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CASE REPORT

Total Hip Arthroplasty in a Patient with Crowe Type 4 Dysplasia, a Challenge for Orthopaedic Surgeons

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ABSTRACT

Introduction: Total Hip Arthroplasty (THA) is a technically demanding procedure in patients with high hip dislocation due to both femoral and acetabular deformity, and morphologic abnormalities. Several problems and complications can be encountered, like nerve palsy, dislocation, non-union of the osteotomy site, peri-prosthetic infection, residual limp and periprosthetic fractures. We are presenting a long journey of a difficult case with dysplastic hip.

Case presentation: A 54 year old woman who suffered from severe right hip pain, with dysplastic hip underwent a THA with subtrochanteric femoral shortening osteotomy. Postoperatively, at two months she fell down and suffered a Vancouver type B1 fracture. She underwent an open reduction and internal fixation procedure with plate, strut graft and cables. After the operation, the patient continued to suffer from pain and wound oozing. Irrigation and debridement was performed, but wound oozing carried on with the evidence of infection both clinical and laboratory results. This led to removal of all the implant, strut allografts, all devitalized bone fragment and instead, those were replaced with an antibiotic coated spacer. After three months, there was no clinical or serologic evidence of infection. Therefore, we performed a revision THA with grafting of fracture side and covered it with mash after removing the spacer. The distal femur was cemented to help stability and reinforcement. After two years, she had no pain and no sign of infection. The Harris hip score was improved from 38 to 85 at the last follow-up and she was mobilized fully without even a need for a walking aidwhich was the patient's mobility requirement-level pre-operatively.

Conclusion: Complex THA cases with dysplastic hips are difficult ones and require many technical considerations and a lot of experience. To improve the outcome, preoperative planning, proper implant selection and postoperative care are mandatory but, never without complications.

Introduction

Total Hip Arthroplasty (THA) has proved its success for improving quality of life and reducing pain even in patients with hip dysplasia however, it is a technically demanding procedure due to the femoral and acetebular

developmental deformities in the latter group [1]. Several problems and complications can be encountered, like nerve palsy, dislocation, non-union of the osteotomy site, periprosthetic infection, leg length discrepancy and periprosthetic fractures [2-5]. The higher the type of dysplasia according to Crowe classification [2], the more the complication rates.

The favourable technique for the Crowe type 4hip dysplasiais to restore the hip center of rotation at the true acetabulum, shortening the femur with subtrochanteric osteotomy [6-9]. In the literature, the complication rates were ranged from 12% to 41% for Crowe type 4 dysplasia [2,10].

We presented a case of a 54 year old woman with Crowe type 4 dysplasia who underwent a THA procedure with subtrochanteric shortening osteotomy. We aimed to show and describe the complexity of the case with its distorted anatomy, our experience, and how to deal with high complication rates in the light of literature review.

Case Presentation

A 54 year old woman presented with bilateral severe hip pain, difficulty in walking even short distances and in other daily activities. Her radiological studies showed Crowe type 4 for right hip and Crowe type 2 Developmental Dysplasia of Hip (DDH) for left hip. The preoperative leg-length discrepancy was - 4 cm for right hip. During the preoperative planning, the templates were used to determine the femoral and acetabular cup size and the amount of the femoral shortening (Echelon femoral component and reflection acetabular cup, Smith-Nephew®). Harris hip scores was used as part of clinical assessment [11].

We performed a THA with 4cm subtrochanteric step cut shorting osteotomy through a posterior approach in the lateral position. We used uncemented cup, graft for femur and cables to help femoral osteotomy.

