HAL open science

Salvage reconstruction of hip ligaments using absorbable material to treat recurrent instability of revision THA without abductor mechanism.

Jérémy Sarrazin, Julien Dartus, Pierre Martinot, Romain Galmiche, Henri Migaud, Sophie Putman, Romain Galmiche

▶ To cite this version:

Jérémy Sarrazin, Julien Dartus, Pierre Martinot, Romain Galmiche, Henri Migaud, et al.. Salvage reconstruction of hip ligaments using absorbable material to treat recurrent instability of revision THA without abductor mechanism.. Orthopaedics & Traumatology: Surgery & Research, 2020, Orthopaedics & Traumatology: Surgery & Research, 107 (1), pp.102783. 10.1016/j.otsr.2020.102783 . hal-04355271

HAL Id: hal-04355271

https://hal.univ-lille.fr/hal-04355271v1

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Version of Record: https://www.sciencedirect.com/science/article/pii/S1877056820303741
Manuscript_5c8e0afa6785263b6c6d1bf4897137d5

Technical note

Salvage reconstruction of hip ligaments using absorbable material to treat recurrent instability of revision THA without abductor mechanism.

Jérémy **Sarrazin** [a,b,*], Julien **Dartus** [a,b], Pierre **Martinot** [a,b], Romain **Galmiche** [a,b], Henri **Migaud** [a,b], Sophie **Putman** [a,b]

a Université de Lille Nord de France, 59000 Lille, France

b Service d'Orthopédie, Hôpital Roger Salengro, Place de Verdun, Centre Hospitalier Régional Universitaire de Lille, 59037 Lille, France

* **Corresponding author**: Jeremy Sarrazin

Service d'Orthopédie, Hôpital Roger Salengro, Place de Verdun, Centre Hospitalier Régional Universitaire de Lille, 59037 Lille, France

E-mail = jeremy.sarrazin@gmail.com

© 2020 published by Elsevier. This manuscript is made available under the CC BY NC user license
https://creativecommons.org/licenses/by-nc/4.0/

Abstract

Dual-mobility and constrained cups can stabilize most recurrent dislocations of total hip arthroplasty (THA), but may fail in case of hip abductor mechanism loss. For such complex situations, we developed an original artificial iliofemoral and ischiofemoral ligament reconstruction technique using a polyglactin 910 mesh (Vicryl ™) associated to repositioning of a Lefèvre constrained liner adapted to hip range of motion to prevent cam effects. The technique was implemented in 2 patients showing recurrent dislocation after THA, associating total femur replacement and cemented constrained liner in a metal reinforcement ring. In 1 of the 2 cases, the abductor mechanism had been entirely sacrificed. This simple and accessible salvage technique prevented recurrence of dislocation at 12 months' follow-up in these complex cases, previously subject to several episodes per year.

Key-words: Total hip arthroplasty, recurrent dislocation, artificial ligament, constrained liner, ligament reconstruction, polyglactin (Vicryl ™).

1. Introduction

Stabilization of recurrent dislocation of total hip arthroplasty (THA) is generally achieved using a dual mobility (DM) cup [1-3]. Constrained implants (CI) such as the Lefèvre liner (Lépine, Genay, France) provide immediate extra stabilization, whereas DM cups can fail, notably in revision, tumoral or septic surgery [4-7] and especially when all hip stabilizers (muscle, capsule, ligaments) have been resected [6], as is not rare in case of total femur replacement [8]. In such cases, stabilization techniques for multi-recurrent dislocation are not codified, with a risk of disarticulation or abandonment of treatment [8]. We managed 2 such cases, with failure of stabilization despite use of CI on total femur replacement, leading us to develop a novel artificial reconstruction technique for the anterior and posterior hip rotation restraint mechanisms (comparable to iliofemoral and ischiofemoral ligament reconstruction) associated to a Lefèvre constrained liner reoriented according to individual range of motion so as to prevent cam effects.

