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Total hip arthroplasty instability in Italy

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Abstract Hip dislocation is a major and common complication of total hip arthroplasty (THA), which appears with an incidence between 0.3% and 10% in primary total hip arthroplasties and up to 28% in revision THA. The hip dislocations can be classified into three groups: early, intermediate and late. Approximately two-thirds of cases can be treated successfully with a non-operative approach. The rest require further surgical intervention. The prerequisite to developing an appropriate treatment strategy is a thorough evaluation to identify the causes of the dislocation. In addition, many factors that contribute to THA dislocation are related to the surgical technique, mainly including component orientation, femoral head diameter, restoration of femoral offset and leg length, cam impingement and condition of the soft tissues. The diagnosis of a dislocated hip is relatively easy because the clinical situation is very typical. Having identified a dislocated hip, the first step is to perform a closed reduction of the implant. After reduction you must perform a computed tomography scan to evaluate the surgical options for treatment of recurrent dislocation that include: revision arthroplasty, modular components exchange, dual-mobility cups, large femoral heads, constrained cups, elimination of impingement and soft tissue procedures. The objective is to avoid further dislocation, a devastating event which is increasing the number of operations on the hip. To obtain this goal is useful to follow an algorithm of treatment, but the best treatment remains prevention.

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Introduction

Total hip arthroplasty (THA) is one of the most successful orthopaedic procedures and is highly effective in relieving pain and improving function [1, 2]. Unfortunately, dislocation remains one of the common complications of THA. As published by Bozic et al. [2] and Sanchez-Sotelo and Berry [3], and according to the national registers of Sweden, Australia and United States [4–6], dislocation is the prime reason for early revision THA. In the national register of Italy [7], recurrent dislocation is the cause of revision THA in 9.3% overall, after aseptic loosening and infection. In the regional register of Emilia-Romagna [8], dislocation is the cause of revision in 9%, but in the first two years this percentage increased to 26%. Furthermore, dislocation is the first cause of multiple revision (22.5%).

The risk of dislocation is influenced by the surgical approach, the underlying diagnosis, the surgical technique, the lifetime of the prosthesis and the patient's compliance with restrictions [9–12]. An improved understanding of the aetiology of dislocation and refinements in surgical techniques have led to a decrease in the rate of dislocation over time.

Although most dislocations after THA are single episodes that can be managed non-operatively [10, 13], some patients require surgical intervention to address recurrent dislocation. The choice of surgical technique to manage recurrent dislocation depends on the aetiology of the problem [14].

Revision arthroplasty for the treatment of recurrent dislocation is more likely to be successful when the cause for the dislocation has been identified [15, 16]. In addition, the timing of the onset of the dislocation influences the decision

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concerning treatment, especially with regard to operative intervention [17, 18].

Component malpositioning and abductor insufficiency are two of the most important recognised causes of recurrent dislocation [10, 19–21]. When malpositioning is the cause, revision of the component is the most effective type of surgical intervention [15, 21, 22]. However, when the aetiology of the dislocation is multifactorial or unknown, the best surgical technique with which to address it is often less obvious and dual mobility or constrained cup are the valid options.

Cause and classification

Prevalence of dislocation has been reported as being between 0.3 and 10% in primary THAs and up to 28% in revision THAs [16]. Approximately two-thirds of cases can be treated successfully with a non-operative approach. The remainder require further surgical intervention [15, 16].

Counting subluxation episodes in addition to dislocations would produce even higher rates. Subluxation is difficult to diagnose and therefore frequently overlooked, a fact that hinders an exact evaluation of its incidence rate, which has been estimated at 2–5.5% [20].

Dislocation rates vary with many factors, including the surgical approach and femoral head size, follow-up duration and many other factors such as female gender, advanced age, specific causes (avascular necrosis of the femoral head, proximal femoral fracture or non-union), obesity, comorbidities with an ASA score of 3 or more, neuromuscular impairments (Parkinson's disease or stroke-related impairments), neurocognitive impairments (psychiatric disease or mental disability) and alcohol abuse. Finally, the dislocation rate is higher in patients with a history of surgery on the same hip, most notably previous THA procedures [23, 24].

Although most dislocations occur early after THA, the dislocation rate increases with follow-up duration with a cumulative risk of 1–1.39% each five years [25, 26].

