Surgical interventions for osteoarthritis of the hip in the young adult: the role of intertrochanteric osteotomies

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Chapter 2

Current clinical practice in the treatment of adult hip disorders: the role of intertrochanteric osteotomies versus total hip arthroplasty

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Many orthopaedic surgeons consider intertrochanteric osteotomy a historical operation with no role to play in modern clinical practice. This is true for a number of hip conditions such as idiopathic osteoarthritis, rheumatoid arthritis and severe osteoarthritis in the elderly patient. However, there exist conditions in selected (younger) patients where an intertrochanteric osteotomy can produce excellent and long lasting results. In these conditions, an intertrochanteric osteotomy should therefore be the preferred treatment.

Historically, the first surgical treatment for osteoarthritis was a resection of the femoral head as described by Girdlestone. This was a pure salvage procedure and its main aim was to reduce pain. The techniques of tenotomies (Voss) and the earliest intertrochanteric osteotomies by McMurray may also be regarded as salvage procedures. During the development of hip surgery, the goal of treatment gradually changed. Apart from pain relief, function and quality of life became increasingly important. When total hip arthroplasty (THA) became feasible, the goal of joint saving therapy changed from a mere salvage procedure to a palliative one. We define an osteotomy as palliative when osteoarthritic changes are too advanced to save the joint but where a replacement can successfully be delayed by this palliative procedure. In the meantime, the osteotomy may even facilitate a future total hip replacement by improving the bone stock. Former salvage types of surgery have no further role to play in the treatment of hip disorders as these have been superseded by THA. Müller et al. advanced joint saving hip surgery. They described and defined the role of intertrochanteric osteotomies in more detail. Introducing a therapeutic type of osteotomy which can be performed if osteoarthritic changes are not too advanced and if the cause of these osteoarthritic changes is a biomechanical factor which can be corrected. If a bio-mechanical factor such as impingement, dislocating forces (e.g. stress on the labrum), or a small weight-bearing area is present, an early correction of this factor can bio-mechanically normalise the hip joint which could mean a long lasting preservation of this joint. The differentiation between palliative and therapeutic intertrochanteric osteotomies is important in clinical practice. It is evident that therapeutic osteotomies should have a place in modern clinical practice. However, this is different for palliative osteotomies in younger patients with secondary osteoarthritis. Several studies show that the survival rates for salvage osteotomies in younger patients is approximately 70-80% after 10 years. The disadvantage of this type of osteotomy is that the results are mostly unpredictable. We believe that a palliative osteotomy in younger and well motivated patients should be considered and that the advantages and disadvantages should be discussed with the patient.

In the modern treatment regimens of osteoarthritis of the hip THA is the treatment of choice for the elderly patient. During the last decennia this age limit is gradually adjusted downwards. Even so, the question remains whether a THA is the best solution for a young patient with a mild (secondary) osteoarthritis. In patients with idiopathic osteoarthritis or rheumatic arthritis no benefit from joint saving
surgery can be expected, however in the treatment of coxa valga (antetorta), dysplasia, post-SCFE, post-LCPD and posttraumatic deformities intertrochanteric osteotomies can give good and long lasting results. Although these disorders could all be excellently treated with hip replacement, joint saving surgery should be the treatment of choice in these young patients since multiple revisions of the hip replacement are inevitable in patients with a life expectancy of more than 40 years. The ongoing improvements in the field of hip arthroplasties by using new materials and improving existing models is very promising; however the current prosthesis are not a panaces. In this younger patient group, the possibility of hip arthrodesis should also not be overlooked completely.

In this chapter we will in turn describe the hip conditions where intertrochanteric osteotomies can produce good to excellent results. The chapter is based on the available literature including this thesis.

**Preoperative considerations**

It is normal practice to wait with surgical interventions in the elderly patient until complaints of pain or limitations are more severe and when more advanced osteoarthritic changes have occurred. In order to achieve optimal results, it is important to perform surgery as early as possible in patients suitable for intertrochanteric osteotomies, preferably after the first typical manifestation of the hip disorder.

