CASE REPORT
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Late Onset Disassembly of a Modular Neck-stem Component after Cementless Hip Replacement without Dislocation: A Case Report and Review of Literatures

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Modular femoral prostheses are characterized by a second neck-stem junction. This modularity provides many clinical benefits including hip offset restoration, intraoperative leg length and anteversion adjustment. Although, this extra junction in modular femoral prostheses can contribute to catastrophic consequences like fracture, cold welding, corrosion and fretting of the modularity. However, only few complications related to the modularity itself have been reported in the literature. We report a unique case of neck-stem component dissociation without dislocation of the R-120PC™ Modular Stem (DJO Surgical). Our 71-year-old obese female patient underwent cementless hip replacement 5 years ago. Following radiographic confirmation of neck-stem dissociation open reduction was performed and wiring fixation was applied to secure the neck to the stem. After reduction and fixation, hip joint was stable, and our patient returned to her daily routine 2.5 months postoperatively. The last follow up was at 12 months after surgery with excellent radiographic and clinical evaluation.

Key Words: Modular hip prostheses, Disassembly, Late onset, Neck-stem component, Dissociation

Modular femoral prostheses are characterized by a second neck-stem junction and offer the advantage of increased flexibility in component selection intraoperatively[1,2]. In modular prostheses, the risk of intraoperative errors in matching and disassembly of the components postoperatively are increased[3,4]. Although several cases of head-neck component disassembly have been reported[2,5], neck-stem dissociation seems to be extremely rare. Dissociation after hip dislocation is a common and well-described disassembly mechanism[6]. We report a case of a late-onset (five years postoperatively) neck-stem dissociation without hip dislocation, that occurred without trauma, and we present all of the possible causes of this rare complication. Furthermore, we provide recommendations to avoid this complication and describe our fixation technique. To the best of our knowledge, only one case with neck-stem dissociation without hip dislocation has already been described[4]. However, it was a case of an early onset disassembly that occurred four months postoperatively[4].

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CASE REPORT

A 71-year-old obese (body mass index, 58 kg/m^2) female patient was admitted to our emergency department unable to walk after experiencing sudden left hip pain during her effort to seat to her couch, without trauma. Physical examination revealed shortening of the limb and pain in passive motion of her hip. In her past medical history, she mentioned a cementless total hip replacement for primary hip osteoarthritis five years ago at another institution. The first surgery was performed via a Kocher-Langenbeck approach and a modular hip prosthesis model type R-120™ (DJO Surgical, Vista, CA, USA) was implanted. On admission, her radiograms revealed incongruity at the neck-stem junction, but we could not determine the presence of a neck fracture or neck-stem disassembly (Fig. 1A). Our patient didn't mention any complication associated with the first surgery and she declared asymptomatic the period between the initial operation and the admission to our department. We have no extra details about the initial operation since it was made at another institution and after our request no data were available. A computed tomography scan was not performed because of the extreme obesity of this patient. We obtained radiographs under manual traction to determine whether this incongruity concerned a neck fracture or a neck-stem disassembly. After recognition of the intact collar and distal part of the neck, the diagnosis of neck-stem dissociation was settled (Fig. 1B). After radiographic confirmation of neck-stem dissociation, open reduction via a Hardinge approach was performed. The cobalt chrome (CoCr) proximal porous-coated R-120PC™ stem and the FMP™ titanium porous-coated acetabular component (DJO Surgical) were found very stable and left in situ. The removed CoCr neck system was found with fretting corrosion and abrasion (Fig. 2), probably due to vibratory motions between the excessive loaded metal surfaces of the stem and neck. We didn't find any crevice or galvanic corrosion since the material of the two components was the same. Based on the intraoperative findings, we cannot definitively exclude any technical failures during first implantation. Whether the fretting or the abrasion of the modular stem was the main cause that resulted in failure, or it occurred following failed implantation and poor locking technique, we cannot say absolutely. A new modular interchange system was implanted, and the 28 mm polyethylene liner was also replaced. The stem taper junction was found with mild corrosion and since there was no other method to secure the neck to the stem, we applied a "figure of eight" wiring fixation to avoid neck-stem dissociation recurrence with a CoCr wire (Fig. 3). After insertion of the modular neck and gently hammered into the stem, the collar of the neck was 2 times looped and fixed with the greater trochanter.

