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Case Report

A 15-Year-Old Boy with Multiple Fractures by Low Energy Trauma

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Abstract

Multiple major bone fractures in children could be a result of major trauma, primary or secondary bone disease. Children with underline end stage renal disease (ESRD) are prone to the development in renal osteodystrophy and result in fractures in the long run if medical care is not sufficient. In countries with good healthcare, children with underline ESRD will receive adequate medical treatment before the development of severe osteoporosis. In countries with poor healthcare, these children seldom live long enough to develop fractures. We describe a 15-year-old boy with multiple bilateral femoral fractures who was finally diagnosed with osteitis fibrosa cystica. This kind of case is rare and the functional outcome is satisfactory under multidisciplinary collaborative treatment. Orthopedic surgeons should maintain high clinical suspicion in face of cases with multiple fractures resulting from a low trauma injury.

CASE PRESENTATION

Multiple major bone fractures in children could be a result of major trauma, primary bone disease, or secondary bone disease. Children with underline end stage renal disease (ESRD) are prone to develop renal osteodystrophy and result in fractures in the long run due to poor bone quality if the medical care is not sufficient. In countries with good healthcare, children with underline ESRD will receive adequate medical treatment before the development of severe osteoporosis. In countries with poor healthcare, these children seldom live long enough to develop fractures. We describe a 15-year-old boy with multiple bilateral femoral fractures who was finally diagnosed as a case of osteitis fibrosa cystica.

A 15-year-old boy was diagnosed with congenital hypoplasia of both kidneys with chronic kidney disease (CKD) under continuous ambulatory peritoneal dialysis (CAPD) since one month old. After one year of peritoneal dialysis, his physician suggested stopping CAPD and follow up at outpatient department (OPD) with renal echo for a while. He did not receive treatment for 15 years thereafter. The boy has been fine despite being thinner and shorter compared to his classmates. He denied history of any previous fracture. On March 3rd, 2012, he suffered from syncope lasting for one minute when he was using computer. Loss of consciousness with bilateral upper limbs flexion and bilateral lower limbs extension were noted when he fell down. Afterwards, painful lower limbs developed and it was so severe that he could not walk anymore. He was sent to our emergent department (ED) immediately. At ED, his consciousness was clear and he could talk without difficulty. However, he was only 140 centimeters (4 feet 7.1 inches) high and weighed only 40 kilograms (88 pounds). Initial lab data showed anemia (hemoglobin: 9.5mg/dl), renal failure (blood urea nitrogen (BUN): 96mg/dl, creatinine: 12.7mg/dl), hypokalemia (potassium (K): 2.8 meq/L), hypocalcemia (ionized calcium (iCa): 2.44mg/dl), and severe metabolic acidosis (pH: 7.247, pCO_2: 40.4mmHg, HCO_3: 17.6mmol/L, sodium: 134 meq/L, chloride: 103 meq/L). Electrocardiogram (ECG) revealed

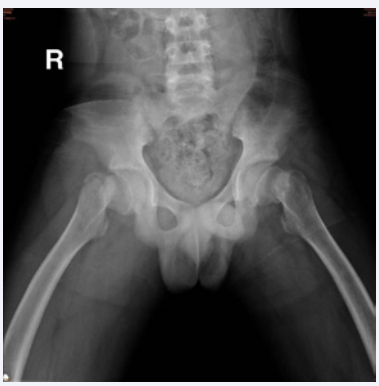

Figure 1 Bilateral femoral neck fracture, Garden type III.

prolonged QT interval. Bilateral knee and pelvic X-ray showed bilateral femoral neck fracture (Figure 1), left distal femoral fracture, right proximal tibial fracture, and thinned cortical bones (Figure 2). Emergent hemodialysis was arranged on the same day. Close vital sign monitoring, strict bed rest and adequate pain control were ordered.

After his condition stabilized, operation was performed under spinal anesthesia. Fractures were reduced with traction on fracture table. Two Knowles pins were inserted into femoral head and through neck on each side under C-arm guidance (Figure 3). The operation procedure was smooth and uneventful. Postoperative condition was stable and the patient was transferred to nephrology ward for further survey.

At nephrology ward, lab data further revealed hyperphosphatemia (phosphate: 5.6mg/dl), hypocalcaemia (iCa: 3.03mg/dl), increased alkaline phosphatase (ALK-P: 261U/L) and intact parathyroid hormone (iPTH: 425 mg/dl). High turnover osteodystrophy (osteitis fibrosa cystica) was suspected.[1] Serum aluminum level was normal (3.0ug/L) which ruled out osteomalacia. Serum 25-hydroxyvitamin D was normal (10.6ng/ml) but serum 1,25-dihydroxyvitamin D was low (11.2 pg/ml). Dual enery X-ray absorptiometry (DXA) showed a Z-score of -2.8.

Under OPD follow up, the bone healed well with solid union (Figure 4) and Knowles pins were removed in July, 2012. The boy walked and ran well at school.

