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EPIPHYSIOLYSIS OF THE HEAD OF THE FEMUR[1]

A Follow-up Examination with Special Reference to End Results and the Social Prognosis

By

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This study is based on a follow-up examination of 147 patients with epiphysiolysis of the head of the femur (EHF). These patients were either admitted to or treated as out-patients in the *Orthopedic Hospital, Aarhus*, during the period October 19, 1936, to April 1, 1949 (Table 1).

TABLE 1
Showing the number of patients followed-up, here classified according to sex and length of observation period.

Observation period, in years	2	3–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–42	Total
Males	1	24	40	21	12	5	2	5	2	1	113
Females	0	7	15	5	4	1	0	0	1	1	34
Total	1	31	55	26	16	6	2	5	3	2	147

The functional results were evaluated and classified as follows:

Group I (Good result).

1. No symptoms or only slight fatigue on vigorous exertion.
2. Actual shortening, max. 1.5 cm.
3. Muscular atrophy, max. 2.5 cm.
4. No limp or very slight limp.
5. Index of motion greater than 75.
6. Full working capacity.

[1] This paper is an abstract of a thesis approved in October 1952 for the degree of M.D. in the University of Aarhus.

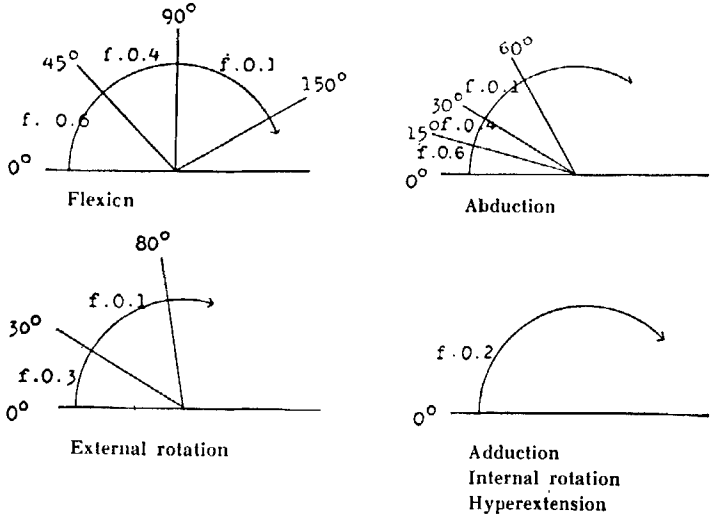

Fig. 1.
Gade's diagram for calculation of the index of motion.

Group II (Fair result).

1. Intermittent hip pain, particularly on vigorous exertion.
2. Actual shortening, max. 3 cm.
3. Muscular atrophy, max. 4 cm.
4. Slight or moderate limp.
5. Index of motion at least 40.
6. Full working capacity.

Group III (Poor result).

1. Intermittent or constant pain, whether provoked by activity or not.
2. Actual shortening exceeding 3 cm.
3. Muscular atrophy exceeding 4 cm.
4. Severe limp.
5. Index of motion less than 40.
6. Reduced working capacity.

The functional value of each motion (index of motion) was calculated according to the method described by *Gade* in 1947 (fig. 1). Since this method does not pay regard to possible contractures, which may introduce a factor of error in calculating the index, it was supplemented with a number of corrections reported by *Jerre* in 1950.

Jerre assigned a negative factor to each limitation of motion, e.g., an adduction contracture of 10° was recorded as abduction —10. The factors used by *Jerre* were as follows:

Limitation of abduction:

For the first 10°	2.0
For further motion	4.0

Limitation of extension:

For the first 15°	0.5
For the next 15°	1.5
For further motion	2.0

Limitation of internal rotation:

For the first 30°	0.3
For the next 15°	1.0
For further motion	2.0

Accordingly, the index of motion was calculated as follows. Positive motions were determined by the method of *Gade* and negative motions by that of *Jerre*, and the difference between the sums of the products thus obtained were taken as an expression of the index.

Anteroposterior and lateral roentgenograms of both hips were taken at the follow-up examination.

In analogy with the methods used by other investigators (*Jerre, Pomeranz* and *Sloane, Moore*), the cases followed-up were classified in two groups, moderate and pronounced EHF, on the basis of a detailed study of the roentgenograms. Epiphyseal slipping corresponding to roughly one third of the diameter of the femoral head was chosen as the border line between the two groups.

The statistical evaluation of the difference in the percentile deviations in the two groups of end results was based on the formula

$$\sigma = \sqrt{p \times q\left(\frac{1}{n} + \frac{1}{m}\right)}$$

where σ is the standard deviation, p and q the percentages of favorable and unfavorable results, and n and m the number of favorable and unfavorable observations.

Roentgenographic Appearance.

Among the 147 cases followed-up, the disease had at first escaped recognition in 32, or 21.8 %. Of the latter, 22 had been subjected to roentgen examination, but all the roentgenograms had either been misinterpreted and classified as Calvé-Legg-Perthes disease, coxitis or sequelae of rickets (11 cases) or "nothing abnormal" had been found (11 cases). Two of the misinterpretations had been made in an orthopedic hospital and the remaining 20 in general hospitals. In all 32 cases, the disease had grown worse before its true nature was recognized.

Of 179 hips, 102 showed *moderate* and 77 *pronounced* EHF at the time of recognition. The femoral head had slipped backward in 11, backward-downward in 166, downward in one, and outward-upward in one case.