Three categories can be defined based on time to occurrence [15, 16]:

–   Early dislocations within the first three (or 6) months after THA are the most common (50-70%) and are accelerated by inadequate healing.
–   Intermediate dislocations occur after the resumption of previous activities, between three to six months and five years after THA, in relation to increased hip mobilisation; this category contributes 15-20% of all THA dislocations.
–   Late dislocations, occurring more than five years after THA, are often related to polyethylene wear; their rate may be underestimated and may reach 32%, with a mean time to occurrence of 11.3 years.

Evaluation of the unstable THA

The prerequisite to developing an appropriate treatment strategy is a thorough evaluation to identify the causes of the dislocation. The direction of the dislocation should be assessed based on the causative movement, femoral head position on the lateral view (which unfortunately is often not obtained) and, above all, direction of the instability as determined during reduction.

In addition to the above-listed risk factors, many factors that contribute to THA dislocation are related to the surgical technique, including the following: surgical approach, component orientation, femoral head diameter, restoration of femoral offset and leg length, cam impingements and condition of the soft tissues.

Surgical approach

The postero-lateral approach is associated with a higher dislocation rate (mean, 6.9%) compared to the antero-lateral approach (3.1%) and anterior approach (0.6-1.3%) [27].

Component orientation

Suboptimal component position often results in early or secondary dislocation but may be difficult to demonstrate.

Acetabular component Lewinnek et al. [19] defined a safe zone of $40 \pm 10°$ of inclination and $15 \pm 10°$ of anteversion. However, many patients have cups outside this safe zone yet do not experience dislocation [28, 29]. A cup that is too vertical and/or anteverted increases the risk of anterior dislocation, whereas a cup that is too horizontal and/or insufficiently anteverted increases the risk of posterior dislocation. Inclination can be reliably measured on a standard radiograph, whereas anteversion cannot. Although numerous radiograph and computed tomography (CT) protocols have been developed, the values often differ between two measurements. Several groups [30, 31] have therefore developed CT measurement protocols that take into account the degree of pelvic tilt measured on a standing lateral radiograph and involve measurements of anteversion in the lying, sitting and standing positions. This point is important, as the orientation of the pelvis and, therefore, of the cup, changes with body position.

Navigation may optimise component positioning, producing substantially lower proportions of cups outside the safe zone compared to conventional surgery, as demonstrated in a prospective study reported by Parratte and Argenson [32].

Femoral component Anteversion of the femoral component is easier to determine, by measuring the angle between the

prosthetic neck axis and the line tangent to the posterior femoral condyles on a CT scan. This value often differs from the surgeon's estimate, by a mean of 16.8° according to a study by Dorr et al. [33].

Also, for the femoral component, navigation may optimise positioning, improving management of limb-length discrepancy and off-set restoring versus freehand techniques [34].

Femoral head diameter

Femoral head diameter influences the stability of the prosthetic joint. In a study by Berry et al. [27], femoral heads measuring 22 mm in diameter were associated with higher dislocation rates; however, the posterior approach was used in most patients. In a study of 2,020 THAs performed via the antero-lateral approach with heads measuring 36 mm or more in diameter, the authors [35] identified a single case of dislocation (0.05%) after a mean follow-up of 31 months. In a prospective randomised controlled trial to compare 28-mm to 36-mm heads implanted via the postero-lateral approach, the dislocation rate was five times higher with the smaller heads [36]. A larger head diameter (36 mm or more) increases the head/neck ratio and delays contact between the neck and the cup; in addition, the 'jumping' distance is increased, allowing for a greater range of 'subluxation' before complete dislocation occurs [37–39]. It has also been demonstrated that a larger metallic head may produce greater fretting damage owing to an increased head-neck moment arm with a risk of trunnionosis [40]. Moreover, for a larger ceramic head it is necessary to use HXPLE to reduce wear and liner breakage.

Restoration of femoral offset

This point is crucial to hip stability, mobility, and optimal abductor muscle efficiency. Femoral offset measured on radiographs varies with femoral anteversion. Merle et al. [41] reported underestimation of femoral offset on antero-posterior pelvic radiographs, with improved accuracy on antero-posterior hip radiographs. Computer-assisted techniques may improve accuracy in restoration of the native offset [34].

Restoration of leg length

Leg-length restoration also improves stability, by maintaining muscle tension. A clinical and radiological evaluation of leg length, although mandatory, is associated with numerous pitfalls and errors, most notably in patients with a controlateral prosthetic hip [42].