2. Technique

A posterolateral approach was used, with the patient in lateral decubitus. The technique requires a stable screwed acetabular reinforcement ring; we removed the cup and cement from the metal reinforcement, which was left in place as it was always well fixed. A polyglactin 910 (Vicryl ™) mesh (Ethicon, Johnson & Johnson, Somerville, NJ, USA) was folded in six and the excess was cut off with scissors so as to obtain a width of 20 mm (Figure 1A), then it was screwed into the middle of the reinforcement ring, forming two bands (Figure 1B). A trial insert optimally reproducing the shape of the Lefèvre liner was temporarily fixed with bone wax, to enable the hip to be reduced and tested so as to optimize the positioning of the final constrained liner and predict cam effects and adaptation to the particular femoral component that was left in place [4]. The definitive CI was then cemented into the reinforcement ring, stretching the mesh bands against the cup to avoid creasing in the cement mantle (Figure 1C). When the cement had polymerized, the mesh bands were fixed onto the prosthetic trochanter by non-absorbable suture (Mersuture™, Ethicon Johnson & Johnson, Somerville, NJ – USA). Three sutures were tied to fix the bands on the anterior and posterior sides of the implant through dedicated tunnels in the total femur implant (Figure 2). The ends of the 2 bands were then tied together and sutured with 3 Mersuture™ X stitches onto the lateral side of the implant (patient 1) or the native greater trochanter (patient 2). The course of the bands thus reproduced the course of the iliofemoral and ischiofemoral ligaments. Tensioning on the anterior and posterior sides was adjusted so as to prevent cam effects between neck and cup: the posterior band was stretched and fixed with the femur in 90° flexion and medial rotation (Figure 3A), and the anterior band with the femur in neutral extension and lateral rotation (Figure 3B) (film 1).

Postoperatively, 6 weeks' immobilization was prescribed in an ipsilateral articulated hip orthosis allowing 0 to 60° range of motion in flexion; the sitting position was allowed. At 6 weeks, full weight-bearing was allowed with rehabilitation focused on muscle reinforcement, followed by resumption of walking with then without aids.

3. Results

In both cases, the total femur implant with tibial shaft fixation (Implantcast, Buxtehude, Germany) articulated with a Lefèvre constrained liner (Lépine) cemented into a Müller ring (Zimmer-Biomet, Winterthur, Switzerland) (Table 1). Indications in both cases were for non-union of iterative fracture between hip and knee implants, both showing recurrent dislocation.

Case 1: Ms D. (72 years, body-mass index (BMI) 37) had undergone hip arthroplasty with total femur and conserved greater trochanter, with 10 dislocations despite use of a DM cup then a Lefèvre liner, both cemented in a Müller ring. (Figure 4A). Finally, she contracted methicillin-resistant Staphylococcus epidermidis infection requiring 1-stage exchange of the total femur and acetabular components (cup and ring). The sequestered greater trochanter, capsule and ligament reinforcements were resected. The prosthesis dislocated again 5 times in 1 year (Figure 4A), and ligament reconstruction was performed (Figure 4B).

Case 2: Ms B. (61 years; BMI 32) had 3 dislocations after implantation of a total femur articulated with CI with conserved greater trochanter and upper part of the lateral cortex fixed with cerclage wiring to the implant (Figure 5A). In the first dislocation, the cup retention ring became detached and the dislocation was irreducible without open reduction and associated ligament reconstruction. She had no history of infection (Figure 5B).

In both cases, clinical assessment at 12 months found no repeat dislocation, despite history of several episodes per year. Table 1 shows functional results.

4. Discussion

Treatment for recurrent THA dislocation is not well defined after resection of the proximal femur and/or hip stabilizers [5-7,11]. This is especially true of total femur prostheses, for which the main complication is dislocation, with rates as high as 6.9% [8]. DM cups have proved effective in preventing dislocation in primary THA revision [1,2,12], notably in tumor surgery involving soft-tissue resection [6]. North American tripolar cups are effective, but with risk of loosening and mechanical complications due to their high constraint and complexity [13]. Lefèvre CIs are a possible solution in case of DM failure, without the mechanical complications of the North American models, being less constrained [4,5].

There exist techniques of abductor mechanism reconstruction using the quadriceps [14] or gluteus maximus plus tensor fasciae latae [15], but they require intact transplants that are sacrificed and are unsuitable in case of trochanteric resection. Allograft reconstruction [16], is expensive, and unsuited to septic contexts.

