J Clin Invest Surg. 2016; 1(1): 1-7
doi: 10.25083/2559.5555.11.17

Research Article

Revision of migrated pelvic acetabular components in THA with or without vascular involvement

Ștefan Cristea[1,3], Andrei Prundeanu[1], Florin Groseanu[1], Ștefan Cuculici[1], Şerban Dragosloveanu[1], Radu Vișan[1], Ionel Droc[2]

[1]St. Pantelimon Emergency Hospital, Department of Orthopedics and Trauma, Bucharest, Romania
[2]Carol Davila Army Centre of Cardiovascular Diseases, Bucharest, Romania
[3]Carol Davila University of Medicine and Pharmacy, Department of Orthopedics, Bucharest, Romania

Abstract

Purpose. The literature describes a high rate of mortality in cases of intrapelvic acetabular component migration, which is a rare but serious complication. Our aim is to establish and propose a treatment protocol according to our results and experience.

Material and Methods. We performed eight (8) total hip revisions with acetabular cup migration between 2006 and 2012. A vascular graft was needed in four (4) of these cases. Two (2) cases were revisions after a spacer for infected arthroplasties. The protocol included the following: X-Ray examination (frontal and lateral views), CT angiography, a biological evaluation, a suitable pre-operative plan, at least six (6) units of blood stock, an experienced anesthesiologist, an experienced surgical team that included a vascular surgeon and a versatile arsenal of revision prostheses, bone grafts and vascular grafts. The anterolateral approach was generally used for hip revisions and the retroperitoneal approach in the dorsal decubitus position was used when vascular risk was involved.

Results: The acetabular defect was reconstructed using bone grafts and tantalum revision cups in 4 cases, Burch-Schneider cages in 2 cases, a Kerboull ring in 1 case and a cementless oblong cup (Cotyle Espace) in 1 case. In 4 cases, an iliac vessel graft procedure was conducted by the vascular surgeon. All patients survived the revision procedures and returned regularly for subsequent check-ups, during which they did not show any septic complications.

Conclusions: Intrapelvic acetabular cup migration is a rare but serious complication that can occur after total hip arthroplasty in either septic or aseptic cases. An experienced, multidisciplinary team of surgeons should be involved in planning and conducting such complicated revisions.

Keywords: intrapelvic, acetabular, cup migration, revision prosthesis, iliac vessel

✉ Correspondence should be addressed to: Ștefan Cristea; e-mail: drstefancristea@yahoo.com

Introduction

This study is an observational report that confirms previous findings in revisions arthroplasty with migrated acetabular component into the pelvis. The literature describes a high rate of mortality related to intrapelvic acetabular cup migration, which is a rare but serious complication. Vascular injury is rare during primary arthroplasty implantation (frequency, 0.008–0.67%) but is very serious (mortality rate, 7%) with significant morbidity (1) especially in cases of intrapelvic migrated cup (2, 3). Intrapelvic acetabular cup migration can occur after total hip arthroplasty, in either septic or aseptic cases. In the case of a total hip arthroplasty, the severe acetabular component protrusion represents the migration of the cement and cup medial to the Kohler line, which results in a large defect of the acetabulum medial wall.

The removal of an acetabular prosthesis component that has migrated in the pelvis can be hazardous (4). The acetabular component that has migrated into the pelvis creates a fibrous tissue, which may be adherent to the pelvic organs, such as the uterus, rectum, bladder and ureter, and also to the common iliac vessels. As such, its removal can lead to uncontrollable bleeding (1), death or other severe complications (5).

The extraction of an acetabular prosthesis that has migrated into the pelvis must be performed with extreme precision following the careful loosening of the fibrous tissue that is adherent to the pelvic organs. There are two different approaches for performing the surgery. On one hand, a retroperitoneal approach can be used to remove the intrapelvic cup or cement mass (6). On the other hand, the Rutheford Morrison approach (7), which allows direct access for the assessment of the pelvic vessels and organs related to the prosthesis, can be used.