Cam impingements

The principles regarding impingement in the natural hip put forth by Ganz et al. [43] are similar in concept to what can occur in the prosthetic hip. To understand impingement, it is helpful to recognise the common mechanisms that cause mechanical abutment in both anatomic and prosthetic hips. In the anatomic hip joint, impingement is a mechanical abutment conflict between the bone of the femur and the pelvis; in a total hip replacement, it is contact between the metal femoral neck and the cup liner or bone-to-bone contact such as between the greater trochanter and the pelvis [39].

The femoral head-neck ratio, which is the relationship between the diameter of the femoral head and the diameter of the femoral neck, influences impingement. Cam impingement is caused by a reduced femoral head-neck ratio. An example is the pistol-grip deformity that is created by a decreased offset of the femoral head-neck junction [43]. Cam impingement in a prosthetic hip is caused by any implant feature that reduces the head-neck ratio. A skirt on the metal femoral head or a large circular femoral neck can cause mechanical abutment in a prosthetic hip through this mechanism [39, 44].

Pincer impingement in the anatomic hip is a mechanical abutment caused by acetabular retroversion, protrusio, or coxa profunda. Pincer impingement in the prosthetic hip is caused by hooded and constrained liners or by placement of a small femoral head in a big acetabular cup [45, 46]. Failure to remove acetabular osteophytes so that the metal neck or the femoral bone abuts on the osteophytes is another cause of pincer impingement.

Because impingement is a dynamic process, it has been difficult to identify it and to define its prevalence on the basis of clinical evaluations or plain radiographs. In the clinical setting, some causes of failure such as wear or dislocation can be related to impingement [10, 38], but a direct relationship with impingement has been difficult to document.

Condition of the soft tissues

Soft-tissue damage (failed healing of a posterior or antero-lateral approach) explains many dislocations but is difficult to demonstrate before revision surgery. Healing failure rates increase with the number of surgical procedures. Non-union of the greater trochanter results in slackness of the abductor muscles, thereby increasing the risk of dislocation, most notably when the greater trochanter is displaced upwards. Thus, THA instability can be related to a single cause, and the treatment is then relatively easy. In most cases, however, multiple factors are involved, which complicates the therapeutic management.

Surgical techniques

Surgical options for treatment of recurrent dislocation include:

– Revision arthroplasty
– Modular components exchange
– Dual mobility cup
– Large femoral head
– Constrained cup
– Elimination of impingement
– Soft-tissue procedures

Revision arthroplasty

As mentioned previously, component malpositioning is one of the primary causes of recurrent dislocation, and component revision is mandatory to successfully treat this type of dislocation (Fig. 1) [10, 15, 16, 19, 21].

However, identifying the malpositioned component is not always straightforward. Plain radiographs provide limited

Fig. 1 a Leg-length discrepancy after primary THA. **b** Correction of discrepancy through stem revision cause subjective subluxation (reduction of femoral off-set). **c** Revision THA with achievement of leg length and femoral offset

information regarding the orientation of the acetabular and femoral components.

Computed tomography (CT) may be needed to more accurately assess component positioning (Fig. 2), especially with regard to version of the acetabulum [30, 31]. Although little component malpositioning is difficult to detect on plain radiographs, the radiographs of a dislocated hip should be scrutinised carefully. In addition to showing the direction of the dislocation, these radiographs can convey other important information. Other critical parameters, such as abductor strength and the overall neurological status of the patient, can be gleaned from clinical examination. Limb-length discrepancy detected on clinical or radiographic examination can be an important finding as it can be associated with component malpositioning [42], because intra-operative instability, which may have been a result of a suboptimally positioned component such as a retroverted socket, could have been addressed by lengthening of the femoral neck to increase the soft-tissue tension.

Correction of the malpositioned component can simultaneously correct the limb-length inequality (Fig. 1c). The ultimate and most accurate information regarding component positioning is obtained from intra-operative inspection of the components during revision surgery. When poor position is demonstrated, changing the component is a logical procedure that has produced highly variable success rates.

