders was ruled out. He had no history of long-term use of medications such as corticosteroids that could affect bone density. Elderly abuse as another differential for the unexplained proximal femur fracture was also considered and ruled out as a possible cause after a thorough physical examination.



Figure 1: X-ray of the left femur showing a fracture of the left proximal femur



Figure 2: Computed tomography scan of the brain showing features suggestive of normal pressure hydrocephalus

Our patient was followed up regularly in the outpatient department starting at 2 weeks post-surgery. The surgical wound had healed well with no signs of infection. He was followed up again at 6 weeks, and he was able to sit with support and initiate partial weight-bearing with assistance. Cognitive impairment related to iNPH persisted, but there was improvement in pain and mobility. He has been asked to follow up again after 3 months.

DISCUSSION

Insufficiency fractures or fragility fractures occur when normal or physiological muscular activity stresses a bone that is deficient in mineral or elastic resistance [9]. Reports on spontaneous long bone fractures in older immobile patients are limited [3]. One case series described six nursing home residents with a “spontaneous long bone fracture” [10]. A prospective study of 30 nursing homes in France reported “spontaneous long bone insufficiency fractures” occurred in 1% (n=55) over a 30-month period, where femoral fractures were associated with worse outcomes, with a 2-month mortality of 54% [11]. A previous observational study of 500 long-term care residents followed over 6 years reported a rate of 3.6% (n=18) for spontaneous insufficiency of long bone fractures, where the most common site for fractures was the femur,

followed by the humerus [12]. The authors observed that all fractures occurred near joint contractures during daily care procedures, without any external trauma or abuse [12].

The most common cause of insufficiency fractures is osteoporosis, although there are numerous other contributors, which include disorders affecting bone mineral homeostasis, bone remodeling, and collagen formation, medications, and local destruction of bone [13]. Our patient had a low calcium level with increased parathyroid hormone levels, along with a raised cortical echogenicity in bilateral kidneys, which could be indicative of an early stage of chronic kidney disease. Serum imbalances in calcium, Vitamin D, and parathyroid hormone levels can lead to alterations in bone morphology and have been found to have associations with adverse outcomes such as increased fracture risk and cardiovascular mortality.

Prolonged bed rest leads to disuse osteoporosis due to an increase in bone resorption and a decrease in bone formation [3]. A study done in 25 healthy volunteers showed bone mineral density reduced by 5% at 60 days with a corresponding increase in bone resorption markers and osteoclast number [14]. Muscle mass is lost quickly following immobility, with disuse atrophy occurring at a rate of 0.5–1% reduction in muscle mass per day, and muscle strength decreases by 50% over 3–5 weeks [15]. Our patient was bed-bound for the last 4 years due to iNPH. Long periods of immobility and bed rest negatively impact bone health.

Nutrition has a major role in bone health [3]. Adherence to calcium and Vitamin D supplementation is poor in the osteoporotic population [3]. Adequate dietary Vitamin D, calcium, and protein intake are essential for bone health and maintaining muscle mass [3]. Untreated osteoporosis will increase the risk of spontaneous insufficiency fractures [3]. Our patient may have been non-compliant with her supplemental home medications.

The treatment of choice for insufficiency fractures is conservative and consists mainly of immobilization of the affected extremity with a cast and analgesics [16]. Management of the underlying etiology is essential to prevent recurrence [16]. However, long bone fractures may add risk of deep vein thrombosis and pressure sores, and other complications related to prolonged immobilization. Hence, our patient was managed surgically with open reduction and internal fixation with metallic implants for early rehabilitation and mobilization.

Cognitive impairment secondary to NPH is a hallmark feature of the condition and often mimics other forms of dementia, which makes diagnosis challenging. NPH primarily affects the frontal lobes and subcortical structures, leading to impaired attention and concentration, slowed psychomotor speed, executive dysfunction (e.g., poor planning, problem solving, and decision making), and memory deficits [17]. Our patient was delirious to person and time, had intermittent mood

fluctuations, and was known to be abusive.

Insufficiency fractures may be difficult to diagnose due to the non-specific presentation of symptoms without a history of inciting incidents [18]. Physicians should include insufficiency fractures in their differential diagnosis for patients who present with localized pain without a history of trauma [18].

CONCLUSION

This case underscores the need for heightened clinical vigilance for insufficiency fractures in cognitively impaired, immobile elderly patients and highlights the importance of proactive nutritional and metabolic bone health management in those with iNPH.

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