Case Report

Fracture Cascade in Patients with End-Stage Renal Disease: Complications and Outcome

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Abstract

We report a 68-year-old end-stage renal disease female patient on dialysis for 15 years. She sustained consecutive fractures starting with left-sided femoral neck fracture, followed 16 months later by a right-sided one. On her recovery from her right hip injury she sustained a stress type subtrochanteric fracture at the entry site of the fixation implants and an ipsilateral humeral shaft fracture. Cementless total hip replacement was done for the left femoral neck, and osteosynthesis was done for her undisplaced right femoral neck fracture. Revision fixation was done for her right subtrochanteric fracture with a long Gamma nail that was statically locked. The humeral fracture was fixed with an interlocking nail in a closed manner. This case highlights the fact that sequential hip fractures is an ominous event which is likely to be followed by a quick cascade of bone injuries with trivial trauma and a high rate of unexpected complications. Our treatment approach is explained here, stressing the unexpected complications and challenges met.

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Introduction

The incidence of pathological fractures is rising sharply throughout the broad spectrum of chronic kidney disease, with roughly reported a fourfold surge of hip fractures in end-stage renal disease (ESRD) in comparison to non-uremic patients [1]. Also concerning is the associated excess morbidity burden and mortality related to hip fractures in ESRD, with 1-year mortality approximately twice that of the non-uremic patients [2]. Even though such a combination of hip fractures and ESRD is obviously grave, there is still surprising paucity within the information concerning multiple aspects of its management [3].

In our case, we had a relatively unforeseen presentation and even more unexpected events during the progress of the patient's condition. Hence, we report this case of a 68-year-old female, fully ambulant (independent community ambulatory, Koval grade 1) [4], on dialysis for 15 years. She sustained bilateral fracture of the femoral neck within a 16-month interval. Her condition was further complicated consequently by subtrochanteric stress fracture of the femur and fracture of the humerus. To the best of our knowledge, most similar reported cases focused on either single or bilateral hip injuries, without addressing the subsequent events that follow [1, 5, 6]. Our challenges and management will be discussed here in a timely manner from our point of view.

Case Report

The patient was a 68-year-old woman with a record of ESRD for the previous 15 years, on haemodialysis three times weekly. Her medical history also included hepatitis C viral infection, hypertension, obstructive and severe restrictive lung disease, and she was on thyroid hormone replacement therapy.

The patient first presented early in March 2013 with progressive left hip pain over 1 week and inability to bear weight. She indicated no history of trauma whatsoever, and she noted that she was fully weight bearing, without any assistive device before that. Immediate hip plain film examination did not show any radiological finding suggestive of hip fracture.

Due to our heightened suspicion of an occult hip fracture in this group of patients, a second-line imaging was done 1 week later, which included MRI and CT scan. This revealed a displaced fracture of the femoral neck, not only evident in MRI, but also in the plain X-rays, classified as Garden type III.

Considering the fact that fracture displacement and the patient's age precluded the internal fixation option, we were left with the other option of arthroplasty. After considering the higher complication rates of revision surgery and the relatively high-end prefracture functional status of this particular patient, we decided to go with total hip arthroplasty in favour of hemiarthroplasty. Also, considering the relatively adequate bone stock, the need of short operative duration, fewer infection rates, and to minimize the cardiopulmonary risks of cementing techniques, we favoured the cementless option, provided that her operative findings would permit so.

In spite of the anaesthetic advance in the management of this group of patients, it was obviously challenging, and another 1 week was needed to stabilize the patient preoperatively. Finally, we proceeded with left cementless total hip replacement as planned formerly, with stainless steel wiring for reattaching the greater trochanter that was detached inadvertently intraoperatively. Her postoperative course was uneventful and she was allowed partial weight

bearing about 1 week postoperatively with a walker frame (Fig. 1a shows a radiograph 7 weeks postoperatively).

On subsequent follow-up visits the patient was fully weight bearing (i.e., Kaval grade 2 14 weeks postoperatively). Her overall satisfactory recovery was indistinct from her normal peers with the same injury, with only one evident complication of cerclage breakage, which fortunately did not affect her overall mobility capability.

In July 2014, roughly 16 months after the index left hip fracture incidence, she presented once more to us with progressive hip pain over 2 weeks, with no history of trauma, except for the problem being on the right side this time. Subsequently, an MRI was done, but this time it was done urgently on the same day, but it did not reveal any fracture. However, considering the persistence of her complaint, we decided to give her the benefit of the doubt and a series of radiographic examinations were done weekly until a crack in the superior cortex finally appeared in her CT scan 3 weeks later, denoting a Garden type I right femoral neck fracture (Fig. 1b).

Owing to the inevitable necessity of getting to the dialysis unit while preparing her for surgery, she reported severe pain of her right arm while her daughter was pulling her out of bed. Lucky enough, she had her arteriovenous dialysis shunt on the left arm. Her X-rays showed spiral wedge fracture of the proximal humeral metaphysis (Fig. 1c).