Complaints in this patient group are not completely identical to those of the older patient. In the latter case, complaints tend to occur after the cartilage has been destroyed to a large degree. In patients suitable for intertrochanteric osteotomies, complaints are mostly caused by a causative factor such as incongruency, impingement, or stress on the acetabular labrum in dysplasia. In screening these patients, the apprehension test (extension/external rotation) and the impingement test (flexion/adduction/internal rotation) could play a role in detecting labral pathology in an early stage.

Functional X-rays could play an important role in deciding which type of intervention would be the preferred option. An abduction view gives a radiological impression of the amount of containment and congruency that can be obtained by a varus osteotomy. An adduction/flexion X-ray does the same for a valgus/extension osteotomy. In patients with a coxa valga and/or mild dysplasia, it is important to make a clinical judgment of to the amount of femoral torsion present. If an increased antetorsion is anticipated, then this should be verified by means of a Dunn X-ray or CT scan. In modern practice the latter is more appropriate. In patients with suspected labral pathology, this can be verified by means of an Arthro-MRI.

It is important to discus the rehabilitation process with the patient before surgery. For instance, in case of a varus osteotomy, the anticipated leg length discrepancy should be discussed as well as the expected temporary occurrence of a Trendelenburg gait. As in every surgical intervention, results and patient satisfaction appear to be improved in well informed and motivated patients.
In this section we will discuss some important anatomical considerations regarding the intertrochanteric osteotomy. Maurice Müller described in detail the surgical technique and this procedure has not changed much since then\textsuperscript{50}.

The osteotomy is performed at the intertrochanteric level, just above the lesser trochanter. Due to the shape of the intertrochanteric region, large contact areas exist after the osteotomy allowing corrections in all planes while leaving sufficient contact surface post correction to achieve stability and consolidation. A second advantage is the relatively small distance from the proximal part making the correction invisible from the outside. A third advantage of this osteotomy level is the rapid healing of the metaphyseal bone. Before making the osteotomy, the seating chisel is inserted into the desired correction angle. When inserting the seating chisel, the anticipated correction and the three-dimensional anatomy of the proximal femur should be considered carefully in order to avoid perforation of the femoral neck. Perforation of the intertrochanteric fossa can damage the branches of the dorsal circumflex artery, causing an a-vascular necrosis of the femoral head (Figure I).

\textbf{Figure I}

Vascularisation and anatomy of the proximal femur.

The desired correction should be anticipated when placing the seating chisel as the blade plate should be fixated to the femur after correction. For example, a seating chisel inserted ventrally cannot be fixated properly to the femur after a flexion osteotomy (Figure II).
Coxa valga (antetorta) and Dysplasia

Deformities such as coxa valga (antetorta) and acetabular dysplasia often co-exist. In hips where the main deformity is on the acetabular side, an acetabulum realigning procedure should be first choice and, if necessary, be combined with a femoral osteotomy. In these cases, there is a relatively shallow and steep acetabulum resulting in a decreased contact surface between the acetabulum and the femoral head. Correction of the femoral side alone cannot solve this problem of containment fully and will fail to eliminate the dislocation force present. Thus, the osteotomy is doomed to fail. However, in some hip deformities, the main deformity lies on the femoral side with only a mild acetabular dysplasia; the acetabulum might be shallow but not too steep. A varus osteotomy may improve the contact area between femoral head and acetabulum in these types of hips and possibly eliminate the dislocating force present. Good and long lasting results may occur. This will not be the case if a fixed subluxation is present, as the weightbearing surface and the dislocating forces are not altered, making the expected results of an intertrochanteric osteotomy poor. The improvement of containment can be judged preoperatively from an abduction correction view (Figure III). However, currently no objective measurements exist to decide whether an acetabular realigning osteotomy or an intertrochanteric osteotomy is the preferred treatment for specific patients.

The femoral antetorsion should not be forgotten in these patients since several have an increased femoral antetorsion which also needs to be corrected. A second consideration is that after the varus osteotomy, the position of the tip of the major trochanter should not exceed the centre of the femoral head in order to avoid a long lasting Trendelenburg gait. If necessary, this can be avoided by performing a distalisation of the major trochanter.