In our study population, we used a simple, limited retroperitoneal approach that enabled the safe removal of these cups that had migrated.

Our aim is to establish and propose a treatment protocol according to our results and experience.

Materials and methods

This retrospective study was comprised of 8 cases of migrated acetabular cup revisions, performed between 2006 and 2012 in the Orthopedic and Trauma Surgery Clinic within the St. Pantelimon Hospital, Bucharest. This study was approved by the Institutional Review Board, with a mean follow-up of 4,2 years (0,9 – 7,2 years).

Six patients presented with aseptic loosening of acetabular component and acetabular bone defect Paprosky type IIIa (4 cases) or IIIb (2 cases) (8, 9). Two were septic spacer revisions.

We were prepared to perform vascular grafting in all cases, but it was needed only in four (4) of these cases due to irreparable vascular lesions.

The study comprised six women and two men, with ages between 42 and 78 and an average age of 64 years. Among these patients, seven were primarily diagnosed with osteoarthritis, two of which occurred secondary to dysplasia, and one suffered from rheumatoid arthritis. Only three of these patients underwent primary hip arthroplasty in our clinic, while the rest were treated in other hospitals.

For their primary arthroplasty, four patients had cemented Stryker prostheses, of which three were Omnifit prostheses and one was Exeter prosthesis. The other four patients had uncemented prostheses, of which one was Zweimuller prosthesis and three were Stryker Omnifit prostheses. The average interval between the first procedure and the revision was 13.25 years and ranged between 7 to 19 years.

Two cases were revised after septic revision using a spacer. Infection was excluded in all patients by means of preoperative punction, scintigraphy and ESR, C-reactive protein and fibrinogen (10) measurements.

Thromboprophylaxy was only used for 45 days, according to literature specifications, with low-molecular-weight heparin (LMWH). After 2008, all 6 patients received a 45-day oral anticoagulant prophylaxis consisting of 220 mg/day Dabigatran.

Figure 1a. An X-ray showing the protruded Zweimuller prosthesis.

For safety revision reasons, we applied a protocol that included the following: calibrated preoperative planning on frontal and lateral view using X ray, Doppler ultrasound, CT angiogram (Fig. 1), biological evaluation including blood tests to detect inflammation and infection, the availability of at least 6 units of blood stock, an experienced anesthesiologist, an experienced surgical team that included a vascular surgeon and a versatile arsenal of revision prostheses, bone grafts and vascular grafts.

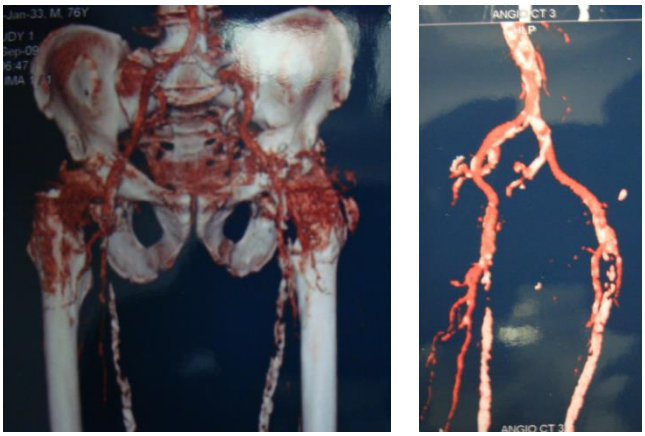

Fig 1b, c: CT angiogram showing a conflict between the migrated acetabular cup and the iliac vessels of the left hip.

The Ranawat criteria were applied for the restoration of centre of rotation (11) and intraoperative stability of the prosthetic components will restore the leg length and function of the revised hip.

Surgical technique

The patient was placed in the dorsal decubitus position. After rotating the table towards the unaffected side, we had complete access to the abdomen. A window in the drapes exposed the iliac crest and the proximal femur. We used the general anterolateral approach for hip revisions and the retroperitoneal approach in cases at risk for vascular involvement. The incision was made parallel to the distal subcutaneous border of the anterior half of the iliac crest, extending prior to the midpoint of the inguinal ligament. This enabled the conversion to the Rutherford Morison approach, which allows direct access to the external iliac vessels and pelvic organs, in case a hemorrhage occurred (12).

