# Segmental Fracture Of A Cemented Femoral Stem - A Case Report And Review Of Litrature

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**Citation**

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**Abstract**

We report an unusual case of segmental fracture of cemented femoral component of bipolar hemiarthroplasty. To our knowledge, this is first case with an incomplete fracture distally while the proximal fracture was complete and displaced. These fractures occurred 68 and 104 mm from the tip of the stem. The distal incomplete fracture started on the lateral side which is the side of maximum tensile forces. Though, this fracture was incomplete, it caused a 5o varus deformation of the stem leading to increased cantilever forces in the proximal part. Though, the use of cemented femoral components is on decline, it is wise to be aware of such rare complications, as in developing countries like ours they are still used widely.

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## INTRODUCTION

Femoral stem fracture is a known complication of hip arthroplasty. However, segmental fracture of the cemented femoral stem is very rare. We are here presenting an interesting case of segmental failure of a femoral stem in a case of bipolar hemi arthroplasty, and review of literature regarding segmental fracture of a cemented femoral stem. To our knowledge, this is first case with a distal incomplete and proximal complete fracture. We here propose the possible mechanism of such failure.

## CASE REPORT

A 55 year old house wife presented to us with severe pain left thigh and difficulty in weight bearing for 3-4 weeks before presentation. She had undergone a bipolar hemi arthroplasty on the same side for fracture neck of femur 4.5 years back at some other institute. 8 months before this episode, the patient had similar episode of pain and was relieved on bed rest and analgesics for 2 weeks. There was no history of fever either at that time or this time. During this mean time she was apparently asymptomatic and was carrying out her daily routine activities. On general examination the patient is of moderate built. Her height was 155 cm and weighed 54 kgs (BMI – 22.5). Local examination revealed a posterior lateral scar of 15 cm and the local area was non tender and there was no local rise of temperature. Radiographs of the hip with femur showed an obvious displaced fracture of the cemented femoral stem at the junction of proximal 1/3$^{rd}$ and distal 2/3$^{rd}$ part.