The patient had a favourable recovery during initial two months. Following that period, she fell down from the bed and suffered a Vancouver [12] type B1 fracture. She underwent an open reduction and internal fixation procedure with plate, strut graft and cables. After the procedure, the patient wasstill complaining of pain and wound oozing was present. The C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR) remained high. Irrigation and debridemant were performed and intraoperative culture retrieved. The culture results showed Meticilline Resistance Staphylococcus Aureus (MRSA). She received intravenous (IV) Teicoplanin treatment. Following the treatment, the value of CRP and ESR remained high. Therefore, we removed all the implants including femoral stem with an extended osteotomyas well as removal of strut allografts and all devitalised bone fragment. We inserted an antibiotic coated spacer with cement beads around femur containing gentamycine and teicoplaninand the patient carried on taking IV antiobiotic. Despite intense infection management for 3 weeks, wound oozing did not stop and blood values (CRP and ESR) did not respond to the treatment. Yet, this led to another revision and change of antibiotic coated spacer with further debridement and washout. In addition to ongoing antibiotic treatment, Vacuum-Assisted Closure (VAC) was applied to the wound and the patient was mobilised with hip-knee-ankle orthosis. However, there was no growth in culture possibly due to ongoing antibiotic treatment. Following all the management, eventually the wound healed well. We removed the spacer, performed a revision THA (ZMR Zimmer revision hip system®), grafted the fracture side and covered it with mash. For reinforcement and stability, the distal femur was cemented. The patient discharged from the hospital shortly after and started physiotherapy, with touch weight-bearing at home. After two years, she had no pain and no sign of infection. The Harris hip score was improved from 38 preoperatively to 85 at the last follow-up. The leg length discrepancy was 1 cm at the last follow-up and the patient was mobilised fully without a need for walking aid which was the patient's mobility requirement-level pre-operatively.

At the last follow-up, there was bone-ingrown and no subsidence or positional change in the ace tabular cup.

Discussion

Hip dysplasia is one of the common etiologic factors of secondary osteoarthritis of hipin adults. Main objectives of the joint replacement surgery are to eliminate pain that restricts daily activities and to improve patient's functional capacity. In the literature, it has been stated that THA for the dysplastic hip has higher complication rates compared with primary osteoarthritis [5,13,14] due to abnormal morphologyof the hip and contracture of the soft tissues. Historically, some authors considered high hip dislocation a contraindication to THA [15,16].

The common complications were dislocation, nerve palsy, leg length discrepancy, non-union of the femoral osteotomy site and infection. The complication rates ranged from 12% to 41% for Crowe type 4 dysplasia in the literature [5]. However, morphology of a severely dysplastic hip increases the complexity of reconstruction and is a technical challenge for an arthroplasty surgeon.

The prevalence of postoperative periprosthetic femur fracture after primary THA has previously been described as 0.4% to 1.1% [17]. Periprosthetic Femoral Fractures (PFF) are amongst the most severe complications after THA [18]. PFF is the third most common reason for THA revision after loosening and recurrent dislocation. They represent a challenge with regard to patient management and recovery. Several risk factors have been identified that are recommended such as local bone quality, patient induced problems, and the arthroplasty itself [19,20]. it is conceivable that certain stem characteristics could further contribute to the risk of postoperative fracture [17]. Vancouver classification is used to assess the treatment options. The proposed treatment for Vancouver B1 is open reduction and internal fixation (ORIF) [21-23]. Strut Allograft can be used to augment fixation and fracture healing when used with a metal plate, as biplanar fixation has been shown to be much more stable than uniplanar fixation [24]. Haddad et al. [25] and Khashan et al. [26] reported very high rates of union and satisfactory alignment of B1 fractures treated using cortical allograft struts with a plate.

In the present study, we usedopen fixation technique usingcortical allograft struts for PFF. On the other hand, open fixation technique could reduce function and increase morbidity and mortality. Also, a second surgical procedure increases the risk of Periprosthetic Infection (PJI). In the present case, we faced withinfection after ORIF. Mardian el al. [27] reported the overall complication rate in theircohort was 25.4 %, with infection (13.4 %) and hardware failure (9 %). Beals et al. demonstrated hardware failure in 13 % and infections in 7 % of ORIF [28]. Successful treatment of PFF requires careful attention to understand the fracture pattern, determine a treatment approach, and to provide an appropriate postoperative recovery protocol.

For our case, we preferred two-staged approach and we performed revision arthroplasty following reassurance of infection eradication and wound healing. Some studies suggest that open debridement with retention of the implant followed by antibiotic treatment is a good option for treatment of acute PJIs [29]. The duration of antimicrobial therapy for acute PJIs has not been well established. On the basis of expert opinion, a duration of 3 to 6 months is recommended [30]. Some studies show that antibiotic therapy had to continue until the clinical resolution of infectious symptoms and the normalization of the CRP [30]. Buchholz et al. introduced the one-stage exchange arthroplasty. This procedure includes excision of the infected components, surgical debridement, and immediate reconstruction with a cemented total hip arthroplasty. The basis of this procedure is the addition of antibiotics in powdered form to cement. The advantage of this technique is avoiding multiple operative procedures and this is particularly important for the patients with other comorbidities. However, these benefits must be weighed against the lower rates of eradication of infection.