The periosteum was incised along the iliac crest, releasing the fibers of the external and internal oblique muscles and those of the transversus abdominus muscle. If necessary, the lateral end of the inguinal ligament was reflected in continuity with the abdominal muscles. The lateral cutaneous nerve of the thigh was carefully identified and protected. The origin of the iliacus muscle was then elevated subperiosteally from the inner table of the ilium, enabling the cup to be visible following the medial retraction of the iliopsoas muscle (13). If the cup migrated both proximally and medially, it was easier to access. If the cup only migrated medially, a more extensive exposure was necessary.

The prosthesis is almost always surrounded by a thick layer of fibrous tissue. The plane between the cup and this fibrous membrane was identified, and the dissection was carefully performed to leave this layer intact. The cup and the surrounding cement were then removed, either as a whole or by piecemeal, depending on its size and position.

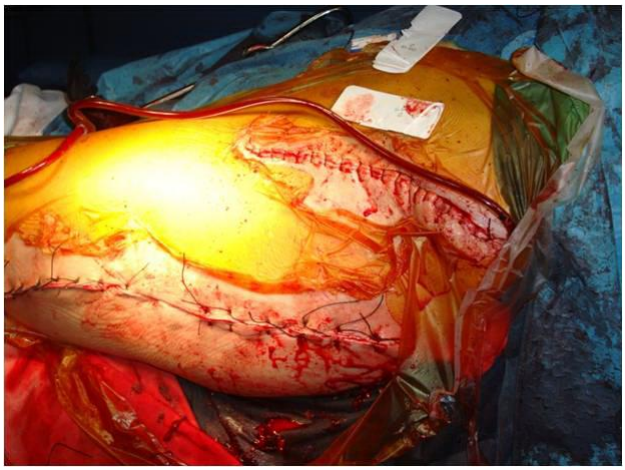

Figure 2a. The two separate approaches used in the case from Fig.1 are shown.

Figure 2c. The extracted Zweimuller cup.

Figure 2b. The granuloma of the Zweimuller prosthesis.

Figure 2d. The X-ray result showing the tantalum cup and bone graft substitute, 3 months Revitan femoral component.

Afterwards, the hip region was approached through a separate anterior-lateral incision, generally using the old scar or by extending the iliac incision, to achieve an anterior approach for the completion of the revision procedure (Fig. 2). A separate incision was used for seven of our patients and an anterior extension was used for one patient.

Results

All patients survived the procedure and returned for periodic follow-ups every 3 months, during which they did not exhibit any septic complications.

The average surgery time was 236 minutes (range between 120-360 min.) with an average use of 5.35 units of blood. Every patient required 3 units of blood, except for one patient who received 9 units due to a vascular injury.

Post-surgery patient evaluations were performed according to the Merle d'Aubigné – Postel scoring system (pain 0-6 points, mobility 0-6 and function 0-6 points). The results were very good in 5 patients, good in 2 patients and satisfactory in 1 case. The Harris Hip Score (HHS) of the aseptic revised patients was 85.2 while that of the septic cases was 72.5. The mean satisfaction score was 8.5 for the aseptic cases, compared to 7.3 for the septic cases.

In all cases, the cup had migrated medially to Kohler's line. Fortunately, severe medial migration is rare and these eight cases represent only 3.6% of the total number of revision hip arthroplasties carried out in our department during the last five years.

The acetabular defect was reconstructed using bone grafts and tantalum revision cups in 4 cases,

Burch-Schneider cages in 2 cases, Kerboull ring in 1 case andoblong cup (Cotyle Espace) in 1 case (Fig. 3).

The acetabular defect was Paprosky type IIIb in 2 cases. In these cases, a 5-6 cm large quadrate of compact bone was removed from the external iliac wing. The graft was fixed in the pelvic defect by creating a new medial wall for the acetabulum and continuity was achieved by adding allograft-autologous morcellized bone combined with a bone substitute.

