



Simultaneous Bilateral Femoral Neck Fracture Treated with Single-stage Hemiarthroplasty in a Patient with Renal Osteodystrophy

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Case Study

ABSTRACT

Simultaneous bilateral femoral neck fracture is a rare occurrence and provides interesting challenge in its management, especially in high-risk patients. We report a case of a 71 year-old gentleman, with multiple co-morbidities including renal osteodystrophy, who presented with bilateral hip pain and inability to bear weight after a trivial fall on his way to the haemodialysis centre. Subsequent radio-imaging revealed bilateral femoral neck fracture, with underlying severely osteopenic bone. Following multidisciplinary assessment, a single-stage cemented bipolar hip hemiarthroplasty was done for the patient with no major intra- and post-operative complication. He recovered well after the surgery with good clinical and radiographic outcome. Bilateral hip cemented bipolar hemiarthroplasty done in a single setting is a viable option for treatment of the rare bilateral femoral neck fracture in a renal osteodystrophy patient who has multiple co-morbidities. The success of the surgery is depending on careful evaluation of all aspects involving the patient and the planned surgery, in order to reduce and eliminate the chance for morbidity or mortality.

Keywords: *Femoral neck fracture; hemiarthroplasty; renal osteodystrophy.*

1. INTRODUCTION

As one of the rarest traumatic injuries, an encounter with simultaneous bilateral femoral neck fracture provides an interesting challenge in decision-making in regards to the overall management. The approach to the patient with bilateral femoral neck fracture, especially in regards to the surgical intervention, need to be more holistic to reduce the burden of morbidity and mortality.

Renal osteodystrophy has been proven as one of the causative factors that predispose to pathological fracture of femoral neck [1]. The spectrum of osteoporotic bone presence in patients with renal osteodystrophy provides a challenge especially in surgical technique and choice of implant in managing such case. Iatrogenic femoral shaft fracture during hemiarthroplasty, non-union after internal fixation, prolonged time to achieve bony consolidation, implant loosening and periprosthetic fracture have all been associated with the poor bone mineral density in renal osteodystrophy [1]. Compounded by presence of other co-morbidities, multiple aspects need to be addressed whether in the preoperative, intraoperative or postoperative stage.

We describe an interesting case of an elderly patient with renal osteodystrophy and other co-morbidities, whom after a trivial fall sustained bilateral femoral neck fracture, and was treated with bilateral hip bipolar hemiarthroplasty done in a single setting. The challenges and the multi-facet approach to this case provide an enlightening experience and interesting learning curve.

2. CASE REPORT

A 71 year-old gentleman presented to the emergency department following a trivial fall. He has underlying end stage renal failure, for which he undergoes regular haemodialysis sessions. His other co-morbidities include ischaemic heart disease with recent non-ST elevation myocardial infarction (NSTEMI) in 2012 and atrial fibrillation, diabetes, hypertension and osteoporosis. Pre-fall, he was well-ambulatory with a walking stick.

Following the fall, he was complaining of severe pain over both hips, and inability to stand and weight-bear. He denied having pre-existing hip pain, although he acknowledged of having episodic "bony pain" over both the upper and

lower limbs, starting about 6 months after the he began to undergo haemodialysis. He was previously well-ambulatory with the usage of walking stick.

Physical examination at the emergency department revealed tenderness over both hip joints, which restricted the range of motions. There were also excessive bruises at the lateral aspect of the left hip, but there was no apparent shortening of both lower limbs. The neurological and vascular examination revealed no abnormal findings.

The radiographs taken revealed a bilateral transcervical femoral neck fracture, which were classified according to Garden classification as type IV. The bone was generally osteopenic, with the primary compressive trabeculae were markedly reduced and tensile trabecular line not visible (Singh Index grade 1).

Further blood investigations revealed that the patient had normochromic normocytic anaemia (haemoglobin (Hb) level of 7.8 g/dL) and hypocalcaemia (corrected serum calcium level of 2.06 mmol/L). As the patient missed his dialysis session scheduled for him on the day of admission, the renal profile was haywire (urea 15.1 mmol/L, creatinine 722 umol/L, sodium 125 mmol/L and potassium 5.5 mmol/L). The patient also has high level of INR (2.79), which was directly contributed by the warfarin he took for his atrial fibrillation. Bridging therapy using low-molecular weight heparin (enoxaparin) was thereafter started. The patient was also transfused with 2 pints of packed cells to replenish his haemoglobin level.