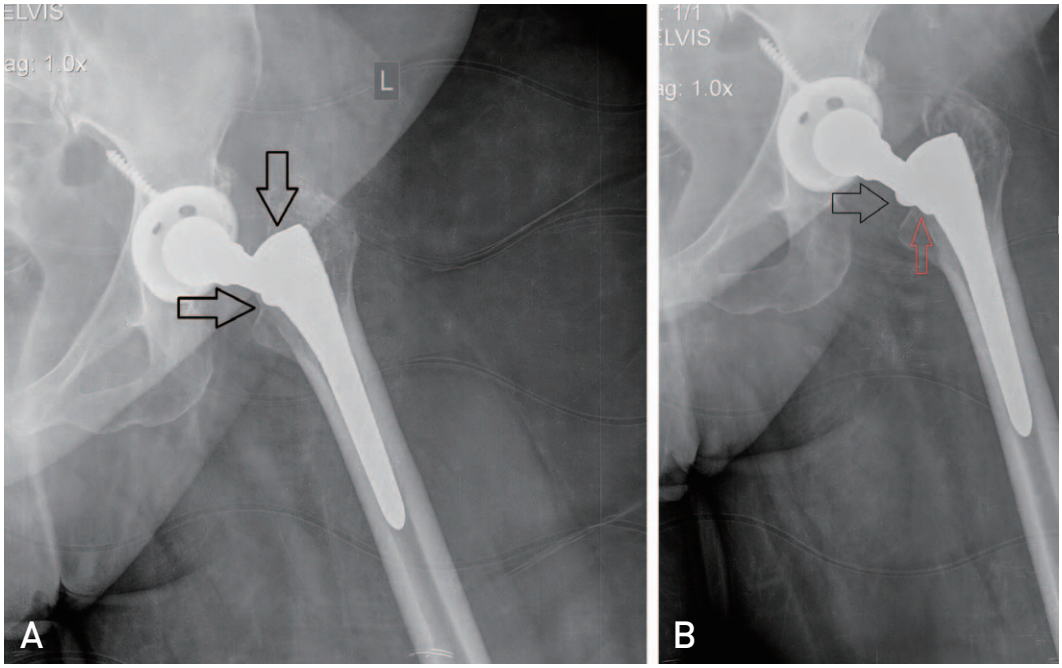

Fig. 1. (A) Anteroposterior hip radiogram, demonstrates neck-stem dissociation without dislocation of the head (black arrows). (B) Anteroposterior hip radiogram with traction application. The black arrow reveals the collar of the neck outside of the junction and the red arrow shows the intact distal part, below the neck's collar.

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We demonstrate our technique by providing a saw bone to highlight our method (Fig. 4). This is the first case that was treated with "figure of eight" wiring technique. However, this technique has been used in fixing intraoperative fractures of greater trochanter in total hip replacement procedures. The head-neck ratio couldn't change because we maintain the acetabular component and the neck diameter is fixed. After reduction of the hip, the joint was stable and without impingement in the functional range of motion, while postoperative radiographic imaging was within normal limits (Fig. 5). The patient had an uneventful postoperative course with no other complications and returned to her daily routine 2.5 months after surgery. At the 12-month follow-up, the Harris Hip Score was 91 and the radiographic control was excellent (Fig. 6). Whether or not to revise the stem component was preoperatively discussed with our patient. We explained that revision of stem and neck components is the best treatment choice for this late onset dissociation, particularly if corrosion was the main cause. Furthermore, we analyzed in detail the revision procedure of this well-fixed stem, the possible complications and the prolonged non-weightbearing period. Our patient understood thoroughly the increased risk of a new dissociation due to stem taper corrosion, although

Fig. 2. Photo of the neck component demonstrates the corrosion.

