



Case Report

The Patient With Chronic Total Hip Arthroplasty Dislocations: A Case Series of Five Patients Who Underwent Revision THA Using Polypropylene Mesh for Capsular Reconstruction

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ABSTRACT

We report a case series of 5 patients who underwent revision total hip arthroplasty (THA) using a polypropylene mesh for capsular reconstruction for chronic THA instability. The average follow-up is 16.6 months (range, 9–20 months). There were no postoperative dislocations in our series. Three patients had previous infections with two-stage revisions before final revision surgery and were infection free at their most recent follow-up. One patient developed a prosthetic joint infection 2 months postoperatively. The use of a polypropylene mesh appears to be another tool that surgeons can use when dealing with the difficult dilemma on how to treat the patient with chronic THA instability and severe abductor and capsular tissue loss.

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Introduction

Hip instability after total hip arthroplasty (THA) is one of the leading causes of revision THA [1]. Orthopaedic surgeons use a variety of techniques to minimize hip instability in the primary and revision setting such as appropriate implant positioning, soft-tissue tensioning, and capsular repair. In addition, a variety of implants are used to mitigate hip instability, such as elevated polyethylene liners, constrained liners, large femoral head sizes, and dual-mobility constructs [2]. Patients with chronic hip instability are a difficult population to counsel about the appropriate surgical or nonsurgical path. Oftentimes, these patients have undergone multiple revision surgeries using some or even all of the listed techniques and implants to mitigate instability. The use of capsular augmentation or reconstruction using a mesh may be a promising option for these problematic patient populations that have failed multiple prior surgical attempts to stabilize the hip.

The use of surgical meshes has dated back to 1891, and they were used as a prosthetic material to repair hernias [3]. Since that time, many materials have been used such as nylon, Orlon, Dacron, and Teflon, but they were fraught with complications such as foreign-body reaction, sepsis, rigidity, fragmentation, loss of tensile strength, and encapsulation [3]. More recently, research in meshes for hernia repair has led general surgeons to use large-pore, monofilament, synthetic meshes [4]. Polypropylene is one of the meshes that exhibit these properties and is commonly used today for hernia repair [5]. However, the use of a polypropylene mesh in orthopaedics for joint capsule reconstruction has been quite limited.

Surgical meshes have been used for hip joint capsule reconstruction in the orthopaedic tumor literature in which wide resection of soft tissues was required because of the extent of disease. Masterson et al. used a polypropylene mesh for capsular reconstruction in oncologic cases requiring wide resections and proximal femoral replacements. In those who received reconstruction with the mesh, 5 of 13 (38%) experienced instability postoperatively, with the most stable construct being a bipolar prosthesis with a polypropylene mesh reconstruction [6]. In addition, Wang et al. used a polypropylene mesh to reconstruct the joint capsule after endoprosthetic reconstruction of the proximal

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Table 1
Age, BMI, and approach of index THA.

Case	Age	BMI	Initial surgery approach
Case 1	45	34	Direct anterior
Case 2	80	42	Posterolateral
Case 3	83	36	2-Incision anterior
Case 4	73	30	2-Incision anterior
Case 5	82	25	Posterolateral

humerus and found decreased rates of glenohumeral dislocation and subluxation [7]. There is no current literature on the use of a polypropylene mesh to reconstruct the joint capsule in patients with chronic hip instability. This is a case series of 5 patients with chronic THA instability who underwent a revision surgery that included capsular reconstruction with a polypropylene mesh by a single surgeon. From the study period of Sept. 2018–Sept. 2019, the author performed 30 revision hip arthroplasties for multiple indications. The 5 patients in the present study comprised the only patients operated on for the indication of multiple prior failed revision surgeries for instability with concomitant deficiency of the abductor mechanism and/or capsular structures about the hip.

