Surgical Treatment of Spastic Hip Dislocation – to Treat or Not to Treat? – My Personal Experience

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SUMMARY

Patients with cerebral palsy often develop a typical adduction-, internal rotation- and flexion contracture of the hip, caused by a central disturbance of muscle tone coordination. This deviation leads, when verticalisation and weight-bearing of the child is absent or insufficient, to coxa valga and spastic hip dislocation. In order to prevent or correct this faulty form, soft tissue release operations or bony joint reconstructive procedures of the proximal femur and acetabular roof or, in severely impaired patients, palliative measures can be performed. The indication must be judged critically, especially in patients with total body involvement. In this paper special procedures, performed for a number of years at the Orthopedic Poliklinik of the University of Munich and the Spastiker-Zentrum (Integrationszentrum für Cerebralparesen ICP) München (“Munich approach”) are described, and the important role of surgery is discussed as part of a comprehensive rehabilitation program in patients with cerebral palsy, including sometimes also the decision, not to perform surgery.

Key words: hip joint, neurogenic dislocation, cerebral palsy
BACKGROUND

The indications and contraindications to surgical treatment in cerebral palsy have changed significantly in time, but are, especially in severely impaired patients, still a matter of controversy. In the German literature, Bernbeck warned against drastic surgical interventions already in the first edition of his book “Kinderorthopädie” in 1954 and recommended performing “only the minimal necessary surgical procedures”, and Hackenbroch emphasized, in 1959, “to forget for the time being that spastic patients can also be treated surgically” [1,2]. Today, however, operations have become, with critical indications, an integral part of the therapeutic program. The present author’s electromyographic studies showed that peripheral orthopaedic surgery does not only correct the deformities and dysfunctions, but also improves the spasticity [3].

Results. The key-position of the hip joint in cerebral palsy. As a key joint the hip:

− plays a central role in the verticalisation of the body and therefore in the development of statomotoric functions, perception, speech and cognition,
− has a high risk of disturbed function (malpositions, contractures) and disturbed form (coxa valga, (sub-)luxation)
− is an important starting point for conservative and operative treatment to further body erection.

Pathogenesis of alterations of function and form of the hip.

In infantile cerebral palsy, the disturbance of statomotoric development with disturbed or absent verticalisation is caused by the combined effects of a pathological distribution of muscle tone, the persistence of phylogenetically preformed reflexes, absence of postural reactions and an underdeveloped perception of space and gravitation, resulting in a disturbed muscle balance between agonists and antagonists. This leads to deviations and asymmetries, which are primarily reversible, and, when these patterns persist, to fixed contractures and deviations, and then alterations of the morphologic factors at the proximal fémur (“form follows function”). The typical deviation of the hip is the flexion-, adduction- and internal rotation-contracture, which leads, in patients who are able to walk, to the characteristic gait pattern with internal rotation. In this deviation the iliofemoral muscle plays an important role, as shown by electromyographic and other investigations in our clinic [3,4,5].

The coxa valga antetorta is a characteristic faulty form of the proximal fémur in cerebral palsy. It develops as a result of insufficient activity of the gluteal muscle, which usually works towards varus and against antetorsion. When the muscular imbalance persists, the initially well preserved joint coherence is lost, the hip becomes decentralized and dislocates even though the acetabulum is radiologically sound (Fig. 1). Besides the muscular imbalance, the central deficit of statomotoric development has unfavourable consequences, because the children insufficiently load the hip, which leads to a faulty growth of the trochanter apophysis and of the femoral neck [5]. This confirms the old orthopaedic experience that a hip which has not “come to function” has a high risk for dislocation.

MATERIAL AND METHODS

A hip dislocation or subluxation occurred in 12% of 1362 patients treated in the Spastiker-Zentrum and the Orthopaedic Poliklinik, München. Within this group, 84% demonstrated severe motor and postural dysfunctions and “total body involvement”. These were mostly tetraplegic patients, who could not be brought to an erect posture [3].

General requirements for surgery in cerebral palsy are as follows:

− Long enough and systematic physical therapy.
− A thorough analysis of the muscles involved in the deformity or functional disturbances, if necessary with EMG and gait lab investigations.
− A minimum of postural and motor function preoperatively so that progress can be expected following the operative procedure. For hip operations we request that the child is able to sit and to bear weight when standing with support.
− Sufficient sensory and cognitive development which allows the child’s to adapt to the new situation after surgery perceptually.
− A postoperative physical therapy program must be provided, optimally under guidance from the operating surgeon.
− The operation has to be part of a general rehabilitation plan that considers all aspects of the disability.