The literature on artificial capsule reinforcement is sparse and mainly concerns tumoral reconstruction, notably in the shoulder [17]. To our knowledge, only 2 articles reported capsule reinforcement in chronic hip instability: 1 isolated iliofemoral ligament reconstruction [18], and 1 isolated ischiofemoral ligament reconstruction [19].

Polyglactin 910 (Vicryl ™) resorbs by hydrolysis after 56-70 days, and at 12 months most of the constraint can be expected to have transferred to fibrous scar tissue reproducing the mesh bands and thus the joint ligaments. Longer follow-up should confirm that interposition of the 2-cm absorbable band between reinforcement ring and cup does not jeopardize fixation. The alternative, consisting in fixing two separate bands in the bone or in the ring, seems unduly complex. In revision surgery, where bone stock is often diminished, this solution incurs problems of immediate stability in the bands, weakening due to the bone tunnels, and difficulty in fixing new hardware with risk of impingement.

The present technique acts simultaneously on 2 parameters: cup repositioning, and ligament reconstruction; respective efficacy, and notably the isolated effect of cup repositioning, is thus impossible to assess. Even so, radiologic analysis (Table 1) showed satisfactory preoperative implant positioning. Clavé et al. [4] recommend orienting the Lefèvre liner in slight anteversion and 50° inclination. The technique also requires cup exchange and, in all cases, repositioning taking account of the existing femoral implant which may not be in optimal anteversion. This is why, to stabilize these revision implants, we prefer to orient the cup according to joint mobility and so as to limit cam effects, rather than using absolute inclination and anteversion values.

This technique prevented recurrence, admittedly only at 1 year's follow-up, but in patients who had been subject to several episodes per year. However, longer follow-up is needed to determine whether increased constraint jeopardizes acetabular fixation.

5. Conclusion

This innovative technique offers a fairly simple and accessible salvage solution for multi-recurrent dislocation in the absence of the abductor system, especially for total femur implants, but cannot resolve implant malpositioning. Results were satisfactory at 1 year, but need longer-term confirmation in a larger sample, although this extreme situation is, fortunately, fairly rare.

Disclosure of interest: The authors have no conflicts of interest to disclose in relation to the present article. Elsewhere, Jeremy Sarrazin has a grant from Arthrex, Sophie Putman is an education and research consultant for Corin, Henri Migaud is an education and research consultant for Corin, Zimmer-Biomet, SERF and MSD and editor in chief of Orthopaedics & Traumatology: Surgery & Research. The other authors have no interests to declare.

Funding: None

Author contributions: JS and RG: surgery; JS, PM and JD: article writing; SP and HM: article re-editing and surgery.

References

1. Mertl P, Combes A, Leiber-Wackenheim F, Fessy MH, Girard J, Migaud H. Recurrence of dislocation following total hip arthroplasty revision using dual mobility cups was rare in 180 hips followed over 7 years. HSS J 2012;8:251-6.
2. Lebeau N, Bayle M, Belhaouane R, Chelli M, Havet E, et al. Total hip arthroplasty revision by dual-mobility acetabular cup cemented in a metal reinforcement: A 62 case series at a minimum 5 years' follow-up. Orthop Traumatol Surg Res 2017;103:679-684.
3. Philippot R, Camilleri JP, Boyer B, Adam P, Farizon F. The use of a dual-articulation acetabular cup system to prevent dislocation after primary total hip arthroplasty: analysis of 384 cases at a mean follow-up of 15 years. Int Orthop 2009;33:927–32.
4. Clavé A, Maurer D, Tristan L, Dubrana F, Lefèvre C, Pandit H. Midterm survivorship of the Lefèvre constrained liner: A consecutive multisurgeon series of 166 cases. J Arthroplasty 2016;31:1970–8.
5. Huten DP, Fournier Y, Gicquel T, Bertho P, Basselot F, Hamadouche M. Risk factors for dislocation after revision total hip arthroplasty with a dual-mobility cup. Matched case-control study (16 cases vs. 48 controls). Orthop Traumatol Surg Res 2019;105:1303-1309.
6. Philippeau JM, Durand JM, Carret JP, Leclercq S, Waast D, Gouin F. Dual mobility design use in preventing total hip replacement dislocation following tumor resection. Orthop Traumatol Surg Res 2010;96:2-8.
7. Fessy MH, Putman S, Viste A, Isida R, Ramdane N, et al. What are the risk factors for dislocation in primary total hip arthroplasty? A multicenter case-control study of 128 unstable and 438 stable hips. Orthop Traumatol Surg Res 2017;103:663-668.