At the follow-up examination, 2.2 % of the 179 hips were, roentgenologically, of type 1 (fig. 2), 25.7 % of type 2 (fig. 3), 34.6 % of

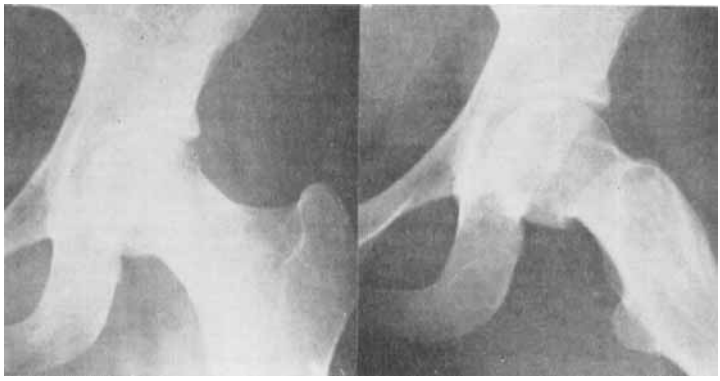

Fig. 2.
Roentgenographic appearance, type 1; left hip[1].

Fig. 3.
Roentgenographic appearance, type 2; left hip[1].

type 3 (fig. 4), 36.8 % of type 4 (fig. 5), and 0.7 % of type 5 (fig. 6), i.e., a considerable majority showed pronounced deviation from the normal anatomic relationship between the head and neck of the femur. Of the cases which had originally revealed *moderate* EHF, 46.7 % were of types 1 and 2, 52.9 % of types 3 and 4, and there was one case of type 5. Of the cases which had originally revealed *pronounced* EHF, 3.9 % were of types 1 and 2, and 96.1 % of types 3 and 4.

Treatment.

Conservative treatment had comprised confinement to bed, physiotherapy, Thomas' splint or other forms of relieving weight-bearing of

[1] For a detailed description of the roentgenograms, see *Oram* (1952) and *Jerre* (1950).

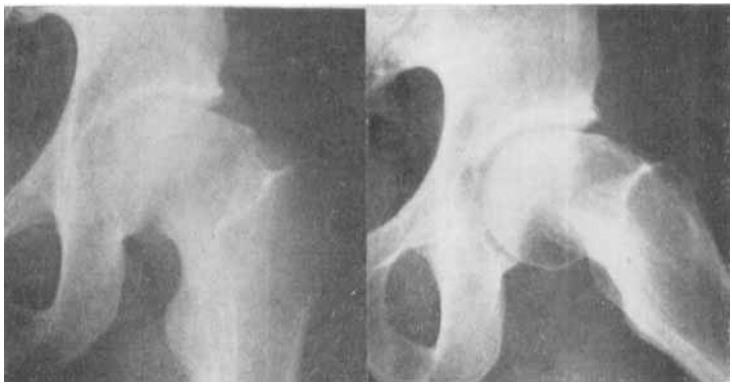

Fig. 4.
Roentgenographic appearance, type 3; left hip[1].

Fig. 5.
Roentgenographic appearance, type 4; left hip[1].

the hip, immobilization in a plaster spica, and skeletal traction. *Operative treatment* had consisted in inforation (multiple drilling), nailing, and osteotomy. Patients who had been treated with closed reduction + plaster spica or skeletal traction (being neither purely conservative nor purely operative) were classified in *a separate group.*

Of the 179 hips, 120 had received primary treatment, i.e., before synosteosis had occurred and immediately after the recognition of the disease, whereas 59 had not received any primary treatment. Some of the latter had been given secondary treatment, i.e., after synosteosis had occurred. Conservative treatment had been employed in 35 %, operative treatment in 45 %, and closed reduction in 20 % of the cases.

[1] For a detailed description of the roentgenograms, see *Oram* (1952) and *Jerre* (1950).

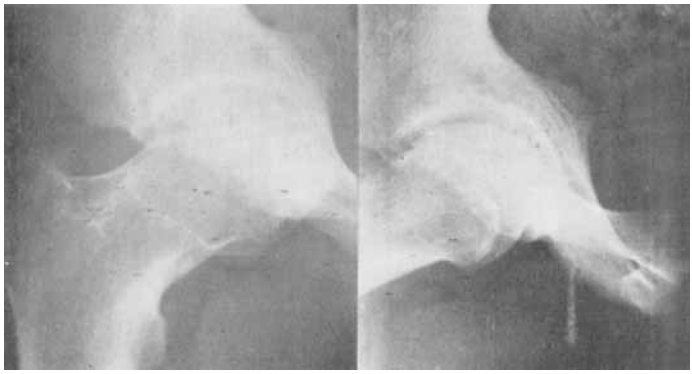

Fig. 6.
Roentgenographic appearance, type 5; right hip[1].

TABLE 2

Showing the number of primarily treated hips, and their classification according to method of treatment and degree of epiphyseal slipping at the institution of treatment.

Primary treatment	Confinement to bed	Plaster spica	Thomas' splint	Skeletal traction	Closed reduction + sk. traction	Closed reduction + pl. spica	Inforation + sk. traction	Closed reduction + inforation	Osteotomy + inforation	Total
Degree of slipping:										
Moderate	14	3	1	4	0	4	44	3	0	73
Pronounced	3	1	0	16	1	19	3	3	1	47
Total	17	4	1	20	1	23	47	6	1	120

1. *Plaster spica.*–Four hips had been immobilized in abduction and internal rotation for 1–5½ months (tables 2 and 4). After the treatment two showed unchanged conditions, and two, increased slipping and partial epiphyseal necrosis. Three hips were later given additional treatment.

2. *Thomas' splint.*–One hip had been treated with Thomas' splint for 18 months (tables 2 and 4). After the treatment the slipping persisted unchanged.