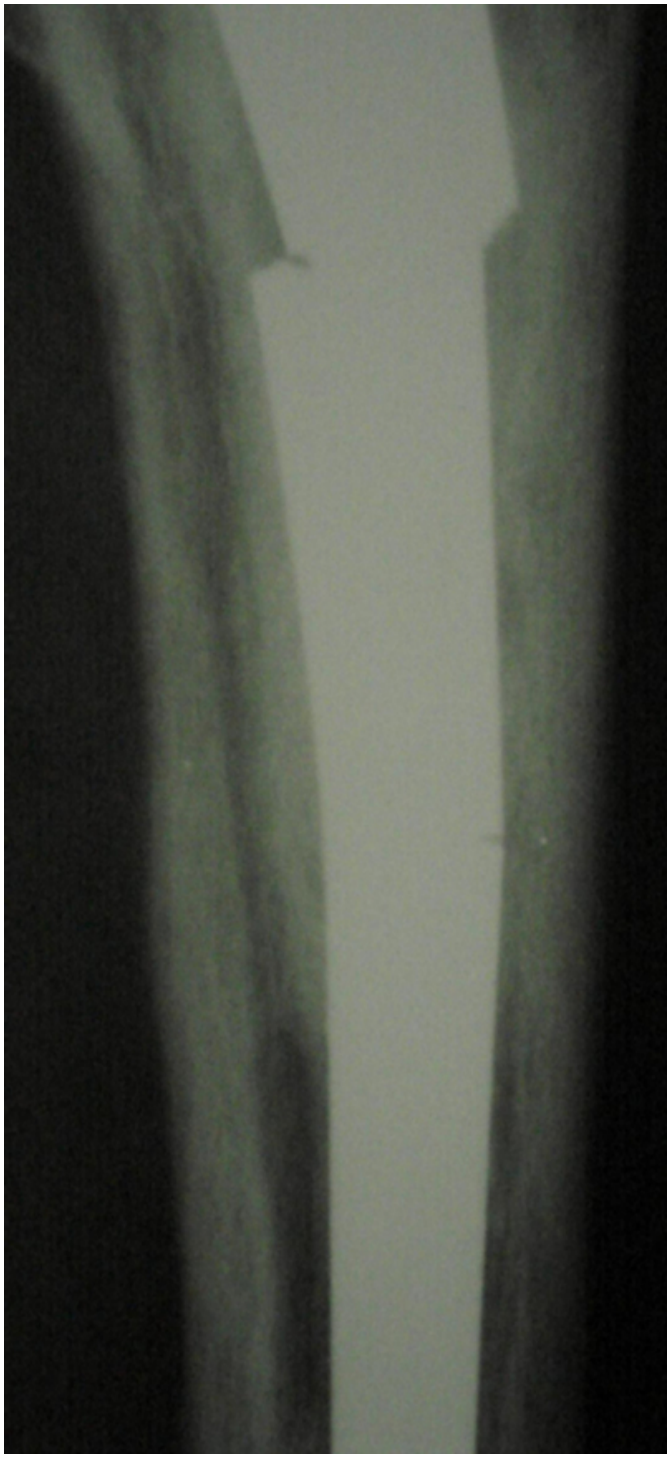
**Figure 1**

Figure 1: Pre operative X-ray AP view of left hip showing a fracture of the cemented femoral component of bipolar prosthesis.

However, on careful examination we found an incomplete fracture of the stem distal to the proximal displaced fracture starting on the lateral side.

**Figure 2**

Figure 2: Magnified view of the same X-ray as shown in fig.1 showing a second fracture which is incomplete and is starting on the lateral side distal to the first fracture.



Revision surgery was planned. After counseling the patient, due to financial constraints, a cemented total hip arthroplasty was done. Intra operatively we found that the distal stem was well fixed and hence we made a distal window to remove the stem. A cemented total hip arthroplasty was done with a

long femoral stem (INOR surgicals, India) and the patient had uneventful post operative period.

## DISCUSSION

Fracture of the cemented femoral stem is a well known complication of hip arthroplasty. Charnley reported an incidence of 0.23% of femoral stem fracture in low friction arthroplasty [1].

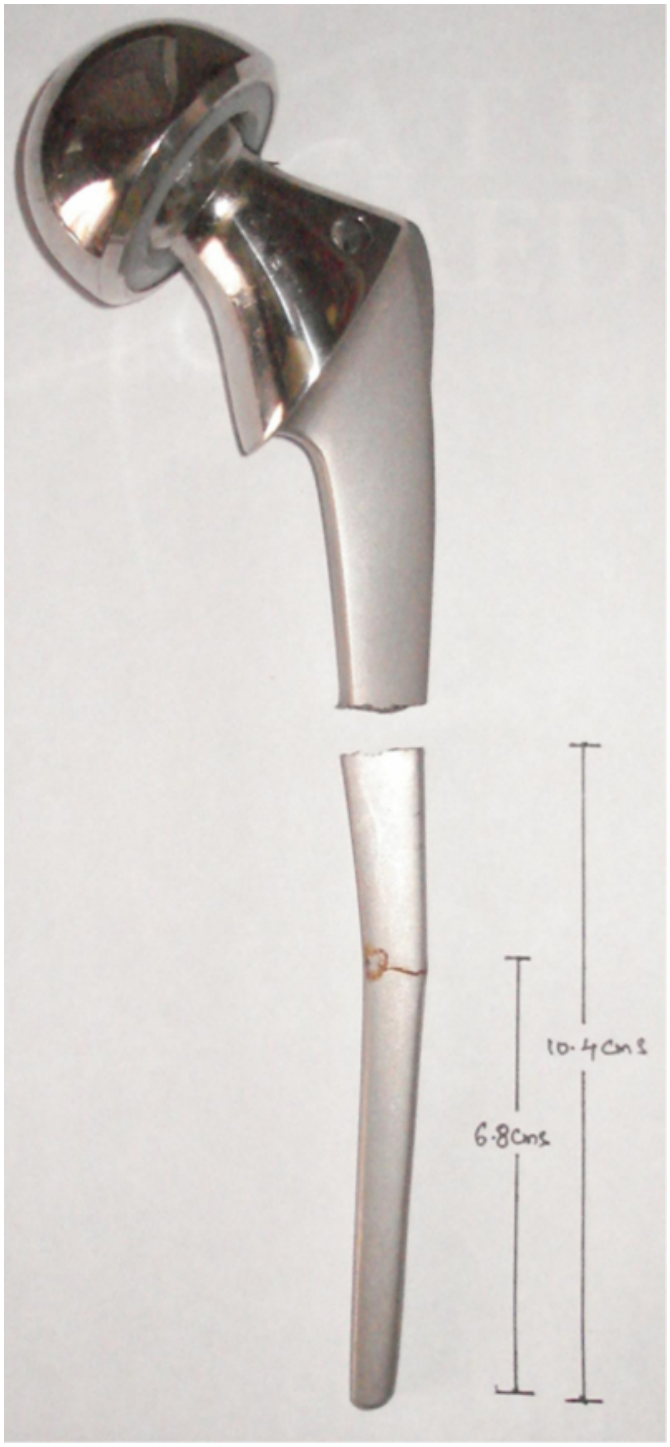
Various factors associated with fracture of cemented femoral stem are excessive weight, high physical activity, long necked prosthesis, varus position of stem, metallurgical defects and scoring of the stem by a drill bit for wire fixation. 316 L stainless steel stems were associated with high incidence of stem fractures, and expenimental studies on the fatigue strength of this alloy have indicated a direct relationship to grain size [2]. The most common cause of stem failure is considered to be loss of support by cement and bone in the proximal third, with the stem subject to cantilever forces that fatigue the metal. These cantilever forces are considered to be increased in varus position of the stem. The antero-lateral side of the stem is considered to be site with maximum tensile stress and thus most of the times the fracture line initiates on the antero-lateral surface of the stem.

