

CASE SERIES

Midterm Clinical and Radiological Outcomes of Total Hip Arthroplasty in Protrusio Acetabuli, Using Novel Technique of Head of Femur as an Autograft – A Case Series

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Purpose: Total hip arthroplasty (THA) in protrusio acetabuli is challenging as it requires the use of massive bone grafts (auto or allograft) along with a wire mesh or reinforcement ring or cage to prevent medial migration of the graft or prosthesis into pelvis. However, there are significant disadvantages associated with use of these devices. The purpose of this study is to assess outcomes of THA in hip protrusion with acetabular defect grade 2 or more, using a novel technique of femoral head used as autograft, without the use of any protrusio ring, wire mesh, or cage.

Methodology: This case series included seven patients, with age 18 years or more and grade 2 or more protrusio acetabuli, who underwent total hip arthroplasty by a single fellowship-trained surgeon between 2019 and 2024. Patient demographics such as age, sex, comorbidities, body mass index (BMI), protrusio grade, etiology, bearing surfaces, along with clinical findings such as intra- and post-operative complications, Oxford Hip Score (OHS), follow up duration etc. were recorded. The Mann–Whitney U test compared functional outcomes between dual mobility and fixed bearing implants, while Spearman's rank correlation assessed associations between BMI and Oxford hip Score, and between protrusio grade and Oxford Hip Score.

Results: Seven female patients were included, with a mean age of 51.9 years and mean body mass index of 29.9 kg/m². Five patients had bilateral disease, with two undergoing single-stage bilateral total hip arthroplasty. Etiologies included rheumatoid arthritis (n=3), prior femoral neck fracture (n=1), history of tuberculosis hip (n=1), steroid and immunosuppressive use (n=1), and unknown cause (n=1). Hypertension was the most frequently observed comorbidity (43%). Mean follow-up was 28.9 months. No complications such as infection, dislocation, aseptic loosening, or periprosthetic fracture were observed. All autologous grafts demonstrated radiographic incorporation. The mean Oxford Hip Score was 39.9, with good (71.4%) to excellent (28.6%) outcomes in all patients. Functional outcomes did not differ between dual mobility and fixed bearing implants ($p = 1.00$). Moderate positive correlations were observed between OHS and BMI ($\rho = 0.625$) and between OHS and protrusion grade ($\rho = 0.670$).

Conclusion: Novel technique of using femur head autograft is an excellent biological method to fill acetabular medial defects during THA, while avoiding complications related to reinforcement devices.

Keywords: Protrusio acetabuli, Total hip arthroplasty, Oxford hip score, Morselized femoral head autograft, Autologous femoral head autograft, Autograft, Case series

How to cite: Ahmed A, Iqbal MS, Haider A, Kaleem AA, Khattak MJ. Midterm Clinical and Radiological Outcomes of Total Hip Arthroplasty in Protrusio Acetabuli, Using Novel Technique of Head of Femur as an Autograft – A Case Series. (JBSS). 2026; 01(03): 10-16

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Introduction

In developing countries such as Pakistan, people with hip pain usually present late when symptoms have worsened enough to cause disability¹. Furthermore, the overall prevalence of protrusio acetabuli remains unknown because it varies across specific populations². The etiologies of protrusio acetabuli are vast because it can stem from a primary idiopathic disorder or from secondary causes including trauma, malignancy, infection, paget disease, and inflammatory conditions such as

rheumatoid arthritis (RA) and psoriatic arthritis^{2,3}. In diseases like rheumatoid arthritis and tuberculosis (TB) hip, if patient continues to bear weight on the osteoporotic joint, it causes bony erosion, creating a large structural defect in the acetabular cavity, followed by medial migration of the femur head leading to a protrusion⁴. Ideal treatment of these cases is total hip arthroplasty (THA). THA in protrusio is challenging as it requires the use of massive bone grafts (auto or allograft) along with a wire mesh or reinforcement ring or cage to prevent medial migration of the graft or prosthesis into pelvis^{2,5}. In

young patients, these additional biomaterials tend to loosen early. Also, excessive use of metallic implants poses a risk of reactivation of infection in the long term. There are a few techniques described in literature for using a femoral head autograft to reconstruct the large structural defects^{6,7}. In our technique we used femoral head as autograft to fill the acetabular defect. In such situations, graft incorporation and healing is a very important factor, so is recreation of center of rotation of hip².

