Irreducible dislocation of the hip in cerebral palsy patients treated by Schanz proximal femoral valgus osteotomy

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Received: 12 January 2008 / Revised: 19 July 2008 / Accepted: 19 September 2008 / Published online: 4 November 2008
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Abstract Palliative Schanz proximal femoral valgus osteotomy is considered a common option for treatment of irreducible hip dislocation in cerebral palsy. From 1992 to 2005, Schanz osteotomy was indicated on 55 occasions in 35 nonambulatory patients with the quadriplegic form of cerebral palsy aged 9–18. Postoperatively, the main emphasis focussed on clinical presentation, improvement of hip range of motion, and pain relief. X-rays were carried out at three, six, and 12 months postoperatively with subsequent average follow up 98 ± 4.5 months. In all patients, the range of hip abduction and flexion increased. In 54 (98.2%) cases painful symptoms significantly improved. One patient (1.8%) had a subsequent femoral head excision because of persistent hip pain. Transient hip pain persisted in four patients (7.3%). Schanz valgus osteotomy improves the hip range of motion, relieves pain, and facilitates care of the patient. Schanz femoral osteotomy is a less invasive method compared to proximal femoral excision and should preferably be used in older children with neurogenic hip dislocation in whom reconstructive surgery is not indicated.

Résumé L'ostéotomie de Schanz est considérée comme un traitement possible des luxations irréductibles chez l'enfant moteur cérébral. De 1992 à 2005, une ostéotomie de Schanz a été réalisée 55 fois chez 35 patients non marchant

et présentant une quadriplégie spastique, ces patients étaient âgés de 9 à 18 ans. La surveillance postopératoire a été centrée sur l'examen clinique, l'amélioration de la mobilité et l'amélioration des phénomènes douloureux. Les radios ont été réalisées à 3, 6 et 12 mois postopératoires avec un suivi moyen de 98 mois $\pm$ 4,5 mois. Chez tous les patients la mobilité de la hanche en abduction et en flexion s'est améliorée. Dans 54 cas (98,2%) la diminution de la douleur est significative. Un patient (1,8%) a nécessité d'une résection de la tête fémorale du fait de douleurs persistantes. Une douleur transitoire a persisté chez 4 patients (7,3%). L'ostéotomie de Schanz améliore la mobilité et la douleur de ces patients. Cette intervention est peu invasive comparée à la résection de l'extrémité supérieure du fémur et peut être préférée chez les enfants âgés présentant une luxation neurologique pour lesquels il n'est pas possible de réaliser une reconstruction de la hanche.

Introduction

In children with cerebral palsy the hip joint appears to be relatively normal at birth. Adduction, flexion, and internal rotation are typical deformities of the hip joint in the spastic type of cerebral palsy patients [5, 10, 13, 24]. With progressive adduction–flexion contracture of the hip acetabular dysplasia, femoral head subluxation and eventually hip dislocation may appear. Coxa valga, increased anteversion of the femoral neck, and subluxation or dislocation of the hip joint are secondary deformities developing during maturation. The centre of hip motion may translate from the centre of the femoral head distally to the level of the lesser trochanter. The hip joint capsule becomes progressively elongated supero-posteriorly with a gradual dislocation of the hip [24].

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Palliative procedures are suggested for painful, dislocated hips in order to facilitate sitting and ease of nursing care for the nonambulatory spastic type of cerebral palsy patients [5, 24]. One palliative treatment option is considered to be Schanz proximal femoral valgus osteotomy, which is preferably used in older children with neurogenic hip dislocation in whom reconstructive surgery is not indicated [20, 24].

In this article, the authors present their own experience with palliative Schanz osteotomy which is favoured for being less invasive in comparison to other methods like femoral head resection. Schanz osteotomy in our hands is preferably used in older nonambulatory children with irreducible hip dislocation.

Material and methods

From 1992 to 2005, 55 hip joints in 35 patients were treated by a palliative proximal femoral Schanz valgus osteotomy in our departments.

In all cases, palliative Schanz valgus femoral osteotomy was indicated for nonambulatory patients with a quadriparetic spastic form of cerebral palsy and suffering painful irreducible hip dislocation. The main purpose of the surgery was to facilitate a difficult nursing care, pain relief, and to allow mobilisation from bed to chair. All patients included in this study were preoperatively clinically and radiologically diagnosed with irreducible neurogenic hip total or marginal dislocation, dysplastic changes in the acetabulum, extremely restricted and painful hip movement, painful sitting, and extreme difficulty with nursing care.