Inspite of extensive search of literature, we found only 3 case reports of segmental fracture of cemented femoral stem [345]. In all the 3 cases it was cemented femoral stem of a total hip arthroplasty. And our case differed from the rest of the three, in the fact, that the distal fracture was incomplete, while in other reports it was proximal fracture if at all that was incomplete. Jarvi k etal, reported a case where the stem broke at 4 different places with the fracture initiation medially and they related the failure to laser etching of the medial surface of the stem, altering the fatigue properties of the implant [3]. Rae et al, reported segmental fracture of a charnley femoral component of low friction arthroplasty. In their case both the fractures were complete but they were relatively more proximal. In both these cases the stem was made of 316 L stainless steel [4]. Pellicci et al, reported a case of double fracture of Muller femoral component of total hip arthroplasty. The implant was made of cobalt chrome alloy. In this case also both the fractures were complete and they occurred at 65 mm and 30 mm respectively from the tip [5]. In these cases wiring of greater trochanter had been done but they did not mention whether scoring of the stem during drilling was a contributing factor or not.

In our case, the stem was made of 316 LVM (low carbon, vacuum melted) stainless steel. Fracture occurred at two levels, 6.8 cm and 10.4 cm respectively from the tip of the stem.

### Figure 3

Figure 3: Fractured femoral stem of the bipolar prosthesis with 2 fractures 6.8 cm and 10.4 cm from the tip of the stem.