Case histories

Case 1

This is a case of a 45-year-old female with a body mass index (BMI) of 34 who initially underwent a left direct anterior primary THA (Table 1). The patient also had undergone a pre-existing lumbar spinal fusion but did not undergo functional sitting and standing lateral pelvis radiographs preoperatively. Within the first 3 months postoperatively, she had 2 anterior hip dislocations and underwent a head and liner revision surgery after her second dislocation. She did well for 1.5 years, then had 2 further anterior dislocations, and then underwent another head and liner revision surgery and abductor repair. Both of the revision surgeries were performed via an anterior approach. It is unclear about the etiology of her abductor tear requiring repair. Based on reviewing the records from the outside facility and her incision location, it was likely iatrogenic from one of her prior anterior hip approaches. One month postoperatively from her revision with abductor repair, she presented with a prosthetic joint infection (PJI) and underwent a two-stage revision for infection via a posterior approach. Over the next year after her reimplantation, she had 5 posterior THA dislocations that were all successfully closed reduced. After her fifth dislocation, she underwent a revision surgery to a dual-mobility

implant with mesh augmentation to reconstruct her posterior capsule. Intraoperatively, the patient's acetabulum appeared to be slightly under anteverted. The decision was made to maintain the well-fixed cup and increase stability by reconstructing the capsule with a mesh along with exchanging the bearing. Fortunately, this device accepted a dual-mobility liner, and the new construct demonstrated excellent intraoperative stability. At her most recent follow-up at 19 months, radiographs (Fig. 1) are stable with no recurrent instability and no signs of infection.

Case 2

This is a case of an 80-year-old female with a BMI of 42 who initially underwent a left posterolateral primary THA. Within the first year, she underwent open reduction and internal fixation (ORIF) for a periprosthetic femur fracture, 2 closed reductions for posterior dislocations, and a two-stage revision for PJI. Over the next 4 years, she had 2 distal femur fractures that underwent ORIF, one associated with a posterior hip dislocation where she underwent a revision to a constrained liner. Postoperatively, she dislocated her constrained liner and was noted to have a loose femoral component on the radiograph. She underwent a revision to a total femur replacement because of severe degenerative joint disease in her ipsilateral knee. Over the next 10 years, she underwent another two-stage revision for a septic total femur and underwent 9 open reductions and constrained liner revisions because of posterior dislocations and failed constrained liner inserts. In the 9 months leading up to her final revision surgery, she had 3 constrained liner failures requiring revisions. She then underwent another revision constrained liner surgery with mesh augmentation to reconstruct the entire hip capsule circumferentially anterior to posterior (Fig. 2). At the final revision surgery, correction of cup anteversion was entertained. However, with the patient's global loss of soft tissue, including abductors and the entire joint capsule, along with diminishing bone stock and a well-fixed acetabular component, the decision was made to simply exchange the constrained bearing and reconstruct the soft tissues with a mesh. This accomplished an adequate constraint of hip motion that was felt sufficient to prevent further failure of the constrained component. At her most recent follow-up at 20 months, she had no signs of infection, had stable implants, and had no further instability.

Case 3

This is a case of an 83-year-old female with a BMI of 36 who underwent an anterior two-incision primary THA. She did well for 10 years and then presented with a posterior hip dislocation and

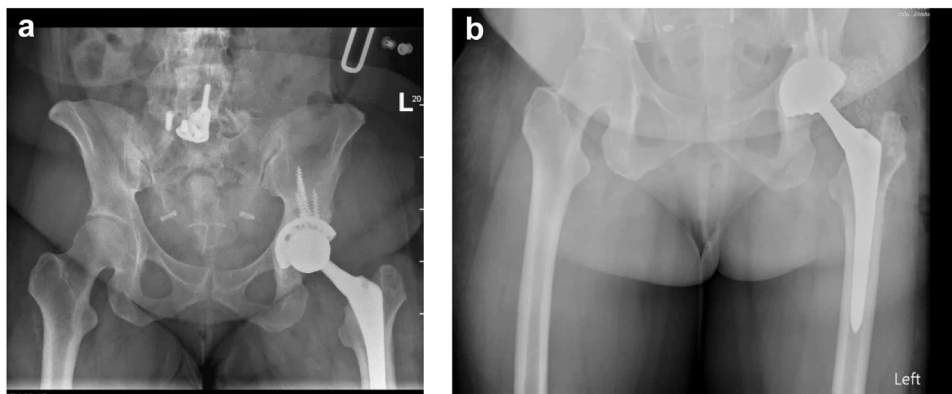


Figure 1. Case 1: preoperative radiographs (a) and postoperative radiographs (b) after revision to a dual-mobility construct using the mesh for capsular reconstruction.