3. *Confinement to bed.*–Seventeen hips had been treated with bed rest for 1–4 months (tables 2 and 4). After the treatment 6 were unchanged, 11 had increased epiphyseal slipping, and 3 partial epiphyseal necrosis. Eleven hips were later given additional treatment.

4. *Skeletal traction.*–Twenty hips had been treated with skeletal traction for 1–3 months (tables 2 and 4). After the treatment 16 were unchanged, 4 had increased

[1] For a detailed description of the roentgenograms, see *Oram* (1952) and *Jerre* (1950).

epiphyseal slipping, and 4 epiphyseal necrosis. Seventeen hips were later given additional treatment.

5. *Closed reduction + skeletal traction.*–One hip had been treated with closed reduction + skeletal traction for 2 months (tables 2 and 4). Owing to increased slipping the treatment was repeated twice without effect 1 month later. Four months after the conclusion of treatment increased slipping and severe epiphyseal necrosis were present. The patient was later given additional treatment.

6. *Closed reduction + plaster spica.*–Twenty-three hips had been treated with closed reduction and immobilization for 1–3 months (tables 2 and 4). After the treatment 13 were unchanged, and 3 showed increased slipping; in one case reduction was complicated by a fracture of the femoral neck and in another by a fracture of the femoral shaft, and epiphyseal necrosis developed in 6 cases. In 6 cases partial reduction was obtained; the upward displacement was diminished, whereas the backward rotation remained unchanged. Epiphyseal necrosis developed in one. Normal anatomic relationship was restored in one. Ten hips were later given additional treatment.

7. *Closed reduction + inforation.*–Six hips were treated with closed reduction and inforation + immobilization or skeletal traction for 1–2 months (tables 2 and 4). After the treatment four showed unchanged conditions and two increased slipping. Epiphyseal necrosis did not develop. One patient was later given additional treatment.

Closed reduction.–Primarily or secondarily, 49 hips were treated with closed reduction by manipulation. Reduction was unsuccessful in 42 cases; partial reduction was obtained in six and complete reduction in one acute case. Partial or complete reduction was obtained only in cases of progressive EHF with acute aggravation. Partial or complete epiphyseal necrosis developed in 10 of the cases in which the reduction was unsuccessful, and in one case after partial anatomic reduction. The risk of epiphyseal necrosis seems to be the same whether reduction is attempted a few days or several months after the onset of symptoms.

8. *Inforation + plaster spica or skeletal traction.*–Forty-seven hips had been treated with inforation + skeletal traction or immobilization for 1–2 months (tables 2 and 4). After the treatment, the degree of slipping was unchanged in 44 and had increased in 3 cases. Epiphyseal necrosis developed in one case. Four hips were later given additional treatment.

9. *Osteotomy + inforation.*–Owing to ankylosis one hip had been treated with osteotomy and inforation + immobilization for 3 months (tables 2 and 4). After the conclusion of the treatment, the slipping and ankylosis were unchanged.

10. *No treatment.*–Fifty-nine hips did not receive any treatment or were treated at a very late stage; in these cases, 1–5 years elapsed before the disease was diagnosed in 63.1 %, 6–15 years in 28.1 %, and 26–42 years in 8.8 %. In 12 bilateral cases, slipping of the untreated hip occurred without accompanying symptoms, and the disease passed unrecognized until the follow-up examination. Conservative treatment was given in 21 cases and operative treatment in 16 cases. Seven of these hips showed epiphyseal necrosis at the institution of the treatment (tables 3 and 4).

End Results.

1. *Epiphyseal slipping and treatment.* After the treatment of 120 hips, the degree of slipping was unchanged in 72.5 %, had increased

TABLE 3

Functional results after primary treatment and no primary treatment, as assessed at the follow-up examination.

	Functional result / Epiphyseal slipping	Group I Mod.	Group I Pron.	Group II Mod.	Group II Pron.	Group III Mod.	Group III Pron.	Total Mod.	Total Pron.	Total
Primary treatment	Unchanged	48	8	7	12	2	10	56	31	87
	Increased	6	2	5	4	4	5	16	10	26
	Diminished	1	3	0	1	0	2	1	6	7
	Number of hips	55	13	12	17	6	17	73	47	120
	Arthritis deformans:									
	Slight	3	4	8	10	1	0	12	14	26
	Severe	0	0	0	3	4	17	4	20	24
	Transitory	4	0	2	2	0	0	6	2	8
	Improved	1	3	2	3	0	1	3	7	10
	Epiphyseal necrosis	1	2	0	3	2	10	3	15	18
	Ankylosis	0	0	0	1	4	12	4	13	17
No primary treatment	Unchanged	8	0	1	0	0	0	9	0	9
	Advanced	11	8	7	15	2	7	20	30	50
	Number of hips	19	8	8	15	2	7	29	30	59
	Arthritis deformans:									
	Slight	3	3	5	8	1	0	9	11	20
	Severe	0	0	1	4	2	7	3	11	14
	Transitory	2	1	1	2	0	0	3	3	6
	Improved	0	1	3	2	0	0	3	3	6
	Epiphyseal necrosis	0	1	0	2	0	5	0	8	8
	Ankylosis	0	0	0	1	2	7	2	8	10

TABLE 4

Degree of epiphyseal slipping in primarily treated and untreated hips.

