

PERTHES' DISEASE — A LONG TERM FOLLOW-UP

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PERTHES' disease is a condition affecting children's hips in which the upper femoral epiphysis apparently becomes avascular and then revascularises over the next few years.

We have undertaken a long term follow-up of patients with Perthes' disease to assess the outcome of the disease process over a long period of time with regard to the clinical condition of the hip. Most of the recent studies lay stress on the radiological assessment of the diseased hip reviewed over a relatively short period of time with little mention of the clinical condition of the hip with regard to pain, stiffness or function.

Because major decisions regarding the form of treatment are made on information gained from these relatively short term follow-up reviews, we felt that it was important to assess the long term clinical result of the hip, treated conservatively, in order to try to understand the natural history of the disease process so that a valid judgement could be made on more recent methods of treatment.

The age at onset of the disease process, the sex of the child, the Catterall¹ grading and the amount of lateral extrusion of the femoral head from the acetabulum in the early stages of the disease were studied.

METHOD

The clinical records of all patients diagnosed as having Perthes' disease of the femoral head prior to 1955 were reviewed at the Shriners Hospital in Montreal and Musgrave Park Hospital in Belfast. An attempt was made to review all those with a complete set of original x-rays and notes. All those patients who could be traced were examined by one or other of the authors and an x-ray of the hip joints taken at follow-up. Thirty-four patients with original x-rays were available for follow-up. Three patients had bilateral disease. This made a total of 37 hips available for study. The follow-up ranged from 23 to 48 years with an average follow-up of 32 years.

Twenty-two patients had been treated in a hip spica without abduction of the hips. Nine patients had been treated on a Jones abduction frame followed by a weight-relieving caliper and three were treated on bed rest alone. It was difficult to be specific about the length of time the different methods of treatment were applied because of the poor quality of the notes available.

The Harris² hip evaluation system was used to assess the hip joints at long term follow-up. The Harris system is based on clinical assessment only. This system

assesses pain, function capacity, range of motion and deformity of the hip joint. With regard to pain, 44 points are awarded if the joint is pain free, going down to 0 points if pain is crippling, confining the patient to bed. Perfect function in the hip is awarded 47 points with restricted function receiving less points. A full range of motion receives 5 points and absence of deformity 4 points, the points becoming less if restriction of motion or deformity is present. Based on these variables, a points scale with maximum 100 points is used:-

Pain	44 points
Function	47 ,,
Range of motion	5 ,,
Absence of deformity	4 ,,
TOTAL	100 points

Thus, a normal hip will receive 100 points while a painful hip with poor function capacity which is deformed and with a limited range of motion will have a low score.

We considered a score of 90 or above to be a satisfactory result and less than 90 to be unsatisfactory.

RESULTS

By the Harris hip evaluation system, 24 hips were found to be satisfactory and 13 to be unsatisfactory, according to our definition at long term follow-up.

With regard to the age at onset of the disease process, it was clearly shown that the younger the child at onset, the better was the long term result. As the age at onset increased, the number of satisfactory results fell, as shown in Table I.

TABLE I
Age of onset and results

<i>Age at onset</i>	<i>Results</i>	
6 years and under	10 Satisfactory	91 per cent
	1 Unsatisfactory	9 per cent
7 and 8 years	10 Satisfactory	66 per cent
	5 Unsatisfactory	33 per cent
9 years and over	4 Satisfactory	36 per cent
	7 Unsatisfactory	64 per cent

There were five female children in our series. Three (60 per cent) had an unsatisfactory result. Even though the numbers are small, this agrees with the other reports — Kelly³ states that female children do less well than boys. The age at onset did not appear to modify the outcome.

An independent observer (R.A.M.B.), interested in Perthes' Disease, graded the original x-rays according to the Catterall classification. Because of the poor quality of the x-rays after many years storage and because lateral views were often not adequate, it was not possible to grade all the cases. Six hips could not be classified,

leaving 31 hips graded. The long term results in each of the Catterall grades are shown in Table II.

TABLE II
Catterall grade and result

<i>Catterall grade</i>	<i>Long term result</i>	
1	Satisfactory	4 (57 per cent)
	Unsatisfactory	3
2	Satisfactory	5 (83 per cent)
	Unsatisfactory	1
3	Satisfactory	9 (75 per cent)
	Unsatisfactory	3
4	Satisfactory	3 (50 per cent)
	Unsatisfactory	3

The ages of onset and outcome are shown in the different Catterall grades in Table III.

TABLE III
Grade, age of onset and outcome

<i>Catterall grade</i>	<i>Age at onset</i>	
1	Satisfactory	4, 4, 6, 9
	Unsatisfactory	7, 9, 12
2	Satisfactory	4, 5, 7, 7, 9
	Unsatisfactory	7
3	Satisfactory	5, 5, 6, 7, 7, 7, 8, 9, 9
	Unsatisfactory	7, 10, 10
4	Satisfactory	5, 5, 8
	Unsatisfactory	7, 7, 9

Our results show that the long term follow-up result did not correlate well with that predicted from the Catterall classification. However, because of the poor quality of the x-rays, it was not possible to confirm or deny the usefulness of the Catterall grading as a prognostic indicator in Perthes' disease.