Carter et al. [47] obtained a higher success rate of 86% but often increased the head diameter (36 mm), in addition to changing the cup. Changing a poorly positioned femoral component is desirable but considerably more invasive than cup
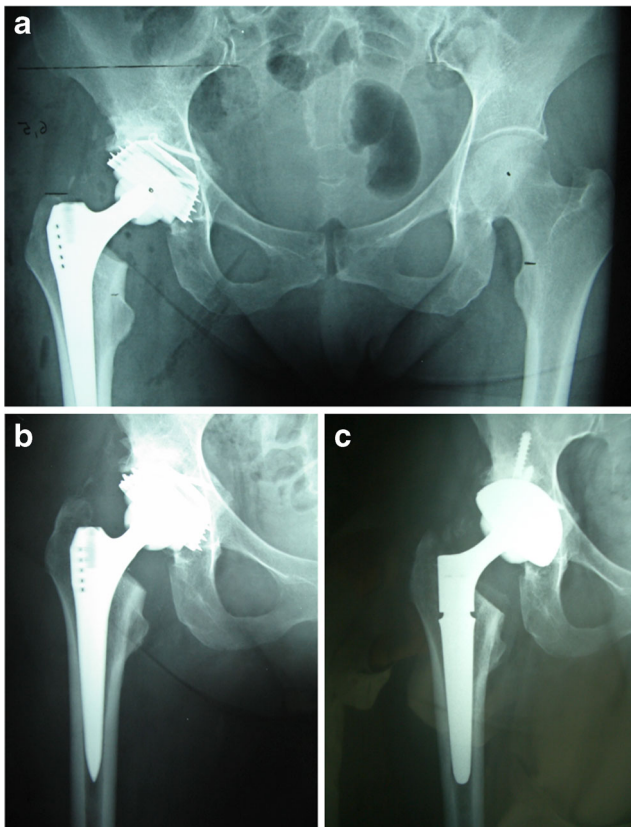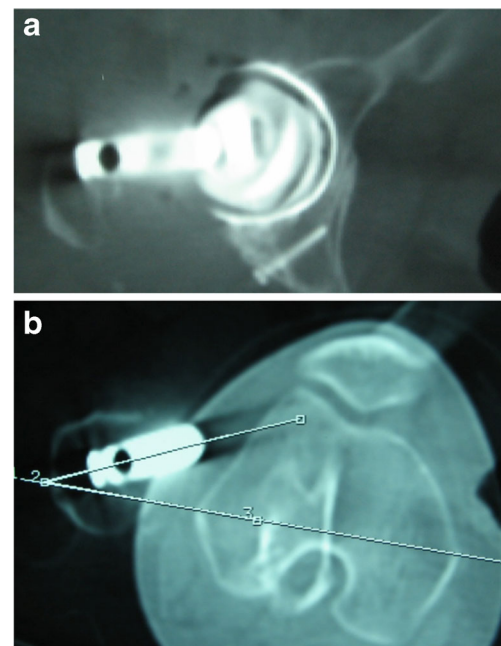
Fig. 2 CT scan of implant in Fig. 1b. Malposition of acetabular (**a**) and femoral (**b**) components

revision; in the study by Carter et al., this procedure was performed in only 11.5% of 156 hips. Always in this study, changing only the liner may carry an even higher failure rate, of 34-55%, as a result of unrecognised suboptimal cup position.

If the component malposition is confirmed, it should be revised to address the recurrent dislocation. An exception may be made for any frail, elderly or infirm patient, in whom a slightly malpositioned component may be accepted to prevent prolonged surgery due to revision of a well-fixed acetabular or femoral component. In these patients, a constrained liner may be utilised in an effort to prevent recurrent dislocation.
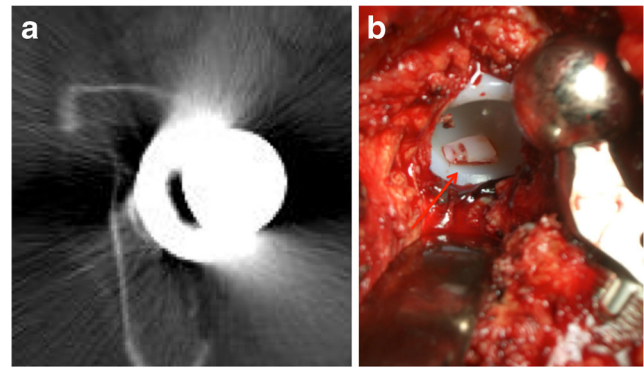
Modular components exchange

Several studies have demonstrated success with the use of modular component exchange for correction of recurrent dislocation after THA [48, 49]. This surgical treatment involves exchanging the acetabular liner and the femoral head with the main intention being to "upsize" the femoral head and/or use an elevated liner. This treatment can be successful only if the patient has well-positioned and well-fixed acetabular and femoral components. In addition, the acetabular component in place must be sufficiently large to allow an adequate thickness of polyethylene (a minimum of 4 mm) to be used with the larger femoral head.