	Epiphyseal slipping	Unchanged	Increased	Diminished	Total	Epiphyseal necrosis
After primary treatment	Confinement to bed	6	11	0	17	3
	Skeletal traction ...	16	4	0	20	4
	Thomas' splint	1	0	0	1	0
	Plaster spica	2	2	0	4	2
	Closed reduction + skeletal traction ...	0	1	0	1	1
	Closed reduction + plaster spica	13	3	7	23	7
	Inforation	44	3	0	47	1
	Closed reduction + inforation	4	2	0	6	0
	Osteotomy + inforation	1	0	0	1	0
	Number of hips	87	26	7	120	18
	Ankylosis	9	6	2	17	
	Arthritis deformans	30	17	3	50	
	Epiphyseal necrosis	11	6	1	18	
	Transitory or improved arthritis deformans	11	5	2	18	
No primary treatment	Number of hips	9	50	0	59	8
	Ankylosis	0	10	0	10	
	Arthritis deformans	2	32	0	34	
	Epiphyseal necrosis	0	8	0	8	
	Transitory or improved arthritis deformans	2	10	0	12	

in 21.7 % and had diminished in 5.8 % of the cases. In the 59 untreated hips the slipping was slight in only 15.3 % and advanced in 84.7 %. *Thus, aggravation of the slipping is much more prone to occur in untreated than in treated cases* ($8 \times \sigma$) (table 3).

By attempted manipulative reduction and skeletal traction complete or partial reduction was obtained in only 15.9 % of the cases (none after skeletal traction). In spite of this active treatment the slipping increased in 18.2 % and remained unchanged in 65.9 %. After other forms of conservative treatment the slipping increased in 59.1 % and remained unchanged in 40.9 %.

After operative treatment, which in this series had not aimed at replacement of the femoral head, the slipping increased in 9.3 % and

TABLE 5

Relation between functional results and length of observation period.

Epiphyseal slipping	Observation period, in years	Functional result			Total
		Group I	Group II	Group III	
Moderate	3–15	65	15	6	86
	16–37	8	5	1	14
Pronounced	3–15	21	26	8	55
	16–42	0	6	16	22
Number of hips ...		94	52	31	177

remained unchanged in 90.7 %. After inforation, slipping increased only in 6.4 % of the cases (tables 3 and 4).

It is thus evident *that the conservative methods and closed reduction aiming at fixation of the epiphysis were less effective than the operative methods used* ($3.6 \times \sigma$). *Closed reduction proved a partial or complete success only in very few cases.*

2. *Functional result and observation period.* The follow-up examination of 100 hips with *moderate* EHF (slight roentgenologic changes, types 1 and 2) revealed that the functional result was good in 73 %, fair in 20 %, and poor in 7 % of the cases. In cases with a *short* observation period (3–15 years), the functional result was good in 75.6 %, poor in 7 %, and fair in 17.4 % of the cases. In cases with a *long* observation period (16–37 years), the functional result was good in 57.1 %, poor in 7.1 %, and fair in 35.8 % of the cases, i.e., statistically, the number of good ($1.4 \times \sigma$), fair ($1.6 \times \sigma$), and poor results ($0.04 \times \sigma$) were essentially the same whether the observation period was short or long. Thus, it is possible to guarantee that the good functional result seen in the cases with short observation periods will in many instances prove permanent, even after the lapse of many years. Of two hips which had been under observation for only 2 years, one showed a good and the other a poor result.

The follow-up examination of 77 hips with *pronounced* EHF (pronounced roentgenologic changes, types 3, 4, and 5) revealed that the functional result was good in 27.3 %, fair in 41.5 %, and poor in 31.2 % of the cases. In cases with a *short* observation period (3–15 years) function was good in 38.2 %, fair in 47.3 %, and poor in 14.5 % of the cases. In cases with a *long* observation period (16–42 years) none showed good function, whereas the functional result was fair in 27.2 % and poor in 72.8 % of the cases, i.e., statistically, the number of poor results was essentially larger in the cases with long observation periods than in those with short periods of observation ($5 \times \sigma$).

TABLE 6

The functional result in 120 primarily treated hips as assessed at the follow-up examination, compared with the function of 22 untreated hips.

Functional result Epiphyseal slipping	Group I Mod.	Group I Pron.	Group II Mod.	Group II Pron.	Group III Mod.	Group III Pron.	Total Mod.	Total Pron.	Total
Form of treatment:									
Confinement to bed	7	0	5	2	2	1	14	3	17
Plaster spica	1		1		1	1	3	1	4
Thomas' splint	1						1	0	1
Skeletal traction ...	2	3	1	6	1	7	4	16	20
Closed reduction + skeletal traction						1	0	1	1
Closed reduction + plaster spica	3	7	1	5		7	4	19	23
Inforation+skeletal traction or spica ...	39	2	3	1	2		44	3	47
Closed reduction + inforation	2	1	1	2			3	3	6
Osteotomy + inforation				1			0	1	1
Total	55	13	12	17	6	17	73	47	120
Untreated cases	13	3	3	2	0	1	16	6	22

Thus, it seems likely that further impairment of function may be expected in the cases with short observation periods, especially because these cases had severe static disturbances of the hip joint (tables 3 and 5).