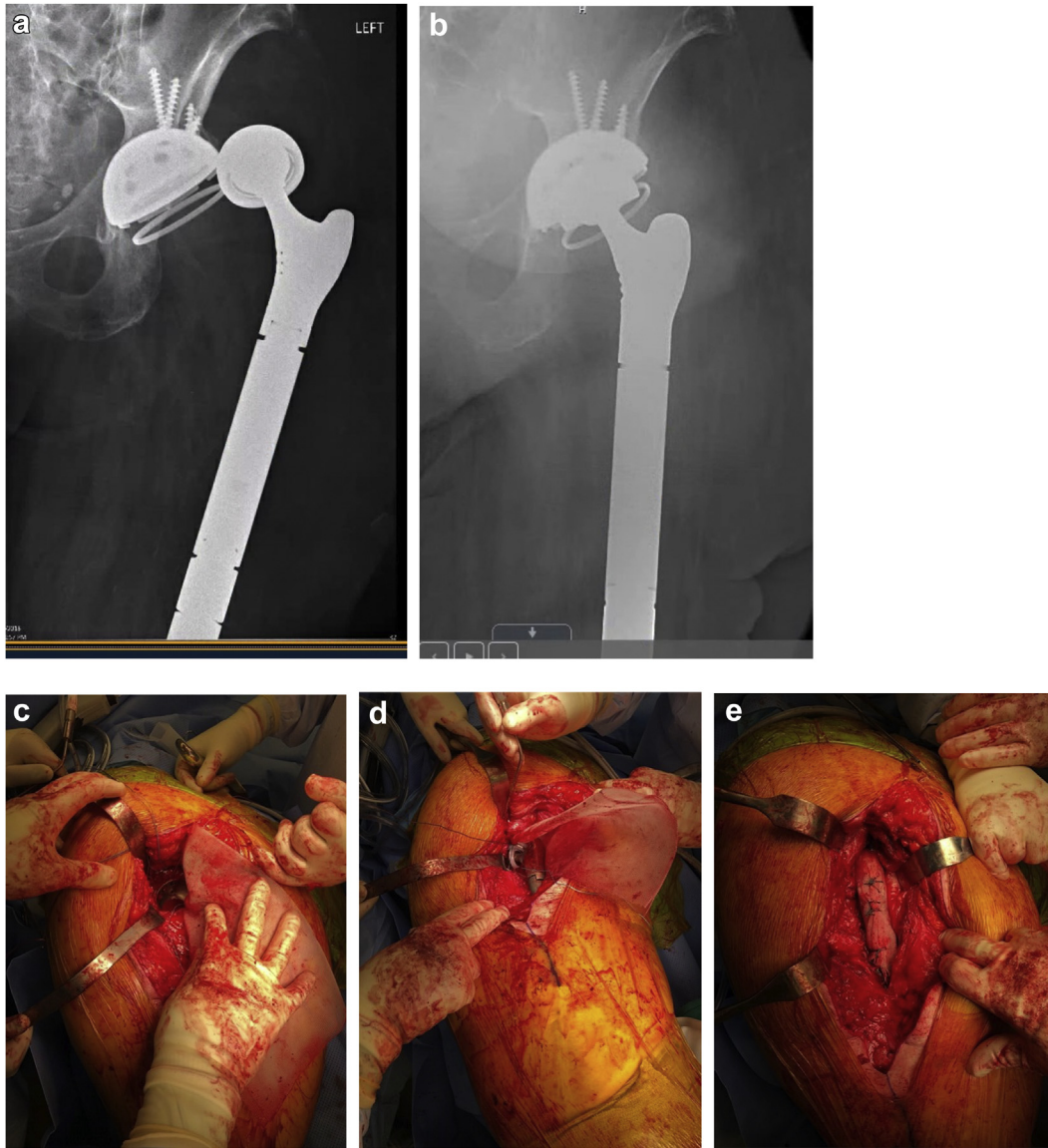


Figure 2. Case 2: a preoperative radiograph of a dislocated constrained liner (a) and a postoperative radiograph (b) after revision constrained liner with capsular reconstruction using the mesh. Intraoperative photos (c-e) showing suture anchors that were placed circumferentially around the acetabulum and around the prosthesis' greater trochanter to reconstruct the anterior and posterior capsules.

