

Effectiveness of Cortical Window Technique for Revision Hip Arthroplasty

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Abstract

Background: Revision total hip arthroplasty requires removal of cement, cement restrictor and stem followed by canal preparations and reaming. Extraction of femoral component is a challenging problem. There are many techniques being used and described in the literature with all having associated with them. We reviewed the effectiveness of new cortical window method for femoral stem extraction in revision hip arthroplasty.

Material and methods: We retrospective reviewed the result of all our patients operated for revision total hip arthroplasty by cortical window creation in diaphysis of femur for extraction of femoral stem. Window size ranged of 2.5 cm x 5 cm to 2.5 x 7.5cm. We analysed the results for age, indication and type of surgery, size and method of closure of cortical window etc. Outcomes recorded were assessed on pain and mobility.

Results: 13 patients with mean age 76 years (range 60 to 88) with mean time duration of revision surgery with 12.5 years (range 5 to 25 years) were included in study. In 11cases femoral stems (85%) were extracted very easily while in 2 cases it was difficulty. In all cases, except one, the size of cortical window was 2.5 cm x 5 cm. In 10 cases, cable wires were used to fix the cortical window, were as in 3 cases of peri-prosthetic fractures additional plates were used. At 6 months 7 (54%) patients were pain free and 5 (38 %) of patients had mild pain. All patients had good mobility with able to do all daily routine work comfortably.

Conclusion: Cortical window is an acceptable technique which can be used during revision total hip replacement. It can be performed in any age regardless of indication of revision. It reliably allows surgeon to prepare canal by removing all components.

Keywords: Revision total hip arthroplasty, Cortical window, Femoral stem extraction

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Introduction

Total hip arthroplasty (THA), nowadays is a routinely performed surgery to provide painless, mobile and stable hip, which is used in various indications like arthritis, trauma, deformities, inflammatory arthropathies etc [1,2]. With the advancements in implant designs, materials, fixation techniques, modern operation theatre facilities and developments in medical field, the incidence of complications following THA, is brought well

under control. Still the surgery is not free of complications and some complications warrant repeat surgery with revision of implants (Revision Total Hip Arthroplasty) [3-5].

With the increase in aging population, availability, extension of indication and excellent short and long term outcomes, of the number of THA performed is increasing tremendously and hence the number of revision is also increasing. Further the number

of patients requiring revision will also increase tremendously [6]. Removal of old implant (acetabular and femoral components) is essential and strenuous step of revision surgery [7]. Despite many techniques described in literature globally, need for a better, less invasive and reliable method of extraction still exists. Hence we conducted this study with aim to evaluate, the effectiveness of "cortical window" technique for successful extraction of femoral component. It also aims at assessing indications, complication, healing of window, mobility improvement and complications related to cortical window mortality and pain following surgery.

Material and methods

This is retrospective observational study is performed on all revision arthroplasty patients operated at our centre by cortical window technique to femoral component between March 2012 to September 2014. Notes of all the patients who underwent revision surgery were reviewed. All patients of revision hip arthroplasty operated by cortical window technique for cemented or uncemented femoral component removal operated in chosen time period were included in the study. Patients with insufficient follow up of less than 6 months were excluded from study so as to analyse healing of window radiologically. Cases, where different surgical techniques for extraction other than cortical window (for e.g. femorotomy or extended trochanteric osteotomy) were used were also excluded. Patients operated by other surgeons, who are not authors to this article were also not reviewed in this study. Thus 13 patients were included in final cohort after filling the inclusion criteria and they formed the study group.

