LONG-TERM ANALYSIS OF A CONSERVATIVE APPROACH IN LEGG-CALVÉ-PERTHES DISEASE

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SUMMARY

The objective of this study is the long-term analysis of patients with Legg-Calvé-Perthes disease who were treated using a conservative approach. Forty-three patients (forty-nine hips at disease's active phase) were analyzed for x-ray imaging according to Catterall and Herring et al. criteria by the time of diagnosis and according to Mose and Stulberg methods by skeletal maturity phase, and, clinically, according to the Larson's criteria or IOWA scale. The average follow-up was 19 years. Patients were divided into two groups: group I, where load was allowed, and group II, in which ambulation was restricted. By the analysis of results achieved according to IOWA scale, there was no statistically significant difference between both groups. Among the employed methods for the active phase of the disease, x-ray classification according to criteria by Herring et al. was the one mostly in accordance with the outcomes seen in Stulberg et al. classification. The authors conclude that the outcomes evaluated by IOWA scale are not correlated to the severity of the disease or to the x-ray evaluation in skeletal maturity phase.

Keywords: *Legg-Perthes disease; Follow-up studies; Treatment outcomes*

INTRODUCTION

In 1910, Legg, Calvé and Perthes described almost simultaneously the major features of a disease, which was, by that time, confused with hip tuberculosis. The disease is described as a self-limiting disorder affecting the hip, and is characterized by total or partial aseptic necrosis of the femoral head, yielded by blood supply interruption, followed by subchondral fracture, revascularization and bone repair[1]. A concept exists that the Perthes disease is caused by numerous episodes of blood supply reduction at the proximal femoral epiphysis, leading to alternate periods of osteonecrosis and repair. However, the etiology and physiopathology of the disease remain unclear, despite of reports providing with important contributions. Waldenström, in 1930, described in details its pathogenic behavior and created a classification based on progression stages. He reported, with an accuracy that remains updated, the necrosis phase, followed by fragmentation of the affected bony block, and subsequent reossification. He did not consider, however, the influence of treatment, although having concluded about its prognosis[2,3].

The Catterall's classification[4] is the most known and used one, and it is based on the extension of the femoral head's affected area, subdividing the patients into four groups. Catterall has also noted that patients in groups I and II presented with a good prognosis and evolved well, even without treatment, while children in groups III and IV should be treated, because they were likely to have a bad prognosis. Herring et al.[5], described a classification based on the femoral head's lateral pillar height during fragmentation stage. The degree of lateral pillar's affection would indicate a better or worse prognosis, implying in the need to treat it or not intending the restraint of the femoral head in the acetabulum.

There are basically two classifications for previewing a prognosis after treatment. Mose's classification[6] proposes the evaluation of femoral head's roundness upon concentric circles. And the classification by Stulberg et al.[7], which uses x-ray studies for evaluation, describes the joint congruency in patients with a mature skeleton, both trying to provide a prognosis of a hip that may eventually evolve to osteoarthrosis in the future.

The objective of this study is the analysis of the long-term results achieved in patients with the Perthes' disease being conservatively treated at the initial phase of the onset of symptoms.

CASE SERIES AND METHODS

The research design was approved by the Committees on Medical Ethics of the Instituto Affonso Ferreira, in Campinas (SP), and Central Hospital of the Irmandade da Santa Casa de Misericórdia de São Paulo. An informed consent term about the study and its objectives was given to all patients and/or families enrolled in the study. Inclusion criteria adopted for patient's participation in the study were as follows: comprehensive medical files regarding patient's x-ray and clinical data, follow-up longer than 10 years after the disease onset, and mature skeleton at the moment of reassessment.