The patient was further referred to a cardiologist to assess the cardiac risk should he undergoes a surgery. An echocardiogram later revealed an ejection fraction of 32% with mild tricuspid regurgitation and minimal regional wall motion abnormalities detected at the left ventricle. The patient was eventually stratified into possibility of having moderate-to-high cardiac risk for non-cardiac surgery. His American Society of Anaesthesiologists (ASA) gradation was classified as ASA class 4.

The decision for surgical intervention was achieved after discussion with the patient and family members, balancing between their hope and expectations with the options of surgical management available. Due to his co-morbidities, the ideal surgery must be able to

address both hip injuries in the same setting, with minimal duration of surgery, in order to minimise both the risks of surgery itself and the risks of anaesthesia.

Following this, the decision for surgical intervention by performing bilateral hip hemiarthroplasty in a single setting was made. The implant chosen was cemented bipolar hemiarthroplasty implant, in view of the osteopenic bone. The proximal femur was classified as type B according to Dorr classification [2].

Thereafter, the patient underwent bilateral hip bipolar hemiarthroplasty a week after the fall. The patient was put under general anaesthesia and positioned in supine position. The approach to the hip chosen was anterior approach (true Smith-Petersen approach). The left hip was chosen to be operated on first, and it was an uneventful procedure with no intraoperative complication. However, due to iatrogenic avulsion of the greater trochanter during the procedure on the right hip, a tension band wiring was done, supplemented with a cerclage wire. The total duration of the surgery lasted about 132 minutes, and the estimated blood loss was 750mls.

Post-operatively the patient was transferred to the intensive care unit (ICU) for observation. The patient was subsequently transfused with 2 pints of packed cells, after post-operative Hb was shown to be at 8.5g/dL. The patient started to mobilise using wheelchair at day 3 after the surgery. He was advised not for weight-bearing yet for the first 6-8 weeks in view of the avulsion fracture of the greater trochanter of right femur and the high risk of periprosthetic fracture due to the pre-existing osteopenia.

At the 8th week post-surgery, the patient started to mobilise with walking frame and able to fully weight-bear. At 4 months after the surgery, the patient was able to use a quadripod for ambulation, and even ambulating without any support for distance less than 10 metres. There was noticeable Trendelenburg gait thus he was advised to use support for safety purposes and fall precaution. The patient was ambulating well and pain-free during the latest follow up at 6 months after the surgery.

3. DISCUSSION

Simultaneous, bilateral femoral neck fracture is among one of the rarest injuries encountered.

Within the literature, three major risk factors have been identified – patients with renal failure, seizures or epilepsies, and high energy trauma [1]. However, there were also reported cases associated with electrical injury [3], injury sustained during electroconvulsive therapy [4] and in patients with other bone diseases such as osteomalacia [1].

Renal osteodystrophy is a known cause for multiple skeletal abnormalities, and the occurrence of fractures in patients with renal osteodystrophy have been well-established [5,6,7]. In patients with renal failure, filtration failure at glomerulus leads to retention of phosphate. With 1,25-dihydroxycholecalciferol decreasing combined with increase phosphate in cytoplasmic matrix of gastrointestinal cell, the absorption of calcium will significantly decrease [8,9]. This leads to profound hypocalcaemia, which in turn causes secondary hyperparathyroidism. The metabolic effect would be increase in bone resorption. Increased cytokines (including IL-1, IL-6, IL-11 and α -TNF) that causes bone microarchitectural disruption was also being proposed as the cause [9].

Our case highlights the unusual choice of hemiarthroplasty done in a single setting to treat both hip fractures. Every aspect of the surgery was considered to minimise risks of doing surgery in patient with renal osteodystrophy and his many co-morbidities. These include the type of anaesthesia, the positioning during surgery, the surgical approaches chosen, the type of implant used, the anticipated blood loss and duration of surgery, and the predicted post-operative physiotherapy regime.