An attempt was made to correlate the degree of extrusion of the femoral head on the early x-rays in our series with the final result. In order to quantify the extrusion of the femoral head, the length of the epiphyseal line lying lateral to the vertical line of Perkins was measured and expressed as a percentage of the total length of the epiphyseal line. This measurement was termed the extrusion index. The extrusion indices of 64 normal hip joints in children aged between 4 and 8 years was measured to find the normal range and none had an extrusion index greater than 20 per cent. In contrast, 28 per cent in the series had an extrusion index greater than 20 per cent (Table IV).

When Fisher's exact probability test was applied to the extrusion index of the normal group, compared to the extrusion index of the diseased hips there was found to be a significant increase in the extrusion index of the diseased hips with $P = < 0.001$. Of the nine with an extrusion index over 20 per cent, only one had an unsatisfactory result. This compares with 8 unsatisfactory hips with the index under 20 per cent. The one unsatisfactory case with an index over 20 per cent was a nine year old.

TABLE IV

Extrusion indices of normal hips in children aged 4 to 8 years show with extrusion indices of hips with Perthes' disease under study

<i>Extrusion index</i>	<i>Normal hips</i>	<i>Perthes' hips</i>
0—10 per cent	47	8
10—20 per cent	17	13
more than 20 per cent	0	9 (28 per cent)

DISCUSSION

Several long term studies on Perthes' disease of the hip have laid stress on the shape of the head radiologically. In this study, a clinical assessment of the hip was made at long term follow-up and quantified using the Harris hip evaluation scale.

The age at onset was shown to be a most important factor when the prognosis of Perthes' disease is considered. Young children aged six years and below tend to have a good clinical result well into the fourth decade. As the age at onset increases, the number of children with a good clinical result decreases and those nine years and above at age of onset had only 36 per cent doing well. This prognostic factor of the age of onset agrees with Ratliff's⁴ work. As the younger children tend to do well irrespective of the method of treatment, perhaps a more conservative approach should be considered in this group.

The number of female children in this study was small, being only 5. These cases did less well compared to their male counterparts but this would have been expected from their age at onset. Kelly and Catterall also showed in their series that female children tend to have a poor prognosis.

The initial x-rays were graded according to the Catterall classification. It was difficult to be accurate in the classification because of the poor quality of the x-rays and the often inadequate lateral x-rays. The results predicted from the Catterall grading did not correspond to the long term clinical findings. When considering the accuracy of the Catterall grading, others have shown considerable observer variation, even with satisfactory x-rays (Hardcastle⁵). We are unable to confirm or deny the usefulness of the Catterall grading as a prognostic indicator.

The extrusion of the femoral head from the acetabulum was expressed numerically as the extrusion index, as previously described. Lateral extrusion is a "head at risk" sign and is thought to indicate a poor long term result. Salter⁶ proposes that, with the loss of containment of the femoral head, pressure from the edge of the acetabulum will cause abnormal pressure on the femoral head that will lead to progressive deformity. In this series, nine hips had an extrusion index of

more than 20 per cent. The extrusion indices of the hips with Perthes' disease was significantly increased when compared to the extrusion indices of the normal hips studied as shown by Fisher's exact probability test.

Different authors have proposed different methods of achieving containment in order to try to improve the long term results but there appears to be little uniformity in the amount of containment achieved by these different methods.^{6, 7, 8, 9, 10, 11, 12} Petrie⁸ recommends 45° abduction when treating patients conservatively in his brace. The femoral osteotomy recommended by Somerville and others¹¹ achieves approximately 20° increase in varus angulation. We were surprised to find from our series that the hips with high extrusion indices did not do as badly as recent literature would lead us to believe.¹³ The ages of onset of the children with very high extrusion indices were equally spread over the different age groups and only one child with a late age of onset had a bad result.

As the long term result in these severely extruded hips was not as bad as expected, careful consideration must be given before surgical containment is decided upon as extrusion of the head may not be such a bad prognostic indicator as thought at present.

SUMMARY

Thirty-four patients suffering from Perthes' disease in thirty-seven hips were reviewed over a three year period. Follow-up time was thirty-two years on average. Initial x-rays were reviewed and assessed according to Catterall's classification. Hips at review were assessed according to the Harris hip rating method. Twenty-two hips were considered satisfactory — i.e. with a Harris rating of 90 or above. Fifteen hips were considered unsatisfactory. As the age of onset increased, so did the chance of a satisfactory hip decrease. Females fared less well than males. Catterall's classification was not found to be a useful prognostic indicator. The degree of extrusion of the femoral head on the early x-rays bore no relationship to the final clinical state. Age alone is the best prognostic indicator of the clinical state of hips affected by Perthes' disease at least to the fourth decade.

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