Toomey et al. [48] described a series of 13 patients treated with exchange of the femoral head and/or acetabular liner. One patient was lost to follow-up, and only one of the remaining 12 patients had recurrent dislocation at a mean of 5.8 years; thus, this surgical treatment had a success rate of 92%, with less extensive morbidity. However, the authors recommended that modular component exchange may be used in only selected cases and that each patient be evaluated thoroughly to identify all factors contributing to the dislocation (Figs. 3 and 4). Additionally, adequate intra-operative stability must be achieved. Despite the success reported by Toomey, modular
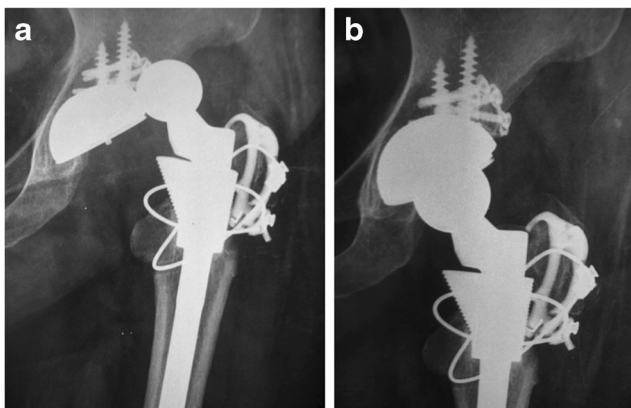
Fig. 4 **a** CT scan of implant in Fig. 3b confirms eccentric reduction. **b** During surgery, modular components exchange (lipped liner, head substitution and correction of femoral anteversion) and reduction of greater trochanter, we found an intrarticular fragment of liner (*arrow*) that had caused the eccentric reduction

components can be problematic [50]. In a report on complications related to 20 hip replacements, Barrack et al. [51] described 15 complications that were related to failure of the modular interface. Complications were attributed to detachment of the femoral head from the trunnion, dislodgment of the polyethylene liner from the shell and asymmetrical rotation of the polyethylene liner. Thus, modular component exchange requires meticulous surgical technique and should be reserved for specific cases.

Cups with elevated rims decrease the dislocation rate [52, 53], they also place considerable mechanical stresses on the cup and can result in cam impingement. McConway et al. [54] reported a 1.6% recurrence rate in 302 cases after a mean follow-up of nearly seven years and with less than 2% of radiolucent lines accentuation.

Dual-mobility cup

The principle of the dual-mobility cup was developed by Gilles Bousquet [55], then used by many different manufacturers. A 22- or 28-mm head is held captive in a polyethylene cup, which is mobile within a cemented or press-fit metal cup made of steel or cobalt-chromium. Either standard or highly reticulated polyethylene is used, and the head can be made of ceramic. Dual-mobility cups provide an increased range of movement and may reduce the risk of dislocation [55–60]. Outcomes after the implantation of dual-mobility cups for THA instability have been evaluated in numerous studies, of which the earliest was conducted by Leclercq et al. [58]. After 2.5 years of follow-up, 13 hips with recurrent dislocation were stabilised without correction of the causes of the instability. Other authors [59] studied 59 cases and found a 1.7% recurrence rate and a 98% eight year survival rate. In 54 cases, Guyen et al. [60] reported a 5.5% recurrence rate after a mean follow-up of four years and in 47 cases. Prudhon et al. [56] studied 79 cases

Fig. 3 **a** Dislocation in THA for intertrochanteric fracture. X-ray shows non-union of greater trochanter. **b** After closed reduction X-ray shows incongruency of articular parameters

of revision with two different types of cementless dual-mobility cup. In this series, 21 cases were treated for recurrent dislocation with no re-dislocation at three years of follow-up.