8. Putman S, Migaud H, Saragaglia D, Jenny JY, Dujardin F, et al. Total femur replacement in non-oncologic indications: Functional and radiological outcomes from a French survey with a mean 6 years' follow-up. Orthop Traumatol Surg Res 2019;105:591-598.
9. Ackland MK, Bourne WB, Uhthoff HK. Anteversion of the acetabular cup. Measurement of angle after total hip replacement. J Bone Joint Surg Br 1986;68:409-13.
10. Delaunay C, Epinette JA, Dawson J, Murray D, Jolles BM. Cross-cultural adaptations of the Oxford-12 HIP score to the French speaking population. Orthop Traumatol Surg Res 2009;95:89-99.
11. Martinot P, Blairon A, Putman S, Pasquier G, Girard J, Migaud H. Course of dislocated posterior hip arthroplasty: A continuous 232-patient series at a mean 10 years' follow up (range, 1-22 years). Orthop Traumatol Surg Res 2018;104:325-331.
12. Simian E, Chatellard R, Druon J, Berhouet J, Rosset P. Dual mobility cup in revision total hip arthroplasty: dislocation rate and survival after 5 years. Orthop Traumatol Surg Res 2015;101:577-81.
13. Shapiro GS, Weiland DE, Markel DC, Padgett DE, Sculco TP, Pellicci PM. The use of a constrained acetabular component for recurrent dislocation. J Arthroplasty 2003;18:250–8.
14. Kohl S, Evangelopoulos DS, Siebenrock KA, Beck M. Hip abductor defect repair by means of a vastus lateralis muscle shift. J Arthroplasty 2012;27:625-9.
15. Whiteside LA. Surgical technique: Gluteus maximus and tensor fascia lata transfer for primary deficiency of the abductors of the hip. Clin Orthop Relat Res 2014;472:645-53.

16. Lavigne MJ, Sanchez AA, Coutts RD. Recurrent dislocation after total hip arthroplasty: treatment with an Achilles tendon allograft. J Arthroplasty 2001;16(8 Suppl 1):13-8.
17. Jin T, Liu WF, Xu HR, Li Y, Niu XH. Biomechanical Properties of Synthetic Mesh Reconstructed Glenohumeral Joint Capsule. Chin Med J 2017;130:1743–4.
18. Fujishiro T, Nishikawa T, Takikawa S, Saegusa Y, Yoshiya S, Kurosaka M. Reconstruction of the iliofemoral ligament with an artificial ligament for recurrent anterior dislocation of total hip arthroplasty. J Arthroplasty 2003;18:524–7.
19. Aota S, Kikuchi SI, Ohashi H, Kitano N, Hakozaki M, Konno S-I. Soft tissue reinforcement with a Leeds-Keio artificial ligament in revision surgery for dislocated total hip arthroplasty. Hip Int 2018;28:324–9.

Figure legends

Figure 1: Preparation of the polyglactin (Vicryl™) mesh, with screw-hole (1A). Positioning first screw for fixing to reinforcement ring (1B). Cementing Lefèvre constrained liner and tensioning of mesh bands (1C).

Figure 2: Preparation of Mersuture™ sutures through tunnels in total femur implant for mesh band fixation.

Figure 3: Fixation of stretched posterior band in 90° flexion and medial rotation to prevent anterior cam effect (3A). Fixation of anterior band in neutral extension and lateral rotation to prevent posterior cam effect (3B). Note 2 bands, knotted and sutured by Mersuture™ to the lateral side of the total femur implant.

Figure 4: Preoperative dislocation despite Lefèvre CI (4A). The whole femoral bone, including the greater trochanter, was resected for 1-stage exchange due to methicillin-resistant Staphylococcus epidermidis infection. Radiograph of technique at 12 months (4B).

Figure 5: Preoperative dislocation despite Lefèvre CI (5A). Conserved greater trochanter and lateral cortex fixed by cerclage wiring to the total femur implant. Radiograph of technique at 12 months (5B).