Methodology

From 2019 to 2024, we searched the hospital electronic database and files of patients who presented with hip pain or disability secondary to protrusio acetabuli, and underwent THA by a single surgeon using our specific technique. Patient's personal information was de-identified. Series of 7 patients were included with age more than 18 years having protrusio greater than 1 (2 or more). Patient demographics such as age, sex, comorbidities, body mass index (BMI), addiction, cause of protrusio, procedure, intraoperative complications, intraoperative blood loss, bearing surfaces used, protrusio grade using x-rays, length of stay (LOS), Oxford Hip Score (OHS), postoperative complications etc. were recorded. Patients having grade 1 protrusio, operated by other surgeon, or operated by other techniques were excluded. After approval from the ethics review committee, data collection was started. Preoperative X-rays were reviewed by fellow arthroplasty. Protrusio was calculated using pelvis anteroposterior x-rays by measuring the distance from Kohler line/ilioischial line and the most medial cortex, as shown in figure 1. Protrusio was classified using Sotelo-Garza/Charnley classification⁸, as shown in table 1. All patients were operated in lateral position using posterior approach by a single fellowship trained arthroplasty surgeon. Same technique was utilized in all patients. The Mann-Whitney U test was used to compare postoperative Oxford Hip Scores between the dual mobility group and the fixed bearing group. Median and interquartile ranges (IQR) were reported for each group. Spearman's rank correlation coefficient (ρ) was used to analyze the relationship between BMI and Oxford Hip Score, and between protrusio grade and Oxford Hip Score. A scatter plot was generated to visualize the correlation. A p-value of <0.05 was considered statistically significant.



Figure 1: Grade 3 protrusio (20.6 mm)

Table 1

Grade	Distance between kohler line and acetabulum
1	1-5 mm (mild protrusio)
2	6-15mm (moderate protrusio)
3	>15 mm (severe protrusio)

Technique

Severe protrusio acetabuli is a unique challenge in hip arthroplasty because of bone altered anatomy, bone defects and hence unreliable long-lasting reconstruction. Options include acetabular cages, metal augments and multihole cups with or without bone cement and bone graft.

Our technique is simple, cost effective and biological with good results and reliable for long term survival. After dislocating the hip, neck osteotomy was performed, in fact in situ osteotomy was performed in case hip was not dislocatable (figure 2). All fibrous tissue was carefully debrided from the head surface and the acetabular lining after dislocation. We then aimed to ream only the acetabular outlet area with the best fitting acetabular size just enough to snugly fit the outer side of the acetabulum (figure 3). The same reamer was then placed on the osteotomized head and neck fragment starting from the neck region and the bone was resected according to the circumference of the reamer (figure 4). The remaining bone was debrided and cleaned and used to fill the rest of the acetabulum medially (figure 5). The rest of the bone from the neck region was morselized to be used as graft filling the voids across the acetabulum with the strut and shaped up acetabular graft. The cup size was selected based on the reamer size and the cup was impacted with the strut shaped up and the morselized bone graft (figure 6). The position was secured with screws through the bone graft and the remaining acetabular bone. As the strut graft was inherently sclerotic, it helped to secure the screws rather firmly. A primary hip implant with no metal cages or augments were used naturally reducing the cost. Patient was kept non weight bearing for few weeks till the graft

was incorporated. Once signs of incorporation were seen on follow-up x-rays, weight bearing was gradually started and progressed as tolerated. The surgeon experience and confidence play a vital role and the technique worked successfully in all of our patients without any untoward difficulty or complication.