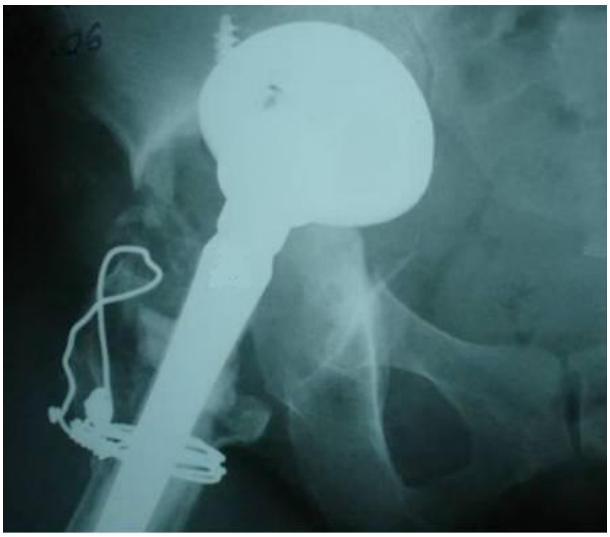

Figure 3a. A protruded uncemented Omnifit Stryker.

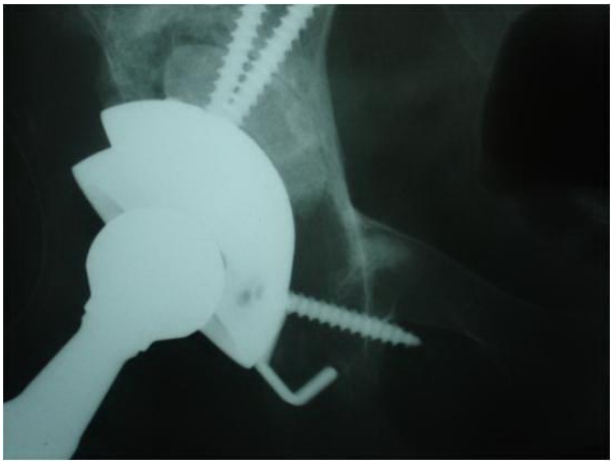

Figure 3b. A Cotyle Espace with massive bone graft reconstruction.

In 4 cases, Paprosky type IIIa, an iliac vessel graft was needed and the procedure was carried out by the vascular surgeon. In these cases, the dissection of the iliac vessels was impossible. In 1 case, the venous haemorrhage was controlled by the direct ligature of the bleeding point, without the need for pelvic vessels exploration.

Equal leg lengths, centre of hip rotation and stability of the revised hip were successfully restored in all patients. Because there is a risk of paralytic ileus in the post-operative period, it is prudent to gradually administrate oral fluids until the patient's intestinal function returns to normal.

The postoperative care varies according to the stability of the revised cup that is attained. Only one patient had a stable revised cup, which allowed for full weight bearing immediately after the operation. The other 7 patients had 3 to 4 months of restricted weight bearing during the bone graft integration. Generally speaking, weight bearing was not allowed for an average of 3 months.

Antibiotics were prophylactically administered for an additional day after the Redon drain removal, but were prolonged for up to 1 month for the septic revisions.

Discussions

Protrusio acetabuli is the medial displacement of the acetabulum beyond the radiographic teardrop, with the medial migration of the femoral head into the pelvis (14, 15). Acetabular protrusions may occur in many bone disorders, such as degenerative joint disease, Paget's disease, rheumatoid arthritis, ankylosing spondylitis, osteomalacia, Marfan's disease and as an effect of irradiation (13, 16).

Vascular injuries associated with hip arthroplasty consist of distal ischaemia, vessel lacerations, pseudo aneurysms and arterio-venous fistulas (5, 17). Complications are often related to cement incorporation of the iliac vessels, aggressive medial retraction, excessive traction on atherosclerotic vessels and improper technique in the preparation of the acetabulum (2, 3).