Film 1: Intraoperative dynamic hip test after anterior and posterior artificial ligament reconstruction.

Table 1: patient data

Case:	**#1: Ms D.**		**#2: Ms B.**	
Gender	Female		Female	
Age (years)	72		61	
BMI (kg/m²)	37		32	
Number of ipsilateral hip procedures	8		5	
Infection	Yes: MRSE, cured		No	
Number of dislocations since last surgery (total)	5 (18)		3, incl. 1 irreducible (8)	
Capsule-ligament system	Absent		Absent	
Abductor system	Absent		Present	
Implants:	Preop	Postop M12	Preop	Postop M12
Femoral	Total femur	Total femur	Total femur	Total femur
Head size (mm)	28	28	28	28
Acetabular	Müller ring + Lefèvre CI	Müller ring + Lefèvre CI	Müller ring + Lefèvre CI	Müller ring + Lefèvre CI
Frontal cup inclination (°) / bi-U line	57	45	33	43
Cup anteversion (°) according to Ackland et al. [9]	31	15	29	22
Limb-length discrepancy (cm)	-4	-3.5	-1	-1
Oxford score / 60 [10]	38	36	29	28
Range of motion (°) **Flexion/extension** **Abduction/adduction** **Internal/external rotation**	100/10 20/10 50/20	100/10 20/20 40/20	110/10 20/10 30/20	110/10 20/10 30/20

Preop: preoperative; post-op: postoperative; MRSE: methicillin-resistant Staphylococcus epidermidis; M: months; BMI: body-mass index

Figure 1 :

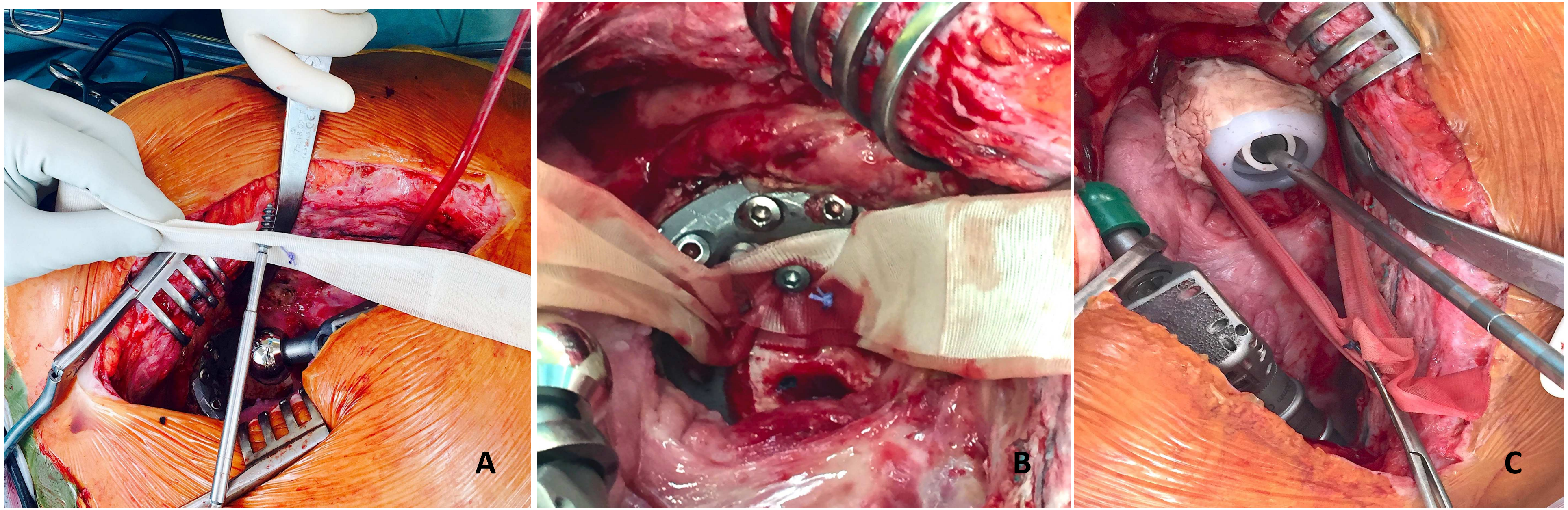


Figure 2 :