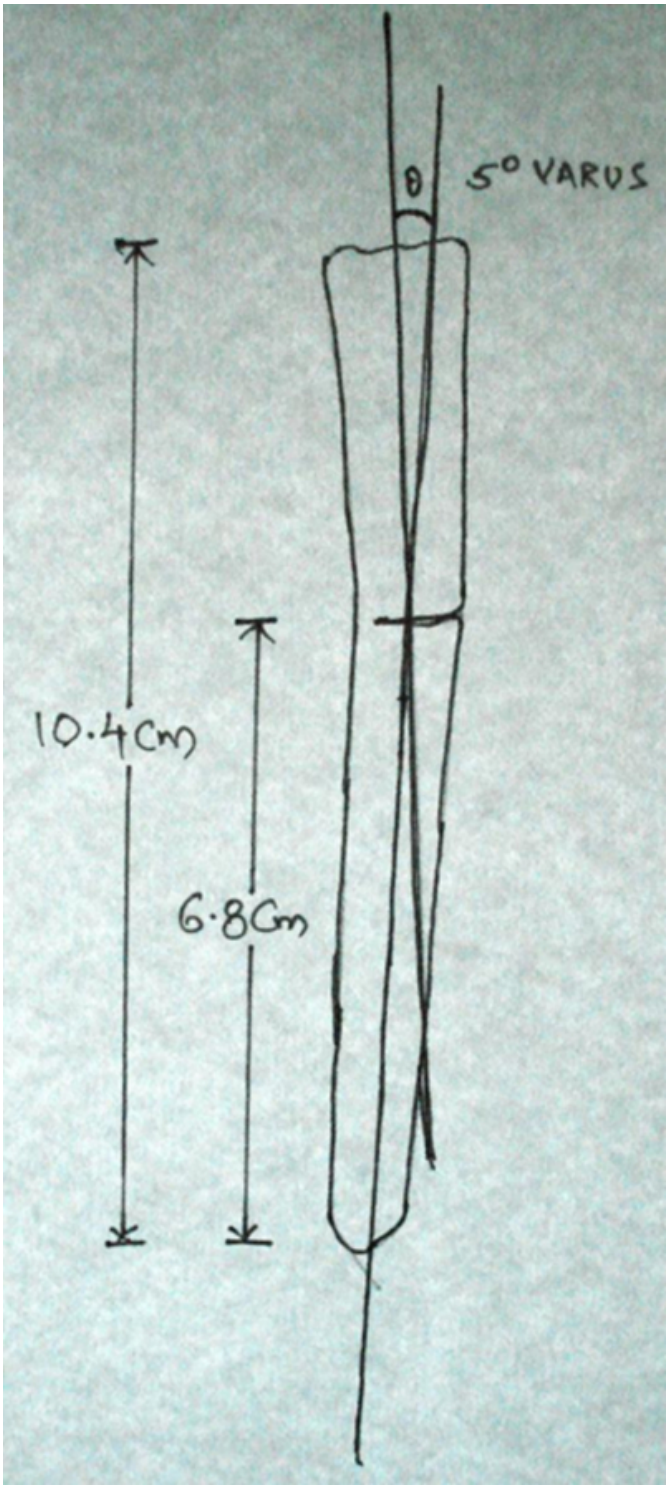



However, the distal fracture was incomplete and it started from the lateral surface. The patient was of moderate built and not a heavy worker. Early X rays show the stem

centered in the medullary canal. The cement mantle was relatively sub optimal distally, and the distal fracture had occurred just proximal to the void in cement mantle. This fracture had started on the lateral side, which is the side of maximum tensile stresses. We believe that the void in the cement mantle might have acted as a stress rider in the distal part of the stem sub optimal fixation. The fracture being incomplete and minimally displaced, the patient was symptomatic only for few days at the time of occurrence of fracture and later was asymptomatic. Analysis of the broken stem revealed that the distal fracture though it was incomplete and minimally displaced; it deformed the stem causing a varus angulation of 5°.

**Figure 4**

Figure 4: Tracing of the distal stem with an incomplete second fracture showing a 5° varus angulation at the distal fracture site which led to increased cantilever forces in the proximal stem.




Thus, though the stem initially was placed in the centre of the medullary canal without any angulation, due to the distal fracture the stem proximal to the fracture started behaving as a varus malpositioned stem. Now a relatively well fixed

distal stem, varus angulated proximal part with some loosening in the cement mantle proximally, all acted as precipitating factors with maximum cantilever forces for the stem to fail proximally. This being a complete and displaced fracture, the patient became symptomatic.

We hypothesize that the initial fracture occurred distally due to repeated cyclic loading of the stem leading to a fatigue fracture. The failure was probably not preceded by loosening of the stem. It is supported by the fact that the patient was asymptomatic after this first fracture for around 8 months, and intra operatively we found the distal stem to be relatively well fixed. It has also been showed that the stem being the stiffest part of the stem – cement – bone complex, it carries enough load to fatigue without loosening. After the distal fracture, the second fracture occurred proximally due to increased cantilever forces in a varus deformed stem. The distal fracture had to have occurred initially. If the proximal fracture had occurred initially, it being a complete fracture would greatly unload the distal stem and it is difficult to explain the occurrence of a further fracture in the distal stem.

Advances have been made in the field of metallurgy and these days most of the arthroplasty components are made of superior alloys which have high threshold for failure. How ever these are quiet costly and in developing countries like India, these relatively cheaper stainless steel implants are still in common use and thus it is wise to keep in mind these relatively rare complications so that such problems can be anticipated and detected early.

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