The two-stage technique has been the treatment of choice for the past two decades. It can be done with two ways. One is the resection arthroplasty in which all of the implants are removed with debridement. Antibiotics are administered for at least 4 weeks, and there is an interval between the Girdle stone resection arthroplasty and the reconstruction. Some surgeons have reported that the surgical implantation of antibiotic-

loaded beads into the wound can enhance the eradication of the remaining micro-organisms [31]. This may be painful for the patient until the time of reconstruction [31].

Duncan and Beauchamp have described another two-stage technique, which obviates the patientsdifficulty of ambulating with a short and difficult to control extremity in the interval between resection arthroplasty and reconstruction [32]. They implant aspacer which is constructed from antibiotic-impregnated cement. The main interval for hip reconstruction arthroplasty is not defined. Fitzgerlad [33] had suggested to perform reconstruction three or more months after resection arthroplasty in patients with less virulent infections, but to delay reconstruction for at least 1 year in patients with more virulent infections. Others have reported success with shorter intervals between the Girdlestone resection arthroplasty and reconstruction of the hip [34].

One of the most devastating complication of THA in high hip dislocation is nerve palsy [35] and can cause permanent functional impairment. Possible causes for nerve palsy are idiopathic, traction, compression, ischemia, and denaturation due to heat [36]. Femoral subtrochanteric shortening is chosen to avoid this risk. We used step-cut subtrochanteric femoral shortening osteotomy in the present case. Restoration of anatomic hip center requires limb lengthening and increase the risk of nerve injury. One choice to overcome this problem is femoral shortening osteotomy. Femoral shortening osteotomy for high dislocation was described by Klisic and Jankovic [37]. Various techniques of shortening osteotomies were described: transverse, chevron, oblique and step-cut [6-8]. Sener et al. [8] reported that two out of twenty-eight hips treated with step-cut osteotomy had non-union. Ondare et al. reported that non-union of the osteotomyoccured in one of fourteen hips treated with transverse osteotomy. Masonis et al. [38] reported that two of 21 hips treated with transverse osteotomy had non-union. All these studies indicate that a large bone contact surface, femoral prosthesis and osteotomy site stability are required for the union of the osteotomy. Hartofilakidis and Karachalios reported two postoperative neurological complications and both were resolved fully within six months in 84 highly dislocated group [39]. Kawai et al. [35] recommended the maintaining the periarticular muscles to protects the vessels and nerves from excessive elongation.

Dislocation is a demanding complication after THA. Component malposition and soft-tissue problems are the two main reasons. In the present case, we did not have such a complication. We suggested that this was due to avoiding aggresive soft tissue release and ideal component position as mentioned in a previous study by Hartofilakidis and Karachalios [39]. In a study by Eskelinen et al. [40], two of 68 THA had twoearly dislocations and were secondary to malposition. Hartofilakidis and Karachalios [39] stated that postoperative dislocations occurred in eight hips within 229 THA in dysplastic, low and high dislocation.

The femoral component was classified according to Engh et al. [13] as bone-ingrown, fibrous stable or unstable. Subsidence of the femoral component was defined as a change in position of >3 mm. Acetabular component loosening was defined as a change $> 2^0$ or > 2 mm in position. In our case, there was bone-ingrown and no subsidence or positional change in the acetabular cup at the last follow-up.

We emphasise that THA in high hip dislocation is a difficult procedure and in order to improve the outcomes and minimise the risk of complications, preoperative planning, proper implant selection and postoperative care are mandatory. Additionally, experience is an important factor in the management of such cases.

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References

1. Takao M, Ohzono K, Nishii T, Miki H, Nakamura N, et al. (2011). Cementless modular total hip arthroplasty with subtrochanteric shortening osteotomy for hips with developmental dysplasia. J Bone Joint Surg Am. 93: 548-555.