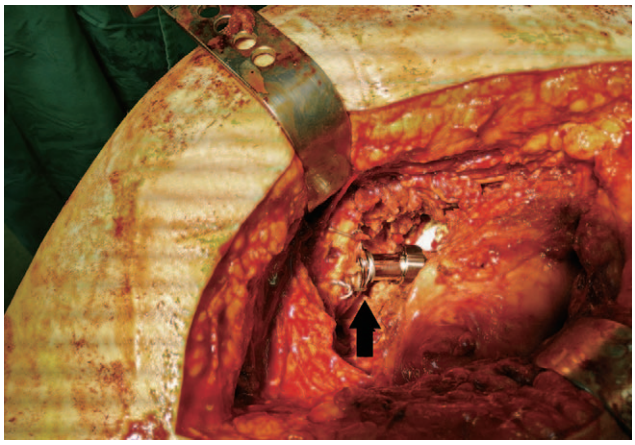

Fig. 3. Intraoperative image demonstrates the wiring application to the neck of the prostheses and the greater trochanter (black arrow).

Fig. 4. Photo of a saw bone demonstrates the figure of eight fixation of the neck to the stem, by using the collar of the neck to secure the junction with the two loops of the wire.

based on her general physical condition, obesity, age, increased complications after stem revision and long-term rehabilitation she asked us not to revise her stem component. Based on the intraoperative findings of the stem taper junction wear and our patient preference we decided to maintain the stem component and we applied the wiring fixation to secure the junction.

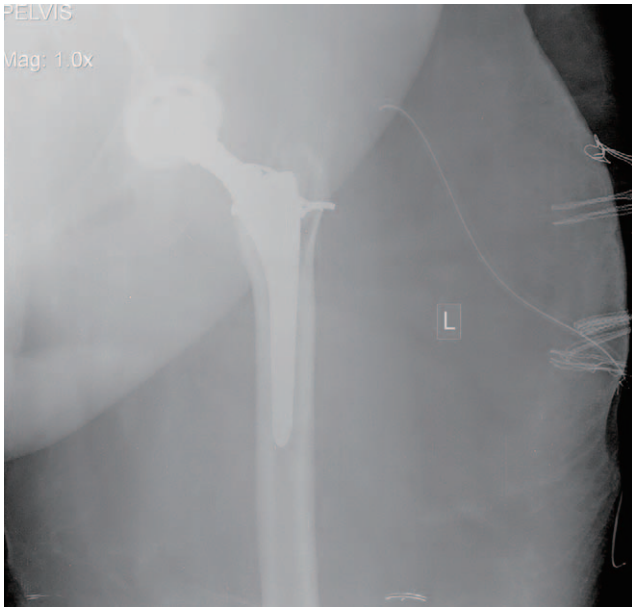

Fig. 5. Postoperative anteroposterior hip radiogram after reduction and wiring.

DISCUSSION

Modular hip prostheses are now widely used by many orthopaedic surgeons because they offer flexibility during surgery by modifications at hip offset, leg length, and femoral anteversion, while the intraoperative blood loss is significantly reduced due to the early implantation of the stem component. These modifications allow for greater accuracy in correcting biomechanical alignment to ensure minimal joint reaction force and correct stress transfer[1]. Hip prostheses with neck-stem junction show greater fretting and crevice corrosion compared to the head-neck junction, increasing metallic debris and soluble metallic ions, both locally and systemically[1,7]. There are several explanations of neck-stem disassembly. The most common mechanism for such disassembly is dissociation after a closed attempt for reduction of hip dislocation, by means of distraction to the trapped femoral head[6]. Another mechanism may be the impingement of the greater trochanter to the acetabular component or to the ilium and the impingement of the femoral neck to the acetabular shell, particularly if the head-neck ratio is small[8]. Furthermore, some infrequent patient activities, such as extreme flexion and abduction, should be restricted to avoid impingement[9]. When impingement does occur, distraction forces are applied, which contributes to a high risk of dislocation and dissociation in case of modularity. Another possible cause of neck-stem disassembly is the sealed air that pushes back the femoral neck and unlocks the taper lock[2,5], which is referred to as the pumping phenomenon.

