

Revision hip replacement by minimally invasive technique with anterior approach: Three case study

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ABSTRACT

Revision total hip arthroplasty is becoming more and more popular, the surgical approach can vary based on anatomy, patient position, experience, and surgeon habits. The posterior incision is often chosen by surgeons while the current literature has very few articles related to ¹⁹ revision ⁴ total hip arthroplasty using anterior incision. In this paper, we present 3 clinical cases revision total hip arthroplasty using minimally invasive anterior incision technique for the 3 patients who had been treated the primary total hip replacement combined with the disaster complications to emphasize the feasibility of this approach and re-evaluate the clinical, x-ray imaging and patient satisfaction.

Key Words: revision hip arthroplasty, anterior approach, mini-invasive surgery

⁹ INTRODUCTION

Total hip replacement surgery is considered one of the most successful surgical interventions today [1]; the success rate of over 90% of the total hip replacement cases is followed up after 15 years ⁵ reporting excellent long-term results in terms of reducing pain and improving function and quality of life in patients [2]. However, there are still cases of failure after the primary hip replacement leading to the need for revision hip replacement surgery [3,4]. The rate ¹⁵ of revision hip replacement in the past few years has increased significantly and is proportional to the primary total hip replacement, this increase may be due to the more widely performed primary total hip replacement in younger patients and more active actions, ² estimated to increase by 137% with 97,000 cases per year from 2005 to 2030 [5]. As quoted by Manrique from The National Inpatient Sample (United States), indications for revision hip replacement include loosening 19.7%; unstable 22.5%; infection 14.8%; bone loss 13% and periprosthetic fracture 5% [3,6,7]. The important thing in revision hip replacement surgery, regardless of the incisions used, is the approach manner, the appropriate use of instruments and support devices. There are many incisions for revision total hip replacement ² such as: posterior incision, modified Hardinge, modified Watson Jones, in which access to the hip through the anterior incision described by Smith - Petersen is becoming popular with advantages: minimal soft tissue damage, less blood loss, shorter hospital stay, improved mobility and good postoperative wound healing. In this article, we present 3 clinical cases with complicated complications after the primary total hip replacement indicated for revision hip replacement at our hospital by minimally invasive technique with anterior approach to discuss

the feasibility of the anterior incision and re-evaluate the postoperative outcome based on the improvement in clinical function, radiographic images and patient satisfaction.

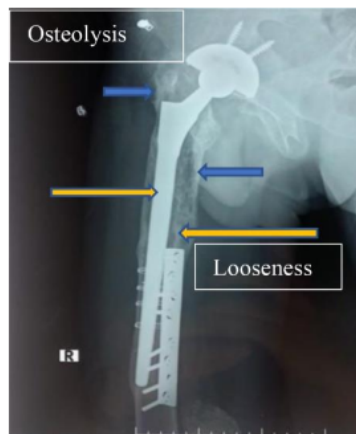
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CASE PRESENTATION

Case 1

A 29-year-old male patient was hospitalized with severe pain and limited range of motion on the right hip after total hip replacement with the posterior incision. Taking the medical history, two years ago, the patient was examined and treated at a provincial hospital with a diagnosis of necrosis of the right femoral head and had the primary un-cemented total hip replacement by posterior incision combined with the right femoral internal fixation with screws plate due to an intraoperative femoral fracture complication. After 1 year of surgery, the patient appeared pain, limited range of motion (ROM) on the right hip joint, the patient went to many places and did not have a specific treatment plan.

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Figure 1: Preoperative X-ray image