Cortical Window Method: Initially, the exact site of creation of cortical window was estimated from preoperative assessment of x-rays and CT scans which was, just below the tip of the prosthesis on lateral aspect, distally. Posterior approach to hip joint was used to expose the femur. Then cortical window site was marked and with a 2mm drill bit 4 corners of window were drilled and with an oscillating saw these corners were joined to make a

square window. While preparing the window, oscillating saw was angled in such a way to produce bevelled edge of window so that it effectively increases surface area of window edge, in turn increasing the contact area between two sides of osteotomy and will enhance healing. Window, a controlled defect created in femoral canal now allows assessment to the femoral implant, cement and cement restrictor for extraction. Various types of osteotomies are used to aid removal of cement. After the procedure, cortical window fragment is replaced back and secured in place with circlage metal cables (fig 1).

As the study was retrospective, the data collection was done by reviewing the patient's electronic medical records, which is regularly maintained in our institute. The operative theatre database as well as operative notes of these patients was also reviewed. Data for variables like age, dates of primary and revision THA surgery, indication for surgery, type of surgery cemented or uncemented, events during surgery and OPD follow up dates etc were noted. The size and use of method of closure (plate, cables or bone graft) of cortical window was also reviewed. Outcomes recorded were assessed on pain (no pain, mild, moderate or severe pain) and mobility at subsequent follow up appointments. Patients X-rays were reviewed for radiological assessment of healing of window, subsidence and presence of any fractures.

Fig 1. Pre-op (a) and post-op (b) x-rays of a patient whose primary THR was revised by cortical window technique



Results

A total of 13 patients with mean age 76 years (range 60 to 88) were included in study. The mean time duration of revision surgery from the primary THA was 12.5 years (range 5 to 25 years). 8 patients (62 %) had revision because of aseptic loosening, 2 due to infection and 3 patients (23%) had fracture as the indication for revision surgery. Almost all patients (12 patients) of cortical window for cemented stem extraction had cemented femoral component except one who needed cortical window for removal of uncemented implant. 12 patients out of 13 had revision of both femoral and acetabular component and 1 patient had revision of only the femoral stem.

As per the operative notes, 11 femoral stems (85%) were extracted very easily after making a cortical window while 2 femoral stem implant removal was done with difficulty. In 9 patients, window was made to remove either cement or cement restrictor, whereas in 3 cases window was made to remove the broken part of femoral stem.

Revision THA was done with "Reclaim" (Depuy) prosthesis in 10 patients, whereas Wagner type uncemented long modular revision prosthesis (Depuy), "Reef" prosthesis which is distally interlocked modular revision femoral stem (Depuy) and cemented "C Stem" which is triple taper polished femoral stem (Depuy) was used in one case each.

In almost all the cases (12 cases) size of cortical window was 2.5 cm x 5 cm, whereas in one case the size was slightly bigger window i.e. 7.5 x 2.5 cm. In 10 cases only metal cable wires were used to fix back the cortical cover of the window. In 3 cases additional plates were also used to increase the stability of a pre-existing fracture as these cases of peri-prosthetic fractures. None of the cases needed bone grafting except in one case with longer cortical window, in which reaming material obtained were used as bone graft around cortical window.

Full radiological healing of cortical window was seen in 9 cases in less than 3 months whereas 2 cases took upto 18 months to heal. There

was insufficient follow up available for 2 cases to comment on healing. In one case of subsidence was found on initial x rays which was stable as seen in subsequent follow ups.

Initially at 6 weeks, 2 patients were pain free and 11 patients had mild pain whereas one had moderate pain. No patients reported severe pain after Revision Total Hip Replacement. At 6 months 7 (54%) patients were pain free and 5 (38 %) of patients had mild pain. All patients had good mobility with able to do all daily routine work comfortably.

Discussion

Although Total hip arthroplasty provides excellent short and long term outcomes, but like all procedures, it is not free of complications [3-5]. Complications arising out of the primary total hip arthroplasty may demand a revision surgery with removal or exchange of previous components. Reasons which need revision total hip arthroplasty are usually aseptic loosening, infection, peri-prosthetic fracture, recurrent dislocation and mal-positioning of components [6-9].