From the examination it appears *that good function can be preserved for many years in the majority of cases with permanent moderate EHF, whereas the functional end result in the majority of cases with permanent pronounced EHF will be only fair or even poor.*

3. *Functional result and duration of symptoms.* A follow-up examination of 120 hips with special reference to the relation between the functional result and the duration of symptoms before instituting the treatment gave the following results. Of 73 hips with *moderate* EHF, 64.4 % had had symptoms for 1–6 months and 36.6 % for 7–12 months before treatment was commenced. In the majority of these cases the functional result was good, regardless of the duration of symptoms. *The good functional result was essentially due to operative treatment which had been employed in about two thirds of these cases.* Of 47 hips with *pronounced* EHF, 76.6 % had had symptoms for 1–6 months and 23.4 % for 7–12 months before treatment was instituted. Here there was a larger number of poor functional results, especially

in the group with symptoms of long duration, which must be ascribed to conservative treatment, employed in 65 % of the cases. *Closed reduction* had had been attempted in 20 % of the cases, including 83.3 % of those with pronounced EHF. The result was good in 41.7 % and fair or poor in 58.3 %, i.e., the difference was not significant. The good results were mainly obtained in cases with acute complete EHF, and the majority of these cases had had symptoms for a prolonged period prior to the acute aggravation of the EHF.

Conservative treatment of cases of EHF with symptoms of short duration should be abandoned. Closed reduction should be attempted only in cases of acute complete EHF.

4. *Functional result and treatment.* (*a*) *Primary treatment.* Con*servative* treatment had been given in 22 of 73 hips with *moderate* EHF. The follow-up examination showed that function was good in 11, fair in 7, and poor in 4 of these cases. *Operative* treatment had been employed in 47 hips; here the functional result was good in 41, fair in 4, and poor in 2 cases. *Closed reduction* had been attempted in 4 hips; the result was good in 3 and fair in 1 case. *Conservative* treatment had been adopted in 20 of 47 hips with *pronounced* EHF. The follow-up examination showed that the function was good in 3, fair in 8, and poor in 9 cases. *Operative* treatment had been employed in 7 hips; the result was good in 3 and fair in 4 cases. *Closed reduction* had been attempted in 20 cases; the result was good in 7, fair in 5, and poor in 8 cases (table 6).

Thus, conservative treatment of moderate EHF may give good results, but also a large number of only fair and poor results. Operative treatment resulted in a large majority with good function and none with poor function. Closed reduction resulted in good function in many cases and none with poor function, but the figures are too small to allow any statistically definite conclusions. The results were better after operative than after conservative treatment (3.4 $\times \sigma$), for which reason the former method should be preferred in moderate EHF.

Conservative treatment of pronounced EHF gave poor results, and those obtained by the operative methods employed were not much better (1.9 $\times \sigma$). Closed reduction led to many poor and fair results, which were not significantly better than those following conservative methods (1.1 $\times \sigma$). Conservative treatment should not be used in pronounced EHF. The material does not allow any conclusions to be drawn as to whether operative methods (particularly open reduction) should be preferred in these cases.

(*b*) *Secondary treatment.* Of the primarily treated hips, 47 were later given additional treatment, and 37 hips which had received no

primary treatment were treated after synosteosis had occurred. *Conservative* treatment and *closed reduction* in cases with *moderate* EHF gave a larger number of good results than the cases with *pronounced* EHF ($2.9 \times$), in which poor function was more frequent ($3 \times \sigma$). *Operative* treatment led in many cases only to a fair functional result, and the end results in cases of moderate and pronounced EHF did not reveal any statistical difference ($0.5 \times \sigma$). A comparison between function *before* and *after* secondary treatment showed practically no change for the better ($1.7 \times \sigma$), whether primary treatment had been given or not.

(*c*) *No treatment.* Twenty-two hips had received neither primary nor secondary treatment. The follow-up examination showed that the functional result was good in the majority of the cases with *moderate* EHF but only in one half of those with *pronounced* EHF. Three hips with moderate EHF revealed slight arthritis deformans, and in 4 hips with pronounced EHF slight arthritis deformans was seen in 3 and severe arthritis deformans and ankylosis in 1 case. In about one half of the untreated cases the observation period was more than 15 years, in the other half 5–10 years (table 6). *Despite lack of treatment, hips with moderate EHF may preserve good function for several years, whereas poor function and arthritis deformans may be the result in untreated hips with pronounced EHF.*

5. *Functional result in relation to treatment in a general or orthopedic hospital.* Of the 120 hips which received primary treatment, 72 were treated in orthopedic hospitals and 48 in general hospitals. The functional results from orthopedic hospitals were significantly better than those obtained in general hospitals ($4 \times \sigma$). *Secondary* treatment of 47 previously treated hips was, in the vast majority of cases, given in orthopedic hospitals. The functional result obtained was poor, and compared with the function prior to secondary treatment, practically unimproved. *Patients with acute EHF should be referred to the orthopedic hospitals.*

6. *Functional result, epiphyseal necrosis, and arthritis deformans.* Partial or complete *epiphyseal necrosis* was found in 29 (16.2 %) of the 179 hips, viz., 18 among 120 with primary treatment, 8 among 59 without primary treatment, and 3 following the secondary treatment (closed reduction) of 47 previously treated hips. Epiphyseal necrosis occurred in pronounced EHF seven times as often as in moderate EHF (partial in 26 and complete necrosis in 3 cases), the incidence being 26.6 % after closed reduction, 21.4 % after conservative treatment, and 2.1 % after operative treatment. The functional results were poor in three-fourths of the cases (tables 3 and 4). *Thus, epiphyseal necrosis*

was far more frequent in pronounced than in moderate EHF, and equally frequent in primarily treated and untreated hips (0.3 × σ). The risk of epiphyseal necrosis following conservative methods and closed reduction is greater than after operative treatment (2.9 and 3.3 × σ, respectively). The functional results were so poor that conservative methods and closed reduction should be abandoned.