When we designed the study we wanted to establish a protocol that allowed us to take the decision when the vascular surgeon or vascular grafting was needed. Now, in retrospection, this matter cannot be properly assessed. In all cases this

protocol was used and due to that the mortality rate was null.

Post-operative follow-up data are critically important for revision surgery of THA. In this type of revision, when the x-ray indicates a severe protrusion of the acetabular component, an MRI or CT exam should be performed. When there is a suspicion of vascular involvement, an angiography or MRI angiogram should be performed. Given our hospital's conditions, angiography is a particularly difficult exam and as such, angiography was only used in five of our patients for defining the relationship between the prosthesis and the pelvic vessels and organs. However, the interpretation of angiograms can be difficult because it is impossible to obtain accurate lateral view exposures. An acetabular prosthesis that appears to be closely related to the vessels on the anterior-posterior view may be in a different transverse plane. Angiograms are however, useful for excluding false aneurysms as an MRI provides considerable information relating to the course of the vessels that are in proximity to the acetabular prosthesis.

A multidisciplinary team of surgeons should take part in the planning of such complicated revisions. It is best to include a vascular surgeon and a general surgeon because the attempt to remove an acetabular component that has migrated into the pelvis can be hazardous. The common iliac vessels, ureter, bladder, rectum and uterus may be adherent to the acetabular component of the prosthesis and the attempt to extract it may lead to organ damage or uncontrollable bleeding (18).

We have used a simple, limited retroperitoneal approach, which has allowed the safe removal of these migrated cups. The described approach is familiar to orthopedic surgeons because it is similar to that used for innominate osteotomy. The intrapelvic migration of an acetabular prosthesis is usually a slow process, during which the cup becomes surrounded by a thick layer of fibrous tissue, separating it from the pelvic vessels and organs. The dissection of the plane between the cup and the fibrous membrane allows the safe removal of the cup and cement, leaving the fibrous layer intact. However, this approach is not appropriate for the removal of all intrapelvic cups. If the pre-operative angiograms show a false aneurysm, the Rutherford Morison approach should be used and the vessels should be explored. A large cement mass that had extruded into the pelvis during primary surgery presents additional difficulties as it may be directly adhered to the pelvic vessels and organs. In such cases, the Rutherford Morison approach may also be advisable. If hemorrhage is encountered when using the limited retroperitoneal approach, the incision can be extended and the approach can be converted to the Rutherford Morison. This involves the mobilization of the peritoneum from the iliopsoas fascia, allowing direct access to the external iliac vessels and pelvic organs. We have found it best to remove the intrapelvic cup before approaching the femur as a rotated acetabular component combined with the proximal migration of the femur may 'lock' the prosthetic head. As such, attempts at dislocation may cause a fracture to the femur or an acetabular wall. The extraction of the cup from within the pelvis frees the prosthetic head and allows the safe mobilization of the femur.

In cases of severe acetabular bone defect, it can be useful to remove a 5-6 cm large quadrate of compact bone from the external iliac wing. The graft can be fixed inside the pelvic defect, creating a new medial wall for the acetabulum and gaining continuity through allografts that are either autologous or comprised of morcellized bone combined with bone substitute (18).

Conclusions

Intrapelvic acetabular cup migration is a rare, but serious complication that can occur after total hip arthroplasty in either septic or aseptic cases. An experienced multidisciplinary team of surgeons should take part in planning and conducting such complicated revision surgeries. A complex evaluation protocol is mandatory prior to the operation and a versatile arsenal of revision prosthesis, bone grafts and vascular grafts must be available.

No form of benefits that are directly or indirectly related to this article's subject has been or will be received from a commercial party.