In seven patients an unsuccessful attempt to reduce the dislocated hip openly had been performed previously. Three patients had previous isolated soft tissue adductor release (adductor longus and gracilis tenotomy), two patients had the above release in combination with a release of hip flexors (iliopsoas and rectus femoris), all with persistent pain, progression of hip migration, and difficulty with nursing care. Two children had had previous adductor soft tissue release combined with bony corrections (open reduction of the hip with derotation femoral osteotomy and pelvic osteotomy) and subsequent hip re-dislocation. The remaining 41 hips had no previous surgical treatment.

Patients were aged from 9 to 18 years with a mean age of 13 years and three months. Inclusion criteria were based on clinical presentation and radiological assessment.

In the postoperative evaluation the main emphasis was focussed on the clinical presentation of the patient, improvement of the hip range of motion, and a pain relief. Radiography examination was carried out at three, six, and 12 months after the surgery, and subsequent clinical follow-up was at yearly intervals.

Surgical technique

The surgery begins with adductor tenotomy in all patients without previous soft tissue release or inadequate response to previous soft tissue surgery. With the patient in supine position, with hip in flexion, abduction, and external rotation, a longitudinal incision is made above the adductor longus muscle. The subcutaneous tissue and deep fascia are incised in line with the skin incision. The adductor longus and the gracilis muscles are sectioned transversely in their tendinous portion approximately 1 cm distal to their origin on the pubic bone. Only subcutaneous and skin suture are performed. The next step is a lateral longitudinal incision beginning at the tip of the greater trochanter and extending distally parallel to the femur (patient is positioned supine, with the hip extended and internally rotated). The subcutaneous tissue and fascia lata are divided in line with the skin incision. A split of the lateral vastus muscle with partial detachment of its proximal origin to the greater trochanter is performed. The proximal femur distal to the greater trochanter is exposed by subperiosteal dissection. Femoral valgus osteotomy is performed at the subtrochanteric level (Fig. 1 a,b). A lateral bone wedge (30–40°) is excised from the proximal end of the femoral shaft. An adapted (30–40° angulation) seven-hole, large AO plate is applied to the lateral aspect of the upper femoral shaft and fixed with three cortical screws to the proximal fragment first. At the same time, a femoral anteversion correction, femoral shortening, and flexion contracture correction can be done. The distal fragment is reduced and the plate is fixed with three cortical screws using a fragment compression device. The vastus lateralis insertion is reconstructed and the fascia lata, subcutis, and skin are sutured. The osteotomy is stable and does not require any additional stabilisation. A knee splint is applied for two weeks to prevent progression of knee flexion contracture and to simplify care of the nonambulatory patient. Check X-rays are done on day one, at three and six months, and subsequently once yearly (c.f. Fig. 2).

Results

The postoperative assessment was focussed on hip range of motion improvement, pain relief, and radiological appearance. The bone union of the femoral osteotomy was radiologically confirmed at six months in all patients. The clinical assessment was routinely done at three, six, and 12 months postoperatively with subsequent yearly follow-up. The average follow-up period was 98 ± 4.5 months. The hip range of motion increased in all patients compared to preoperative findings and was considered significant in 49 hips (89.1%) when abduction of 30–35° was achieved. The

Fig. 1 **a** Pelvic X-ray of bilateral neurogenic hip dislocation. **b** Pelvic X-ray after bilateral Schanz valgus osteotomy

remaining six hips had improved range of movement with final abduction less than 30°.

Pain relief was achieved in 51 cases (92.7%). A transient hip pain persisted in four patients (7.3%). Asymmetrical hip position (“windblown hip”) [21] was noticed in one boy (1.8%). In this case the palliative unilateral Schanz valgus osteotomy was performed after a selective dorsal rhizotomy which is assumed to have caused the asymmetry. He was unable to sit and remained bed-bound; however, the pain symptoms improved significantly.

A persistence of fixed lumbar hyperlordosis (Fig. 3) was noticed in a significant number of patients. In our study, this group was represented by 14 patients (40%). It is clear that the lumbar scoliosis is not affected by Schanz valgus osteotomy and remains unchanged after the surgery.

Fifty-four (98.2%) patients were found to have the correct X-ray appearance of the operated hip, with good position of the metalwork, femoral head pointing lateral to the acetabulum, and the lesser trochanter proximalised

Fig. 2 **a** Pelvic X-ray after one-year bilateral Schanz valgus osteotomy in a 13-year-old girl. **b** Pelvic X-ray of 13-year-old girl (identical patient as Fig. 2a) after bilateral plate removal and femoral head excision on the left side

Fig. 3 Persistence of fixed lumbar hyperlordosis after Schanz valgus femoral osteotomy in a 12-year-old patient

facing the original acetabulum. In one patient the Schanz valgus osteotomy was performed for subluxed (marginally dislocated) painful right hip with advanced dysplastic changes in the acetabulum. The hip position remained subluxed in a check X-ray five years postoperatively; however, the patient was left with a pain free marginal dislocation of the right hip, with acceptable abduction of 30°.