Arthritis deformans was found in 84 (46.9 %) of the 179 hips, being slight in 46 and severe in 38 cases. It was present in pronounced EHF three times as often as in moderate EHF. In a group of 28 hips with *moderate* EHF, slight arthritis deformans was three times as frequent as severe arthritis deformans. In another group of 56 hips with *pronounced* EHF, severe arthritic changes were slightly more frequent than slight changes. They were more frequent after conservative treatment and closed reduction than after operative treatment (3.8 × σ). In the presence of *severe arthritis deformans* function was poor in three-fourths and fair in one-fourth of the cases, while none showed good function. The observation period was 3–15 years in 52.1 % and 16–42 years in the remaining cases. Hips with *slight arthritis deformans* revealed fair function in more than one half of the cases, poor function in 4.4 %, and good function in the remaining cases. The observation period was 3–15 years in 71.7 % and 16–37 years in the remaining cases. *Transitory arthritis deformans* had been present in 14 hips. At the follow-up examination the arthritic changes had subsided in all cases, and the function was classified as good in one half of the cases and fair in the other half. In most of these cases the observation period was relatively short (about 10 years), for which reason it could not be decided whether the result was permanent or not (tables 3 and 4).

Thus, arthritis deformans showed the highest incidence after pronounced EHF. In moderate EHF slight arthritis deformans was most frequent; in pronounced EHF severe arthritis deformans was slightly more frequent. Arthritis deformans showed a higher incidence after conservative treatment and closed reduction than after operative treatment. Arthritis deformans was equally frequent in untreated cases and those treated with conservative methods and closed reduction. Secondary treatment did not produce any improvement of the arthritis deformans; on the contrary, it resulted in aggravation. Some of the hips with short observation periods showed improvement, but this was not the case with any of those with long observation periods. In most cases, the functional result was only fair or even poor.

Social Prognosis.

At the onset of the disease, 58.8 % of the 147 patients were engaged in agricultural work, 7.5 % were apprentices or housemaids, 32.7 % attended school, and 1.3 % were mental defectives without any occupation.

At the follow-up examination, 21.7 % of the patients were engaged in agricultural work, 56.4 % were skilled and 20.4 % unskilled workers, and 2 patients were mental defectives under public care. Of 113 skilled and unskilled workers in the series, 38 % had sedentary occupations, 46 % had occupations involving much standing or walking, and 16 % were unskilled laborers with hard physical work. Equal numbers of the patients were engaged in handicrafts and commerce, but only a few had entered the professions.

Of the patients, 64 (44.1 %) had had to *change their occupations* on account of the sequelae of the hip lesion; in two-thirds of them the EHF had been classified as pronounced and in one-third as moderate. Among the patients who had had to change their occupations, the majority had been engaged in agricultural work (62.8 %), and some had been apprentices or housemaids (35.4 %), whereas only a few of the patients in whom EHF had been diagnosed before they left school had subsequently had to make a change of occupation (12.5 %), because occupational guidance had been offered to them at the conclusion of the treatment. *After the change of occupation,* three-fourths of the patients were engaged in skilled and one-fourth in unskilled trades. More than three-fourths of the patients showed full working capacity; only 3.2 % were incapacitated, and the remaining patients had reduced capacity for work. Of these 64 patients, 62.5 % had arthritis deformans and 23.4 % ankylosis. *Sequelae of pronounced EHF and arthritis deformans were the most frequent causes of a necessary change of occupation, but in spite of hip deformity, pain and arthritis deformans the working capacity was nevertheless good in the new occupation in most cases.*

Eighty-one patients *made no change of occupation*; in two-thirds of these cases the EHF had been classified as moderate and in one-third as pronounced. Only 6.2 % had reduced capacity for work, whereas the rest were fully able to continue. About one third had arthritis deformans and ankylosis. Of these patients, 44.4 % were employed in skilled and 40 % in unskilled trades, while 15.6 % were engaged in agricultural work. In one half of the patients EHF had been diagnosed before they left school, and at the conclusion of the treatment several of them had been referred to suitable occupations.

This must be realized when taking into account the fact that change of occupation was not required in some patients with pronounced EHF and arthritis deformans in this group. *Thus, slight hip deformity and preserved joint motion allowed most of the patients to continue in their former occupation.*

At the follow-up examination, function was *good* in 50.4 % of the patients (all fully able to work); *fair* in 29.9 % (three-fourths of these fully capable of working, the rest partially or fully incapacitated); and *poor* in 19.7 % (half of these fully able to work, only 3.4 % incapacitated, and the rest with reduced capacity). Most of the patients who were partially or fully incapacitated were cases with pronounced EHF and arthritis deformans. The length of the *observation period* was 3–15 years in 80 % and 16–42 years in 20 % of the cases. *Many of the patients with only fair or poor function had nevertheless been fully able to work for several years.*

If a patient with EHF is to be referred to hard physical work, such as agriculture, the most important requirements are that his hip function is good, and that joint motion is preserved. Socially, it must be considered the best solution if patients with impaired hip function are transferred to a suitable skilled trade, since it will then be possible to preserve full working capasity in the large majority of cases. It is not so fortunate if patients who have to change occupation, due to their hip disease, merely "drift into" some unskilled trade (26.6 %), since this generally means hard physical work unsuited to these patients. *If these patients are referred to work in a suitable skilled trade, their working capacity is likely to be preserved.*

SUMMARY

A follow-up examination of 147 patients with epiphysiolysis of the head of the femur is reported.

In the majority of cases, patients with permanent, moderate EHF preserved good function for many years. There were practically equal numbers of good, fair and poor results, whether the observation period was long or short. The functional end result in patients with permanent pronounced EHF was only fair or even poor in the majority of cases. In this category, poor results were five times as frequent after long, as after short observation periods.