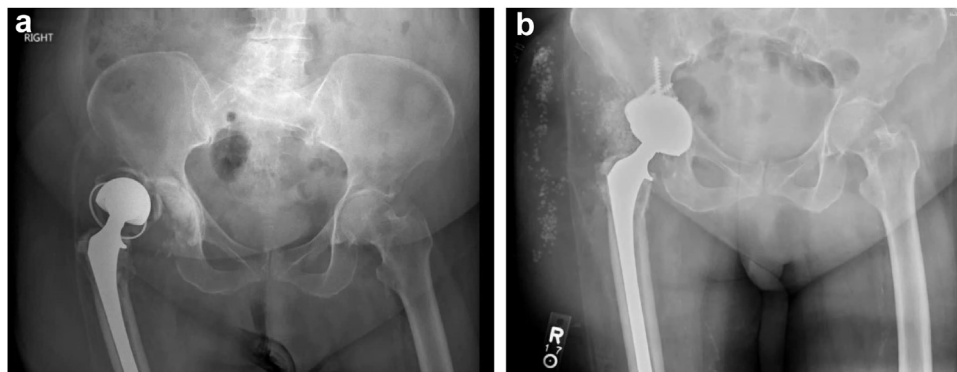


Figure 3. Case 3: A preoperative radiograph of a dislocated constrained liner spacer (a) and postoperative radiograph (b) after revision to a dual-mobility construct with capsular reconstruction using the mesh.

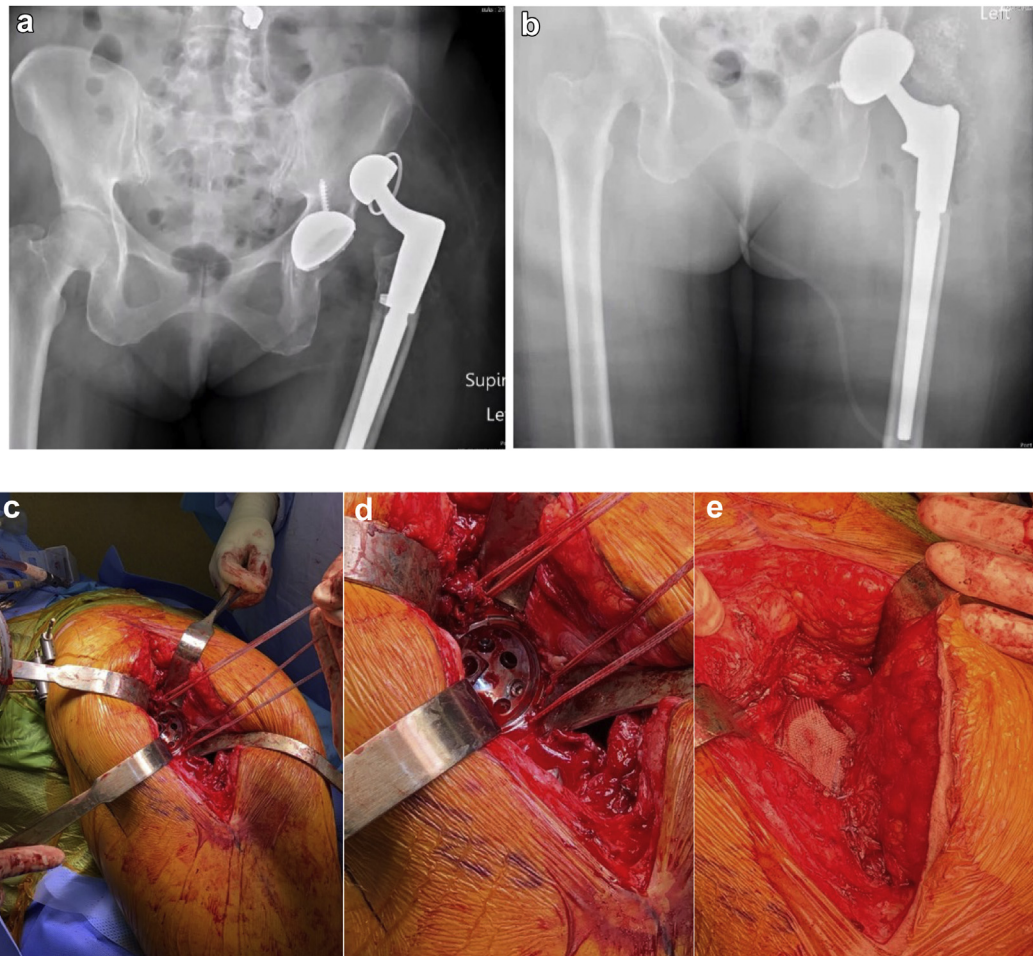


Figure 4. Case 4: a preoperative radiograph (a) and a postoperative radiograph (b) after mesh reconstruction with intraoperative pictures (a-e) showing suture anchor placement and mesh reconstruction.