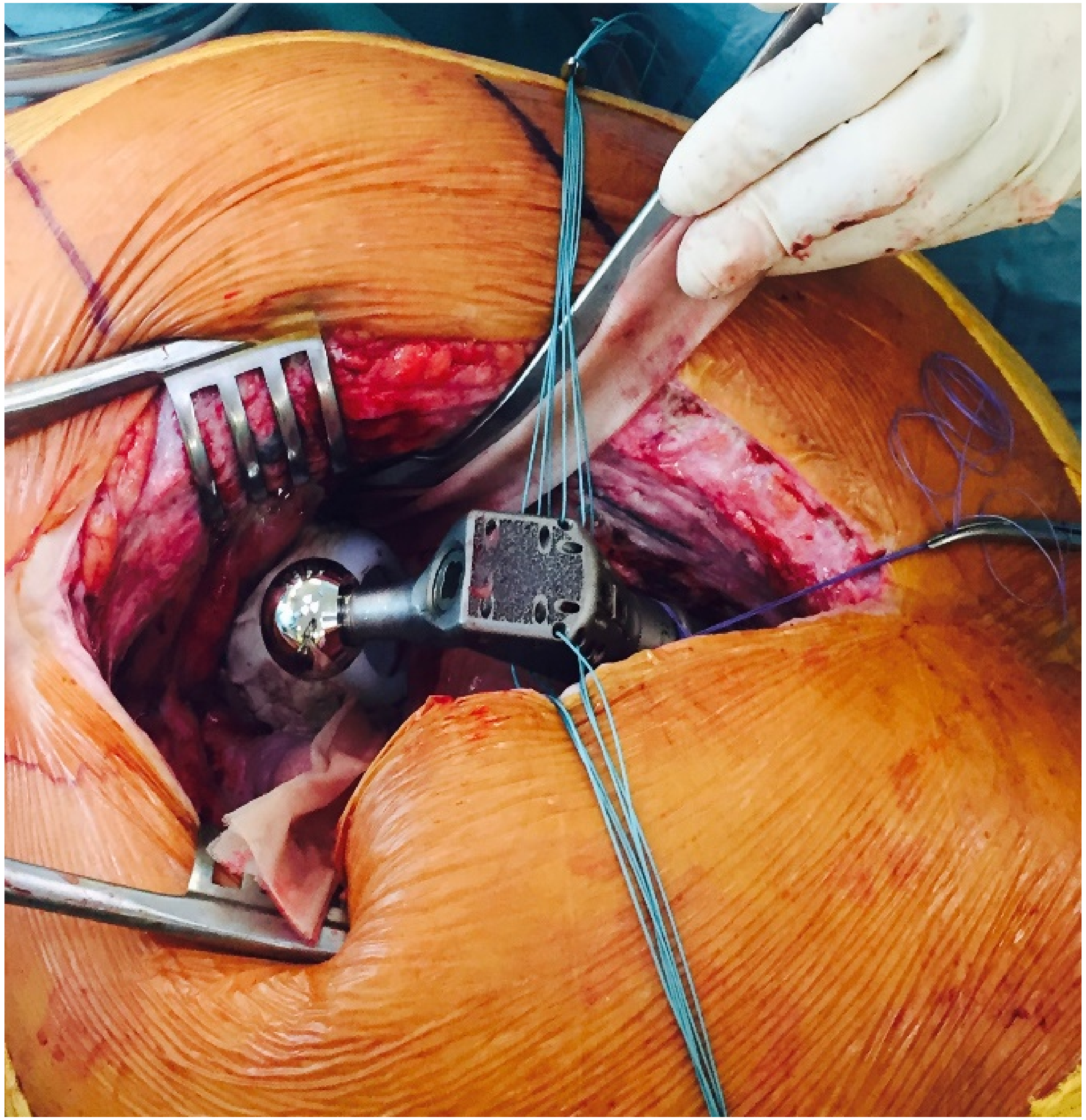


Figure 3 :

