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THE INCIDENCE OF SLIPPED CAPITAL FEMORAL EPIPHYSIS

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Paré (1572) describes separation of the upper femoral epiphysis in this manner: "Likewise the epiphysis of the head of this bone sometimes gets loose and separates so that the surgeon is misled, estimating that there is a dislocation and not a separation of the epiphysis of the bone in question. Here the young surgeon shall notice that the epiphyses of the bones often get loose and separate due to inner or outer causes: outer sometimes by the fault of the surgeon, who manipulates the tender bones of the small children too rudely, or by falling or other causes . . . : inner caused by certain fluids which have been floating and rotting in the joint as seen in pox and small-pox or by not variolar fluids."

Although it has thus long been clear that there can be different causes of epiphyseal separations in the femur, it is often impossible to maintain the distinction.

This paper therefore deals with slipping epiphyses of the femur, irrespective of aetiology.

REVIEW OF LITERATURE

Howorth (1966) in an excellent survey has penetrated the literature in the field of slipping epiphysis of the hip, but did not present a material.

Ferguson & Howorth (1931), *Brogden* (1935), *McAusland* (1935), *Scott* (1936), *Lütken* (1947), *Badgley, Isaacson, Wolgamot & Miller* (1948), *Ponseti & Barta* (1948), *Heyman* (1949), *Jerre* (1950), *Rüther* (1954) found the proportion of males to vary from 47.4 per cent to 83.3 per cent in materials of 32-423 cases. In the larger materials the

proportion was 65-80 per cent and the significance of the male preponderance is thus verified.

The authors mentioned above have found the left hip to be engaged in 56.0-66.7 per cent of unilateral cases.

The number of bilateral involvement of the hips varies very much in different materials, and seems to depend on how well the patients have been examined on both sides. *Jerre* (1950) states that his series of 166 patients gives a more reliable picture of the sex distribution and of the frequency of left- and rightsided cases respectively than previous series. In his series 23 per cent were bilateral. *Billing & Severin* (1959) on the other hand with an advanced roentgenological technique found that the disease was bilateral in 80 per cent of their series of 63 cases. Recent slipping was observed in 29 per cent. *Klein, Joplin, Reidy & Hanelin* (1953) in their early cases had 20 per cent engagement on the contralateral hip, but after meticulous re-checking of the roentgenograms they found the number to be doubled.

The term "pre-slipping stage" is condemned by *Watson-Jones* (1944), *Jerre, Klein et al., Billing et al.*

Waldenström (1939) found the most common age of the first symptoms in boys to be 12-16 years, in girls 10-14 years. This is in accordance with the findings of *Klein et al. Jerre* on the other hand states that the mean age for boys is as high as 16.0 ± 0.1 years and for girls 13.5 ± 0.5 years. *Billing & Severin* (1959) compared the time of the initial symptoms with the time when the Y cartilage ossified and found it to be within a period of three years when the skeletal age was considered and during the same period in both boys and girls.

The incidence of slipping is seldom given by former authors, as these cases are often referred from other hospitals in large districts where it is impossible to determine whether all cases have been dealt with or not.

Waldenström found 30 cases of epiphyseolysis of the hip in all surgical and orthopaedic departments in Sweden 1932. There were 100674 patients totally in these departments, thus the frequency was 0.3 per cent.

The prognosis as to full movement in the hip was formerly considered severe and the results published often contained cases with necrosis of the head of the femur (*Camitz* (1929), *Waldenström* (1939), *Wolf* (1947)).

Since the introduction of nailing of the epiphysis by *Wilson* (1938) the outcome has been much better and *Severin* (1954) who introduced

the use of the slender Nyström nail had neither secondary slipping nor epiphyseal necrosis in his series.

Both *Wiberg* (1941) and *Billing & Severin* (1959) state, that nailing across the epiphyseal cartilage does not cause the zone to close earlier than otherwise.

MATERIAL

In Gothenburg, a city on the western coast of Sweden, capital epiphyseal separations of the femur are treated only in two hospitals: The Orthopaedic Clinic of Sahlgren's Hospital and the Department of Paediatric Surgery, Children's Hospital. The latter clinic treats patients only to the age of 15 (inclusive) and cases of seemingly obviously traumatic origin have been treated there in the first place. The other cases have been treated at the Orthopaedic Clinic.

The period studied, 1947-66 (inclusive), included 81 patients, 33 of whom had been treated at the Department of Paediatric Surgery and 48 at the Orthopaedic Clinic. All those patients who have been sent from hospitals outside Gothenburg have been excluded from this series.

30 patients had right-sided, 33 had left-sided and 18 had bilateral slipping of the epiphysis.

The age- and sex distribution is clear from Figure 1.

The material includes one boy only 3 years old. He was struck by a steam-roller and the trauma was thus unusually severe.