The primary and crucial step in revision surgery is to remove the previously implanted components without much iatrogenic tissue trauma. Thus removal of old implants is a challenging arduous task for surgeon which is extremely demanding, time consuming and can potentially cause more damage to host bone [10]. Various techniques and instrumentation for approaching the femoral part of component have been mentioned in literature, all having their own set of complications like invasive, non-union or migration of osteotomies and delayed weight bearing [11-18]. A conventional trochanteric osteotomy, which is too proximal, has limited value in removal of well-fixed femoral implant and cement distally. It also has associated complications of non-union, proximal migration of trochanter and trendelenburg gait disturbance [11,12]. Complications reported with a sliding trochanteric osteotomy were non-union and minor fractures [13,14]. An extended trochanteric osteotomy gives better exposure femoral implant, cement mantle and cement plug removal [15,16]. However, Scott

King et al reported 18 % intraoperative fracture with trochanteric tip fracture and trochanteric migration rate of 18 % was also noticed [17]. Antal et al recommended use of retrograde genocephalic removal in selected cases of broken femoral stem but this may lead to fracture while impacting and infected cases can lead to a spread to the knee joint [18]. Ultrasonic devices are costly and not available in all hospitals.

Cortical window method is a novel method used for femoral stem extraction [19-23]. Some of the surgeons have used cortical window creation for extraction of stem, but they created window proximally on antero-medial aspect, but we created a cortical window distally, 1cm below the tip of the prosthesis on lateral aspect, with exact site estimation done by x-rays and CT scans. We used an oscillating saw by joining the corners of pre-drilled holes at corners of window, to create a controlled defect. Window, thus created in femoral canal allowed access to the femoral implant, cement and cement restrictor. After the procedure, the cortical window fragment is replaced back and is secured in place with circlage metal cables.

Cemented femoral stems require revision more than uncemented stems. In our series, 12 were (92%) cemented stem and only one was uncemented stem. During assessment it was noted that in cortical window was required to remove the femoral stem in only 15% cases, which was difficult. In rest of the cases, stem was easily removed even without making the cortical window, but the cortical window technique was still required to remove cement restrictor and cement and for canal preparation. In two cases, access to acetabulum was difficult to establish because of femoral implant, hence in these cases cortical window can be performed first to aid removal of stem, to increase acetabular exposure.

In all reported series majority of the revision THA are done for aseptic loosening like in our series, which takes years to occur after the primary surgery [6,8]. Hence the higher mean

age and delay after the primary surgery is understandable. Our study, demonstrate that cortical window technique, can be used in extraction of femoral stem, despite of presence of aseptic loosening. Almost in more than 90% of our cases, revision was done by uncemented long Wagner type modular stem and cemented long femoral stem was done in one case, with ease.

Further since there is loosening in these cases, the extraction can be done easily with small size window of 2.5 cm x 5 cm as ours. This is much smaller breach in cortex compared to extensive trochanteric osteotomy. Further, since the window is smaller in size, it heals very well in 3 months only, with only cables or wires and doesn't require additional plates or bone grafts, except in cases, where the indication of revision is a peri-prosthetic fracture, because closed lid itself act as bone autograft and helps with healing process. In some of our patients, cortical window took too long to heal, probably because radiological healing of window is very variable and it is possible that these cortical windows are healing without callus formation with the formation of cutting cones which is less visible on x-rays [24].

To improve the quality of data, a larger sample size with a comparison group, longer follow-up and data from prospective sources is recommended. A detail collection of confounding factor data and statistical analysis will reduce selection bias.

Conclusion

The cortical window procedure can be successfully performed in extremely elder patients in almost all types of indications for revision total hip arthroplasty for femoral stem extraction with easy. It can be used for both cemented and uncemented prosthesis. The cortical window so made which can be fixed with cables or wires only, show good healing in 3 months. Surgeons can certainly add cortical window technique to their armamentarium as a possible solution when faced with complex revision of femur.

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