2. Crowe JF, Mani VJ, Ranawat CS. (1979). Total

hip replacement in congenital dislocation and dysplasia of the hip. J Bone Joint Surg Am. 61: 15-23.

3. Anwar MM, Sugano N, Masuhara K, Kadowaki T, Takaoka K, et al. (1993). Total hip arthroplasty in the neglected congenital dislocation of the hip. A five- to 14-year follow-up study. Clin Orthop Relat Res. 295: 127-134.

4. Cameron HU, Botsford DJ, Park YS. (1996). Influence of the Crowe rating on the out- come of total hip arthroplasty in congenital hip dysplasia. J Arthroplasty. 11: 582-587.

5. Park MS, Kim KH, Jeong WC. (2007). Transverse subtrochanteric shortening osteotomy in primary total hip arthroplasty for patients with severe hip developmental dysplasia. J Arthroplasty. 22: 1031-1036.

6. Yasgur DJ, Stuchin SA, Adler EM, DiCesare PE. (1997). Subtrochanteric femoral short- ening osteotomy in total hip arthroplasty for high-riding developmental dislocation of the hip. J Arthroplasty.12: 880-888.

7. Reikeraas O, Lereim P, Gabor I, Gunderson R, Bjerkreim I. (1996). Femoral shortening in total arthroplasty for completely dislocated hips: 3-7 year results in 25 cases. Acta Orthop Scand. 67: 33-36.

8. Chareancholvanich K, Becker DA, Gustilo RB. (1999). Treatment of congenital dislocated hip by arthroplasty with femoral shortening. Clin Orthop Relat Res. 360: 127-135.

9. Biant LC, Bruce WJ, Assini JB, Walker PM, Walsh WR. (2009). Primary total hip arthro- plasty in severe developmental dysplasia of the hip. Ten-year results using a ce- mentless modular stem. J Arthroplasty. 24: 27-32.

10. Sponseller PD, McBeath A. (1988). Subtrochanteric osteotomy with intramedullary fixation for arthroplasty of the dysplastic hip. A case report. J Arthroplasty. 3: 351-354.

11. Harris WH. (1969). Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. J Bone Joint Surg Am. 51: 737-755.

12. Duncan CP, Masri BA. (1995). Fractures of the femur after hip replacement. Instr Course Lect. 44: 293-304.

13. Engh CA, Bobyn JD, Glassman AH. (1987). Porous-coated hip replacement. The fac- tors governing bone ingrowth, stress shielding, and clinical results. J Bone Joint Surg Br. 69: 45-55.

14. Sofu H, Aydin BK. (2013). Common Complications of Total Hip Arthroplasty in Dysplastic Hips. J Orthop & Traumatol-Special Topics 6: 69-74.

15. Charnley J, Feagin JA. (1973) Low-friction arthroplasty in congenital subluxation of the hip. Clin Orthop Relat Res. 91: 98-113.

16. Eftekhar NS. (1978). Principles of total hip arthroplasty. St. Louis: CV Mosby. 437-455.

17. Watts CD, Abdel MP, Lewallen DG, Berry DJ, Hanssen AD. (2015). Increased risk of periprosthetic femur fractures associated with a unique cementless stem design. Clin Orthop Relat Res. 473: 2045-2053.

18. Sadoghi P, Liebensteiner M, Agreiter M, Leithner A, Bohler N, et al. (2013). Revision surgery after total joint arthroplasty: a complication-based analysis using worldwide arthroplasty registers. J Arthroplasty. 28: 1329–1332.

19. Moreta J, Aguirre U, de Ugarte OS, Jauregui I, Mozos JL. (2014). Functional and radiological outcome of periprosthetic femoral frac- tures after hip arthroplasty. Injury. 46: 292-298.

20. Singh JA, Jensen MR, Harmsen SW, Lewallen DG. (2013). Are gen- der, comorbidity, and obesity risk factors for postoperative periprosthetic fractures after primary total hip arthroplasty? J Arthroplasty. 28: 126–131.

21. Rayan F, Dodd M, Haddad FS. (2008). European validation of the Vancouver classification of periprosthetic proximal femoral fractures. J Bone Joint Surg. 90: 1576-1579.