was found to have a septic THA with adverse local-tissue reaction due to trunnionosis. She underwent a revision with an articulating antibiotic spacer with cemented constrained liner. Intraoperatively,



Figure 5. Case 4: a postoperative radiograph of a dual-mobility acetabular component cemented into the acetabulum with high-dose antibiotic cement to act as an articulating antibiotic-coated cement spacer after irrigation and debridement and removal of the mesh for infection.

she was noted to have abductor necrosis and acetabular bone loss. One month postoperatively, she had a failed constrained liner, dislocated, and underwent repeat revision of her constrained liner. She again suffered failure of the constrained liner and underwent revision to a dual-mobility construct (Fig. 3) with mesh augmentation to reconstruct her posterior capsule. At her most recent follow-up at 17 months, she had no signs of infection and has had no hip instability.

Case 4

This is a case of a 73-year-old female with a BMI of 30 who underwent an anterior two-incision primary dual-modular THA. The femoral prosthesis had a modular neck and was later recalled by the manufacturer because of issues related to corrosion at the neck-stem interface. She was found to have adverse local-tissue reaction with complete loss of her abductors on metal artifact reduction sequence magnetic resonance imaging and underwent revision THA. Over the ensuing 6 years, she had a total of 10 dislocations (anterior and posterior), with 5 requiring an open reduction and revision using both dual-mobility and constrained liner constructs. She then underwent revision to a dual-mobility construct with mesh augmentation to reconstruct her posterior and anterior capsules, as she had 6 dislocations in the year prior (Fig. 4). At 2 months postoperatively, she developed a PJI and underwent an irrigation, debridement, explant of components and mesh, and placement of an articulating dual-mobility

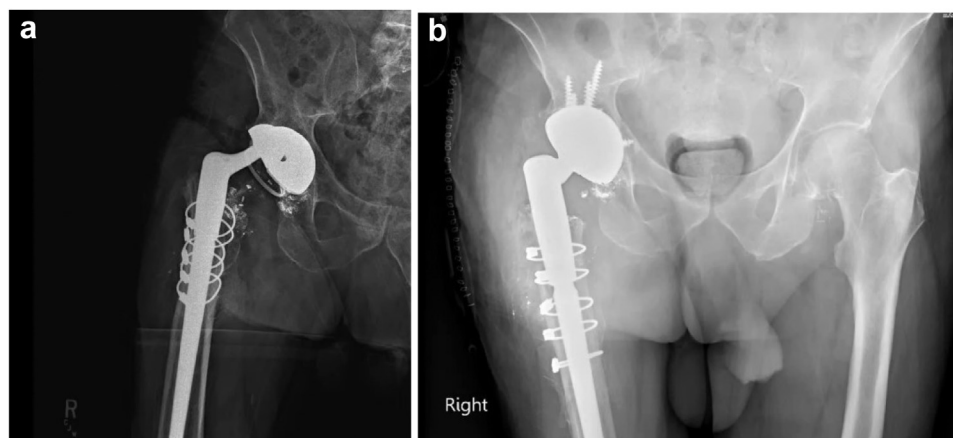


Figure 6. Case 5: a preoperative radiograph of the dislocated constrained liner (a) and a postoperative radiograph after revision to dual-mobility construct with mesh augmentation (b).

antibiotic cement spacer (Fig. 5). At her most recent follow-up at 18 months, she had no signs of infection and has had no further instability.

Case 5

This is a case of an 83-year-old male with a BMI of 25 who initially underwent a right posterolateral THA. He went on to have a total of 9 posterior THA dislocations, 5 requiring an open reduction, and underwent 6 revision surgeries for instability. In the 3 months preceding his latest revision surgery, he failed 2 constrained liner inserts. He then underwent revision to a dual-mobility (Fig. 6) construct with mesh augmentation of his anterior and posterior capsules. Two months after his mesh reconstruction, the patient suffered an ipsilateral tibial shaft fracture because of a syncopal episode. At his most recent follow-up at 9 months, his hip remained stable, and he had no signs of infection and has had no instability.