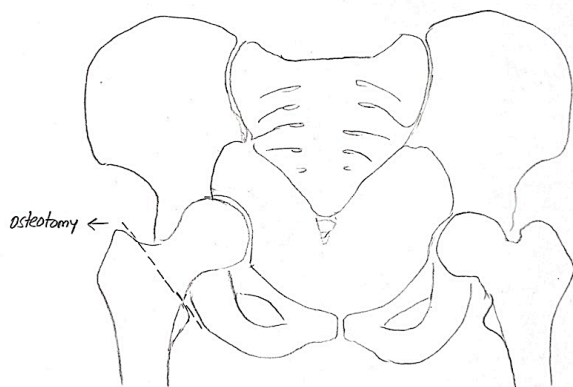


Figure 2

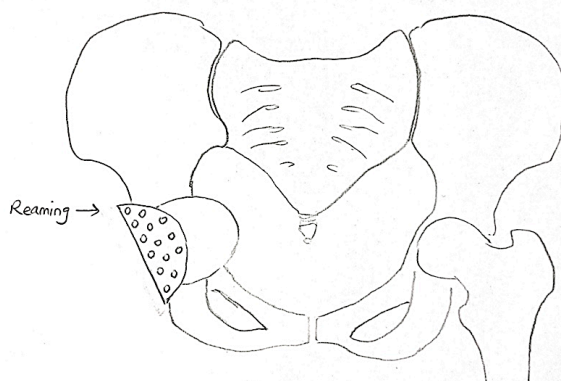


Figure 3

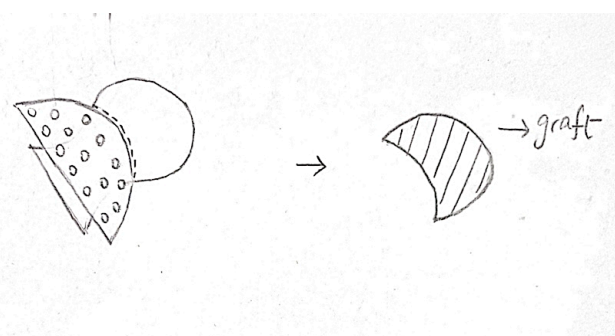


Figure 4

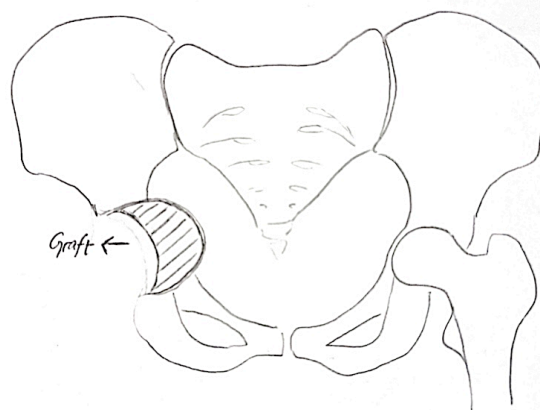


Figure 5

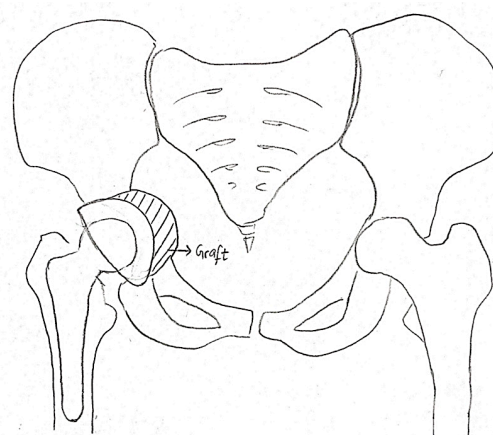


Figure 6

Results

A total of seven patients were included in this case series; all were female, with a mean age of 51.9 ± 18.4 years (range: 26–75 years). Five of the seven patients presented with bilateral hip pain secondary to protrusio acetabuli. The mean duration of symptoms prior to presentation was 5.0 ± 1.9 years (range: 3–8 years). Rheumatoid arthritis was identified as the underlying cause in three patients. Among the remaining patients, one had a previous conservatively managed fracture of the femoral neck, one had a history of tuberculosis hip, one developed protrusio following prolonged steroid and immunosuppressive therapy after renal transplant, and in one patient no clear etiology could be determined. Hypertension was the most frequently observed comorbidity (43%), followed by diabetes mellitus, hypothyroidism, and chronic kidney disease (each 14%). The mean BMI was 29.9 ± 2.5 kg/m², with six patients classified as overweight or obese. None of the patients reported any addiction or history of smoking.

Radiographically, four patients demonstrated Grade II protrusio and three demonstrated Grade III protrusio. Two patients underwent single-stage bilateral primary total hip arthroplasty (THA), while one patient required a staged bilateral procedure. Rest of the four patients underwent unilateral THA. The mean length of stay was 6.1 ± 2.0 days (range: 3–9 days), and the

mean intraoperative blood loss was 238.6 ± 38.0 ml. All procedures were performed by the same arthroplasty-trained surgeon using a posterior approach in the lateral position. Metal-on-polyethylene dual mobility bearings were used in 71.4% (n=5) of hips, while ceramic-on-polyethylene fixed bearings were used in 28.6% (n=2) (figure 7).

