

Outcome after transphyseal hip fractures

4 children followed 34–48 years

Ragnar Jerre and Jon Karlsson

We report long-term outcomes in 4 patients with transphyseal fractures of the hip, a rare injury. All the patients were treated without surgery. The results were good in all the patients at follow-up, 34–48

years after injury. The only complication we found was a leg-length discrepancy of 3 cm in 1 patient due to premature closure of the capital femoral physis.

Department of Orthopedics, Östra Hospital, S-416 85 Göteborg, Sweden. Tel + 46 31-374000. Fax -374092
Submitted 96-11-01. Accepted 97-03-01

Transphyseal fracture of the hip is an acute separation of the femoral head from the femoral neck through a previously normal growth plate, which must be distinguished from physiologic of the hip (slipped capital femoral epiphysis, SCFE) in adolescence (O'Reilly 1971). This injury is rare and most of the previous reports are case reports with a short or medium-length follow-up period (Colonna 1929, Ingram and Bachynski 1953, Lam 1971, O'Reilly 1971, Ratliff 1974, Milgram and Lyne 1975, Pförringer and Rosemeyer 1980, Davison and Weinstein 1992). Furthermore, only 6 patients were mature at follow-up in these studies.

We report the long-term results after transphyseal fractures of the hip in 4 patients.

Patients and methods

From 1946 to 1965, 2 girls and 2 boys with transphyseal fractures of the hip were treated in our hospital (Table). All 4 children had suffered a severe trauma; 2 had fallen from a height of approximately 3 meters, 1 was struck by a steam-roller and 1 by a lorry. The age at trauma was between 1 year 8 months and 3 years 9 months. The epiphysis was displaced 5–15 mm posteriorly in all cases (Figure) and in 2 hips (cases 1 and 3) there was a slight valgus tilting of the epiphysis. 3 patients were treated with a hip spica for 5–8 weeks and 1 patient was treated with skeletal traction through the tuberosity of the tibiae for 6 weeks. No reduction was performed.

At review after 34–48 years, the Harris (1969) hip score (maximum points 100) was used to assess the clinical results. Furthermore, Trendelenburg's sign

was evaluated and the leg-length discrepancy was measured using wooden boards of different thickness placed under the short limb until the iliac crests were level in the standing position. The radiographic re-examination included 5 views of the hip (Hansson et al. 1993). These included an anteroposterior view, non-weight bearing, a Billing (1954) lateral view, non-weight bearing and anteroposterior, anterolateral and posterolateral views with weight-bearing (Ahlbäck and Rydberg 1985). The joint space was measured and classified as normal if it measured 3 mm or more at the superior level and 2.5 mm or more at the posterior and anterior levels (Hansson et al. 1993). On the anteroposterior view, the articular distance (ATD) was measured according to Edgren (1965) to identify growth disturbances in the subcapital growth plate. 1 patient refused to undergo the radiographic re-examination.

Results

No short-term complications were recorded. The clinical results, using the Harris hip score, were between 96 and 100 points (Table). Trendelenburg's sign was negative in all patients, but 3 patients had a leg-length discrepancy of between 0.5 and 3 cm. The patient with a leg-length discrepancy of 3 cm used a shoelift. Radiographically, the joint space was normal in the 3 patients who underwent radiographic re-examination (Figure). The ATD was equal in both hips in 1 patient, while it was reduced in the other 2 by 5 mm and 24 mm, respectively, compared to the unaffected hip. No angular deformities of the femoral neck were seen.

Data on the 4 patients

A	B	C	D	E	F	G	H	I	J	K	L	M
1	1	Struck by a steam-roller	3/7	15	Hip spica, 7	48	Tram driver	96	neg	1.5		
2	2	Fall from height	1/8	5	Hip spica, 8	42	Cleaner	100	neg	0.0	No	32/32
3	1	Fall from height	2/4	10	Hip spica, 5	40	Fireman	97	neg	3.0	No	-9/15
4	2	Struck by a lorry ^a	3/9	5	Traction, 6	34	Pensioner ^b	100	neg	0.5	No	23/28

A Case	E Displacement, mm	K Leg length discrepancy, cm
B Sex	F Treatment, weeks	L Radiographic arthrosis of the hip
1 boy	G Follow-up, years	M Articulotrochanteric distance, ATD
2 girl	H Occupation	Affected/unaffected hip, mm
C Trauma	I Harris hip score (points)	^a associated injury, fracture of the pelvis
D Age at trauma (years/months)	J Trendelenburg's sign	^b disability pension for other reasons

Case 3



At the time of the trauma.



At the re-examination.



Discussion

In contrast to physiologic of the hip in adolescence, transphyseal fractures of the hip occur after major trauma (Ratliff 1968, Ogden 1990). Furthermore, children suffering from this injury are young. In our

study, the oldest child was 3 years 9 months, which is in line with the literature review by O'Reilly (1971), in which only 2 of 19 children were 5 years or older. Our patients, as well as the others previously reported (Ratliff 1974), represent a Salter and Harris type I injury of a previously normal growth plate.

There is no consensus about the treatment of non-displaced (widening of the epiphyseal plate) or minimally displaced (less than 1/4 of the diameter of the femoral neck or 25° angulation) transphyseal fractures of the hip. Swiontkowski (1994) recommends open reduction and fixation with smooth Steinmann pins, while Ogden (1990) and Tachdjian (1990) advocate nonoperative treatment, whenever possible.