Conservative treatment and closed reduction in *moderate* EHF gave some good results, but there were many cases with only fair or even poor function. Operative treatment led to a large majority of good

results and only very few poor results. Conservative methods and closed reduction should be replaced by operative treatment in moderate EHF. Conservative treatment and closed reduction in *pronounced* EHF led to poor results. The results obtained by operative methods were not much better, but here the figures are too small to allow definite conclusions to be drawn.

Secondary treatment was rather ineffective and did not lead to any improvement of function. Good function may be preserved for many years in untreated hips with moderate EHF, whereas poor function and arthritis deformans may result in untreated hips with pronounced EHF.

A comparison between the results obtained in general and orthopedic hospitals showed that poorer functional results had been achieved in the former, for which reason it is recommended that patients with acute EHF be referred to treatment in orthopedic hospitals.

The risk of increased epiphyseal slipping is greater in untreated than in treated hips. Conservative methods and closed reduction are less effective in attempted fixation of the femoral head than operative treatment. Attempts at closed reduction proved a partial success only in a minority of cases. Partial or complete epiphyseal necrosis was observed both in treated and untreated hips; it was more frequent after moderate EHF and showed a higher incidence after conservative treatment and closed reduction than after operative measures. Arthritis deformans was most frequently observed in pronounced EHF. The risk of arthritis deformans is greater after conservative treatment and closed reduction than after operative treatment. Non-treatment involves the same risk of arthritis deformans as conservative treatment and closed reduction. Some cases of slight arthritis deformans improved in the course of a few years, whereas severe arthritis deformans persisted unchanged, even after many years of observation.

In the majority of cases, the social prognosis is good. Moderate EHF and preserved joint motion allowed most patients to continue in their former occupations, and nearly all of them were fully able to work. Sequelae of pronounced EHF were the most frequent cause of changes of occupation, but in spite of hip deformity, arthritis deformans and pain, most of these patients showed a good standard of efficiency in their new occupations. It was essentially patients with hard physical work (often within the agricultural industry) who had to change occupation; most of these patients took up a skilled trade, which in the majority of cases made it possible for them to preserve their working capacity, but a few went into unskilled labor, which resulted in partial or complete incapacity for work in several cases.

RESUME

Le réexamen de 147 malades atteints d'épiphysiolyse de la tête du fémur est rapporté.

Dans la majorité des cas, les malades souffrant d'épiphysiolyse permanente, modérée de la tête du fémur, ont néanmoins conservé une bonne utilisation fonctionnelle pendant de nombreuses années. On a constaté qu'il y a pratiquement un nombre égal de résultats bons, moyens ou mauvais, que la durée de la période d'observation soit longue ou courte. Le résultat définitif fonctionnel chez les malades souffrant d'épiphysiolyse prononcée de la tête du fémur ont été moyens ou mauvais dans la plupart des cas. Chez cette catégorie de malades, les mauvais résultats étaient cinq fois aussi fréquents après une longue période d'observation.

Le traitement conservateur avec réduction fermée dans les cas *modérés* d'épiphysiolyse a donné quelques bons résultats, mais il y a beaucoup de cas aussi où le résultat fonctionnel est assez médiocre. Le traitement opératoire a donné dans la grande majorité des cas de bons résultats et très peu de mauvais résultats. Le traitement conservateur avec réduction fermée doit être remplacé par le traitement opératoire dans les cas modérés d'épiphysiolyse de la tête du fémur. Dans les cas *prononcés,* le traitement conservateur avec réduction fermée a donné des résultats très piètres. Ceux obtenus par la méthode opératoire n'ont été guère meilleurs, mais les données statistiques sont trop peu importantes pour permettre d'en tirer des conclusion valables.

Le traitement secondaire a été pour ainsi dire inefficace et n'a pas apporté d'amélioration fonctionnelle. Dans les cas d'épiphysiolyse de la tête du fémur, la fonction de la hanche peut se maintenir bonne pendant un certain nombre d'années alors que dans les cas plus avancés, elle devient mauvaise et l'on constate de l'arthrite déformante.

En comparant les résultats obtenus en général à ceux des hôpitaux orthopédiques, on s'aperçoit que dans les formes pour lesquelles il a été recommandé l'hospitalisation aux malades souffrant d'épiphysiolyse aiguë de la tête du fémur, les résultats fonctionnels ont été moins bons.

On risque plus souvent de voir s'accroître le glissement épiphysaire dans les hanches non traitées que dans celles qui sont mises en traitement. Les méthodes de traitement conservateur et la réduction fermée sont moins efficaces quand il s'agit de fixer la tête fémorale que dans le traitement opératoire. Les essais de réduction fermée ont eu un succès partiel dans une minorité seulement des cas. Une nécrose épiphysaire partielle ou complète a été observée aussi bien dans les

hanches soumises au traitement que dans celles qui n'avaient pas été traitées; celle-ci est plus fréquente dans les cas prononcés que dans les cas modérés et son incidence est plus élevée après le traitement conservateur et la réduction fermée qu'après des mesures opératoires. L'arthrite déformante a été observée le plus souvent dans les cas prononcés. On risque plus fréquemment l'arthrite déformante après un traitement conservateur et la réduction fermée qu'après le traitement chirurgical. Par ailleurs, on court le même risque d'arthrite déformante lorsque la maladie n'est pas traitée. Quelques cas d'arthrite déformante légère ont été améliorés en l'espace de quelques années, alors que les cas graves d'arthrite déformante ont persisté sans changement, même après de nombreuses années d'observation.