In contrast to the left hip, the right-sided fracture was incomplete and non-displaced. Hence, we proceeded with osteosynthesis 6 days after the diagnosis had been established by CT scan by means of three cancellous, partially threaded 7-mm cannulated screws. We took all the necessary steps and measures to minimize the risk of implant failure and/or non-union, which included reaching the subcortical bone of the femoral head to get a good grip in the bone, using washers to minimize pressure on the cortex, and inserting them carefully in a parallel manner to allow controlled fracture impaction (Fig. 1d). The humeral fracture was fixed with a statically locked interlocking nail in a closed manner (Fig. 1e). The patients remained wheelchair bound for the first 3 months postoperatively, then she was allowed to walk with a frame (i.e., Koval grade 3).

Over 4 months postoperatively in her subsequent follow-up visits, clinical evaluation of her fractures was assuring of a satisfactory outcome. Right hip plain film examination showed obvious neck shortening and backing out of screws, however the neck fracture seemed to remain impacted in both the anteroposterior and lateral views, without any evidence of fixation failure clinically or radiologically.

Regrettably, 6 weeks later, our patient presented back for the third time with right hip pain, totally unable to bear weight even on her walker, after a trivial twisting injury while rising up from her chair. Right hip plain film examination revealed a subtrochanteric fracture of the femur distal to the last cannulated screw, with apparently united fracture at the neck level. Clearly, the new fracture pattern was consistent with stress type mechanism induced by the cortical holes of the cannulated hip screws (Fig. 2a).

One week later, fixation revision was done. Initially, the hip screws were removed, the femoral neck fracture was checked under the image to verify the presumptive diagnosis, then osteosynthesis was done using a long Gamma nail with distal two locking screws (Fig. 2b, c). The patient was pleased with the degree of pain relief postoperatively and was bed bound for 3 weeks, then allowed wheelchair mobility for another 3 weeks. She was back mobilizing with a frame 2 months postoperatively.

Four months after her last surgery she reported right knee pain limiting her knee bending and weight bearing. Her check X-rays showed the distal nail end impinging and penetrating the anterior femoral cortex (Fig. 2d). Comparing her immediate postoperative X-rays with the

last ones confirmed that this mishap most likely developed postoperatively. Considering the acceptable functional outcome we agreed to carry on as she tolerates. Her regular follow-ups were satisfactory for a further 3 months when she eventually was admitted to intensive care in February 2016 for her chest restrictive lung functions. Unfortunately, her general condition deteriorated; she went into cardiopulmonary failure and passed away.

Discussion

The usual questions we always face whenever we deal with this misfortunate group are whether surgery is justifiable in face of the highly documented mortality and morbidity rates and whether we can follow the classic recommendations adopted for their normal counterparts.

Considering the fact that the bone pathology does not prevent the femoral neck fracture from healing, internal fixation is a widely accepted option by many of the authors in non-displaced neck fractures [7]. However, the compromised bone quality frequently leads to failed osteosynthesis, and that is why the sentiment of many authors is gradually shifting in favour of arthroplasty in comparison to internal fixation [8]. Nevertheless, the overall complications of arthroplasty are definitely much higher, and long-term results are guarded, which is leading to the reality that there is still no gold standard in treating non-displaced femoral neck in ESRD [9].

Recapitulating the sequence of events in our patient, we learned that femoral neck fractures have a brief prodromal-like stage uniquely expressed by the patient even before it becomes manifest on radiographic imaging. Despite the apparent success of the first surgery, it ushered a cascade of fractures that had a cumulative effect on the final outcome.

In this case, the decision making was influenced by the prefracture functional status, the need to maintain the patient in a relatively active condition, and lastly the need for safe pain alleviation and easy nursing purposes. Acknowledging the inevitable grim outcome, we customized our surgical interventions to provide the minimal objectives with the least surgical risks. The surgical plan in this critical group should be designed on an individual basis to provide the vital and basic demands.

Statement of Ethics

The authors have no ethical conflicts to disclose. Informed consent was obtained from the patient and her identity is kept anonymous.

Disclosure Statement

The authors have no conflicts of interest to declare. No grant was received from any funding agency.

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Fig. 1. **a** Radiograph of left hip 7 weeks postoperatively. **b** Follow-up CT scan 3 weeks later denoting a Garden type I right femoral neck fracture. **c** Radiograph showing spiral wedge fracture of the proximal humeral metaphysis. **d, e** Initial postoperative radiographs showing osteosynthesis of both fractures, the right hip, and the right humerus.

Fig. 2. **a** Right subtrochanteric fracture of the femur distal to the last cannulated screw 24 weeks after fixation. **b, c** Immediate postoperative radiographs showing fixation of the right subtrochanteric fracture with a long Gamma nail. **d** Radiographs 4 months postoperatively were evident of the distal nail end impinging and penetrating the right anterior femoral cortex.