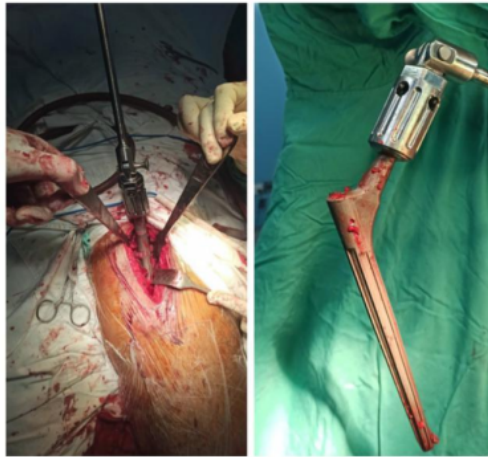


Figure 2: The initial stem is removed

The patient came to our hospital with clinical signs: right hip pain, limited ROM, Harris score: 45 points, leg length discrepancy: 2cm, body mass index BMI 24.2. The plan radiography image shows loosening and osteolytic on the right of proximal femur (Figure 1, green arrow); The stem is deeply subsidence and the image of loosening around the stem is from zone 2 to zone 7 according to Gruen's classification (Figure 1, yellow arrow). Patient was diagnosed: Loosen periprosthetic after right total hip replacement due to infection (combined with internal fixation by screws plate due to intraoperative femoral fracture). Then, the patient was assigned to surgically remove the right femur screw plate and replace the right revision hip replacement by minimally invasive technique with anterior incision. The approach to the revision hip replacement is similar to the technical procedure of the primary but with a 9-10cm longer skin incision; separation between the inter-muscular septum (the sartorius and tensor fascia latae muscle in the superficial layer; the rectus and the lateral vastus muscle in the deep layer) to access the anterior capsule; A T-shaped capsulotomy allows exposure of the femoral head and neck. The actual perioperative assessment of the cup component in the primary procedure is still stable while the stem is loosening and should be easily removed (Figure 2). We decided to keep the cup and replace only the stem

component. Using a long stem implant with the anti-rotation locked screws are horizontal bypassing at the distal end of the stem under C/arm control (Figure 3).

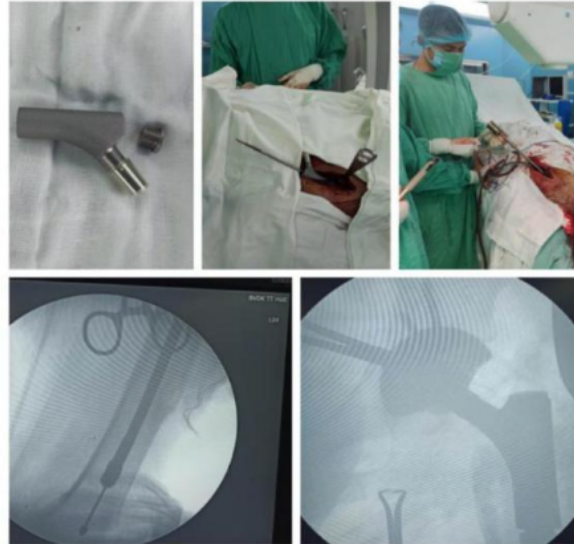


Figure 3: Using long and anti-rotation stem components

A second incision was made in the lateral medial third of the femur to remove the femoral screws plate. After surgery, the patient's general condition was good with mild pain according to the VAS pain scale, reaching 4 points, no significant leg length discrepancy. The patient was rehabilitated in bed on the 2nd day after surgery and walking with crutches after 5 days (Figure 5). Postoperative function assessment results Harris 66 points (Average level); X-ray image showing the components in the correct position (Figure 4A). After 3 months, the patient was pain-free, the incision was heal, the Harris score was 95 points (Very Good level). Patients expressed satisfaction at level 2 according to Britton's assessment [7]. After 11 months, X-ray images shows bone healing and no abnormal changes of implant components (Figure 4B).

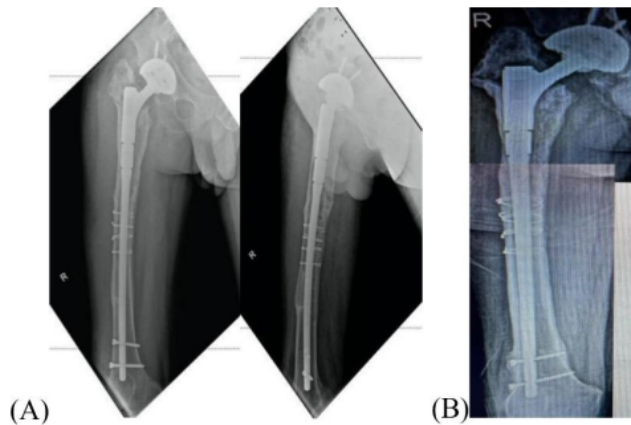


Figure 4: X-ray image after surgery (A) and after 11 months (B)



Figure 5: Rehabilitation exercise on the 5th day

Case 2

A 34-year-old male patient was admitted to the lower-level hospital with a diagnosis of an Avascular necrosis of the left femoral head and had an uncemented total hip replacement by the posterior incision. About 1 month later, the patient appeared infected and leaked fluid at the wound and during the next 8 years, the patient underwent 14 major and minor surgeries to deal with complications from infection around the operated hip at the different lower - level hospitals.