The mean follow-up duration was 28.9 ± 13.3 months (range: 12–52 months). Postoperative functional outcomes assessed using the Oxford Hip Score demonstrated a mean score of 39.9 ± 2.0 (range: 38–43). Scores of 42–48 were categorized as excellent and 34–41 as good; 28.6% (n=2) of patients achieved excellent outcomes, while 71.4% (n=5) achieved good outcomes. Importantly, no intraoperative or postoperative complications were observed, including prosthetic joint

infection, periprosthetic fracture, heterotopic ossification, dislocation, or aseptic loosening during the follow-up period. All autologous bone grafts demonstrated successful incorporation at final follow-up (Figure 8).

Comparison between dual mobility and fixed-bearing THA revealed no statistically significant difference in functional outcomes (Mann–Whitney $U = 5$, $p = 1.00$) (Table 4). The association between Oxford Hip Scores and BMI revealed a moderate positive correlation (Spearman's $\rho = 0.625$) (Figure 9). Similarly, a moderate positive correlation was also found between Oxford Hip Scores and protrusio grade (Spearman's $\rho = 0.670$) (Figure 10). However, both these correlations did not reach statistical significance ($p > 0.05$).

Table 2: Demographics

Variables	Variables	Mean $\pm$ SD	Frequency (%)
Age (years)	Age (years)	51.9 ± 18.4	
Gender	Female		7 (100)
Gender	Male		0 (0)
BMI (km/m ²)	BMI (km/m ²)	29.9 ± 2.3	
Cause of protrusio	Neck of femur fracture		1 (14.3)
Cause of protrusio	Tuberculosis of hip		1 (14.3)
Cause of protrusio	Steroid induced		1 (14.3)
Cause of protrusio	Rheumatoid Arthritis		3 (42.9)
Cause of protrusio	Unclear etiology		1 (14.3)
Comorbidities	Diabetes Mellitus		1 (14.3)
Comorbidities	Hypertension		3 (42.9)
Comorbidities	Hypothyroidism		1 (14.3)
Comorbidities	Chronic kidney disease		1 (14.3)
Duration of symptoms (years)	Duration of symptoms (years)	5.0 ± 1.9	
Grade of protrusio	Grade 2		4 (57.1)
Grade of protrusio	Grade 3		3 (42.9)
Side involved	Bilateral		5 (71.4)
	Right		2 (28.6)
Side operated	Bilateral (single stage)		2 (28.6)
	Bilateral (two staged)		1 (14.3)
	Right		3 (42.9)
	Left		1 (14.3)