Dans la majorité des cas le pronostic social est favorable. L'épiphysiolyse modérée de la tête du fémur avec conservation de la mobilité articulaire permet à la plupart des malades de continuer à vaquer à leurs occupations antérieures et presque tous possédaient leur pleine aptitude au travail. Des séquelles d'épiphysiolyse grave de la tête du fémur ont été les obstacles les plus fréquents à la pleine aptitude au travail, mais malgré la déformité de la hanche, l'arthrite déformante et les douleurs la plupart de ces malades avaient un bon rendement dans leur travail. Ce sont notamment les malades ayant un dur travail physique (souvent ceux occupés dans les industries agricoles) qui furent obligés de changer d'occupation; la plupart de ces malades apprirent un métier et la majorité d'entre eux purent garder leur capacité de travail, tandis qu'un certain nombre prirent du travail comme ouvrier non spécialisé, ce qui eut pour résultat une incapacité partielle ou complète au travail dans beaucoup de cas.

ZUSAMMENFASSUNG

Eine Nachuntersuchung von 147 Patienten mit Epiphyseolyse des Femurkopfes wird vorgelegt.

In der Mehrzahl der Fälle bewahrten Patienten mit mässiger Verschiebung eine gute Funktion viele Jahre hindurch. Die Anzahl der guten, mässigen und schlechten Resultate war ungefähr dieselbe, gleichgültig ob die Beobachtungszeit eine kurze oder lange war. Das funktionelle Endresultat bei Patienten mit ständiger ausgesprochener Epiphysenlösung war hingegen nur ein mässig gutes oder ein schlechtes in der Mehrzahl der Fälle. In dieser Kategorie waren die schlechten Ergebnisse fünfmal so häufig nach langer als nach kurzer Beobachtungszeit zu finden.

Konservative Behandlung und unblutige Einrichtung gab in Fällen

von mässiger Epiphysenlösung einige gute Resultate. Meist war das Ergebnis jedoch nur mässig oder sogar schlecht. Operative Behandlung führte zu einer überwiegenden Mehrzahl von guten und nur zu sehr wenigen schlechten Resultaten. Konservative Behandlung und unblutige Einrichtung sollten bei mässiger Verschiebung mit der operativen Behandlung erstattet werden. Konservative und unblutige Behandlung führen bei ausgesprochener Epiphysenlösung zu schlechten Ergebnissen. Die Resultate, welche mit operativen Methoden erzielt wurden, waren nicht viel besser. Diese letzte Gruppe ist jedoch zu klein, um endgültige Schlussfolgerungen zu gestatten.

Sekundärbehandlung war ziemlich unwirksam und ergab keine Verbesserung der Funktion. Gute Funktion kann viele Jahre hindurch in unbehandelten Hüften mit mässiger Epiphyseolyse erhalten bleiben. In unbehandelten Hüften mit ausgesprochener Epiphysenlösung kann hingegen das Ergebnis schlechte Funktion und Arthritis deformans sein.

Ein Vergleich zwischen den in allgemeinen und orthopädischen Krankenhäusern erzielten Resultaten zeigte, dass die schlechteren funktionellen Ergebnisse in den allg. krankenhäusern erhalten wurden. Es wird daher empfohlen, dass Patienten mit akuter Epiphysenlösung zur Behandlung an orthopädische Kliniken über wiesen werden.

Die Gefahr eines zunehmenden Gleitens der Epiphyse ist grösser in unbehandelten als in behandelten Hüften. Konservative Behandlung und unblutige Einrichtung sind weniger wirksam in der Fixierung des Femurkopfes als die operative Behandlung. Der Versuch der unblutigen Einrichtung zeitigte einen teilweisen Erfolg nur in einer Minderheit der Fälle. Eine teilweise oder vollständige Nekrose der Epiphyse wurde sowohl in behandelten als auch in unbehandelten Hüften beobachtet. Sie war häufiger in Fällen von ausgesprochener als in mässiger Epiphysenlösung und ereignete sich öfters nach konservativer und unblutiger als nach operativer Behandlung. Arthritis deformans wurde am haüfigsten bei ausgesprochener Epiphysenlösung beobachtet. Die Gefahr der Arthritis deformans ist grösser nach konservativer Behandlung und unblutiger Einrichtung als nach operativer Behandlung. Keinerlei Behandlung bringt dieselbe Gefahr der Arthritis deformans mit sich, wie konservative und unblutige Behandlung. Einige Fälle leichter Arthritis deformans wiesen Zeichen der Besserung im Verlaufe von einigen Jahren auf, während schwere Arthritis deformans selbst nach einer Beobachtungszeit von vielen Jahren unverändert verblieb.

Die soziale Prognose ist in der Mehrzahl der Fälle gut. Mässige Veränderungen und erhaltene Gelenksfunktion gestattete den meisten

Patienten in ihrer ursprünglichen Beschäftigung fortzufahren und beinahe alle von ihnen waren voll arbeitsfähig. Folgezustände schwerer Epiphysenlösung waren die häufigsten Ursachen einer Veränderung der Beschäftigung, aber trotz Hüftdeformität, Arthritis deformans und Schmerzen zeigten die meisten dieser Patienten eine gute Leistungsfähigkeit in ihrer Beschäftigung. Es waren wesentlich Schwerarbeiter (haüfig in der Landwirtschaft), die eine andere Beschäftigung aufnehmen mussten. Die Mehrzahl dieser Patienten ging zu einer Facharbeit über, die es ihnen ermöglichte, ihre Arbeitsfähigkeit aufrecht zu erhalten, während einige wenige ungelernte Arbeit aufnahmen. Dies führte in einigen Fällen zu teilweiser oder vollständiger Arbeitsunfähigkeit.

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