

EARLY AND LATE RESULTS OF BRACKETT'S OPERATION FOR PSEUDARTHROSIS OF THE NECK OF THE FEMUR IN INFANTILE COXA VARA

A Review of 30 Operations

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The early and late results of 30 Brackett operations for pseudarthrosis of the neck of the femur are reviewed. The cause of the pseudarthrosis in 28 hips was congenital or infantile coxa vara. The patients' ages at the time of the operation ranged from 2 to 43 years. The early results were good. Only three out of a total of 30 cases failed to unite; 27 hips became stable. Necrosis of the femoral head occurred in six hips. Late results, on average 13 years after the operation, differed greatly from the early results. The majority of the hips were stable but only three completely painless. All but four were affected by secondary osteoarthritis which in six cases was slight.

Key words: Brackett's operation; pseudarthrosis of the neck of the femur; infantile coxa vara

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Brackett & New published their primary results in 1917. The results of the Brackett operation have been reviewed by Brackett (1938), Magnuson (1932, 1940), Rowe & Ghormley (1944), Ivins & Ghormley (1947), and Merle d'Aubigne & Thomine (1968), who treated pseudarthroses following a fracture, whereas Babb et al. (1949), Langenskiöld (1949) and Pylkkänen (1960) reviewed the results after treatment for pseudarthrosis of the femoral neck in congenital or infantile coxa vara.

The purpose of the present study is to ascertain the early and late results of the Brackett operation in non-union of the femoral neck caused by congenital or infantile coxa vara, and also in two chil-

dren with non-union of the femoral neck from other causes. The purpose was also to find out whether this operation may still be indicated in certain cases.

PATIENTS AND METHODS

From 1945 to 1968 Brackett's operation was carried out at the Orthopaedic Hospital of the Invalid Foundation on 29 patients (14 male and 15 female). Both hips were operated on in one patient, and the total number of hips treated was thus 30. The cause of the pseudarthrosis was coxa vara infantum in 28 hips. A two-year-old child with congenital dislocation of the hip and an eight-year-old child with a pseudarthrosis of traumatic origin were also included in the series. The patient's ages ranged from 2 to 43 years. At the time of the operation 12 of the patients were children. A follow-up exam-

Table 1. Age of patients at operation and at follow-up, and duration of follow-up.

		Age at operation						
Years		2-9	10-14	15-17	18-19	20-24	25-29	30-34
No. of hips		3	2	7	3	8	3	4
		Age at follow-up						
Years		16-19	20-24	25-29	30-34	35-39	40-44	45-61
No. of hips		3	3	3	7	5	4	5
		Duration of follow-up						
Years		1-4	5-9	10-14	15-19	20-24	25-29	
No. of hips		5	4	6	9	3	3	

ination was carried out in the spring of 1972 on a total of 20 hips which were examined both clinically and roentgenologically. Running follow-up entries with radiographs were available in the hospital records of all of the patients, as well as of the 10 patients who failed to attend this particular follow-up examination. The follow-up periods ranged from 1 to 29 years, average 13 years. At the time of the follow-up examination, or at the last visit to the outpatient clinic, nearly all patients were fully grown (Table 1).

Operative technique

An antero-lateral incision was made in the interval between the tensor fasciae latae and the rectus femoris muscles. The joint capsule was incised in line with the femoral neck to reach the pseudarthrosis. All dense scar tissue of the non-union was excised. In the first four operations, the freshened cancellous bone surface was placed end-to-end without excavation of the femoral head. The results were not good, and therefore in all the other hips the femoral head was excavated to form a concavity or a socket for the distal fragment. Next, the remnant of the neck was removed and an osteotomy of the proximal part of the greater trochanter with its attached muscles was performed. The shaft was inserted as deep into the head of the femur as was possible without breaking the articular surface of the head. The word implantation has therefore been used to describe the procedure. The greater trochanter was fixed either by a screw or a wire to the upper lateral surface of the femur. If necessary, the tension of the adductor muscles was relieved by tenotomy performed through a separate incision. No metal or bone fixation between the head and shaft of the femur was used.

The extremity was immobilized in plaster for 6 to 8 weeks. Active mobilization of the limb was commenced thereafter and, depending on the

degree of consolidation verified roentgenologically, the patient was allowed to start walking one or two months after the removal of the plaster.

RESULTS

The series is heterogeneous as regards the patients' ages. The age at operation varied between 2 and 43 years, and at follow-up between 16 and 61 years. The early results are those which became manifest during the first postoperative year, while those observed after the first year are classified as late results.

Early results

No fatal complication occurred. On three occasions there was a superficial wound infection. Deep thrombosis developed in three instances. The consolidation was successful in all three cases.

During the operation, the proximal end of the femoral shaft could be placed in a good, central position inside the head on 16 occasions compared with the upper part of the head on 10 occasions. On four occasions the operation was made without excavating the head.