Dual-mobility cups are now very widely used to prevent instability after revision THA, also in Italy. Civinini et al. [61] prospectively followed 33 patients who underwent isolated acetabular revisions with a minimum of two years' follow-up. There were no dislocations. Survivorship rates of acetabular components were 97% at five years; the re-revision rate for any reason was 3%. No patients had progressive osteolysis, component migration or loosening on radiographs. Their data suggest that the use of a dual-mobility cup reduced the risk of dislocation without increasing loosening from two to five years. In a prospective study of 2107 revision THAs including 62% with dual-mobility cups, the authors [62] found a three month dislocation rate of only 4%. Enthusiasm about these very good results must be tempered by knowledge of the fixation problems seen with press-fit dual-mobility cups. Massin et al. [63] found a lower eight-year survival rate of press-fit grit-blasted cups made of hydroxyapatite-coated steel, compared to the original tripod cup and to cobalt-chromium cups (91% versus 98% and 100%, respectively). However, the fixation problems reported in this series are related to use of the first generation of dual-mobility cup.

Finally, the deeper concavity of dual-mobility cups is associated with greater wear [35], which carries a risk of intra-prosthetic dislocation (IPD) due to locking-system failure. Mean time to IPD is 10 years. Besides, the risk of this complication can be minimised by avoiding neck-cup impingement and is extremely low with the newest-generation implants [37, 63, 64]. Nevertheless, even with the original tripod cup, 15-year survival rates were greater than 85% in the long-term studies [65, 66], each of which included more than 400 cases.

Large femoral head

Large-diameter heads are associated with decreased dislocation rates [27, 35–37] and are therefore useful for the treatment of THA instability [67–69]. Stability increases with the diameter of the femoral head up to 38 mm; with larger diameters, variable results have been reported [67–69]. In a study by Amstuz et al. [68] of 29 THA revisions for dislocation managed with head diameters of 36 mm or more, the recurrence rate was 13.7%. Suboptimal cup orientation was noted in the six hips with persistent instability; after correction of cup position, none of the hips was unstable after a mean follow-up of 5.5 years. Dislocation rates after revision THA for reasons other than instability with 36- or 40-mm heads was lower than 32-mm heads after a mean follow-up of five years [69]. Most of the available studies focused on the impact of large head diameter on primary THA stability and wear debris volume.

However, there are various other friction-causing combinations for which the medium- and long-term outcomes are unclear. Now metal-on-metal implants are not used due to the high risk of pseudo-tumour formation [70].

Constrained cup

The constrained acetabular liner is an invaluable tool in the armamentarium for surgical treatment of recurrent dislocations. Its success has been widely demonstrated [71–74]. This device is especially suited for the treatment of recurrent dislocation secondary to soft tissue (abductor) deficiency. It is also an excellent option for patients with recurrent dislocation of unknown aetiology, elderly patients in whom the components are well fixed and patients with neurological impairment. In other words, constrained liners are used as a salvage treatment option in the most difficult subset of cases.

Anderson et al. [71] was the first author to describe the use of constrained liners in patients with recurrent dislocation.

He reported a success rate of 72% in a study of 18 patients followed for a mean of 31 months (range, 24-64 months) after the use of this device.

The only factor predictive of failure was an increased acetabular abduction angle of the metallic acetabular cup. At the time of follow-up, there was no radiographic or clinical evidence of loosening of the acetabular component. One of the main advantages of a constrained liner is its ability to provide stability without the need to revise a well-fixed and well-positioned acetabular component. Callaghan et al. [75] reported the clinical and radiographic outcomes of 31 revision THAs in which a constrained liner had been cemented into a well-fixed cementless acetabular shell. At an average of 3.9 years posto-peratively, 29 constrained liners (94%) remained securely fixed in the cementless shell and only two liners had failed. One of the failed liners had separated from the cement, and the other had failed as a result of fracture of the capturing mechanism. Each hip was successfully revised with another cemented constrained liner. No acetabular component showed radiographic evidence of progressive loosening or associated osteolysis. The authors drew attention to the importance of proper preparation of the liner, correct sizing of the component, and the use of optimal cementing technique. Their meticulous surgical technique may explain the good results despite the suboptimal outcomes of this technique in other studies [74, 76].

Noble et al. [76] examined 57 constrained cups of four different designs recovered during THA revision surgery performed 36 months on average after the primary procedure. Locking ring failure explained 51% of revisions and cup loosening a further 28%.

Cooke et al. [74] identified three types of early failure of a constrained acetabular implant. Eight patients (14%) required

a re-operation because of failure of the constrained liner, with seven of them having had recurrent dislocations. Failures were described on the basis of the mechanism of implant failure. There were three Type-I failures (of the bone-prosthesis interface), two Type-II failures (of the liner locking mechanism) and one Type-III failure (of the femoral head locking mechanism).