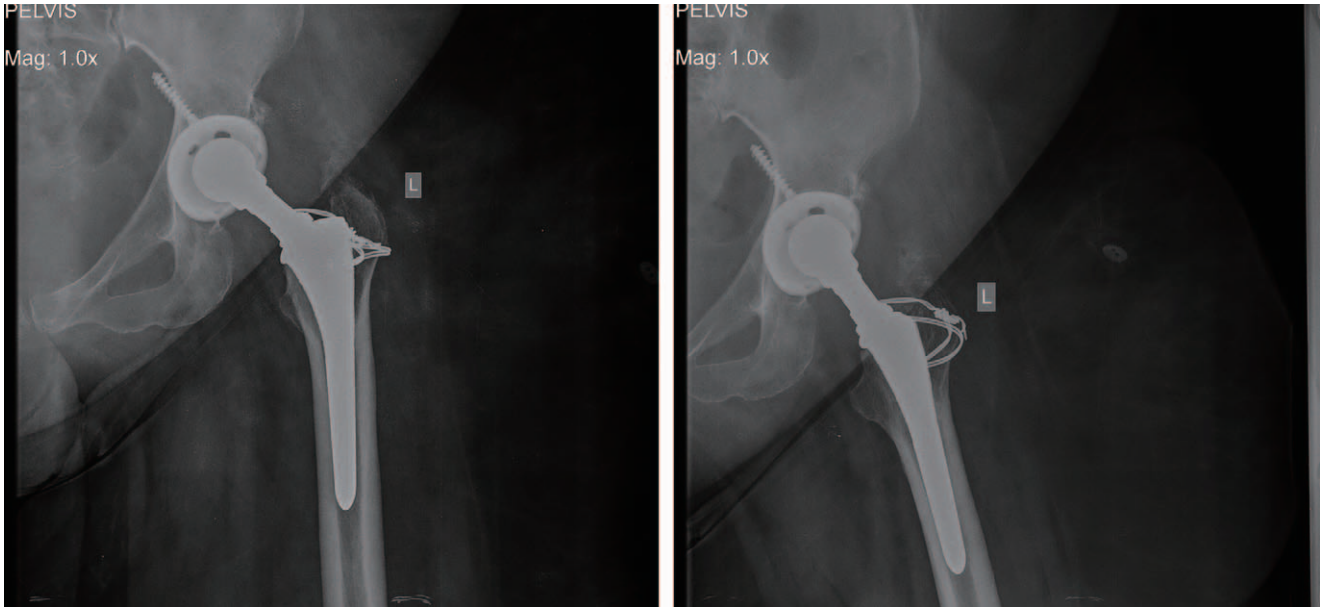

Fig. 6. Anteroposterior and profile hip radiogram 12 months postoperatively.

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Thus, surgeons should manually confirm the taper lock after assembly of the prosthesis. Most surgeons use hammer blows to press fit the neck taper. This technique can damage the articulation bearing surfaces and provide less stability of the manual insertion of the coupling followed by a small number (100) of walking cycles (9). Thus, prosthesis damage can be avoided, but high index of awareness is needed, because early physiotherapy in bed before weight-bearing can produce distraction forces to the taper junction, particularly if the physiotherapist is not instructed to avoid certain manoeuvres (flexion, abduction)[9]. Before taper junction assembly, the surfaces should be cleaned meticulously to avoid contamination and loosening[7,9]. Recent biomechanical analysis suggests changing the material of the neck adapter from titanium to cobalt-based alloy[7]. The combination of the cobalt-based neck and the titanium alloy stem increases the taper connection safety, shows higher rigidity and stiffness, reduces the micro-movements of the connection, and provides improved resistance against fretting and lower notch sensitivity compared to the titanium alloy neck. These micro-movements of the titanium alloy neck increase the abrasion and loosening; thus, finally leading to dissociation by creating negative pressure in the acetabular area. Although, this combination (titanium alloy stem and CoCr neck) enhances the galvanic corrosion, while titanium alloy necks present lower fatigue strength. In patients treated with a modular hip stem with titanium alloy neck, several parameters have been characterized as risk factors for implant failure and should be taken into consideration. These include intraoperative connection contamination by blood or tissues, excessive loading due to patient weight above 100 kg or high level of activity, and male gender[7].