RESULTS

The following surgical strategies have been developed at the Orthopaedic Poliklinik and the Spastiker-Zentrum München (“Munich approach”) according to pathophysiologic factors in the spastic hip [6]:

1. Soft tissue release procedures

− to support verticalisation
− to facilitate function (after verticalisation)

Procedures to support verticalisation by removal of contractures which impair function and with that
as prevention of spastic hip dislocation should be performed as early as age 3 or 4 years, if previous conservative treatment did not lead to verticalisation because of disturbing muscular deviations, but the child can at least sit, bear weight and can adapt to the new situation after surgery perceptually. Severe statomotoric or mental deficits as well as marked rump hypotonicity are contraindications.

Many methods of soft tissue release procedures are described in the literature:

Adductor procedures:
- subcutaneous or open tenotomy
- muscle transfer to the os ischii (Stephenson, Donavan)
- lengthening of the aponeurosis (Baumann)

Release or lengthening of the spina muscles and/or hip flexors:
- lengthening of the hip flexors (Anthonson)
- release of the iliopsoas muscle (Keats, Morgese)
- lengthening of the aponeurosis (Baumann)
- Transfer of iliopsoas muscle:
  - to the hip joint capsule (Bleck)
  - antero-lateral (Mustard)
  - connection with the released tendon of the rectus femoris muscle (Göb)

The so called “Rectus-Iliopsoas-connection” was first performed and described by Göb 1967 in the Orthopaedic Poliklinik München as a partial intervention for muscle detoning in spastic hip contractures [4]. The procedure had been mentioned already by the Austrian orthopaedic surgeon Erlacher in 1928 for the treatment of hip muscle paralysis in poliomyelitis [7]. The correct term would be “Rectus-ipsosas-connection”, because only the end of the psoas tendon is connected with the detached proximal rectus tendon (“proximal rectus transfer”). To remove the typical flexion-, adduction- and internal rotation – contracture, the rectus-ilio/psoas-connection as well as the distalisation of the sartorius muscle, the notching of the anterior rim of the little gluteus muscles, the mostly open tenotomy of the adductors and possibly the lengthening of the medial knee flexors have proven successful (Fig. 2).

Postoperatively a pelvis-leg cast respectively synthetic bandage is applied for 3 to 4 weeks. A few days after surgery standing boards are applied, so that the patient can be elevated. Thus the child can play, eat and participate in lessons with a special table. Furthermore rump control can be practiced, as well as verticalisation and space perception can be trained. After removal of the cast or bandage systematic physiotherapeutic rehabilitation is performed with special training programmes, supported by technical devices, for example night and day-splints, adjustable standing boards, crutches, rollators or walkers of different design, and stabilising shoes (Fig. 3 a-c).

Results of the “Connection” operation. At the Orthopaedic University Poliklinik München the Rectus-Iliopsoas-connection has been performed in 20 patients (Fig. 4). The results of the operation were good if the patient was operated before the age of 5 years.
(Ilio)psoas-connection surgery has been performed over 30 years in more than 300 patients, mostly on both hips and often in combination with additional soft tissue release procedures. The operation removed not only the hip flexion contracture, but also, through weakening of the contract agonist, improved the motoric power of the secondary-paretic antagonists, i.e. the hip extensors. This could be demonstrated by EMG exams [3]. Coupling the tendons of the psoas and rectus muscles supported knee extension. Thus children formerly unable to stand and walk could be brought to a standing position if at least standing readiness was present. For patients in the post-verticalisation stage, troublesome flexion-, adduction- and internal rotation-deviations could be resolved. In a long-term study after a mean of 13 years, a significant improvement of the functional status according to Hoffer could be noted. 49.3% of 71 documented patients were able to walk preoperatively, 50.7% were not able to walk and confined to a wheelchair [8]. After the postoperative phase, only 8.4% were still in the wheelchair. After a mean of 13 years 80.3% of the patients at a mean age of 19 years retained their ability to walk. The radiologic status was also positively influenced in 90% of the patients. On average, the Reimers-Index was significantly reduced from 28.6% preoperatively to 18.2% postoperatively, which represents a clear and marked improvement of hip containment [9] (Tab. 1).