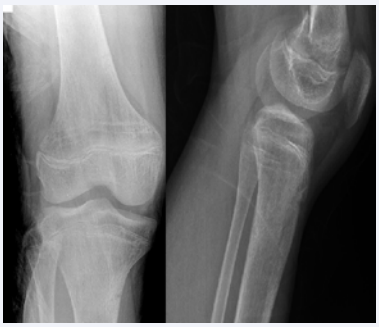

Figure 2 Left distal femoral fracture, right proximal tibial fracture, and thinned cortical bones.

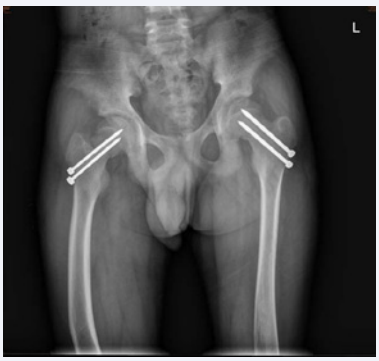

Figure 3 Precise anatomical reduction, rigid internal fixation with Knowles pins.

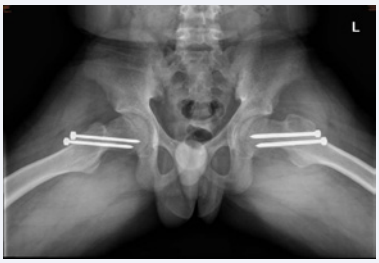

Figure 4 Primary bone healing with solid union, 4 months after operation.

DISCUSSION

Simply falling down from a chair is a low energy trauma and hence a rare cause of bilateral femoral neck fractures [2]. Seizure related bilateral femoral neck fractures have been reported, but most of the patients were adults [2]. An eight-year-old boy with bilateral femoral neck fracture had been reported, in which the boy fell from a tree as high as 25 feet [2] A 27-year-old Asian male suffering from bilateral sub trochanteric femoral fracture without any fall or trauma event was also reported, and it was finally proven to be a genetic problem in bone morphogenetic protein-7 [3]. Another 34-year-old female at 22 weeks of pregnancy experienced both hip intra capsular femoral neck fracture, which was pregnancy related [4]. Our case described a boy with underline osteitis fibrosa cystica secondary to congenital hypoplasia of both kidneys who suffered from bilateral femoral neck, left distal femoral, and right proximal tibial fractures. Such case has never been described in previous literature since children with ESRD seldom survive in undeveloped countries whereas children born in developed countries usually enjoy good medical care which prevented them from developing severe renal osteodystrophy.

Renal osteodystrophy can be classified into high and low turnover bone lesions. High turnover bone lesion includes osteitis fibrosa cystica, while low turnover bone lesion includes adynamic bone disease and osteomalacia.[5] Bone biopsy is the gold standard for distinguishing specific type of renal osteodystrophy, while determining high or low bone turnover is much more important than identifying specific forms of renal osteodystrophy in most clinical settings [5] Diagnosis of high turnover bone disease can be made with lab data [1]. Lab data of cases of osteitis fibrosa cystica often revealed high serum phosphate, low serum calcium level, high iPTH, and high ALK-P, whereas lab data of cases of renal phosphate wasting osteomalacia often showed low serum phosphate, normal serum calcium, and normal 25-hydroxyvitamin D [6].

In this case, lab data showed high serum phosphate, low serum calcium level, high iPTH, and high ALK-P. Based on these findings, we diagnosed the patient with high turnover bone disease. The lower the calcium and higher the PTH levels are, the more likely high turnover lesions are. A serum PTH higher than 200 pg/ml and calcium lower than 10 mg/dl has 85% sensitivity and 100% specificity for high-turnover bone disease [7]

To make a diagnosis of osteoporosis in child, we need both bone mineral density and a history of clinically significant fracture

(lower extremities lone bone fracture, vertebral compression fracture, or two long bone fractures of the upper limbs) [8]. Low bone mineral content in child is defined as Z-score lower than 2.0. In DXA of children, posterior-anterior spine and subtotal (total body less head) views are recommended. Time interval for repeating a bone density measurement is 6 months [8].

Other clinical considerations for osteitis fibrosa cystica include prompt correction of metabolic acidosis and limitation of phosphate intake [9]. It is also recommended that operation should be done within 48 hours from the fracture occurrence [10]. We conformed to these recommendations in this case.

The incidence of ESRD in children under the age of 15 ranges from 5 to 10 cases per million children [11]. Merely 27.8% of children with underline ESRD develop renal osteodystrophy with radiographic features [12]. Only a few pediatric centers worldwide are familiar with bone biopsy in children, and only 5 among 21 children undergoing biopsy were diagnosed as osteitis fibrosa cystic [13]. Osteitis fibrosa cystica is rare in developed countries and the functional outcome is satisfactory after surgery. It can never be overemphasized that orthopedic surgeons should maintain a high clinical suspicion in face of cases with multiple fractures resulting from a low trauma injury. Also, multidisciplinary collaboration is important for a comprehensive care delivery. To prevent future fractures, serum PTH level should be kept at around 150 pg/mL and serum phosphate level should be closely monitored. Phosphate intake should be strictly limited and the dialysis efficacy must be evaluated periodically [14,15].

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