Necrosis of the head was seen one year postoperatively in six hips. In three the operation had been made without excavating the femoral head, in two the shaft was in contact with only the upper part of the head, and in one the head, which originally had been well fitted, postoperatively slipped into a bad posi-

Figure 1 a. A 17-year-old boy. Pseudarthrosis of the femoral neck has developed from infantile coxa vara of the right hip. The head of the femur is completely detached from the neck, but despite considerable decalcification its articular cartilage is smooth and its shape is normal. Clinical investigation showed that Trendelenburg's sign was decidedly positive, the patient had a bad limp and mobility of the hip was greatly restricted. Owing to pain in the hip the patient was only able to do light work.



Figure 1 b. Brackett's operation was performed 18 months later. The radiograph was taken 6 weeks postoperatively. The femoral shaft is well implanted and fitted into the head of the femur.

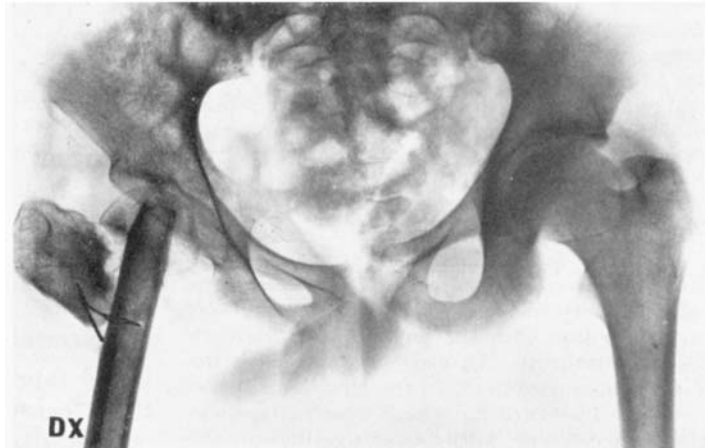
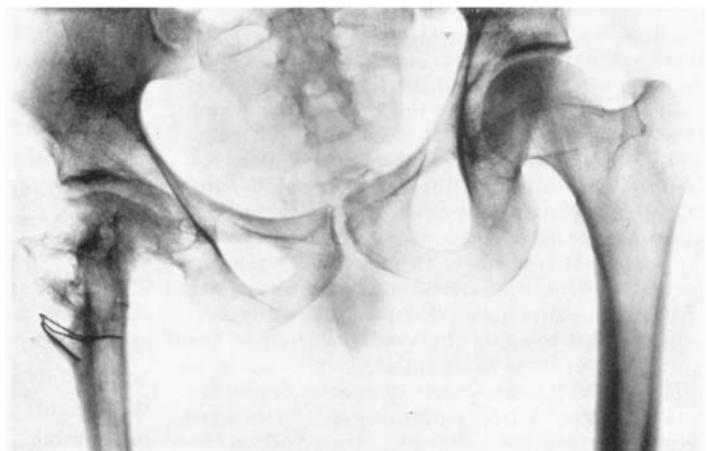


Figure 1 c. Radiograph taken 18 years after Brackett's operation. The patient, now 36 years old, is a labourer. The hip is tender on exertion and has become stiffer, but Trendelenburg's sign is negative. The femoral head is flattened in shape and incipient, slight osteoarthritis is visible.



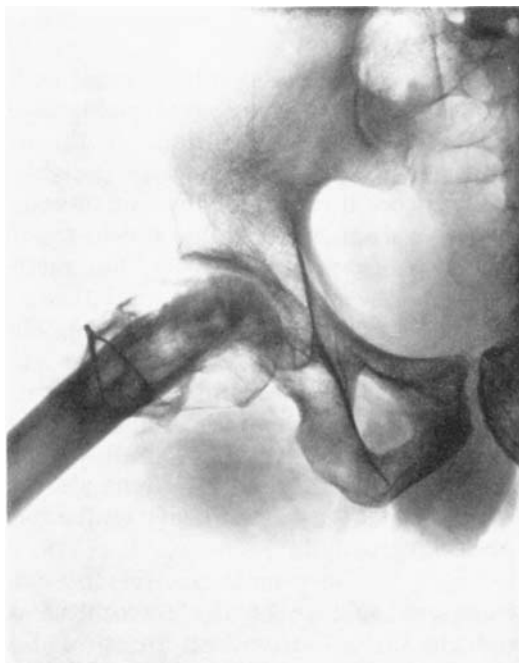


Figure 1 d. Axial radiograph taken 18 years after operation. In this direction the shape of the head is very good.

tion. In only one case of necrosis of the head did the osteosynthesis fail to consolidate.

Initially, the overall mobility of the hips diminished in 19 and remained unchanged in 11 cases. Ten of those who retained mobility shared the following features: a good implantation was reached at the operation, it still remained good postoperatively, and union was soon established. Preoperatively nine patients had an extension deficit of a minimum of 30 and a maximum of 60 degrees. These deficits were eliminated by the Brackett operation.

Length differences between the two legs ranged preoperatively from 2 to 7 cm. In only four patients were the legs of equal length. The operation increased the difference in lengths in 10 patients by 1 to 3 cm, and reduced it in 10 by 1 to 5 cm; in the others the difference remained unchanged.

