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Case Report

“Cup-in-Cup” for revision cup in total hip arthroplasty – An innovative technique

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ABSTRACT

Background: Revision total hip replacement surgery with isolated poly-ethylene liner wear along with a stable uncemented acetabular shell involves the difficult decision of revising the entire acetabular component or only the liner. However, the unavailability of a similar poly liner can be dealt with a novel technique of cup-in-cup by retaining the stable uncemented shell and cementing a new poly-ethylene liner in it.

Case Report: A 77-year-old male came with complaints of pain in the right hip and a limp of 4 months duration after 17 years of a revision hip surgery. Poly-ethylene liner was found to be worn out intraoperatively with both the uncemented shell and stem very stable. The same company's poly-ethylene liner was not available. To prevent extensive revision in a high surgical-risk patient and to prevent blood and bone loss, a new polyethylene cup was cemented in the old stable uncemented shell. At 3 years of short-term follow up patient can walk pain-free independently.

Conclusion: The “cup-in-cup” technique with cemented poly-ethylene cup into a retained well-fixed and well-positioned uncemented shell is good and gives promising result.

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1. Introduction

As the number of total hip arthroplasty (THA) procedures increase, the need for revision surgeries is also likely to increase. Revision THA can be a complex and challenging problem due to various factors like extensive approach, bone and blood loss, technical difficulties etc. Hence the operating surgeon needs to be prepared for various scenarios by keeping all the necessary instruments and different types of prosthesis available. This preparedness ensures that the surgeon can address any unexpected challenges that may arise during the procedure.^{1,2}

This is an interesting case report highlighting the challenges and considerations in revision THA when dealing with isolated liner wear with stable acetabular shell and femoral stem. The surgeon needs to carefully assess the

clinical and radiological findings and make the decision on whether to revise only the liner or the entire acetabular shell.

2. Case Report

This case report describes a complex revision THA procedure in a 77-year-old male with multiple comorbidities who had a history of multiple previous hip surgeries. The patient's initial hip surgery was an Austin-Moore's arthroplasty for a fractured neck of the femur in 1994, which failed after four years and was then converted to a cemented THA in 1998.(Figure 1) However, in 2003, the cemented hip loosened with peri-implant osteolysis, which prompted a revision surgery.

During this revision surgery in 2003, an uncemented long stem with an uncemented multi-hole cup with screws and a polyethylene liner was used, which lasted till 2020.(Figures 2 and 3)

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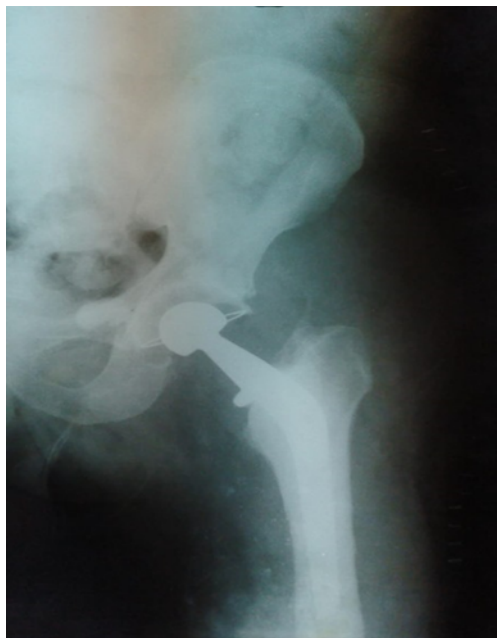


Figure 1: 1998 Cemented THA - AMP Revision



Figure 2: 2003 Cemented THA Lysis



Figure 3: 2003 revision surgery from cemented THA to Long stem uncemented THA with multihole uncemented cup

After 17 years, in mid-2020 patient presented with 4 months duration complaints of hip pain, limping gait and difficulty in standing from a sitting position. On clinical examination patient had pain on active as well as passive movements of the hip. On CT radiology some proximal stem lucency was seen with otherwise intact and stable cup and stem. There were no systemic complaints. Infection/inflammation markers were within the normal range.