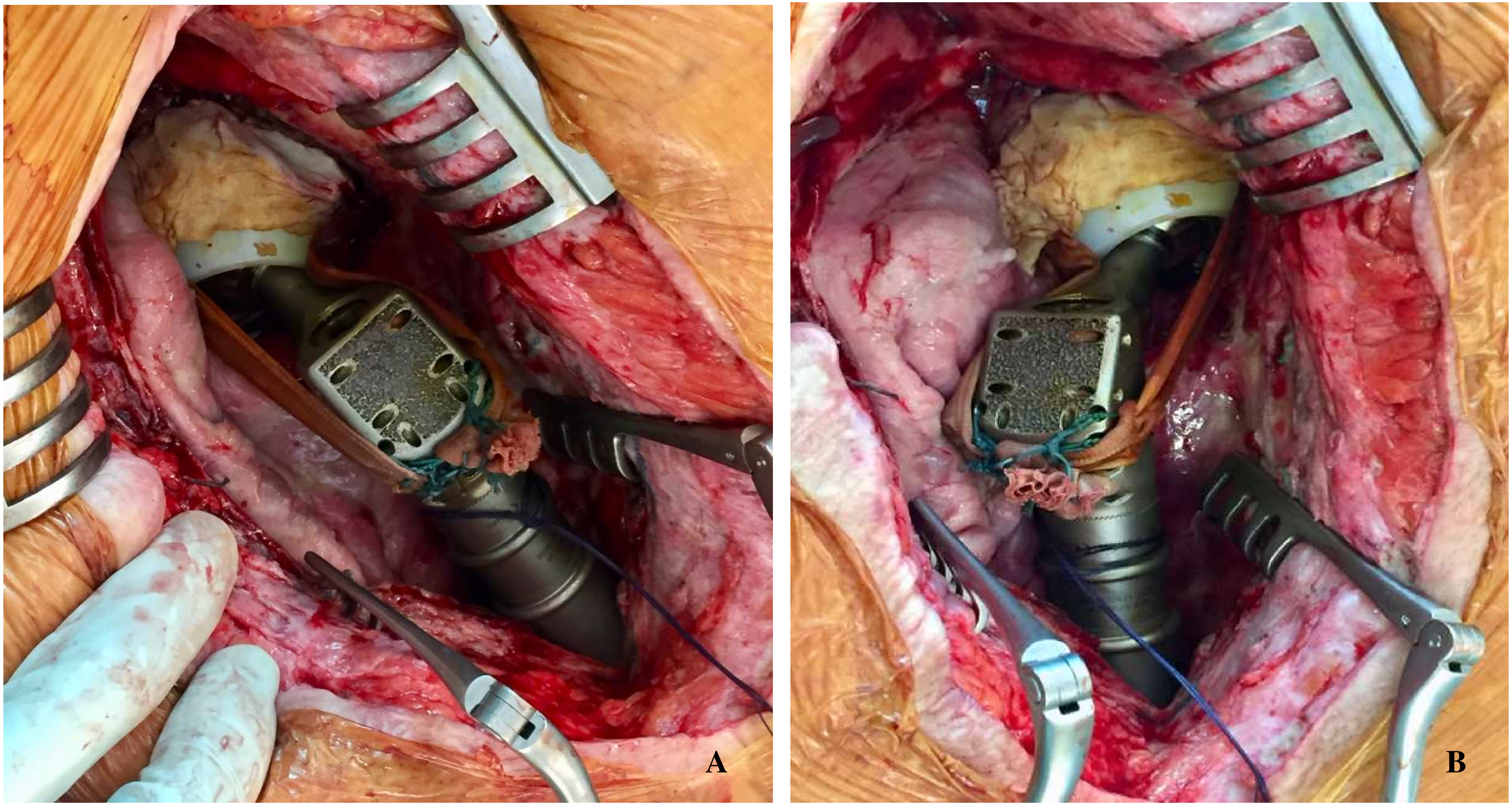
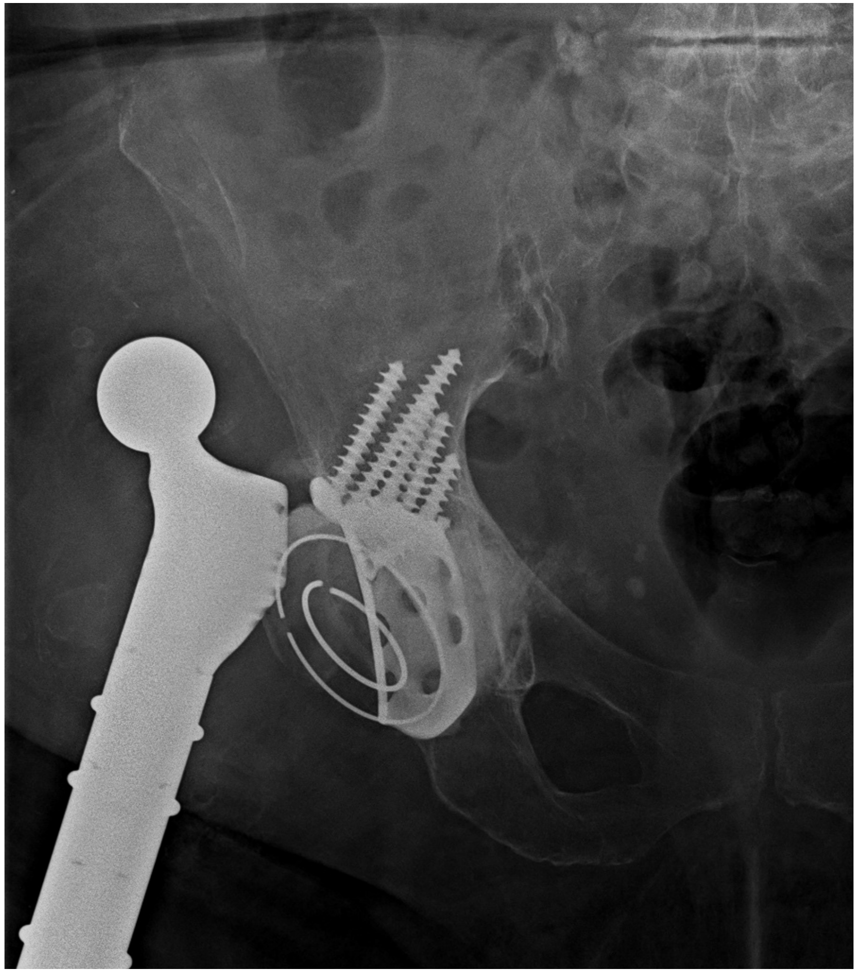