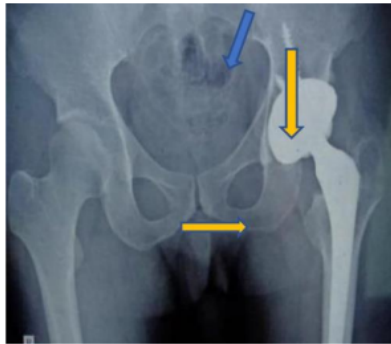


Figure 6: Loosening and osteolytic periprosthetic after 8 years



Figure 7: Removed implant and insertion of an antibiotic loaded cement spacer

The patient came to our hospital with clinical signs: limited ROM on the left hip, fluid leakage at the old wound; Lower extremity imbalance with the left side 4 cm shorter than the right. X-ray images showed the osteolytic in regions 1,2 and 6,7 around the joint according to Gruen classification (Figure 6, yellow arrow) and in zone II around the acetabulum according to the De Lee and Charnley classification (Figure 6, green arrow). Patient was diagnosed: Chronic infection of the left hip joint after un-cemented total hip replacement. We carried out a debridement of the infected tissue around the joint, the acetabulum and the stem components were loose so it was relatively easy to remove then inserted antibiotic cement spacer (Figure 7); Collected fluid from the left hip joint for antibiotics and TB tests. After taking two samples of fluid and specimens for

testing, the biochemical result was determined to be Tuberculosis of the hip. The patient had an interdisciplinary consultation and agreed on treatment with an aggressive dose of tuberculosis regimen combined with plastic surgeons to operate the biceps muscle flap transfer to cover the soft tissue defect in the left hip following several times of soft tissue debridement and vacuum assisted closures implements (Figure 8).



Figure 8: Biceps femoris flap transfer to cover the soft tissue defect ¹⁷ on the left hip.

The patient's local condition ⁴ was stable postoperative: no infection wound, no inflammation leaking fluid and well soft tissue around the left hip joint. The patient continued to take anti-TB drugs at home. The patient was admitted our hospital according to the appointment for periodic re-examination. Clinical signs noted: limited ROM on the left hip; the clean wound; the biceps femoris flap was well; the left leg was 4 cm shorter than the right leg (Figure 9) and BMI: 23.3.



Figure 9: Leg length discrepancy 4cm longer than on the right leg and
and well soft tissue condition on the left hip

The patient was indicated for revision hip replacement surgery by minimally invasive technique, the anterior incision was 9cm (Figure 10) in which longer than the conventional anterior incision of 5-6cm.

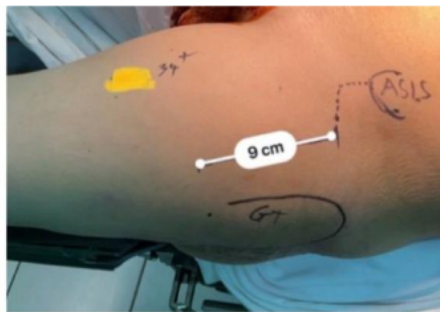


Figure 10: 9cm skin incision

Starting dissect in between the inter-muscular septum to access the anterior capsular of the hip joint; removed the old cement in the femoral canal, we opened the femoral window about 2-3cm to clean the canal (the cap bone re-fixated by a reinforcing steel wire rings). The next technical steps were similar to the traditional anterior approach of the total hip arthroplasty, reaming the

acetabulum and femoral canal, performing a revision total hip replacement with a long stem component under C/arm control.

The patient's general condition postoperative was stable, the wound was dry, and rehabilitation was done in bed on the first week; walk-assisted with crutches in the following weeks; postoperative Harris score at 65 points (Mean range); Good radiography images. After 1 month, 3 months of followed-up, the patient had no pain; no leg length discrepancy; the wound did not leak fluid; the Harris score after 3 months reached 82 points (Good range). The X - ray images showed the implant on the correct position (Figure 11A; B and C); There was evidence of bone healing at the femoral window.

