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Case Report

Implant Failure and Acetabular Protrusion Post Austin Moore Prosthesis: A Case Report

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ABSTRACT

Implant failure and acetabular protrusion are significant complications following Austin Moore prosthesis insertion, particularly in elderly patients with hip fractures. Total hip arthroplasty (THA) offers superior outcomes compared to hemiarthroplasty (HA) but comes with its own set of challenges. Understanding the risk factors and implications of these complications is crucial for choosing effective management. In this article, we report a 76-year-old woman who presented with severe left hip pain post-fall, eight years after HA with an Austin Moore prosthesis due to a trochanter fracture. The patient was able to walk with a walker before the fall. Physical examination revealed tenderness and limited range of motion. Radiographic imaging confirmed acetabular protrusion and AMP neck fracture. Conversion to THA using a hybrid system was performed successfully, with the patient exhibiting no post-operative complications. This case report showed that implant failure and acetabular protrusion pose complex challenges, exacerbated by patient demographics, implant design, and bone quality. THA emerges as a preferred option due to its superior outcomes, although conversion from HA is associated with increased risks. Early diagnosis and intervention, as well as a multidisciplinary approach and careful consideration of patient-specific factors, are crucial for optimizing patient outcomes and quality of life.

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INTRODUCTION

Hip fractures are the most common type of frailty fracture, with implant failure occurring in approximately 1-7% of patients with hip arthroplasty (Thien et al., 2020). Factors contributing to these fractures include patient age, osteoporosis, and the duration since the initial hemiarthroplasty (HA) procedure (Suhm et al., 2019). The acetabular protrusion, another significant complication associated with long-term HA, is characterized by the migration of the prosthesis into the pelvic cavity, occurring in up to 10% of cases over 10 years (Koerner et al., 2019). These complications are notably higher in elderly populations due to age-related bone density loss and increased likelihood of falls (Cooper et al., 2019).

The focus of this case report is to highlight the implant failure and acetabular protrusion risk factors and serious complications in patients with long-term hemiarthroplasty. While hemiarthroplasty is commonly used for proximal femur fractures or severe osteoarthritis and offers benefits such as lower dislocation rates and faster operative times, it is often complicated by acetabular erosion and implant failure. Total hip arthroplasty (THA), on the other hand, has superior functional outcomes and lower long-term revision rates. Understanding these complications' risk factors and management strategies is crucial for improving patient outcomes.

By presenting this case report, we aim to provide valuable insights into the prevalence and management of these complications, emphasizing the comprehensive and thoughtful consideration of individual patient factors since early management decisions. The case report will demonstrate the importance of a multidisciplinary approach involving orthopedics, radiology, and rehabilitation, highlighting the necessity of surgical revision and medical interventions to improve bone quality and prevent further fractures.

CASE REPORT

We present a 76-year-old woman who was admitted to the orthopedic outpatient unit due to severe pain in her left hip after slipping at home. She has a history of hemiarthroplasty (HA) installed an Austin Moore prosthesis (AMP) type 1 on her left hip approximately 8 years ago due to a trochanter fracture. During that time the patient could walk with the help of a walker. Based on physical examination, tenderness and limited range of motion due to pain were found. A plain radiograph showed acetabular protrusion and AMP neck fracture. THA with a hybrid system (cemented cup and uncemented long stem) was done to replace the AMP. Post-operative care is carried out in the high-care unit as a precaution against bone cement implantation syndrome. After 24 hours, no signs of infection and no complications were found so the patient was transferred to the inpatient ward, on day 5, the patient was sent home for outpatient treatment with the help of physiotherapy. The patient can walk well with LLD 1 cm. The patient did not continue follow-up and rehabilitation.

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Figure 1. Pre-Hemiarthroplasty

Figure 2. Post-hemiarthroplasty

Figure 3. AMP neck fracture and acetabular protrusion before THA procedure.

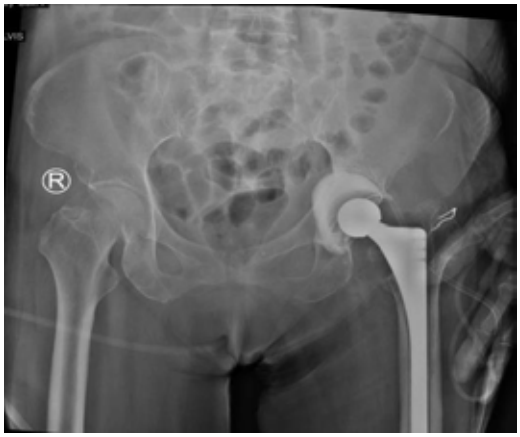

Figure 4. Post THA procedure.