The literature concludes that in selected younger patients with mild osteoarthritic changes due to coxa valga and mild dysplasia, excellent results can be obtained by intertrochanteric varus osteotomies.
A 35 year old female with symptomatic OA secondary to coxa valga and a mild dysplasia. A varus intertrochanteric osteotomy was performed. After 21 years she was still free of complaints (last X-ray)
Slipped Capital Femoral Epiphysis

Not all patients who suffer from a slipped capital femoral epiphysis (SCFE) develop osteoarthritis (OA) in adulthood. However, this patient population has an increased risk of developing OA. The pathophysiology behind these arthritic changes consist of acetabular-femoral impingement present in an insufficient or uncorrected SCFE or in unnoticed sub-clinical cases. A prominent part of the anterior metaphyseal femoral neck contacts the anterior part of the acetabulum during flexion. Based on the aetiology of this disorder, a valgus/extension osteotomy with or without resection of the hump is the best solution. Since the disorder is only present on the femoral side, there is no role for acetabular realigning procedures in these pathologic changes. The literature does not describe specifically the role of intertrochanteric osteotomies for post-SCFE in adults. However, several studies include this type of patients and have reported good long-term results. Early intervention appears to produce better results in this type of disorder.

Legg-Calvé-Perthes Disease

Not all patients who suffer from Legg-Calvé-Perthes disease (LCPD) in childhood develop osteoarthritis in adulthood although in several patients a deformed hip joint is present. This deformity consists mainly of a broad and flattened femoral head with a short femoral neck in varus position. In most cases, the acetabular side is also more or less abnormal probably due to an adaptation of the developing acetabulum to the deformed femoral head.

Osteoarthritic changes develop in adulthood in 50% of these hip deformities. It is most likely that these arthritic changes are caused by an acetabular-femoral incongruency. The origin of this incongruency lies in the fact that the deformed femoral head does not completely fit into the acetabulum. The aim of surgical intervention should be an (early) correction of this incongruency. For post-Perthes deformities both acetabular realigning osteotomies as well as femoral osteotomies are described. The main theory explaining the development of osteoarthritis in these hips is the hinging of the femoral head on the edge of the acetabulum. The best known is the "hinge on abduction" in which the lateral part of the femoral head hinges on the lateral part of the acetabulum. In these types of hips, a valgus (extension) osteotomy should be the preferred treatment eliminating both the causative factor and the contractures present by a realignment of the leg. In Post-Perthes hips where containment of the femoral head is not complete after osteotomy, adding an acetabular shelf plasty can produce excellent results (Figure IV). In some cases, valgisation alone is not sufficient to restore the function of the abductors due to the relatively high position of the major trochanter. In these cases a simultaneous distalisation of the major trochanter is advised.
A 22 year old male with a symptomatic hip deformity after a LCPD on both hips. A valgus osteotomy was performed with an acetabular roof plasty on both hips. The radiographic result after 10 and 12 years is shown in the second X-ray.

Posttraumatic deformities.

Posttraumatic deformities can be subdivided into deformities after acetabular fractures, malunions after femoral neck fractures and nonunions after femoral neck fractures.

The most well known indication for intertrochanteric valgus osteotomy is the treatment of femoral neck nonunions as described by Pauwels. Pauwels described that instability of the fracture is caused by the shearing forces that occur due to the angle it creates to the resultant of the hip joint force (R). By placing the fracture line perpendicular to R by means of a valgus osteotomy, the fracture becomes
completely stable. This stable situation contributes to the healing of proximal femoral nonunions. The presence of early signs of avascular necrosis, where the femoral head is still spherical, does not necessarily imply a contra-indication for intertrochanteric osteotomies.

Femoral neck malunion is a rare complication. If a malunion is present, it can cause an impingement between femoral neck and acetabulum causing early osteoarthritic degeneration. An early correction is required to avoid these osteoarthritic changes. In these post-traumatic deformities, a shortening of the affected leg is often present. Correcting the malunion with an intertrochanteric osteotomy also allows simultaneous intertrochanteric shortening. The direction of the deformity present in these malunions is mostly varus/extension. This means that the correction needed is a valgus/flexion intertrochanteric osteotomy. A resection of the hump can be performed if impingement persists partly after the osteotomy.