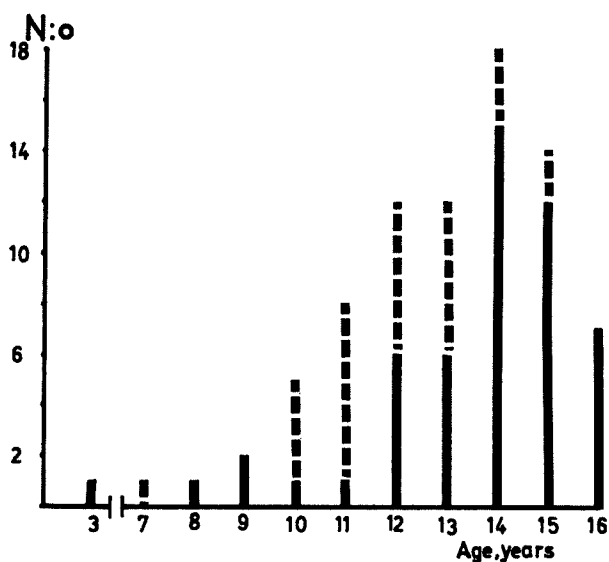


Figure 1. Age and sex distribution of 81 cases of slipped capital epiphysis.

Age at first admittance is recorded.

Girls: Interrupted column. Boys: Solid column.

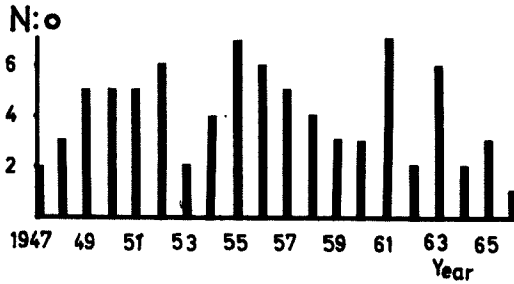


Figure 2. The frequency of slipped capital femoral epiphysis in Gothenburg 1947-66.

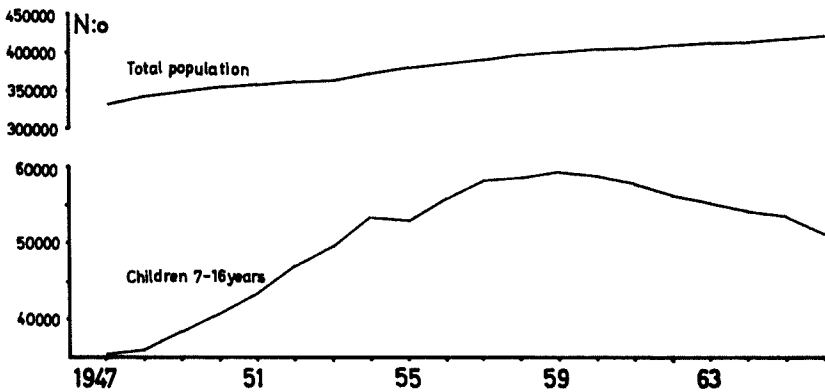


Figure 3. Number of all inhabitants and of children (7-16 years) in Gothenburg 1947-66.

The most common age at which the first symptom appeared was 12-15 years, but occasionally younger patients occurred.

There were 53 boys and 28 girls.

The girls were generally affected earlier, their mean age being 11.8 years, whereas the boys' was 13.5 years, and the mean age of both sexes was 12.8 years. The frequency was low, varying between 1 and 7 cases annually in the city, see Figure 2.

The population of the city has increased from 333272 to 424473 inhabitants during the period investigated. The number of births varied between 14.6 and 19.6 per 1000 of the mean population.

Although the total population has increased, the number of children in the age-group concerned (7-16 years old) had decreased, especially during the last 7 years of the period investigated, see Figure 3.

If the frequency is compared to the number of children in the age-group of 7-16 years, the incidence is obtained, see Figure 4.

The incidence is decreasing significantly, both if studied as a regression or if divided in 5-year periods. The mean annual frequency 1947-51 was 1.03/10000, 1952-56: 0.96/10000, 1957-61: 0.76/10000 and 1962-66: 0.52/10000 of the population of 7-16 years.