In conclusion, hip arthroplasty with use of a constrained acetabular cup should be considered to be an option for the surgical treatment of patients with extensive soft-tissue deficiency, deficiency of the abductor mechanism, dislocation with no discrete or identifiable cause, recurrent dislocation despite prior attempted surgical correction, also in case of failure of a dual-mobility cup, and finally in old and frail patients with well-fixed metallic shell.

Patients should be selected carefully for treatment with this technique, only after detailed examination for the cause of the dislocation and after it has been determined that other interventions are unlikely to be successful. Prior to insertion of a constrained liner, it is crucial that the positions of the femoral and acetabular component be scrutinised.

Elimination of impingement

Because impingement is a dynamic process, it has been difficult to identify it and to define its prevalence on the basis of clinical evaluations or plain radiographs. In the clinical setting, some causes of failure, such as wear or dislocation, can be related to impingement [10, 38], but a direct relationship with impingement has been difficult to document. To avoid the impingement is the goal during the primary implant: elimination of skirts on femoral heads, chamfering of the polyethylene rim, narrow femoral necks, large femoral heads, and perhaps modular femoral necks, are the tricks.

However, when the cause of impingement is the presence of an osteophyte detected on the CT scan is possible to remove it. Furthermore, liner exchange and larger femoral head is an option to eliminate impingement when the components are correctly positioned.

Soft tissue procedures

Other, currently less-used surgical procedures for addressing recurrent dislocation include reinforcement of the soft tissues, the abductor mechanism, around the hip [15, 16], trochanteric advancement and trochanteric lowering [77, 78]. The main problem associated with these procedures is the variability in outcome. These procedures can also be technically demanding and are likely to fail if used in patients with component malpositioning. Therefore, soft-tissue reinforcement and trochanteric advancement are being used with less and less frequency, and only in cases in which component position has absolutely been determined to be acceptable.

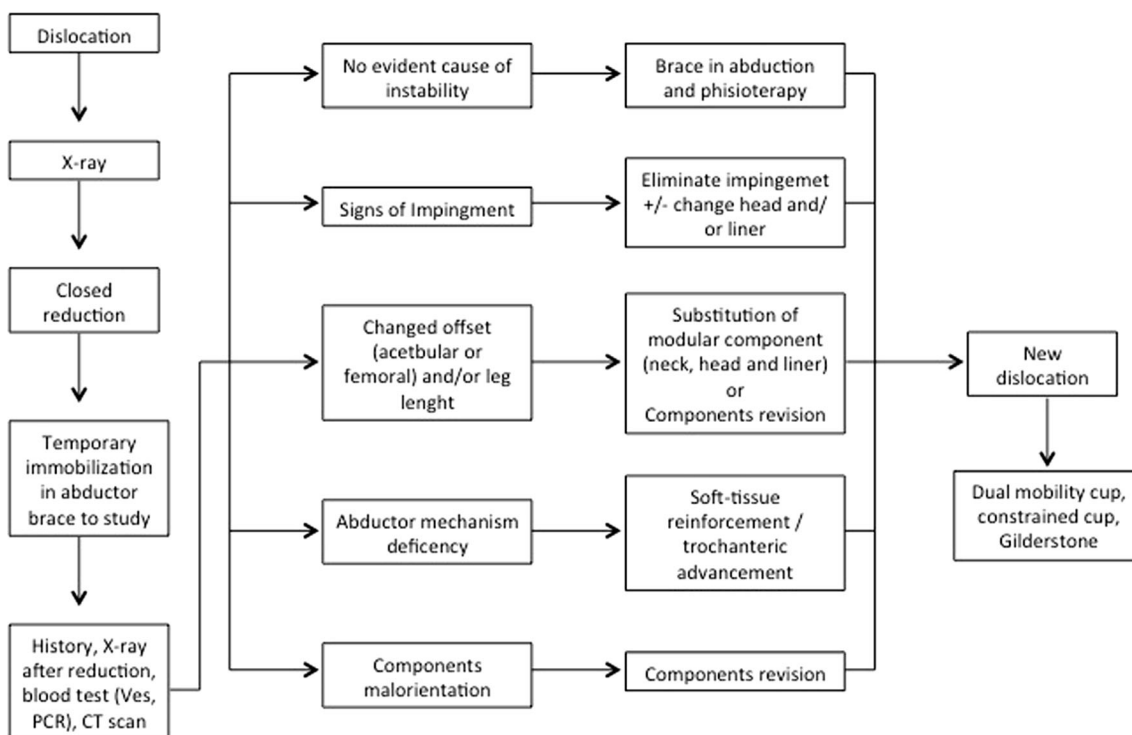Often these procedures are consistently used in combination with the above-described techniques.