Incongruency and osteoarthrosis are common problems after acetabular fractures. In these fractures, cartilage damage occurs during the initial trauma making it susceptible to developing secondary osteoarthrosis. If a malunited acetabular fracture, causing functional limitations, co-exists with an increased risk of developing secondary osteoarthrosis, it would seem logical to correct the acetabular side where the deformity is located. However, these corrections are in general too complicated or even impossible. Therefore, it could be justifiable to adjust the normal femoral side to the abnormal acetabular side by aiming the largest part of the unaffected femoral head to the largest part of the unaffected acetabulum thereby restoring normal joint motion and lowering the risk of osteoarthritic degeneration. In younger patients with more advanced osteoarthritic degeneration and where contractures are present, a palliative osteotomy could be considered. We have been able to document good outcomes in this patient group. This is probably due to eliminating the contractures (re-alignment) and could be caused by the biological osteotomy effect as well.

**Posttraumatic Avascular Necrosis of the Femoral Head**

Based on the average age of the patient population with avascular necrosis of the femoral head (AVN) it seems like an ideal group to consider joint saving surgery. This is also reflected in the large number of publications on this subject. The main thought behind intertrochanteric osteotomies in AVN is that the affected part of the femoral head is rotated away from the weight-bearing part of the joint, preventing collapse. This can be achieved by intertrochanteric osteotomies as corrections in all three dimensions are possible.

The literature shows no evidence of good outcomes in idiopathic AVN treated by intertrochanteric osteotomies. The benefit of intertrochanteric osteotomies is doubtful in this patient group. Most retrospective reports concern patients with an atraumatic AVN but some studies also
include traumatic AVN which show a better outcome. However, in these young patients, the outcome of an intertrochanteric osteotomy remains unpredictable.

A special group of younger patients consists of those with a deformed femoral head after a post-traumatic AVN, similar to a post-Perthes deformity. These patients may benefit from a valgus intertrochanteric osteotomy combined with an acetabular shelf plasty.

**Total hip arthroplasty versus Osteotomy**

In several younger patients with secondary osteoarthritis, the pros and cons of both total hip arthroplasty (THA) and intertrochanteric osteotomies should be considered and discussed with the patient. We believe that in younger patients the emphasis should be on long term results as well as good short term results. Aronson described in 1986 that three myths in hip surgery continue to survive. The first concerns the belief that all treated childhood hip disorders result in normal hip joints, the second is the belief that THA is a panacea for all hip related problems and the third concerns the belief that there is hardly a role left for intertrochanteric osteotomies. Aronson wrote that these myths remain popular with orthopaedic surgeons despite the fact that the literature refutes these views. Twenty years on, his views still hold true.

In the younger patient group, we believe that the decision to perform a THA is too easily made and is often based only on good short term results. The intertrochanteric osteotomy, besides given good short term results in selected patients, may also be regarded as an investment for the future by preserving bone stock for a future THA, should one become necessary. Patients who may benefit from an intertrochanteric osteotomy resulting in good and long lasting results should be carefully selected.

**Total hip arthroplasty after a previous osteotomy**

Opponents of intertrochanteric osteotomies use the argument that osteotomies impair the outcome of future THA. In the literature a few reports mention a poorer long -term outcome of THA after a previous osteotomy while several other studies showed no difference. In large controlled case study, we recently demonstrated that the long term outcome of a cemented THA is not compromised by a (well-performed) previous intertrochanteric osteotomy. Although a THA after a previous osteotomy can be a more challenging procedure with more (controllable) intra-operative complications, the long-term outcome is identical to that of a primary THA when performing an intertrochanteric osteotomy, attention should be paid to the feasibility of performing a future THA.
Conclusion

Several retrospective studies report poor overall results for intertrochanteric osteotomies. These studies also included older patients and hips with advanced osteoarthritis. From these studies, certain hip conditions in selected patient groups can be isolated. In these cases we can obtain good and long lasting results. This seems especially true for younger patients with early secondary osteoarthritis caused by a correctable biomechanical factor.
References