One hundred thirty seven patients were invited by telephone and telegram to reassessment, being subdivided into two groups. In group I, those patients followed-up without restraining treatment

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Received in: 11/09/04; approved in: 07/08/05

and load restraint, allowed irrespectively to disease's phase were included, with clinical treatment being recommended with rest in bed and traction, in severe limitations of the range of motion. Surgical treatment for restraint was indicated by the presence of signs of "head at risk"[8,9]. In group II, treatment was provided with load restraint during the active phase of the disease, necrosis and/or fragmentation, alternating periods of 6 weeks with plastered immobilization in abduction and inward rotation, followed by plaster removal for two or three weeks - intending a gain in the range of motion - but load was not allowed yet. Treatment was discontinued at the early reossification phase, according to clinical and x-ray tests, in accordance to the criteria by Thompson and Westin[10].

Twenty three patients from group I came for reassessment, totaling 26 affected hips. The mean follow-up time was 19.5 years, ranging from 10 to 33 years. The incidence on right side occurred in 20 hips, and on the left side, in 6, being 19 males and four females. The mean age at the moment of diagnosis was 6.5 years old, ranging from four to nine years old (Table 1).

Twenty patients from group II came for reassessment (23 affected hips). The mean follow-up time was 18.5 years, ranging from 16 to 22 years. The mean age at the moment of diagnosis was seven years old, ranging from four to 11 years old. Right side incidence occurred in 16 hips, and the left side was affected in 7, with 16 males and four females in group II (Table 2).

METHODS

Method of treatment during active phase of the disease

In group I, the patients were followed-up without treatment, allowing load release and, if they presented any clinical signs of joint irritability an/or defense attitude with muscle contraction or a loss in the range of motion, they were hospitalized and submitted to traction until achieving clinical improvement of pain. Then, they performed active and passive exercises for gaining range of motion. By the moment pain was improved, load was again allowed, regardless of the anatomicopathological phase of the disease at the time. If patients presented signs of "head at risk", especially to joint subdislocation, they would be submitted to surgery for femoroacetabular restraint, or to varusing femoral osteotomy or to Salter-type reorientation of acetabular ceiling. From group I, 16 have not been submitted to additional treatment but rest and eventual traction, four patients were submitted to surgery during the active period of the disease, with three being submitted to varusing subtrochanteric osteotomy at 6 years old, and one patient, at 5 years old, was submitted to acetabular reorientation osteotomy employing the Salter's technique. Two other patients were submitted to surgical treatment after the disease was cured, one of them at 13 years old, in whom the major trochanter lowering was performed, and the other, at 23 years old, was submitted to resection of an osteochondral fragment at the right hip joint (Figure 1). Up to the moment of this evaluation, no patients were submitted to arthroplasty.

In group II, 23 affected hips of 20 patients were included. All of them had been previously treated by longitudinal cutaneous traction in bed, followed by gradual abduction until muscle relaxing and reduction of the contraction of adductors and resulting centration of the femoral head at the acetabulum. After that, lower limbs were immobilized with plastered tubes, keeping hips in abduction and medial rotation, associating broom sticks between tubes (Figure 2).

The desired abduction was around 30 degrees, and the inward rotation spontaneously permitted by the child, without analgesia. At hospital discharge, parents were recommended to not allow load for six weeks. When they returned, the plaster was removed and the lower limbs were released for two or three weeks for range of motion gain, but careful guidelines were given as to not impose load to the affected lower limb. Clinical and x-ray tests were performed at the moment of return. This cycle was repeated until they were able to recover joint motion, and as soon as lateral column reossification occurred, which was characterized by the disappearance of x-ray signs of necrosis areas at the load zone of the hip, released for gait and followed up in an outpatient basis, according to the criteria of the early discontinued treatment by Thompson and Westin[10] (Figures 3 and 4). In this group of patients, five were submitted to tenotomy of adductor tendons prior to plaster placement. After the active phase of the disease, or at mature-skeleton phase, five patients were submitted to valgusing osteotomy between 12 and 22 years old. There was no patient submitted to arthroplasty up