Discussion

The treatment for patients with chronic THA instability has remained a challenge for decades [8]. In this case series, we found favorable results with the use of a polypropylene mesh for capsular reconstruction to help mitigate THA instability. The 5 patients had a documented 43 prior dislocations, with 20 of those dislocations occurring within the 12 months preceding their mesh reconstruction (Table 2). In the follow-up period at an average of 16.2 months, there had been no recurrent dislocations (Table 3). However, capsular reconstruction with a mesh was used in conjunction with other measures to increase stability. In 4 of our 5 cases, a dual-mobility construct was used, which has been shown to decrease dislocation rates in revision THA [9–11] and revision THA with abductor deficiency [12]. In case 2, capsular reconstruction with a

mesh was used in conjunction with a constrained liner, which also has shown to increase THA stability [13]. However, this patient failed 9 previous constrained liners, and the only change made in her last revision surgery was the capsular reconstruction with a mesh giving some evidence that in select patients who have failed constrained prosthesis multiple times, reconstruction of the joint capsule may be a promising option. Finally, other methods to augment and restore soft-tissue integrity of the hip have been described. Whiteside's technique of gluteus maximus muscle transfer in patients with abductor insufficiency to augment abductor function has been used [14]. The authors are unaware of any series using gluteus maximus muscle transfer to treat a multiple failed chronic dislocating THA, although this technique could be used in conjunction with mesh reconstruction.

The technique for capsular reconstruction in these patients used Bard polypropylene mesh (Bard Inc., New Providence, NJ). For posterior capsular deficiencies such as those in case 1, the hip was approached posterolaterally, Iconix suture anchors (Stryker Corporation, Kalamazoo, MI) were used in the posterior acetabulum at the 12, 3, and 6 o'clock positions (Fig. 7), and a folded double layer was fixed to the suture anchors and then fixed to the greater trochanter to reconstruct the posterior capsule from the 12 o'clock to the 6 o'clock positions. For larger capsular deficiencies, such as in case 2–5, a direct lateral approach was performed. With the absence of a functional greater trochanter due to the patient's prior infections and fractures necessitating a total femur replacement such as those in case 2, the mesh was used to encapsulate the prosthesis reconstructing the anterior and posterior capsule (Fig. 2) using circumferential suture anchors surrounding the acetabulum. Cases 2, 3, and 4 all required circumferential repair with the mesh. Case 5 required mesh augmentation from the 11 to 7 o'clock positions. A minimum of 2 suture anchors and a maximum of 4 were used in all cases. Additional attachment of the mesh to remnant soft tissues and capsular stump was performed using #2 Ethibond suture (Johnson & Johnson

Table 2

Number of dislocations, revisions, and infections before revision with capsular reconstruction with the mesh.

Case	Dislocation direction	Total dislocations	Dislocations within 12 months	Open reductions	Closed reductions	Revision surgeries	Previous infection
Case 1	Posterior/anterior	7	5	0	7	4	Yes
Case 2	Posterior	14	3	12	2	18	Yes
Case 3	Anterior	3	3	2	1	2	Yes
Case 4	Posterior/anterior	10	6	5	5	5	No
Case 5	Posterior	9	1	5	4	6	No

Table 3
Final revision surgery approach, implants, and follow-up.

Case	Final revision approach	Final surgery	Subsequent dislocation	Follow-up (months)
Case 1	Posterolateral	Dual mobility with capsular reconstruction with the mesh	No	19
Case 2	Direct lateral	Revision constrained liner with capsular reconstruction with the mesh	No	20
Case 3	Direct lateral	Dual mobility with capsular reconstruction with the mesh	No	17
Case 4	Direct lateral	Dual mobility with capsular reconstruction with the mesh	No	18
Case 5	Direct lateral	Dual mobility with capsular reconstruction with the mesh	No	9

Medical Devices, New Brunswick, NJ). After capsular reconstructions were completed, the range of motion and stability were assessed to the limits of motion stressing the capsular reconstruction, but without stressing the repair to failure. In all cases, the joint remained stable within the new capsular confines. Postoperatively, patients with prior posterior instability were given precautions of no hip flexion greater than 90 degrees and to limit internal rotation. If they also experienced prior anterior instability, they were also given precautions of no hyperextension and to limit external rotation.