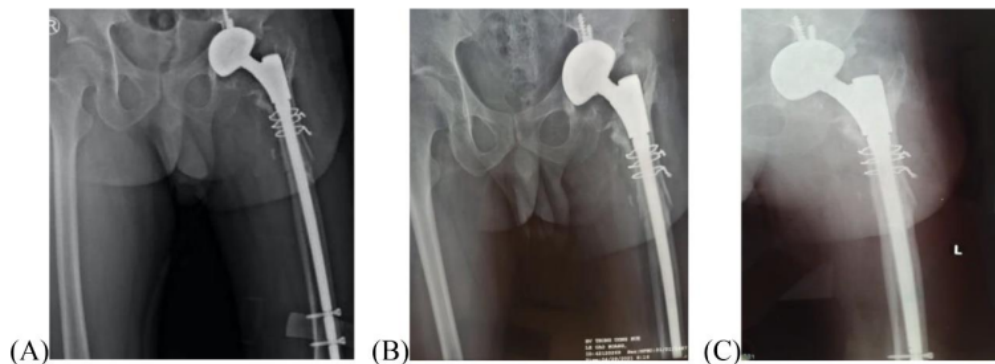


Figure 11: X - ray images postoperative (A), 1 month (B) and 3 months late (C)

Case 3

A 70-year-old patient was hospitalized with pain at left hip. X ray image showed the femoral neck fracture and suspicious tumor image (Figure 12). We also conducted interview the family medical history and found out that his wife had stomach cancer 5 years ago. Then he had been operated the primary total hip replacement on the left and sampled for pathology.

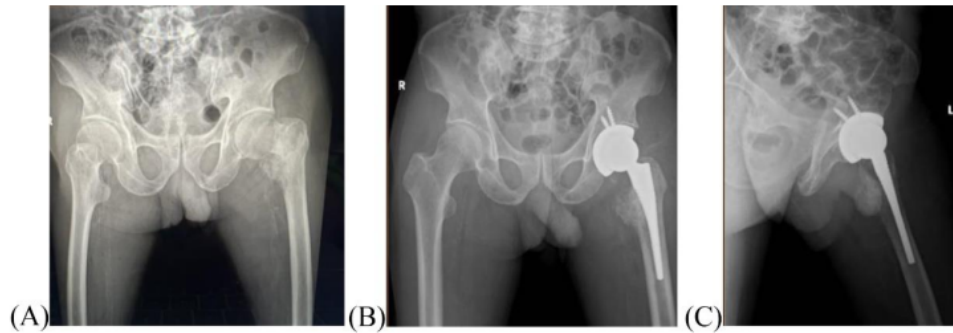


Figure 12: (A): Femoral neck fracture and abnormal contrast block; (B) and (C) Post-operative hip joint images.

After operation, the patient was general condition in well and walking normally. The result of pathology indicated carcinoma but his family hid and did not want to inform him this result of biopsy.

Four months later, the patient fell and was painful on the left hip while walking in his house. He was taken to the hospital for an X ray and examination. The X ray and CT scan images showed the proximal femoral fracture on the left with Vancouver B2 classification (Figure 13A). He had been diagnosed that Periprosthetic fracture after the left primary total hip replacement (suspected femoral metastatic carcinoma).

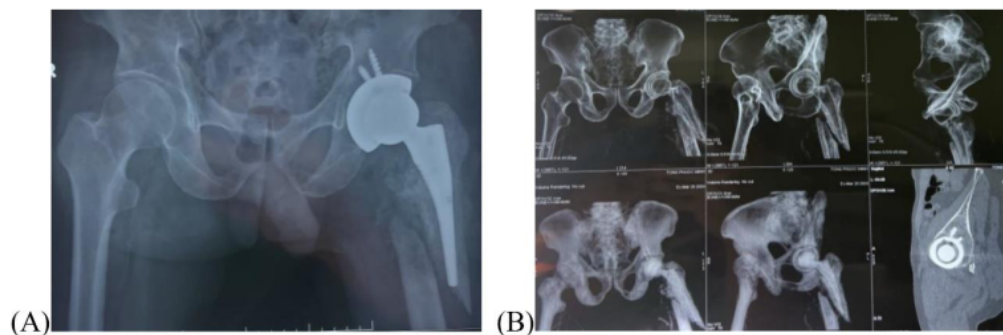


Figure 13: (A) Vancouver B2 Classification; (B) Left hip images on CT Scan

On 13 April 2024, patient had been operated for the revision left hip replacement surgery by minimally invasive technique with two incisions. We did the same approach tactics on the

