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Balloning Osteolysis around Acetabular Component on Long Term Follow-Up in 15 Years Old Total Hip Arthroplasty (THA) Using Proxima Short Femur Stem: A Case Report

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Abstract **Case Report**

Introduction: In developed countries, cementless THA is the hip replacement procedure of choice, taking over cemented THA. The uncemented THA necessitates the need of snugly fitting long femur stem which can later lead to thigh pain and proximal stress shielding seen in stems loading in diaphysis. Long conventional femur components carry risk of intra and early perioperative fracture risk upto 2.5% and incidence of thigh pain upto 11%. These issues can be avoided by preserving bone stock with the use of short metaphyseal femur stem that fix at metaphyseal cancellous bone. These proxima stems load femur metaphysis more physiologically and can be inserted in a minimally invasive way. ***Case report:*** Here we present a long term follow-up of 15 years of an operated case of left hip THA done using short proxima stem of DePuy in a 41 years old male suffer from left hip osteonecrosis. At 15 years, there was ballooning periacetabular osteolysis and loosening of acetabular cup. ***Conclusion:*** Short metaphyseal proxima stem of DePuy is a good alternative in uncemented THA, especially in young adults required hip replacement surgery due to debilitating hip disorder, giving similar survival rates when compared with conventional long femur stem. This provides advantage of being minimally invasive, less soft tissue damage, less stress shielding with more physiological load distribution and preserving bone stock. The revision replacement surgery that will be required eventually in future can be better managed due to preserved bone stock and soft tissue.

Keywords: Total hip arthroplasty (THA), total hip replacement (THR), proxima, short stem, balloon osteolysis.

INTRODUCTION

In developed countries, cementless THA is the hip replacement procedure of choice, taking over cemented THA. The uncemented THA necessitates the need of snugly fitting long femur stem which can later lead to thigh pain and proximal stress shielding seen in stems loading in diaphysis. Long conventional femur components carry risk of intra and early perioperative fracture risk upto 2.5% and incidence of thigh pain upto 11%. These issues can be avoided by preserving bone stock with the use of short metaphyseal femur stem that fix at metaphyseal cancellous bone. These proxima stems load femur metaphysis more physiologically and can be inserted in a minimally invasive way [1].

The short metaphyseal proxima femur stem of DePuy is made of titanium forged alloy with porous hydroxyapatite coating of 30 micron thickness with each pore size of 100-200 micron. A tapered trapezoidal geometry of Proxima DePuy stem has characteristic lateral flare fitting with proximal femur contouring, extending upto metadiaphyseal junction [2].

The steep initial learning curve of short stems with higher rates of malalignment in varus upto 20% remains the points of concern in inexperienced hands. This can lead to increased stress at bone stem interface and early failure of THA [1].

Intraoperatively precision is must while taking femoral neck cut, as a neck cut of more than planned level can result in significant bone loss required for snug fit of short proxima stem [3].

CASE REPORT

A 41 years old male came to our OPD with left hip pain which was insidious in onset and gradually progressive since 1 year but aggravated to acute hip

pain after a trivial fall 15 days back. The patient was operated for left hip osteonecrosis 15 years back by THA using minimally invasive proxima DePuy stem. On examination, there was no local swelling with mild trochanteric tenderness. The hip range of motion was unrestricted but painful, especially at extremes of motion. On plain X rays, there was no evidence of fracture with ballooning osteolysis seen around acetabular component (fig.1). On CT scan, periacetabular ballooning osteolysis and acetabular cup loosening is evident (fig.2). The patient will be adviced for bone scan and after all foci of infection are ruled out, he will be posted for revision THA surgery.

This is a diagnostic case with long term follow-up of 15 years using short metaphyseal THA stem of Proxima DePuy.

Fig-1: Previous surgical scar and X rays at presentation showing periacetabular osteolysis.

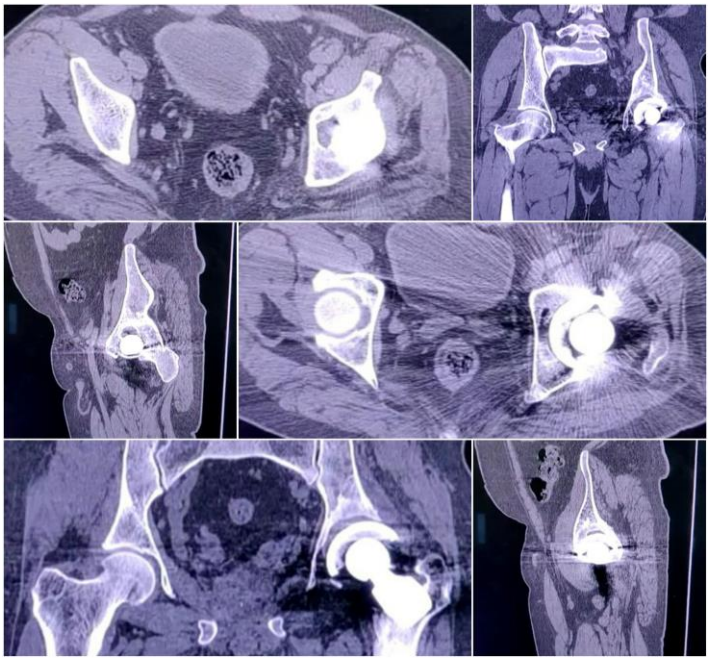

Fig-2: CT scan cuts in axial, sagital and coronal views showing extent of periacetabular osteolysis and loosening

DISCUSSION

Short metaphyseal femoral components provide uniform stress distribution within the femur and adequate bone ingrowth around the prosthesis. The uncemented prosthesis under load begins to push against the surrounding bone with resorption of perioperatively traumatised bone resulting in gradual migration of stem before osseointegration. This coupled with relative micromotion at bone prosthesis interface can cause risk of implant loosening with increased risk of revision [3].