Neck-stem dissociation without dislocation has been described previously only once in the literature. In this case, the dissociation was revealed only four months postoperatively after a revision hip arthroplasty and the authors revised both stem and neck components[4]. However, in our case a late-onset dissociation occurred, five years after total hip replacement, making the case unique. The explantation of the well-fixed stem and re-implantation of a new uncemented or even cemented prosthesis may induce additional complications and risks[10], such as excessive bone loss, increased intraoperative time and infection rate, increased blood loss and venous thromboembolic disease, increased rates of mortality and prolonged non-weight bearing period. Regarding the risk for a new disassembly, it is possible but the additional use of figure of eight wiring was intraoperatively and until 12 months postoperatively stable enough to guarantee short- and long-term hip stability. Furthermore, we preferred to inform our patient about pros and cons of stem revision, to enable her to make a well-informed treatment choice.

In our case, several factors contributed to the disassembly of the neck-stem junction. A modular prosthesis was not a reasonable option for this obese female patient. The excessive load of the interface between stem and neck components increases the micro-movements to the junction and results in fretting corrosion, founded particularly at the neck of our case. It is likely that the patient in this study, in an attempt to sit on her couch, caused an excessive flexion in the hip and a possible impingement of the neck to the acetabular component. This impingements in addition to the increased micro motion to the junction due to the corrosion were possibly the main causes of this rare dissociation.

CONFLICT OF INTEREST

The authors declare that we obtain a signed consent form of our patient to publish this rare case. Our patient understood that her name will not be published, and efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

REFERENCES

1. Kop AM, Keogh C, Swarts E. *Proximal component modularity in THA--at what cost? An implant retrieval study. Clin Orthop Relat Res. 2012;470:1885-94.*
2. Ahmed P, Kumar D. *Late disassembly of femoral head and neck of a modular primary total hip arthroplasty. J Orthop Case Rep. 2015;5:8-10.*
3. Barrack RL, Burke DW, Cook SD, Skinner HB, Harris WH. *Complications related to modularity of total hip components. J Bone Joint Surg Br. 1993;75:688-92.*
4. Kouzelis A, Georgiou CS, Megas P. *Dissociation of modular total hip arthroplasty at the neck-stem interface without dislocation. J Orthop Traumatol. 2012;13:221-4.*
5. Shiga T, Mori M, Hayashida T, Fujiwara Y, Ogura T. *Disassembly of a modular femoral component after femoral head prosthetic replacement. J Arthroplasty. 2010;25:659.e17-9.*
6. Star MJ, Colwell CW Jr, Donaldson WF 3rd, Walker RH. *Dissociation of modular hip arthroplasty components after dislocation. A report of three cases at differing dissociation levels. Clin Orthop Relat Res. 1992;278:111-5.*
7. Grupp TM, Weik T, Bloemer W, Knaebel HP. *Modular titanium alloy neck adapter failures in hip replacement--failure mode analysis and influence of implant material. BMC Musculoskelet Disord. 2010;11:3.*
8. Bunn A, Colwell CW Jr, D' Lima DD. *Bony impingement limits design-related increases in hip range of motion. Clin*

Orthop Relat Res. 2012;470:418-27.

9. Pallini F, Cristofolini L, Traina F, Toni A. *Modular hip stems: determination of disassembly force of a neck-stem coupling. Artif Organs. 2007;31:166-70.*
10. Badarudeen S, Shu AC, Ong KL, Baykal D, Lau E, Malkani AL. *Complications after revision total hip arthroplasty in the medicare population. J Arthroplasty. 2017;32:1954-58.*