anterior incision (9cm in length, Figure 14 A) by sparing the intermuscular space to reach the previous hip implants. Trochanteric slide osteotomy has been well done for femoral mobilization. ³ The greater trochanter is osteotomized from its tip to just distal to the insertion of the vastus lateralis, creating a wafer of approximately 2 cm (Figure 14B). The stem covered by the carcinoma bone mass had been dislocated and removed out easily (Figure 14 C) but the cup still intact firmly into the acetabular. The cup removing was unnecessary. Then, we made the second incision skin in line parallel to the femoral shaft, connecting two incisions to expose the femoral fracture site periprosthetic.



Figure 14: (A) Connecting two incisions; (B) Detaching the greater trochanteric; (C) Stem removed out enclosed with bone mass

At the distal femoral part, we did cut 6cm far from the tumor, then femoral canal broaching had been done. The trial femoral modulars were set up to confirm proper limb lengthening and hip stability. Whenever the properly final size of modular femoral stem had been inserted into the femoral cavity, the real neck and head were connected in continuity (Figure 15 A). Once again, hip stability testing was very important ¹⁴ with the hip joint in position of flexion and external rotation. The last important step was to reattachment the great trochanteric combined abduction muscle with three durable sutures into the holes of proximal femoral modular (Figure 15 B).



Figure 15: (A) The real stem+ connection + head insertion; (B) Reattached great trochanteric with abduction muscle

The wound was checked for bleeding; the fascia late closing by layers of subcutaneous and skin; A drainage could be insert into if necessary. Follow up on X rays post-op; 1st and 2rd month later showed no signs of abnormal of the implant components, the patient can walk normally with supporting of a crutch (Figure 16).

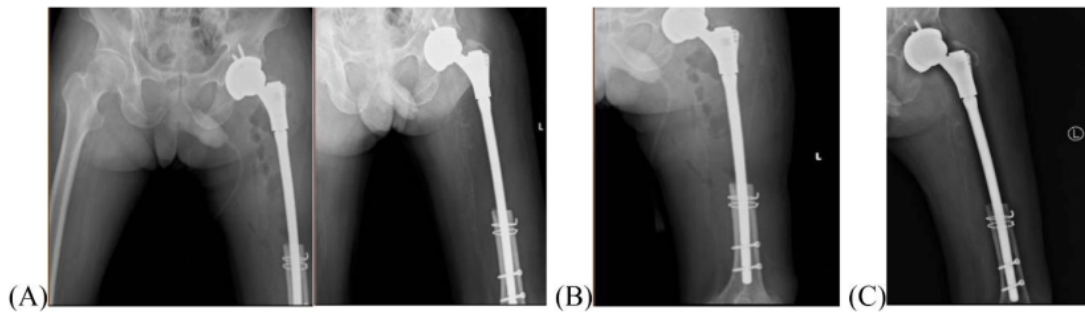


Figure 16 (A): X ray post-op image; B: 1st month; (C) 2rd month

DISCUSSION

Masterson believed that there was no single incision used for all cases of hip replacement and that the surgeons must be the master of the technique with the incisions he or she chose [8]. According to Manrique, anterior incision can be indicated in total hip replacement and no complications have been recorded in the literature; Patients with the BMI < 30 would be ideal for anterior approach of total hip replacement, which should be performed in centers with experienced surgeons and trained surgical staff [9]. The methodical knowledge of the anterior approach, in