Table 3: Clinical outcome variables

Variables	Variables	Mean $\pm$ SD	Frequency (%)
Intraoperative blood loss (ml)	Intraoperative blood loss (ml)	238.6 ± 38.0	
Length of stay (days)	Length of stay (days)	6.1 ± 2.0	
Oxford hip score (OHS)	Oxford hip score (OHS)	39.9 ± 2.0	
	Excellent (OHS 42–48)		2 (28.6)
	Good (OHS 34–41)		5 (71.4)

Complications	Complications		0 (0)
Follow up duration (months)	Follow up duration (months)	28.9 ± 13.3	

Table 4

Implant type	Oxford hip score – median (IQR)
Dual mobility	40 (38 – 43)
Fixed bearing	40 (38 – 42)

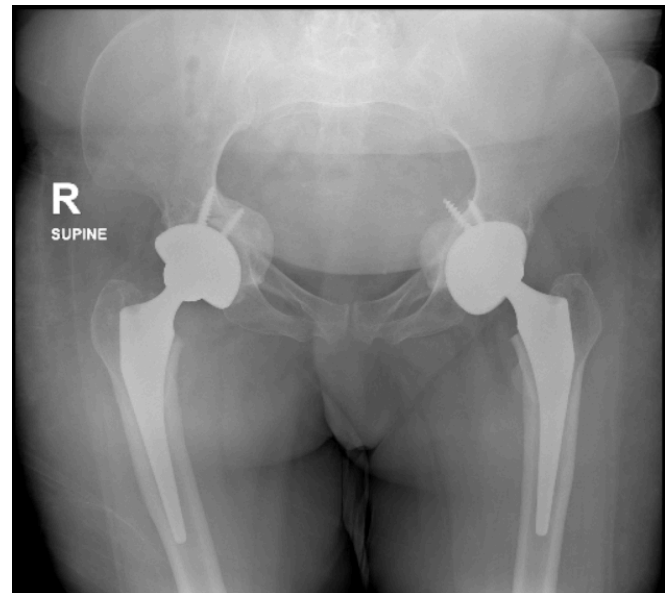


Figure 8: 75-year-old lady with bilateral protrusio acetabuli (grade 3). Bilateral THA (single stage) using head as autograft at 14 months follow up.

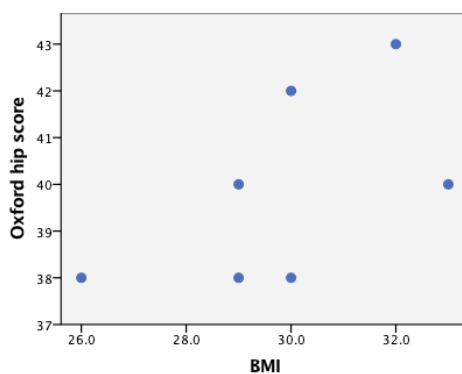


Figure 9 Association of BMI and Oxford Hip Score (Spearman's $\rho = 0.625$)

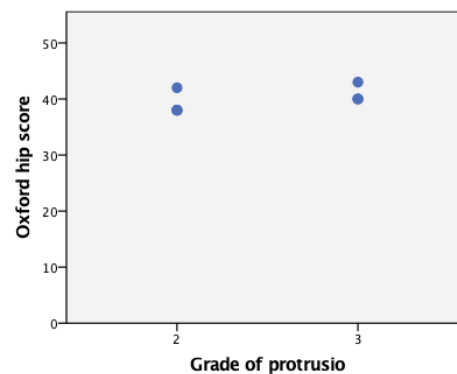


Figure 10 Association between protrusio grade and Oxford Hip Score (Spearman's $\rho = 0.670$)