Preoperatively, Trendelenburg's sign was positive in all pseudarthrotic hips. Postoperatively it was negative in all those in which the osteotomy had consolidated, and positive only in three hips that did not unite (Table 2).

Table 2. Early and late results after Brackett's operation.

	Early results	Late results ¹⁾
Trendelenburg's sign		
markedly positive	3	3
slightly positive	—	6
negative	27	16
Pain		
at rest	—	14
in walking	9	8
none	21	3
Arthrosis		
marked	—	15
slight	—	6*)
none	30	4*)

¹⁾ Five patients were followed up from 1961 to 1964 and 20 in 1972, whereas five patients were not seen after 1957, and the late results of these are not known.

*) All patients without osteoarthritis and half of the patients with slight osteoarthritis were under twenty-one years of age at the time of the operation.

Late results

The majority of the patients of these series treated with the Brackett operation had been followed up in 1957 (Pylkänen 1960). Five patients were subsequently re-examined from 1961 to 1964 and 19 patients with 20 treated hips in 1972. Only four patients had no osteoarthritis, and one had an ankylotic hip. All patients with osteoarthritic hips suffered from pain on exertion, and two thirds of these had pain even at rest. Yet Trendelenburg's sign was markedly positive in only three non-union hips, slightly positive in six hips, and the rest of the hips were stable.

As a result of secondary osteoarthritis

the mobility of every second hip had diminished since the 1957 follow-up examination. The hips without osteoarthritis had retained their mobility, and were even more mobile than before the operation.

A feature common to all hips without osteoarthritis was that the proximal end of the femoral shaft had initially been brought into a good, central position inside the femoral head and the consolidation was rapid. The average follow-up period was 18 years. Three of the patients were engaged in heavy manual work, and one went to a high school. At the time of the operation their ages had been 2, 19, 20 and 20 years, respectively.

In five of the hips with slight osteoarthritis a good implantation was achieved, and in only one was the contact of fragments poor. The initial consolidation was good. The average follow-up period for this group was 17 years. At the time of the operation three had been over 20 years, and the others younger.

Whatever may have been left of the epiphyseal plate, it is removed in Brackett's operation, and the neck of the femur, therefore, cannot be expected to grow postoperatively. The epiphysis of the greater trochanter is not destroyed by the operation, and growth could be observed in children; on one occasion a trochanteric epiphysiodesis had to be performed. In three children, longitudinal growth of the healthy lower limb was restricted by means of a distal epiphysiodesis of the thigh and/or a proximal one of the leg. On one occasion, a shortening operation was performed. *In children, the growth of the femoral head is of the greatest interest.* In the operation, a cartilaginous femoral head comprising only a little cancellous bone is implanted on the top of the shaft. Despite this the head can grow moderately and retain a relatively good, almost spherical shape (Figure 1 a, b, c, d).

DISCUSSION

The purpose of this operation must be to obtain a painless, stable and mobile hip, without shortening the limb. Is the attainment of such a good result possible?

The procedure is a radical intra-articular operation. It is carried out to repair long-standing pseudarthroses. The method treats the femoral head as if it were a real sequestrum (Brackett & New). The purpose is to create an extensive and firm contact between the freshened cancellous bone surface of the femoral head and the proximal top of the shaft, so that vascularization should soon invade the femoral head from the shaft and union take place rapidly.

Owing to the pseudarthrosis, the cartilaginous surface of the femoral head and the articular socket are probably affected with degenerative changes, and the atrophied head is osteoporotic. Apparently, the shape of the head no longer fully corresponds to that of the socket. This can perhaps remodel itself postoperatively in children but not in adults.

Anatomically, the reconstruction remains deficient. Because of absence of the femoral neck and the displacement due to the pseudarthrosis it would not have been possible to preserve the neck by the technique described by Merle d'Aubigne & Thomine (1968).

It is easy to understand that such a hip cannot withstand decades of strain. A premature osteoarthritis can be expected. It is also evident that the postoperative mobility of the hip is restricted. Even the movement of the pseudarthrosis is "lost". However, the hip becomes painless and stable, and the limb is not shortened.

Prosthetic replacement cannot be recommended for children and young adults of working age. The Brackett operation helps the patient to get along for some twenty years, and in some cases a permanently good result is obtained. By

the time the secondary osteoarthritis sets in, the patients are older, and it should be anatomically possible to perform a total prosthesis operation on their hips. Such an operation has been successfully carried out once, 29 years after the Brackett operation.

It is self-evident that severe coxa vara cases must be treated by extra-articular osteotomy before the development of a pseudarthrosis. Union of a pseudarthrosis can be considered impossible to achieve (Johanning 1952). The reconstruction of the femoral neck, once it has disappeared, by means of trochanteric osteotomies and bone grafts (e.g., those described by Pauwels (1949) and Müller (1971)) is extremely difficult. *In certain hips, primarily those of children and young adults with long-standing pseudarthroses, a good result can be achieved with the Brackett operation.*

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