Premature fusion at the proximal femoral physis and avascular necrosis of the femoral head (AVN) are frequent complications after transphyseal fractures of the hip (Ratliff 1968, O'Reilly 1971, Milgram 1975, Pförringer and Rosemeyer 1980, Ogden 1990, Tachdjian 1990, Swiontkowski 1994). The prognosis depends on the amount of displacement of the epiphysis and the treatment. The poorest results have been obtained when the femoral head was also dislocated from the acetabulum (Ingram and Bachynski 1953, Ogden 1990). Ratliff (1968, 1974) found AVN, premature fusion or nonunion in 9 of 11 displaced transphyseal fractures, treated with traction and closed or open reduction. In Ratliff's studies, good results were obtained in 2 patients, both with displaced transphyseal fractures. 1 was treated with traction and the other with manipulative reduction. Pförringer and Rosemeyer (1980) described 4 cases in which a good result was obtained in 2 after open reduction and fixation with Kirschner wires, while the result in the other 2 was poor with AVN after traction. However, the patients with good results were only 9–17 years old at follow-up. Davison and Weinstein (1992) reported 4 cases, all treated with some form of internal fixation, and with an average follow-up of 24 (3–42) years. The clinical result was good in 3 cases. However, 2 of these patients developed coxa vara. The remaining patient had AVN.

All 4 patients in our series were treated nonsurgically with a hip spica or traction without reduction. We found no AVN and at re-examination no arthrosis had occurred and no angular deformities were visible. This indicates that remodeling, like that seen in patients with physiodesis of the hip, may occur (Bellemans et al. 1996). We therefore recommend that non-displaced or minimally displaced transphyseal fractures of the hip should be treated by immobilization without reduction. However, we did find a leg-length discrepancy in 3 of 4 patients, probably due to premature closure of the proximal physis of the femur. This well-known complication was also seen on the radiographs as a reduced ATD in 2 of 3 hips. Overgrowth of the greater trochanter leads to a risk of impingement and decreased abduction muscle force (Edgren 1965, Langenskiöld and Salenius 1967, Engelhardt 1979, Ordeberg et al. 1990). To reduce the effect of

this complication, repeated radiographic investigations until the physis is closed might be of value and, if necessary, physiodesis of the greater trochanter can be performed. This operation is most effective in children less than 8 years of age. Furthermore, we recommend physiodesis of the longer leg in patients with a presumed leg-length discrepancy exceeding 2 cm (radiographic measurement) as an adult.

We conclude that the long-term results are good after non-displaced or minimally displaced transphyseal fractures of the hip treated with immobilization but without reduction.

References

- Alhåck S O, Rydberg J. The radiology of degenerative hip disease. In: The young patient with degenerative hip disease. (Eds. Sevastik J, Goldie I). Almqvist & Wiksell, Stockholm 1985: 33–40.
- Bellemans J, Fabry G, Molenaers G, Lammens J, Moens P. Slipped capital femoral epiphysis: a long-term follow-up, with special emphasis on the capacities for remodeling. *J Pediatr Orthop Part B* 1996; 5: 151–7.
- Billing L. Roentgen examination of the proximal femur end in children and adolescents. *Acta Radiol (Suppl 110)* 1954.
- Colonna P C. Fracture of the neck of the femur in children. *Am J Surg* 1929; 6: 793–7.
- Davison B L, Weinstein S L. Hip fractures in children: a long-term follow-up study. *J Pediatr Orthop* 1992; 12: 355–8.
- Edgren W. Coxa plana. A clinical and radiological investigation with particular reference to the importance of the metaphyseal changes for the final shape of the proximal part of the femur. *Acta Orthop Scand (Suppl 84)* 1965.
- Engelhardt P. Therapie der beginnenden juvenilen Hüftkopflösung unter Berücksichtigung des Schenkelhalswachstums. *Z Orthop* 1979; 117: 795–800.
- Hansson G, Jerre R, Sanders S M, Wallin J. Radiographic assessment of coxarthrosis following slipped capital femoral epiphysis: a 32-year follow-up study of 151 hips. *Acta Radiol.* 1993; 34 (2): 117–23.
- Harris W H. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty. *J Bone Joint (Am)* 1969; 51: 737–55.
- Ingram A J, Bachynski B. Fractures of the hip in children. *J Bone Joint Surg (Am)* 1953; 35: 867–86.
- Lam S F. Fractures of the neck of the femur in children. *J Bone Joint Surg (Am)* 1971; 53: 1165–79.
- Langenskiöld A, Salenius P. Epiphyseodesis of the greater trochanter. *Acta Orthop Scand* 1967; 38: 199–219.
- Milgram J W, Lyne E D. Epiphyseolysis of the proximal femur in very young children. *Clin Orthop* 1975; 152: 202–10.
- Ordeberg G, Hägglund G, Hansson L I, Sandström S. Articulotrochanteric distance in slipped capital femoral epiphysis. *Arch Orthop Trauma Surg* 1990; 109: 191–3.

- O'Reilly D E. Acute traumatic separation of the capital femoral epiphysis. *South Med J* 1971; 64: 847-51.
- Ogden J A. Proximal femoral injuries. In: *Skeletal injury in the child*. (Ed. Ogden J A). W.B. Saunders Company, Philadelphia 1990: 688-741.
- Pförringer W, Rosemeyer B. Fractures of the hip in children and adolescents. *Acta Orthop Scand* 1980; 51: 91-108.
- Ratliff A H C. Traumatic separation of the upper femoral epiphysis in young children. *J Bone Joint Surg (Br)* 1968; 50: 757-70.
- Ratliff A H C. Traumatic separation of the upper femoral epiphysis in young children. *Orthop Clin North Am* 1974; 5: 925-31.
- Swiontkowski M F. Fractures and dislocations about the hip and pelvis. In: *Skeletal trauma in children*. (Eds. Green N E, Swiontkowski M F). W.B. Saunders Company, Philadelphia 1994; 307-43.
- Tachdjian M. *Pediatric Orthopedics*. W.B. Saunders Company, Philadelphia 1990:1016-81.