Discussion. The effect of soft tissue release procedures, especially in the adductor muscles, as a form of prevention of spastic hip dislocation, is subject to controversy in the literature. An evidence report published by Stott and Piedrahita comes to the conclusion that after adductor release procedures an improvement of the radiologic status occurred only in 168 out of 530 hips, and an improvement of the Reimers-Index only in 241 out of 467 hips, probably due to the heterogeneity of the patients [10]. On the other hand, our positive results concerning hip dislocation have been confirmed by many authors, for example, Frischhut et al., Senst and Schöttler, Miller et al., Schörle and Manolikakis, Strobl, Presedo, recently published with nearly the same results as ours, Snela et al. and others [11-17].
2. **Bony joint reconstructive procedures:**

For osteotomies of the proximal femur (ex. derotation-varisation-osteotomy) and reconstruction of the acetabular roof (according to Salter; Tönnis, Chiari, Pemberton, Dega) for a subluxated or dislocated hip joint, a restrictive indication is necessary, since the results are often disappointing. Even in patients who can walk, the femoral neck can develop again into valgus after an optimal joint reconstruction, due to muscular imbalance, and the dislocation recurs. The most important factor is not the radiologic findings and the age, but the development stage of the child, who should at least show a readiness to stand and an acceptable level of compliance. The bony reconstructions have to be combined with detoning soft tissue interventions, because good results can otherwise not be maintained. Contraindications are very severe statomotoric and mental deficits with “total body involvement”.

3. **Palliative procedures**

In severely impaired patients with a high spastic hip dislocation, only palliative measures can be indicated to maintain the sitting ability, to facilitate nursing care and to reduce pain. This can be performed by a tenotomy of the adductors and sometimes additional hip muscles, and in some cases by a femoral head resection or a subtrochanteric angulation-osteotomy. For a high hip dislocation in elder children and adolescents who can stand and walk, a subtrochanteric angulation-osteotomy can be, in our experience, also a palliative alternative procedure instead of extensive reconstructive operations. The functional result is surprisingly good; an increased Trendelenburg limp, sometimes a genu valgum is tolerable. The minor trochanter molds itself to the original acetabulum postoperatively and therefore follows the natural course of the disease, as can be compared with the X-ray of a 19-year-old girl who is not able to stand alone (Fig. 4).

With that, the problem arises of a high spastic hip dislocation in most severely impaired patients confined to wheelchairs or the bed and who will never stand. The indication for surgery in these cases is subject to controversy above all. Many authors [Brunner and Baumann [18], Braatz [19] and others]...
perform extensive reconstructive procedures for the following reasons:

- to maintain the ability to transfer the patient;
- to facilitate nursing care;
- to reduce hip pain;

and they obtain very good results.

On the other hand, there are also reasons against extensive reconstructive procedures:

- a high risk of recurrent dislocations and disappointing results
- good functional adaptation of the minor trochanter to the original acetabulum gradually (“spontaneous bracing”) (Fig. 6). This does not lead to marked functional deficiencies and patients can even complete professional training (see below)
- hip pain is frequently temporary and can usually be treated with conservative measures.

These observations correspond to our experiences and determine our treatment strategy, which is to refrain from extensive joint reconstruction in these cases. A recurring point of controversy is the question if patients with high spastic hip dislocation have pain or not. It must be considered that subjective statements are often imprecise due to a marked dysfunction of body patterns and in principle hard to determine. In the literature the frequency of pain is reported differently. According to a study published by Noonan et al. and other authors a high dislocation of the hip in severe cerebral palsy patients is not invariably associated with hip pain [20-22]. Experience with many of our own patients confirms this opinion. An example is a young lady (Fig. 5) in the wheelchair during her professional training in the Spastiker-Zentrum München. We were not successful in bringing her to an upright position, not even by muscle releasing surgery at the age of 5. Now she is satisfied, in the wheelchair, without pain despite a bilateral high hip dislocation. Fig. 6 shows a good late result after an early Rectus-Iliopsoas-connection-operation in a boy, now undergoing professional training at a printing machine in our Spastiker-Zentrum.

In conclusion, I would like to answer the question in the title of my paper “Surgical treatment of spastic hip dislocation – to treat or not to treat” according to our own experience as follows:

Soft tissue release procedures:

- to further statomotoric development and muscular function, before and after verticalisation, and as prophylaxis of hip dislocation – yes
- in combination with bony procedures – yes
- in severely impaired patients who cannot sit and stand (except in cases for palliative procedures, see below) – no

Bony joint reconstructive procedures:

- to improve hip containment and muscular function – yes
- in severely impaired patients (“total body involvement”) – no

Palliative procedures:

- soft tissue release procedures (see above) – yes
- resection of femoral head and neck – yes
- subtrochanteric angulation-osteotomy – yes
- also as an alternative method in older patients who are able to stand and walk – yes.

The important role of surgery as a part of an entire rehabilitation programme in patients with cerebral palsy, especially in spastic hip dislocation, should be emphasised, but the considerable difficulties associated with establishing indications for the surgery should also be highlighted. Each patient needs an individual therapeutic plan, established by an interdisciplinary team, including sometimes also the decision not to perform surgery!
REFERENCES