Discussion

In this case series, we report the mid-term clinical and radiological outcomes of THA performed for moderate to severe protrusio acetabuli using a novel technique in which the femoral head is utilized as an autologous structural graft without the use of reinforcement rings, cages, wire mesh, or additional metallic augmentation. Our results demonstrate that this technique is safe, reproducible, and provides reliable functional improvement with excellent graft incorporation and absence of major complications at a mean follow-up of 28.9 months. The management of protrusio acetabuli remains challenging due to medial acetabular bone loss, altered hip

biomechanics, and increased risk of implant migration⁹. Traditional approaches frequently involve impacted bone grafting combined with reinforcement rings or cages to prevent medial cup migration. However, literature consistently highlights the disadvantages of these devices, including complexity of surgical exposure, increased cost, potential long-term loosening, and risk of infection reactivation¹. Similarly, previous reports have shown that uncemented or cemented cups placed directly into a deficient medial wall without proper bone grafting carry a high risk of loosening due to thermal necrosis and poor mechanical support¹⁰. In contrast, our technique utilizes the patient's own femoral head as structural autograft, offering biological advantages including superior osteoconductive and osteoinductive properties, complete host-graft compatibility, and elimination of disease-transmission risk inherent to allografts. Similar to the findings of Kushwaha et al., who used femoral head autograft in post-tubercular protrusio hips with excellent consolidation and functional recovery, our results confirm that adequate graft impaction into a well-prepared, vascular host bed provides stable support for acetabular component placement and medial defect reconstruction¹. The functional outcomes in our cohort were encouraging, with all patients achieving good to excellent Oxford Hip Scores (OHS). Notably, we did not observe any case of graft collapse, cup migration, aseptic loosening, periprosthetic fracture, or dislocation during the follow-up period. This complication-free course compares favorably with current literature, where complication rates were higher in cases involving reinforcement cages or cemented cups without bone grafting³. Our findings are also consistent with previous reports describing stable outcomes of autograft reconstruction for protrusio acetabuli in rheumatoid arthritis and other etiologies of protrusio acetabuli⁹. Furthermore, the underlying causes of protrusio, which included rheumatoid arthritis, steroid use, chronic kidney disease, TB hip, and previous conservatively treated femoral neck fracture, did not influence graft incorporation or post-operative hip function. This reinforces the biological advantage of using autologous bone, even in metabolically compromised or osteoporotic bone states.

An interesting observation in our study was that there was a moderate positive correlation between BMI and Oxford Hip Score, as well as between protrusion grade and Oxford Hip score, indicating a trend toward higher functional scores with increasing BMI and protrusio grade. However, both these correlations were not statistically significant, likely due to the small sample size.

A key strength of our study is that all procedures were performed by a single fellowship-trained arthroplasty surgeon using a standardized posterior approach, eliminating inter-surgeon variability. In addition, three patients underwent bilateral THA (single-stage or staged), emphasizing the feasibility of this technique even in complex bilateral disease.

However, certain limitations deserve consideration. First, our sample size is small (n=7), limiting generalizability. Second, the absence of a control group—such as patients treated with cages or allografts—prevents direct comparative analysis. Third, although our follow-up duration of up to 52 months provides meaningful mid-term insight, longer surveillance is necessary to evaluate the durability of graft integration, the potential for late loosening, and survivorship of implants. Fourth, this study does not include a direct comparison of outcomes between unilateral, bilateral staged, and bilateral single-staged THA. Despite these limitations, the study offers meaningful evidence supporting the use of femoral head autograft in THA for significant protrusio acetabuli. Our outcomes are in line with existing literature advocating that adequate graft impaction with a well-positioned uncemented cup can restore hip biomechanics, improve medial bone stock, and avoid the complications associated with reinforcement devices¹.

Conclusion

Use of femoral head as an autograft is valuable in case of hip pathologies with acetabular defect and protrusio acetabuli, in patients planned for THA. It provides a biological environment for acetabular defect healing and avoids cost and complications associated with metallic cages, rings or meshes.

Conflict of interest: No financial conflict of interest to disclose.

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