Figure 4: Preoperative ex-ray of uncemented THA showing lucencies around the stem in the proximal part

The patient was advised to undergo revision surgery for both the stem and the cup due to suspected poly-ethylene liner wear. During the surgery, intra-operatively, it was

confirmed that the poly-ethylene liner was indeed worn out with a fracture in its postero-lateral region. This liner wear was likely contributing to the patient's symptoms of hip pain and difficulty in standing from a sitting position.

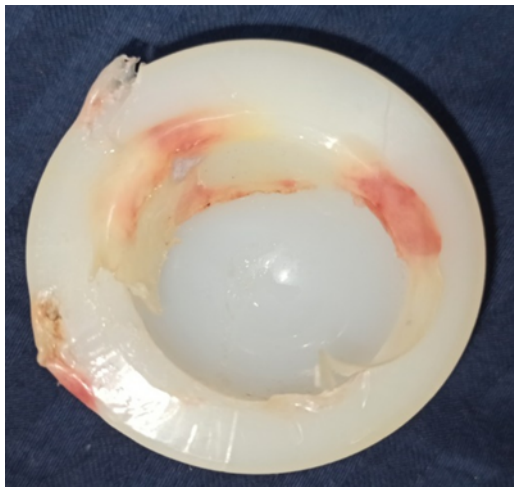


Figure 5: Uncemented THA polyethylene liner wear and fracture

However, the positive news was that the stem was found to be stable, despite the radiological findings of lucency. This is an important finding as a stable stem significantly influences the decision in the revision THA scenario. Additionally, the metal shell was also found to be very stable during the surgery, which further supported the decision to retain it rather than replace it. Preserving the well-fixed metal shell can reduce blood and bone loss, operative time and the morbidities associated with it.

Furthermore, the frozen section analysis during the surgery did not show any signs of infection, indicating that the revision surgery was not complicated by an active infection at the surgical site.

Due to tribological advancements in implant designs, the same poly-ethylene liner was no longer available. With the expertise and experience of the senior surgeon, extensive revision surgery was avoided with an innovative technique of retaining the well-fixed uncemented shell and cementing a new poly-ethylene cup into it. All the screws were removed from the acetabular shell and again its stability as well as position was confirmed. A thorough wash was given using pulse lavage. The holes of the screws were curetted. Bone cement was applied over the metal shell and a new poly-ethylene cup of a smaller size was placed into it in the desired anteversion and inclination using manual pressure and held in place until the bone cement cured. A trial femoral head was used to evaluate the intraoperative stability of the hip and the neck length was adjusted with a longer one. The hip was reduced and its stability was checked again. The patient's recovery after the revision surgery was uneventful. The patient was mobilized out of bed with the support of a walker the very next day. The

patient was discharged on postoperative day 5 and was able to mobilize with the support of a cane. At a follow-up of 3 years patient was able to walk independently without experiencing any pain or limitation in his daily activities.

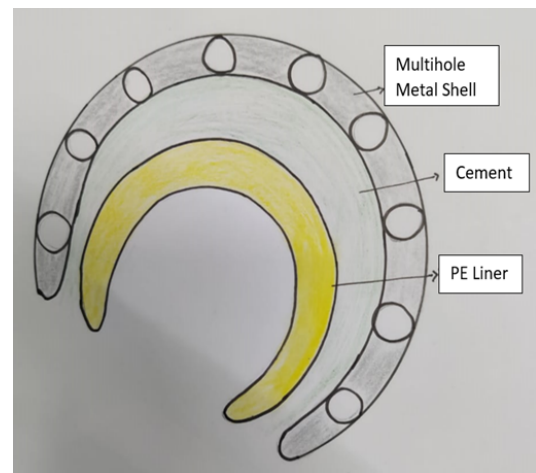


Figure 6: 'Cup-in-cup' technique – Smaller cemented Poly-ethylene cup fixed in stable, well-positioned uncemented shell