Radiostereometric analysis showed mean migration of prosthesis at 2 years follow-up to be equal in both conventional and short proxima stems. Salemyr et al demonstrated lower periprosthetic bone loss with use of proxima stem with decreased incidence of thigh pain due to prevention of stem tip sclerosis and impingement [3].

In young adults with debilitating hip disorders, choice of uncemented THA remains crucial as the potential for revision in their lifetime is high and future reconstructive options need to be planned. In such patients, short metaphyseal stems which preserve bone stock for future revision surgeries and minimizing stress shielding in femur plays an important role. This anatomically designed implant with conical and undersized distal apex prevents transfer of distal load by minimizing contact between prosthesis and femoral diaphysis [4].

Proxima stem demonstrates lower rates of thigh pain when compared with conventional femur prosthesis due to rigid axial and torsional stability of proxima stem in 3 cortices of metaphysis and absence contact between distal stem and femoral cortex. This also delays long term osteolysis [4, 5].

Periprosthetic osteolysis after THA due to loss of adjacent bone is the most common reason for revision in mid to long term THA. Localised ballooning bony lesions adjacent to prosthesis on radiographs are seen before clinical symptoms of implant loosening. The cause for osteolysis is multifactorial with factors like surgical technique, implant design and stability of fixation playing crucial role. In long term, tissue response to wear particles derived from bone prosthesis interface and their fluid pressure and movement determines the risk factors for loosening. This joint fluid follows path of least resistance towards areas without any bone ingrowths [6, 7].

Periprosthetic osteolysis is also accompanied by inflammatory response characterized by presence of macrophages, lymphocytes, multinucleated foreign body giant cells, osteoclasts and fibroblasts. This osteoclastic bone reaction is directly proportional to wear particles of implant, especially of polyethylene liner. There is also increased expression of tumor necrosis factor alpha, RANK ligand and its receptors which control the osteoclastic activity [6].

Dorr method to evaluate osteolysis measures the distance from the superior and inferior edges of the cup to the edge of the femoral head. Half of the difference between these two measurements defines femoral head penetration [7].

Revision surgeries after periprosthetic osteolysis can be accurately planned with the help of CT imaging which identify location and severity of osteolysis [6].

Revision THA due to osteolysis has been seen in 10% of all THA cases. Macrophages ingest these wear particles sized less than 7 microns and form granulomas which progress through screw holes and cause ballooning in retroacetabular bone. Shelf life, thickness and sterilization process of polyethylene, along with modularity and bearing surfaces of prosthesis influence osteolytic reactions. Management is based on patient's symptoms, activity level and comorbidities. Debridement and bone grafting of osteolytic lesions in acetabulum can be tried by using empty screw holes of metal cup as windows. The definitive management by revision arthroplasty can be done later [6, 7].

The newer highly cross linked polyethylene liners stabilized with vitamin E to prevent oxidation have been tried. Improved wear properties are noted due to latest sterilization and processing advancements [6, 7].

The fibrous tissue encapsulates the cavity of sclerotic bone adjacent to acetabular cup and serve as channel for expansion of osteolysis to more wealer, deeper and cancellous porous layers of pelvic bone [8].

The Saleh *et al.* and Gross classification distinguishes between cavitary and segmental defects based on the anticipated remaining bone stock after implant removal. Type I has no notable loss of bone stock (a well-fixed cup with osteolysis), type II has contained cavitary loss, type III has uncontained segmental loss involving 50% of the acetabulum affecting one column, type IV is segmental and involves 50% loss in both columns, and type V is associated with pelvic discontinuity [7].

Rubash, *et al*. developed a classification system for the uncemented acetabular cups based on the stability of the acetabular shell and the exchangeability of the liner as follows:

1) Type I, is the well-fixed cup with focal osteolysis and the poly liner is exchangeable, in these cases if the cup position is acceptable it could be retained with change of the head an poly liner as well as debridement of the osteolytic defect. 2) Type II, is a well-fixed cup with focal osteolysis but the liner is not exchangeable. For example the locking mechanism is damaged, or the shell is worn out or malpositioned. In these cases the entire cup needs to be replaced. 3) Type III, is a loose cup requiring a complete revision [8].

CONCLUSION

Short metaphyseal proxima stem of DePuy is a good alternative in uncemented THA, especially in young adults required hip replacement surgery due to debilitating hip disorder, giving similar survival rates when compared with conventional long femur stem. This provides advantage of being minimally invasive, less soft tissue damage, less stress shielding with more physiological load distribution and preserving bone stock. The revision replacement surgery that will be required eventually in future can be better managed due to preserved bone stock and soft tissue.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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