One concern is the use of a polypropylene mesh in patients with a history of prior PJI. Of our 5 cases, 3 had a prior PJI (cases 1, 2, and 3). Of these three cases, there were no signs of infection at 19, 20, and 17 months postoperatively, respectively. Thus, in our limited series, we have shown that, in the short term, reconstruction of the capsule with a polypropylene mesh may still be an option in the face of prior PJI. However, our patient in case 4 developed a PJI 2 months after revision using the mesh that required implant and mesh removal. This patient had no prior history of infection. It is possible that the adjunctive use of the mesh could have an increased risk for PJI; however, aseptic revision THA itself is 4 times more likely to develop PJI than primary THA [15]. Perry et al. investigated two-stage exchange and polypropylene mesh reconstruction for PJI with extensor mechanism disruption after TKA. They found survivorship free of mesh failure or PJI was 75% at 2 years [16]. This is similar to our data in which we had 80% survivorship free of mesh failure or PJI at 16.2 months. However, further investigation regarding PJI and polypropylene mesh is warranted.

This case series shows another surgical technique that can be used by surgeons who are faced with patients who have failed

numerous prior surgical attempts to correct chronic THA instability, especially in the face of severe soft-tissue deficiency. This is a small cases series, and further experience with this technique is needed to determine its ultimate utility. In addition, the revision to a dual-mobility construct itself may increase stability that is enough to prevent further dislocation in many patients. However, in this series, 4 of the 5 reported cases had already failed prior constrained or dual-mobility constructs without success until mesh augmentation was used as well. There is no compromise for poor component positioning, but the use of a polypropylene mesh may be a promising option in patients with chronic dislocations and deficient joint capsules, when there are seemingly no other good options. Larger clinical studies are warranted to further investigate the safety and efficacy of using a polypropylene mesh for capsular reconstruction.

Summary

The use of a polypropylene mesh to reconstruct the hip joint capsule may be a promising option in a patient with difficult chronic hip instability who has undergone multiple prior revisions using many different techniques to mitigate instability. In this case series, the polypropylene mesh has been shown to be able to be implanted in patients with prior PJI with more than 1-year follow-up without signs of PJI postoperatively. However, other means to create a stable hip joint such as constrained liners and dual-mobility constructs used in conjunction with hip capsule reconstruction should be used to increase stability. Further research in this area is needed.

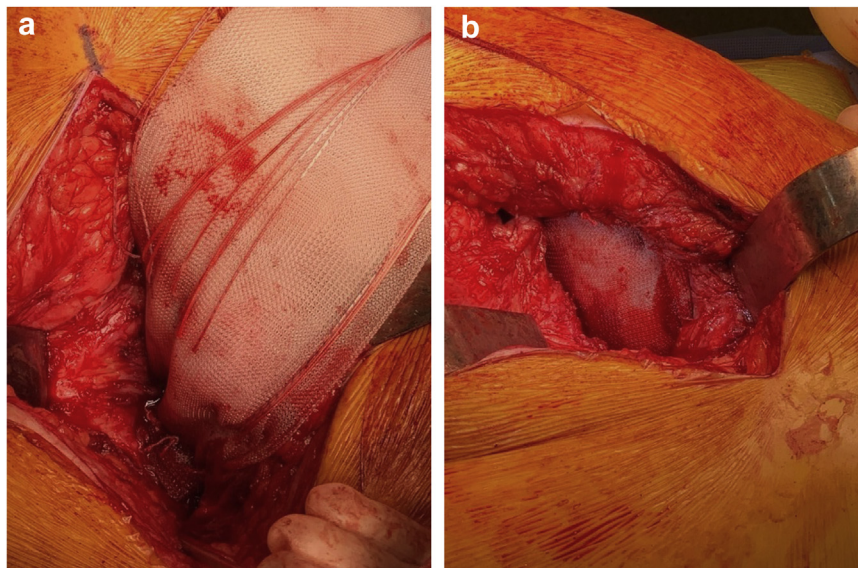


Figure 7. Intraoperative photos showing the mesh anchored in the posterior acetabulum with suture strands from anchors coming through the mesh (a) and after the mesh is sutured to the greater trochanter (b).

Conflicts of interests

J.P. Nessler has received royalties from Stryker and is a paid consultant for Stryker; the other author declares no potential conflicts of interest.

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