Perthes’ disease after the age of twelve years

ROLE OF THE REMAINING GROWTH

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In order to define the prognostic factors in Perthes’ disease in children older than 12 years, we reviewed 15 patients at the end of growth who were aged 12.1 to 14 years at presentation. The patients with the worst long-term prognosis (Stulberg class V) were compared with the others for age, skeletal maturity and remaining growth (Oxford method), as well as Catterall and Waldenström classifications at presentation. A significant difference (p = 0.001) was found for remaining growth (25% in Stulberg class V and 35% in the others) and also for the results at the end of growth when the remaining growth was over 30%, since this allowed sufficient time for reformation and remodelling of the femoral head.

Our aim in this retrospective study was to define any significant prognostic factors in patients who develop Perthes’ disease after the age of 12 years.

Patients and Methods

We reviewed the charts of 15 children who had been treated for Perthes’ disease and were aged 12 years or older at diagnosis, had an open capital femoral growth plate on radiographs at presentation, documented follow-up until after skeletal maturity, and the availability of complete clinical and radiological data.

The patients were classified, using the radiographs obtained at presentation, according to the Waldenström and Catterall classifications. Skeletal maturity was assessed on the normal hip and pelvis using the Oxford method. The remaining growth was expressed as a percentage of complete skeletal maturation. Special attention was given to the time of closure of the capital femoral growth plate. The time between diagnosis and the first radiograph showing closure of the growth plate was recorded. Classification of the end-result was made using the latest radiograph available after skeletal maturity by the method of Stulberg, Cooperman and Wallensten. Patients with the worst long-term prognosis (Stulberg class V) were compared with the others for age, Catterall and Waldenström classifications at presentation, remaining growth potential, and the time between presentation and closure of the capital femoral growth plate. The Mann-Whitney U test for small populations (<10) was used for statistical analysis.

All the patients were boys. There was no bilateral involvement. Details of the patients are shown in Table I. The mean age at presentation was 13.4 years (12.70 to 14.00; median 13 years). Ten patients were within ±2 SD of skeletal maturity; the remaining five were all above the third SD. The mean remaining growth was 30% (20 to 44; median 31). Ten cases were classified as Catterall group III and five as Catterall group IV. All patients were at an early radiological stage of the disease. The radiographs of the three patients classified as Waldenström period B showed only mild fragmentation.

A variety of treatments was used including conservative non-weight-bearing management in four patients, femoral...
osteotomy in nine, a shelf procedure in one, and a pelvic osteotomy in one. All the operations were carried out before closure of the capital femoral growth plate which occurred at a mean of 13.6 months (3 to 69; median 15) after diagnosis.

**Results**

After skeletal maturity, two patients were classified as Stulberg class II, two as Stulberg class III, three as Stulberg class IV, and eight as Stulberg class V. Comparing the Stulberg grade-V patients with the others no significant difference could be detected for Catterall grade, Waldenström periods or age at diagnosis. A statistically significant difference was found, however, for the remaining percentage of growth (Mann-Whitney U test, p = 0.001), and the time between diagnosis and closure of the capital femoral growth plate (Mann-Whitney U test, p = 0.0006).

The mean percentage of growth remaining was 25% in the Stulberg class V and 35% for all the others (Fig. 1). All the patients in Stulberg class V developed closure of the capital femoral growth plate within 12 months of follow-up.

**Discussion**

The prognosis for Perthes’ disease occurring in late childhood and adolescence is usually reported as poor. This seems to be due to the lack of potential for reformation and remodelling of both the femoral head and the acetabulum. The only paper in the English literature which focuses on the outcome of Perthes’ disease after the age of 13 years, by Ippolito et al., points out that remodelling is still possible, even in the last few months preceding closure of the growth plate, but no prognostic factor was clearly demonstrated in their study.

We found that there was a significant difference in the result at the end of growth when the remaining growth was over 30%, as determined by the Oxford method. This appears to be enough to allow reformation and remodelling of the femoral head. At the beginning of the phase of reformation, the course of the hips in this age group was similar to that in younger patients. In all patients in Stulberg class V this similarity ceased at the end of growth, or rather when the capital femoral growth plate closed. In all these patients, collapse occurred in the central part of the femoral head leading to a flat non-congruent head and what had started as Perthes’ disease and progressed to the reformation phase, finished as an adult necrosis of the femoral head, with closure of the growth plate being the determining factor. On the other hand, in all the other patients, skeletal maturity was reached when at least two-thirds of the femoral head had remodeled.

Our study shows that chronological age is not a reliable prognostic factor since it can differ from bone age. Ippolito
et al.\(^2\) also point out that, in some patients, a good result can be obtained despite the older age of the patient.

We found two factors to be valuable in determining the prognosis of Perthes’ disease after the age of 12 years, namely, the time remaining until closure of the capital femoral growth plate and the percentage of growth remaining as estimated by the Oxford method. The former can only be judged retrospectively and is therefore not helpful in establishing a prognosis at the time of presentation. The percentage of remaining growth can, however, easily be estimated from the radiograph at presentation. When it is less than 30% which corresponds to a closed acetabular growth plate, the prognosis is poor and the short time left for reformation and remodelling will result in a Stulberg class-V hip. When it is more than 30%, correct management of this condition can lead to a Stulberg class-IV or better result at the end of growth, with a much improved prognosis in the long term.

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References

7. Mann HB, Whitney DR. On a test of whether one or two random variables is stochastically larger than the other. Ann Math Statist 1947;18:52-4.