Complications

Due to severe pain, one patient (1.8%) underwent a subsequent femoral head resection 12 months after a bilateral palliative Schanz valgus osteotomy (Fig. 2 a,b). As a result, this patient was able to sit comfortably in a wheelchair and had no more pain.

Discussion

The prevalence of hip subluxation or dislocation in cerebral palsy varies from 2.6% to 28% depending upon the severity of muscle contracture involvement in relation to the type of cerebral palsy [13, 24]. Dislocation of the hip occurs more frequently in nonambulatory patients with the spastic type of cerebral palsy. It is more commonly seen in quadriparetic and diparetic patients [5].

Soft tissue muscle procedures improving the position of the femoral head and preventing the progress of migration are considered to be the basal surgical treatment for patients with cerebral palsy [12, 20, 21]. Procedures on bones in the area of the hip joint in patients with cerebral palsy are indicated according to the degree of femoral head migration, sometimes in combination with open reduction of the hip [1, 2, 5, 8, 9, 18, 22, 23]. It is obvious that a treatment of dislocated hip in adolescent or adult patients with cerebral palsy is far more difficult. Reconstructive procedures are not appropriate in most cases, even if technically possible [5, 24].

In patients over the age of ten years with complete and irreducible hip dislocation it is sometimes necessary to perform palliative surgery to relieve the pain and to enable nursing care [13, 24]. In patients with prolonged hip dislocation the femoral head can deform (medial flattening against ilium and lateral notching by a pull of abductors) and severe acetabular dysplasia with consequent osteoarthritic changes usually occurs [3, 5, 19]. Palliative procedures such as Girdlestone's proximal femoral excision [11], Milch valgus proximal femoral osteotomy with femoral head excision [17], Schanz valgus subtrochanteric osteotomy [20], hip fusion [3, 5, 19, 25], or total hip replacement are the most commonly used methods of treatment for irreducible painful hip dislocation in cerebral palsy patients.

We believe that a mobile and pain free dislocated hip is better result than a stiff and painful reduced hip in patients with spastic type of cerebral palsy. Arthrodesis and total hip replacement have been documented as relatively unsuccessful by some authors [3, 5, 19]. However, there are papers finding total hip arthroplasty a reasonable alternative for treatment of paralytic hip in older aged group of patients highlighting strict selection in indications for surgery [25]. De Moraes [7] reports good experience with arthrodesis as a solution for treatment of 124 children with average age 15,4 years. Most authors recommend either subcapital or subtrochanteric proximal femoral resection [4–6, 14, 24]. McHale et al. [16] and Tachdjian [24] suggest proximal femoral resection combined with valgus subtrochanteric osteotomy and they both document pain relief, ease of perineal care, and facilitation of sitting. Faflik [9] presents Schanz valgus proximal femoral osteotomy in two patients and femoral head resection in another three cases. Leet [15] presents a combination of valgus proximal femoral osteotomy and femoral head resection. There is a lack of evidence in the literature on the long term results after isolated Schanz valgus proximal femoral osteotomy which was a reason for creating this study.

We document very good results in 54 (98,2%) cases of Schanz valgus proximal femoral osteotomy in 34 non-ambulatory patients with a quadriparetic form of cerebral palsy aged 9 to 18. One patient's hip had to be subsequently converted to femoral head excision as a result of persistent pain. Transient pain after surgery which resolved within the first three postoperative months was seen in less than 10% of patients and has been explained by the joint capsule and the surrounding soft tissues gradual lengthening in the immediate postoperative recovery period.

Palliative Schanz valgus proximal femoral osteotomy is a recognised surgical method to achieve good pain relief and increase range of movement in patients with neurogenic hip dislocation caused by the spastic type of cerebral palsy. In the authors' care, the osteotomy is indicated in nonambulatory cerebral palsy children over ten years of age with painful irreducible dislocated hip in order to decrease pain, ease nursing care, and facilitate sitting. Schanz valgus femoral osteotomy is less invasive when compared with proximal femoral excision and should be preferably used for children with neurogenic hip dislocation in whom reconstructive surgery is not indicated.

Acknowledgement The work was supported by grant IGA MZ NR 8333-3.

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