References

1. Wasielewski RC, Crossett LS, Rubash HE. Neural and vascular injury in total hip arthroplasty. *Orthop. Clin. North Am*. 1992; 23(2): 219-235. PMID:1315014
2. Joseph NM, Roberts J, Mulligan MT. Financial impact of total hip arthroplasty: a comparison of anterior versus posterior surgical approaches. *Arthroplast Today* 2016; 3(1): 39-43. PMID:28378005 https://doi.org/10.1016/j.artd.2016.01.002
3. Slater RNS, Edge AJ, Salman A. Delayed arterial injury after hip replacement. *J Bone Joint Surg Br*. 1989; 71(4): 699. PMID:2670952
4. Head Hug KT, Fernando ND. Intra-abdominal migration of a k-wire during revision total hip arthroplasty. *Arthroplast Today*. 2016; 3(1): 3-5. PMID:28377998 https://doi.org/10.1016/j.artd.2016.09.002
5. Lee JM. The Current Concepts of Total Hip Arthroplasty. *Hip Pelvis*. 2016; 28(4): 191-200. PMID:28097108 https://doi.org/10.5371/hp.2016.28.4.191
6. Eftekhar NS, Nercessian O. Intrapelvic migration of total hip prostheses: operative treatment. *J Bone Joint Surg Am.* 1989; 71(10): 1480-6. PMID: 687281 https://doi.org/10.2106/00004623-198971100-00005
7. Talwar S, Laddha BL, Jain S, Prasad P. Choice of incision in surgical management of small bowel perforations in enteric fever. *Trop. Gastroenterol*. 1997; 18(2): 78-9. PMID:9323924
8. Paprosky WG, Perona PG, Lawrence JM. Acetabular defect classification and surgical reconstruction in revision arthroplasty, *J Arthroplasty* 1994; 9(1): 33-44. PMID: 8163974 https://doi.org/10.1016/0883-5403(94)90135-X
9. Petrera P, Trakru S, Mehta S, Steed D, Towers JD, Rubash HE. Revision total hip arthroplasty with a retroperitoneal approach to the iliac vessels. *J Arthroplasty* 1996; 11(6): 704-8. PMID: 8884446 https://doi.org/10.1016/S0883-5403(96)80009-X
10. Johanson NA, Driftmier KR, Cerynik DL, Stehman CC. Grading acetabular defects: the need for a universal and valid system. *J Arthroplasty*. 2010; 25(3): 425-31. PMID:19375888 https://doi.org/10.1016/j.arth.2009.02.021
11. Campbell DG, Garbuz DS, Masri BA, Duncan CP. Reliability of acetabular bone defect classification systems in revision total hip arthroplasty. *J Arthroplasty*. 2001; 16(1): 83-6. PMID:11172275 https://doi.org/10.1054/arth.2001.19157
12. Grigoris P, Roberts P, McMinn DJ, Villar RN. A technique for removing an intrapelvic acetabular cup. *Bone Joint Surg Br*. 1993; 75(1): 25-7. PMID: 8421027
13. Kindynis P, Garcia J. Protrusio acetabuli. An update on the primary and secondary acetabular protrusion. *J Radiol*. 1990; 71(6-7): 415-24. PMID:2254870
14. McBride MT, Muldoon MP, Santore RF, Trousdale RT, Wenger DR. Protrusio acetabuli: diagnosis and treatment. *J Am Acad Orthop Surg*. 2001; 9(2): 79-88. PMID:11281632 https://doi.org/10.5435/00124635-200103000-00002
15. Flecher X, Sporer S, Paprosky W. Management of severe bone loss in acetabular revision using a trabecular metal shell. *J Arthroplasty*. 2008; 23(7): 949-55. PMID:18534494 https://doi.org/10.1016/j.arth.2007.08.019
16. Schuh A, Jezussek D, Bennemann M, Hönle W. Pathogenesis of hip osteoarthritis. MMW Fortschr Med.2007; 149(37): 27-8. PMID:17918457
17. Calligaro KD, Dougherty MJ, Ryan S, Booth RE. Acute Arterial complications associated with total hip and knee arthroplasty. J Vasc Surg. 2003; 38(6): 1170-7. PMID: 14681604 https://doi.org/10.1016/S0741-5214(03)00918-2