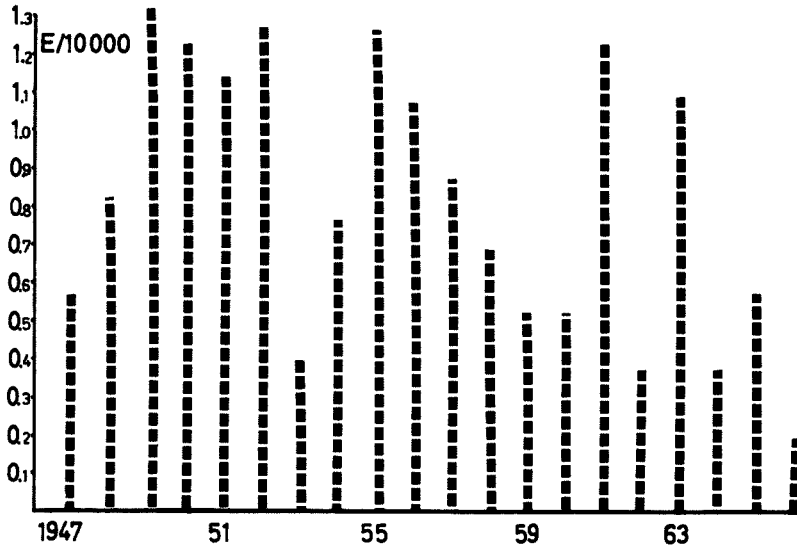


Figure 4. Proportion of epiphyseolyses/10000 of population 7-16 years old.

As this is a total investigation, the diminishing tendency in the incidence of slipping capital epiphysis in Gothenburg can be stated as true.

If, however, one wants to study the matter in view of calculation of probability and significance, the numbers of population can be regarded as samples from hypothetical, infinitely large populations.

If the four 5-year groups of mean annual incidence are regarded successively as "true" and if each one is compared to the following one, this question can be raised: Is the following observed number of incidence so much lower than the preceding one that the sample can not be regarded as drawn out of the same population, from which the "true" value had emanated?

See Table 1, where the differences have been studied by means of one-sided Poisson-tests. The line of significance has been drawn at the 5 per cent level.

The incidence has thus decreased especially during the last 5-year period.

Table 1. Difference in frequency in parts of the period studied.

Difference in frequency between the periods 1947-51 and 1952-56:	Not significant.
1947-56 and 1957-61:	Not significant.
1957-61 and 1962-66:	Significant.
1947-56 and 1957-66:	Significant.
1947-61 and 1962-66:	Significant.

DISCUSSION

The distribution of the sexes in epiphyseolysis of the hip is in accordance with the specifications in the literature. As to the age at onset,

there are differences. The high mean age in Jerre's material is mentioned above. It contains a few patients with an astonishingly high age: up to 24 years, which may explain this high mean age. These findings are not in accordance with the closure of the epiphyseal line given by *Ruckensteiner* (1931), which is 18 years for males and 17 for females. Nor is this high age in accordance with *Billings et al.* findings about the ossification of the Y-cartilage. It is thus unlikely that all of Jerre's cases have had their age registered at onset of the symptoms.

The preponderance of the left side in one-sided cases in this material is in accordance with other materials.

This can be explained by the higher ash weights in bones from the right than from the left extremities found by *Virtama* (1960). A relationship between the strength of bone and its mineral or ash content has been demonstrated by *Vose & Kubala* (1959). *Alffram* (1964), in fractures of the neck of the femur also found the left side to be affected more often than the right one. Left-sided injuries are also more common in elbow fractures, irrespective of the side of dominance (*Henrikson* 1966).

The incidence of capital epiphyseal separations in the femur can be calculated from Waldenström's figures, as the total population in Sweden at the time of his investigation was 6 142 000. His 30 cases were thus 0.05/10000 of the population or about 0.5/10000 children in the corresponding age-group.

Jerre's cases are collected from three hospitals, one in each of three cities in the southern part of Sweden. The total population, according to official statistics in the cities at the end of his investigation was 305662 inhabitants. With the same type of calculation it gives 0.5 cases annually/10000 of the children in the corresponding age-group.

As the hospitals mentioned treat patients from the countryside around the cities, the population is greater and the incidence correspondingly smaller. Nevertheless the figure is not so far from the one in my own material. In Jerre's investigation, the number of cases was increasing in the later years, which he explains as being due to the fact that people formerly did not seek medical advice so often as they do nowadays. An improved diagnosis also among non-specialists and a more frequent consultation with orthopaedic surgeons may also have contributed.

As these factors ought to be valid also in Gothenburg, it is very astonishing, that the incidence is decreasing, for, as stated above, no other hospitals cater to these patients. The traumatic injuries such as

fractures of the elbow have increased significantly in Gothenburg both in absolute and in relative numbers in the same region (*Henrikson 1966*).

A possible explanation is the higher standard of living in the later years with better food for the children.

SUMMARY

Out of a population during the period 1947-66 increasing from 333272 to 424473 in Gothenburg, the children in the age-group 7-16 years amounted to 11-15 per cent and of these 1-7 annually had slipping epiphysis of the hip, totally 81 cases.

Bilateral slipping occurred in 18, right-sided in 30 and left-sided in 33 cases. Boys were preponderant: 53 out of the 81 cases.

The mean age at first symptom was in boys 13.5 years, in girls 11.8 years and in both sexes together 12.8 years.

The incidence varied between 0.2 and 1.3 cases annually/10000 of the population in the corresponding age-group and showed a significant decrease, especially during the last 5-year period, possibly because of better living-conditions.

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