DISCUSSION

This case highlights the significant complications of implant failure and acetabular protrusion in a long-term hemiarthroplasty patient. These issues are not uncommon in patients with prolonged prosthetic implants, particularly those like the Austin Moore Prosthesis (AMP) used in this patient. The increasing age of patients and the extended use of such implants contribute to the incidence of these complications (Munro et al., 2020; Lee et al., 2021). The incidence of these complications is higher among elderly patients, particularly those with osteoporosis or reduced bone mineral density, which are common in postmenopausal women (Cooper et al., 2019). The patient in this case, being 76 years old, fits the demographic profile at increased risk for both implant failure and acetabular protrusion. Moreover, a history of low-energy trauma, such as a fall from standing height, further exacerbates the risk (Suhm et al., 2019). This scenario underscores the complexity and challenges associated with managing long-term HA complications.

In elderly populations, low-energy falls are a common cause of acetabular fractures, with studies showing that 47.12% of such fractures result from falls from standing height or lower

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(Rogmark and Leonardsson, 2016). This case aligns with these findings, emphasizing the susceptibility of geriatric patients to hip fractures from minimal trauma. AMP neck fractures are recognized as the most frequent failure mode in hip hemiarthroplasty, alongside other complications such as dislocation, acetabular wear, and infection (Khan et al., 2019).

Risk factors for implant failure include mechanical stress and wear, biological response to the prosthesis, and surgical technique. Mechanical stress and wear are linked to the design of the AMP, which subjects the prosthesis to significant mechanical stress, particularly in active or overweight patients (Chen et al., 2019). Over time, this can lead to material fatigue and eventual failure of the prosthesis. The biological response, such as osteolysis and aseptic loosening, also contributes to implant failure. The body's immune response to wear particles from the prosthesis can cause bone resorption around the implant, leading to loosening and failure (Smith et al., 2020). Surgical technique and initial placement of the prosthesis play critical roles, as improper alignment or positioning during surgery can increase the risk of stress concentrations and implant loosening (Jones & Wang, 2021). Surgeons' experience and precision are crucial to minimizing these risks. This case illustrates implant failure linked to the AMP design, which lacks an acetabular component, which generates significant mechanical stress and wear on the acetabulum, accelerating its erosion. The continuous stress and friction also cause material fatigue, making the implant prone to breakage. The situation is exacerbated by additional trauma from the fall. Thus, the combination of mechanical stress, accelerated wear, and material fatigue from the outdated AMP design directly contributes to the implant's failure and the resultant acetabular protrusion.

Acetabular protrusion involves the migration of the prosthetic component into the acetabulum, often leading to severe pain and functional impairment. This condition typically arises from chronic mechanical stress and bone resorption around the implant site (Lee et al., 2021). Risk Factors for Acetabular Protrusion are 1) Bone Quality, Osteoporosis, and poor bone quality are significant risk factors for acetabular protrusion. Elderly patients, particularly postmenopausal women, are at higher risk due to decreased bone density, making the acetabulum more susceptible to erosion and protrusion (Liu et al., 2019). 2) Prosthesis Design, which does not include an acetabular component, can lead to increased wear on the acetabulum. Over time, this can cause the prosthetic head to migrate into the pelvic cavity, resulting in acetabular protrusion (Kim et al., 2020). 3) Inadequate Prosthetic Fit between the prosthesis and the patient's bone can lead to micro-movements and increased pressure on the acetabulum. This can accelerate the erosion process and lead to protrusion (Garcia-Rey et al., 2018). The plain radiograph in this case confirmed the diagnosis, necessitating a THA to replace the AMP and address the acetabular defect.

The conversion from HA to THA is often necessitated by complications such as those presented in this case. However, this conversion is not without risks. Prosthetic dislocations are notably one of the highest postoperative complications associated with this procedure (Enocson et al., 2019). Despite these risks, THA is often favored due to its potential to improve the quality of life. Systematic reviews of acute THA procedures have demonstrated high survivorship rates, ranging from 77% to 100% over follow-up periods of 24 to 97 months (Cheng et al., 2020). Moreover, THA is associated with better long-term outcomes in

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terms of reduced acetabular erosion compared to HA (Zhang et al., 2021).