addition to the specific equipment for this incision, is also one of the decisive factors for the success of the surgery. In cases where exposing the upper femoral head is difficult, the surgeon should consider performing bone window chisel or traditional great trochanteric osteotomy technique to facilitate removal of the initial stem [10]. One of these three cases study, traditional trochanteric osteotomy in which ⁸ preserves the lateral aspect of the great trochanteric, the abductors, and vastus lateralis in continuity had been done. In this way, the abductor muscle (gluteus medius) and the vastus lateralis inserted had been reattached to facilitate the surgical exposure and benefit functional recovery later. Through the presented clinical cases, we have a few observations: there are no significant difficulties or complications during operation using the anterior approach with minimally invasive technique in which separate only between the inter-muscular septum to achieve the anterior hip capsular in comparison with the other incisions that have to muscles cutting. The indication to the anterior incision for hip replacement in patients who have had their first hip replacement with a posterior incision is completely reasonable because of the anatomical structures on the front of hip are still intact. The length of the incision can be flexibly extended upwards or downwards in case the old stem remove requires opening the femoral window or removing the cement of the initial hip replacement. In addition, for Asians in general and Vietnam in particular, BMI is often at the thin or normal level < 25.0 , which is lower than the normal BMI in general on world ($>25.0 - 30.0$), so we think that using the anterior approach for primary hip replacement as well as revision is the appropriate, correct and preferred choice. But ¹ a surgeon who is highly skilled in the use of an approach can overcome many of its limitations in order to perform fairly difficult revision procedures. Nevertheless, awareness of the unsurmountable limitations of each approach is crucial, and surgeons must acquire experience with other approaches [11].

CONCLUSION

² Revision total hip replacement can be successfully performed through anterior incision with a tendency to be minimal invasive surgery that offers many advantages such as minimizing soft tissue damage, early rehabilitation, improve mobility rapidly thereby contributing to improving the quality of treatment and bringing satisfaction to patients. Furthermore, an experienced and well-trained orthopedic surgeon in both hip arthroplasty and plastic surgery will reshape an optimal treatment strategy, increase efficiency and reduce costs for the patient especially who underwent the primary hip replacement surgery with catastrophic complications.

¹¹ **Conflict of interest:** none declared

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REFERENCES

1. Varacallo M, Luo TD, Johanson NA, Total Hip Arthroplasty Techniques, in StatPearls. 2024: Treasure Island (FL) ineligible companies. Disclosure: T David Luo declares no relevant financial relationships with ineligible companies. Disclosure: Norman Johanson declares no relevant financial relationships with ineligible companies.
2. Goodman GP, Engh CA, Goyal N. Revision total hip arthroplasty exposure considerations: Which way in? Seminars in Arthroplasty. 2015;26(3):150-155.DOI: <https://doi.org/10.1053/j.sart.2015.09.010>.
3. Kurtz S, Mowat F, Ong K, Chan N, Lau E, Halpern M. Prevalence of primary and revision total hip and knee arthroplasty in the United States from 1990 through 2002. J Bone Joint Surg Am. 2005;87(7):1487-97.DOI: 10.2106/JBJS.D.02441.

4. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am.* 2007;89(4):780-5.DOI: 10.2106/JBJS.F.00222.
5. Sabah SA, Knight R, Nicolson PJA, Taylor A, Kendrick B, Alvand A, et al. Epidemiology of revision hip replacement surgery in the UK over the past 15 years-an analysis from the National Joint Registry. *BMJ Open.* 2023;13(10):e072462.DOI: 10.1136/bmjopen-2023-072462.
6. Bozic KJ, Kurtz SM, Lau E, Ong K, Vail TP, Berry DJ. The epidemiology of revision total hip arthroplasty in the United States. *J Bone Joint Surg Am.* 2009;91(1):128-33.DOI: 10.2106/JBJS.H.00155.
7. Britton AR, Murray DW, Bulstrode CJ, McPherson K, Denham RA. Pain levels after total hip replacement: their use as endpoints for survival analysis. *J Bone Joint Surg Br.* 1997;79(1):93-8.DOI: 10.1302/0301-620x.79b1.6572.
8. Masterson EL, Masri BA, Duncan CP. Surgical approaches in revision hip replacement. *J Am Acad Orthop Surg.* 1998;6(2):84-92.DOI: 10.5435/00124635-199803000-00002.
9. Manrique J, Chen AF, Heller S, Hozack WJ. Direct anterior approach for revision total hip arthroplasty. *Ann Transl Med.* 2014;2(10):100.DOI: 10.3978/j.issn.2305-5839.2014.09.11.
10. Brown JM, Mistry JB, Cherian JJ, Elmallah RK, Chughtai M, Harwin SF, et al. Femoral Component Revision of Total Hip Arthroplasty. *Orthopedics.* 2016;39(6):e1129-e1139.DOI: 10.3928/01477447-20160819-06.
11. Kerboull L. Selecting the surgical approach for revision total hip arthroplasty. *Orthop Traumatol Surg Res.* 2015;101(1 Suppl):S171-8.DOI: 10.1016/j.otsr.2014.07.031.