Fig. 5 Algorithm of treatment of THA instability in our institution

Discussion

Dislocation after THA is a common complication. As published by Bozic et al. [2] and Sanchez-Sotelo and Berry [3], and according to national register of Sweden, Australia and United States [4–6], dislocation is the prime reason for early revision THA. Also, in the regional register of Emilia-Romagna [8], a region of Italy, dislocation is the cause of revision in 26% in the first two years. Furthermore dislocation is the first cause of multiple revision (22.5%).

Surgical treatment for THA instability is usually considered after the second or even the third dislocation episode in patients without obvious component malposition, failed closed reduction, or significant greater trochanter displacement.

In a patient who is younger than 70 years of age and has no risk factors, the cup should be changed and properly positioned. If allowed by the implants, the head diameter should be increased. In cases of isolated wear, a change of liner, with a preference for an elevated lip design but with the risk of controlateral dislocation by cam effect deserves consideration. In patients who are older than 70 years and/or have risk factors for instability (multiple surgical procedures or neurological impairments for instance), a dual-mobility cup seems the best solution.

A constrained cup may be considered, particularly in the oldest patients. Furthermore, in these old patients, when they have a well-fixed cementless cup, a polyethylene cup can be cemented in the appropriate position into the shell. The five year survival rate with this method was 78% [79].

In older frail patients with acetabular loosening and stable Charnley femoral stem, Civinini et al. [61 purpose isolated acetabular revision with assembly of the dual-mobility cup in situ on the non-modular head of the stem].

With a cementless cup, the liner can be exchanged for an elevated lip liner and the head diameter can be increased if allowed by the implants. With a cemented cup, a lip augmentation device can be considered. In young patients, however, a change of cup with an increase in head diameter seems preferable, also with the use of a dual-mobility cup, helpful in multifactorial instability, in compromisation of soft tissue and in multiple revisions.

In the event of inadequate femoral offset or excessive anteversion or retroversion, replacement of the femoral component should be considered. A lateralised component or a component with a greater degree of varus is usually required to restore offset. A less invasive means of restoring offset consists of changing the length of the neck and/or the diameter of the head (if the cup liner can be changed); care should be taken, however, to avoid excessive lengthening of the lower limb. When the primary THA includes a removable neck, this component alone can be changed, and its length and orientation can be modified. When changing a femoral component, the use of a removable neck design can be considered to optimise anteversion, offset and neck length. The stem should be changed if it is loose or unstable.

The soft tissues must always be repaired to the extent possible. In addition to the above-described procedures, suturing the fascia lata to the greater trochanter and vastus lateralis muscle with the hip in abduction is useful. A fracture or non-union of the greater trochanter should be treated. When no cause is identified, lowering of the greater trochanter can be considered but carries a risk of non-union.

Immobilisation can be helpful in patients with severe soft tissue alterations or with factors such as agitation or poor motor co-ordination [13].

Conclusions

Surgical management of recurrent dislocation following THA is a challenging problem.

Identification of the aetiology is critical for successful treatment. Close scrutiny of component position is a crucial step in the management of these patients.

Unrecognised component malposition should always be suspected. Revision of the malpositioned component is perhaps the most effective type of surgical intervention in the treatment of recurrent dislocation. During revision surgery, it is imperative that the components be carefully inspected to determine if they are optimally positioned. When revision surgery is planned, the necessary equipment should always be available for revision of the malpositioned component.

When dislocation is multifactorial or idiopathic, the potential surgical options include modular component exchange, dual mobility cup, use of a larger femoral head and lipped liner, and insertion of a constrained acetabular component.

Soft-tissue reinforcement and trochanteric advancement have variable and less successful results and should be used in only carefully selected cases.

The objective is to avoid further dislocation, a devastating event which is increasing with the number of surgeries on the hip. To obtain this goal is useful to follow an algorithm of treatment (Fig. 5), but the best treatment remains prevention.

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