The use of a hybrid THA system, combining a cemented cup and an uncemented long stem, was chosen to provide a stable and durable solution for this patient. This approach helps ensure better fixation and load distribution, which is crucial for patients with compromised bone quality (Siddiqi et al., 2022). In this case, the decision to utilize a hybrid THA system (cemented cup and uncemented long stem) was driven by the need to address both the acetabular protrusion and the AMP neck fracture. Literature indicates no significant difference in revision risks between cemented and hybrid systems, suggesting that the choice of system should be tailored to individual patient needs and anatomical considerations (Konan et al., 2020). The cemented cup was particularly chosen due to its immediate fixation capability, which is vital for early postoperative mobilization, and its reliability in patients with poor bone quality. Furthermore, the surgeon's experience and preference for cemented techniques played a role in this decision, as these techniques have demonstrated successful outcomes over the years. Post-operative care in the high-care unit was essential to monitor for potential complications, such as bone cement implantation syndrome, a risk associated with cemented components (Gomez-Hernandez et al., 2019). This is a potentially life-threatening complication, although no complications were observed in this patient (Olsen et al., 2018).

A small medial wall defect in this case suggests that the primary structure of the acetabulum remains largely intact. This allows for a prosthetic cup that closely matches the original shape of the patient's acetabulum, ensuring a more anatomical fit. In this scenario, the cement fixation is enough to provide stability. It offers immediate fixation and load distribution, which is particularly beneficial in cases where bone stock may be compromised or insufficient for a press-fit technique. This method reduces the risk of micromotion at the bone-implant interface, thereby enhancing the longevity and success of the implant (Lewinnek et al., 2021).

After 24 hours without complications, the patient was transferred to the inpatient ward and subsequently discharged on day five with outpatient follow-up and physiotherapy. Quality of life after surgery, currently 4 months improved. The patient can walk well. Early mobilization and physiotherapy are vital for recovery, helping to restore function and prevent further complications (Paprosky et al., 2019).

Managing such complex cases requires a multidisciplinary approach involving orthopedic surgeons, radiologists, and physiotherapists. Advances in surgical techniques, implant materials, and post-operative care protocols have improved outcomes for patients undergoing revision surgeries (Munro et al., 2020). THA was chosen for this patient based on advantages in pain reduction, functional improvement, prosthetic longevity, and stability. Recent studies strongly support the use of THA, particularly in cases complicated by prosthetic failure and acetabular protrusion, as it provides a comprehensive and durable solution. However, ongoing research is needed to develop better preventive strategies and treatment modalities to address these complications effectively.

The limitation of this research is the absence of follow-up and rehabilitation, primarily due to the patient's reluctance to follow-up. Follow-up is crucial for monitoring the result of conversion to THA. Regular follow-up allows for timely interventions and rehabilitation is also essential to ensure proper recovery, enhance joint function, and reduce the risk of

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post-THA complications. The lack of these post-operative measures in this case limits the ability to fully understand the progression and contributing factors of the conversion to THA from HA implant failure.

Future research should focus on enhancing the durability and biocompatibility of prosthetic materials, improving surgical techniques, and developing better diagnostic tools for early detection of potential complications (Jackson et al., 2020). Additionally, preventive measures such as pharmacological management of bone density and regular monitoring of implant stability can help mitigate the risks associated with long-term hemiarthroplasty (Siddiqi et al., 2022).

CONCLUSION

This case highlights the importance of recognizing and managing risk factors for implant failure and acetabular protrusion. By understanding these factors—mechanical stress, biological responses, surgical technique, bone quality, prosthesis design, and fit—clinicians can better anticipate complications and tailor their surgical and post-operative strategies accordingly. Addressing the surgical and post-operative challenges. Performing conversion arthroplasty from HA to THA is associated with an increased risk of multiple joint complications in both the short and mid-term follow-up period. THA is more desirable to avoid acetabular erosion. THA remains the gold standard for treatment, providing improved outcomes and quality of life for patients. Continued research and advancements in prosthetic design and surgical techniques are vital for improving outcomes in hip arthroplasty patients.

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