Figure 4 :



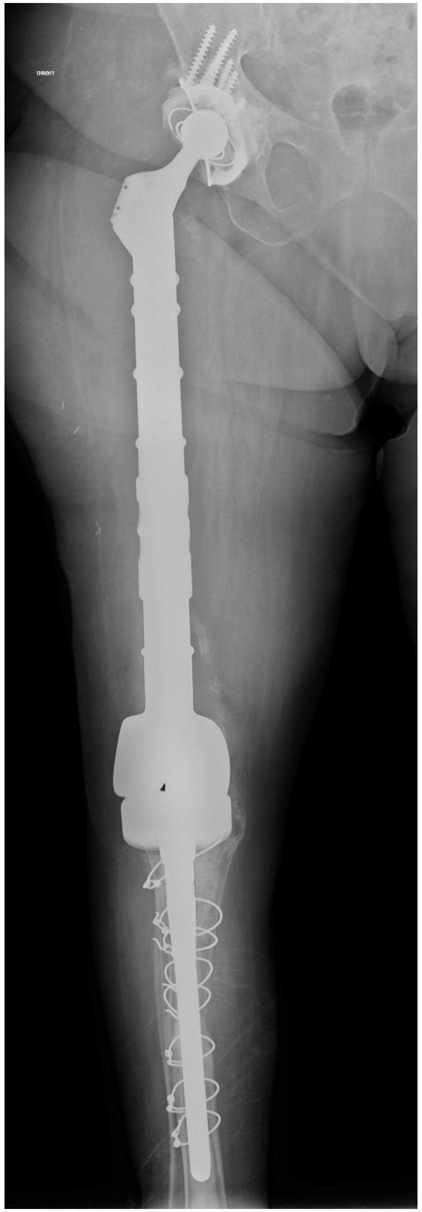


Figure 5 :