Figure 7: Immediate postoperative x-ray of the cup in cup technique



Figure 8: Postoperative x-ray of the cup-in-cup technique at 3 years follow-up



Figure 9: Patient standing without any support and sitting on a chair at postoperative 3 years follow-up

3. Discussion

The presented study demonstrates the effectiveness of the 'Cup-in-Cup' technique as a preferable alternative to the conventional revision method for a well-fixed and well-positioned shell during a revision hip arthroplasty surgery. The use of this technique offers several advantages such as minimized blood and bone loss, reduced intra-operative time and overall perioperative morbidity.

Indications of the metal shell to be retained were identified as:

1. Stable shell when assessed intraoperatively
2. Anteversion and inclination of the cup is acceptable
3. Sufficient thickness of polyethylene could be cemented.
4. This is also supported by Koh et al and Maloney et al.^{1,3}

The cemented poly-ethylene cup to be used in this procedure should be of a smaller diameter than the outer retained shell to allow for a cement mantle of 2-3mm, ensuring a stable fixation. This undersizing also allows a slight reorientation with more anteversion during cementation without excessive overhanging out of the rim edge of the retained metal shell. J Wegrzyn et al have described this with a dual mobility cup as it ensures the greatest construct strength.⁴⁻⁸

Screw removal was performed to avoid the potential problem of a retained screw getting buried in cement in case a further revision is required. The holes of the multihole shell were curetted such as to act as anchoring holes for the cement to increase the fixation strength in contrast to roughening the inside of a smooth shell with a burr as roughening may create particulate debris as described by J Wegrzyn et al, Challagan et al and Boner et al.^{4-6,9}

This technique proves to be particularly beneficial for high-risk or low-demand patients. By offering a viable option to address liner wear and fracture without requiring the removal of a well-fixed uncemented shell, the "cup in cup" technique helps avoid potential iatrogenic bone loss associated with conventional acetabular component revision.^{4-8,10,11}

The short-term result at the 3-year follow-up of the patient who underwent this 'cup-in-cup' technique was favourable with no reported complications. This provides confidence in the stability and durability of this technique.

This technique is mainly for cup revision and to our knowledge this has not been reported in the literature. It can be utilised for similar case scenarios in the future.

4. Conclusion

This 'cup-in-cup' technique is mainly for revision cup arthroplasty surgery and proves valuable in high-risk patients with isolated poly-ethylene liner wear when the

same liner is not available with the company or its locking mechanism is affected and where extensive revision surgeries to change to cup cannot be undertaken. This technique reduces the blood and bone loss and reduces the intraoperative time and perioperative morbidity.

At 3 year follow up the patient can walk independently without any pain or limitation in the daily activities. There was no reported complication.

Further follow-up and more extensive studies are necessary to evaluate the long-term performance of this cup-in-cup technique and will help further establish the role and benefits of this technique in enhancing patient outcomes and satisfaction.

5. Abbreviation

THA: Total Hip Arthroplasty; CT: Computed Tomography.

6. Ethics Approval and Consent to Participate

Ethics approval was obtained from the Bombay Hospital Institute of Medical Science Ethics committee.

7. Consent for Publication

Informed consent was obtained from the study participant before writing the case report.

8. Author's Contributions

Dr H R Jhunjunwala was the primary operating surgeon for this surgery and the technique described is based on his experience.

Dr Pratik Sunil Tawri and Dr. Ashwin Joshi were the assistants during the revision surgery and contributed to writing and editing the manuscript. The author has read and approved the final manuscript.

9. Source of Funding

No funding was received during this study.

10. Conflict of Interest

The authors declare that they have no competing interests.

11. Availability of Data and Materials

Data sharing does not apply to this article as no datasets were generated or analysed during the current study.

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