The positioning of choice in this patient was supine position, to relatively reduce the risk of iatrogenic fractures and injury associated during positioning, especially considering the osteopenic bone condition. The choice for anterior (true Smith-Petersen) approach were made concurrent to this factor. Should a lateral approach was chosen, the patient needs to be positioned in such way that one side of the fractured hip would be on top of the other. With the patient in supine position, cleaning and draping was done simultaneously without the need to re-drape or re-position the patient. This had saved some valuable time during which the patient was under anaesthesia. Furthermore, the outcome of both the anterior Smith-Petersen and lateral Hardinge approach was reported to be comparably similar [10]. The true Smith-Petersen

approach was chosen over modified Watson-Jones approach due to surgeon's familiarity with the former.

The bigger aspect to be considered in relation of the surgery was the options between hemiarthroplasty and total hip arthroplasty. Systemic reviews comparing between these 2 groups for treatment of femoral neck fracture has

been reported before – with superior result in terms of patient-based outcomes (eg Harris hip score) and lower re-operative rate favouring the total hip arthroplasty group [11,12,13]. These reviews also found out that there were no significant differences in terms of mortality and post-operative infection between the two groups. The hemiarthroplasty group was also shown to have lower dislocation rate [11,12].



Fig. 1. Anteroposterior (AP view) of pelvis radiograph showing displaced bilateral neck of femur fractures with disruption of both Shenton's lines. The bone generally looks osteopenic, although the proximal femur can be classified as type B according to Dorr's classification



Fig. 2. The lateral views of both hip joints taken after the trauma, emphasising on the severity of the osteopenia with the trabeculae lines hardly identified



Fig. 3. Post-operative anteroposterior view of the pelvis

Both cemented implants were well-fixed with almost similar vertical and medial offset. Note the right hip the tension band wiring was used to fix the iatrogenic greater trochanter avulsion, supplemented with a cerclage wire at proximal femur

However, it is worth to highlight that these reviews were mainly based on fit and healthy elderly patients [11]. As the patient was stratified to have moderate-to-high cardiac risk during the surgery because of his co-morbidities, minimising blood loss and duration of surgery became among the priorities. Increased blood loss may lead to anaemia-induced cardiac ischaemia, whereas the longer the duration of surgery, inevitably the longer the patient will be placed under anaesthesia. Studies have shown that blood loss is increased and longer duration of surgery taken place in the total hip arthroplasty group, as compared to bipolar hemiarthroplasty [14,15]. Due to these, and in addition of higher rate of dislocations, in patients aged ≥ 70 years with a femoral neck fracture in the absence of advanced radiological osteoarthritis or rheumatoid arthritis of the hip, Van den Bekerom et al do not recommend total hip arthroplasty as the treatment of choice [15]. Furthermore, isolated case reports have shown that bilateral bipolar hemiarthroplasty is a viable option for treatment of bilateral femoral neck fracture, whether done in a single stage or 2 separate surgeries [16,17,18].

As the choice of bipolar hemiarthroplasty was favoured over total hip arthroplasty, the type of implant, whether cemented or uncemented, was also weighed upon. The obvious factor of severe osteoporosis (although the proximal femur being classified as Dorr type B) heavily pointed towards the choice of cemented implant. However, due to his co-morbidities, the possibility of bone cement implantation syndrome (BCIS) was never discounted for. As BCIS may lead to unwanted complications, including hypotension and cardiac arrhythmias (eventually cardiac arrest) [19], the insertion of cement during the surgery was done carefully, with the attending anaesthesiologist repeatedly informed prior to the insertion and patient's haemodynamic status continuously monitored.

Post-operatively, the choice of cemented bipolar hemiarthroplasty, especially with the additional iatrogenic avulsion fracture of the greater trochanter, had restricted the ability of the patient to weight-bear immediately after the surgery. However, this was not a great hindrance to recovery as the patient eventually returned to his

pre-fall ambulatory status, by mobilising with the use of walking stick.

4. CONCLUSION

In conclusion, bilateral cemented bipolar hemiarthroplasty done in a single setting is a viable option for treatment of the rare bilateral femoral neck fracture in a renal osteodystrophy patient who has multiple co-morbidities. The success of the surgery is depending on careful evaluation of all aspects involving the patient and the planned surgery, in order to reduce and eliminate the chance for morbidity or mortality.

CONSENT

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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