22. Corten K, Vanrykel F, Bellemans J, Frederix PR, Simon JP, et al. (2009). An algorithm for the surgical treatment of periprosthetic fractures of the femur around a well-fixed femoral component. J Bone Joint Surg. 91: 1424-1430.

23. Laurer HL, Wutzler S, Possner S, Geiger EV, El Saman A, et al. (2011). Outcome after operative treatment of Vancou- ver type B1 and C periprosthetic

femoral fractures: open reduction and internal fixa- tion versus revision arthroplasty. Arch Orthop Trauma Surg. 131: 983-989.

24. Yasen AT, Haddad FS. (2014). The management of type B1 periprosthetic femoral fractures: when to fix and when to revise. Int Orthop. 39: 1873-1879.

25. Haddad FS, Duncan CP, Berry DJ, Lewallen DG, Gross AE, et al. (2002). Periprosthetic femoral fractures around well-fixed implants: use of cortical onlay allografts with or without a plate. J Bone Joint Surg Am 84: 945-950.

26. Khashan M, Amar E, Drexler M, Chechik O, Cohen Z, et al (2013). Superior outcome of strut allograft-augmented plate fixation for the treatment of periprosthetic fractures around a stable femoral stem. Injury. 44: 1556–1560.

27. Märdian S, Schaser KD, Gruner J, Scheel F, Perka C, et al. (2015). Adequate surgical treatment of periprosthetic femoral fractures following hip arthroplasty does not correlate with functional outcome and quality of life. Int Orthop. 39: 1701-1708.

28. Beals RK, Tower SS. (1996). Periprosthetic fractures of the femur. An analysis of 93 fractures. Clin Orthop Relat Res. 327: 238–246.

29. Font-Vizcarra L, Garcia S, Bori G, Martinez-Pastor JC, Zumbado A, et al. (2012). Long-term results of acute prosthetic joint infection treated with debritement and prosthesis retention: a case control study. Int J Artif Organs 35: 908-912.

30. Zimmerli W, Trampuz A, Ochsner PE. (2004). Prosthetic-joint infections. N. Engl. J. Med. 351: 1645–1654.

31. Mc Donald DJ, Fitzgerlad Jr RH, Ilstrup DM. (1989). Two-stage reconstruction of total hip arthroplasty because of infection. J Bone Joint Surg Am. 71: 828-834.

32. Duncan CP, Beauchamp CP. (1993). A temporary antibiotic-loaded joint replacement system for the management of complex infections invalving the hip. Orthop Clin North Am. 24: 751-759.

33. Fitgerlad Jr RH. (1995). Infected total hip arthroplasty: diagnosis and treatment. J Am Acad Orthop Surg. 3: 249–262.

34. Garvin KL, Hanssen AD. (1995). İnfection after total hip arthroplasty past, present and future. J Bone Joint Surg Am. 77: 1576-1588.

35. Kawai T, Tanaka C, Ikenaga M, Kanoe H. (2011). Cemented total hip arthroplasty with transverse subtrochanteric shortening osteotomy for Crowe group IV dislocated hip. J Arthroplasty. 26: 229-235.

36. Park JH, Hozack B, Kim P, Norton R, Mandel S, et al. (2013). Common peroneal nerve palsy following total hip arthroplasty: prognostic factors for recovery. J Bone Joint Surg Am. 95: e551-555.

37. Klisic P, Jankovic L. (1976). Combined procedure of open reduction and shortening of the femur in treatment of congenital dislocation of the hips in older children. Clin Orthop. 119: 60-69.

38. Masonis JL, Patel JV, Miu A, Bourne RB, McCalden R, et al. (2003). Subtrochanteric shortening and derotational osteotomy in primary total hip arthroplasty for patients with severe hip dysplasia: 5-year follow-up. J Arthroplasty. 18: 68-73.

39. Hartofilakidis G, Karachalios T. (2004). Total hip arthroplasty for congenital hip disease. J Bone Joint Surg Am. 86: 242-250.

40. Eskelinen A, Helenius I, Remes V, Ylinen P, Tallroth K, et al. (2006). Cementless total hip arthroplasty in patients with high congenital hip dislocation. J Bone Joint Surg Am. 88: 80-91.