GROUP I	AGE	CURRENT AGE	FOLLOW-UP	SIDE	GENDER	TREATMENTS/ SURGERIES
1	8	26	18	R	MALE	NO TREATMENT
2	7	22	15	R	MALE	ORTHOSIS WITH LOAD RELEASE
3	6	23	17	R	MALE	NO TREATMENT
4	5	30	25	R	FEMALE	SALTER'S OSTEOTOMY
5	4	19	15	R	MALE	LOWERING OF THE GREAT TROCHANTER AT 13 YEARS OLD
6	7	38	31	R	MALE	VARUSING OSTEOTOMY
7	6	39	33	R	MALE	INTRA-ARTICULAR FRAGMENT RESECTION AT 13 YEARS OLD
	6	39	33	L	MALE	NO TREATMENT
8	4	16	12	R	FEMALE	NO TREATMENT
9	9	20	11	R	MALE	NO TREATMENT
10	8	41	33	L	MALE	NO TREATMENT
11	5	22	17	R	MALE	VARUSING OSTEOTOMY
	5	22	17	L	MALE	NO TREATMENT
12	5	20	15	R	MALE	TRACTION, REST AND SPRING
13	7	22	15	R	MALE	NO TREATMENT
14	8	18	10	R	MALE	NO TREATMENT
15	7	26	19	R	MALE	NO TREATMENT
16	7	26	19	R	MALE	NO TREATMENT
	7	26	19	L	MALE	NO TREATMENT
17	4	20	16	R	MALE	NO TREATMENT
18	7	22	15	R	FEMALE	NO TREATMENT
19	9	27	18	R	MALE	NO TREATMENT
20	6	21	15	R	MALE	NO TREATMENT
21	9	42	33	R	MALE	NO TREATMENT
22	7	26	19	R	MALE	TRACTION, REST AND SPRING
23	6	25	19	L	MALE	VARUSING OSTEOTOMY

Source: Medical Files Service, Instituto Affonso Ferreira.

Table 1 - *List of patients from group I, describing age at diagnosis, current age, follow-up time, affected side, patient's gender, and treatment employed.*

to the moment of this evaluation.

After the analysis of patients from group I and II, the outcomes for those not submitted to surgery were separated, building a third group (group III). Among the 43 patients with 49 hips affected by the disease, 34 patients were separated (38 hips) who had not been submitted to bone surgery during the active phase of the disease and during the post-cure period. The only procedure some of these patients have been submitted to was the tenotomy of adductors associated to broom stick-type plaster placement.

GROUP II	AGE	CURRENT AGE	FOLLOW-UP	SIDE	GENDER	SURGERIES
1	4	25	21	R	Male	
2	11	27	16	L	Male	Valgusing osteotomy at 12 years old
3	5	21	16	R	Male	
4	8	28	20	R	Male	
5	7	30	23	R	Male	Valgusing osteotomy at 17 years old
6	7	26	19	R	Female	
	7	26	19	L	Female	
7	6	26	20	R	Female	Adductors tenotomy at 6 years old
8	10	32	22	L	Female	Valgusing osteotomy at 22 years old
9	6	19	13	R	Male	
	6	19	13	L	Male	
10	5	26	21	R	Male	Valgusing osteotomy at 20 years old (pseudoarthrosis)
11	7	26	19	R	Male	Valgusing osteotomy at 13 years old
12	5	23	18	R	Male	
	5	23	18	L	Male	
13	5	23	18	R	Male	
14	10	28	18	R	Male	Adductors tenotomy at 10 years old
15	10	28	18	R	Male	
16	5	24	19	R	Female	
17	10	29	19	R	Male	Adductors tenotomy at 10 years old
18	7	27	20	R	Male	Adductors tenotomy at 7 years old
19	8	27	19	L	Male	
20	7	26	19	L	Male	Adductors tenotomy at 8 years old

Source: SAME: Medical and Statistical Files Service, Santa Casa de São Paulo

Table 2 - *List of patients from group II, describing age at diagnosis, current age, follow-up time, affected side, patient's gender, and treatment employed.*

Clinical evaluation method

In the updated evaluation, a questionnaire according to the criteria of the Iowa scale, described by Larson, in 1963[11] was applied, which consists of a number of questions to be answered by the patient him/herself and to be complemented by clinical test, being then submitted to a grade, in a scale ranging from zero to 100 scores. From these 100 scores, 35 are designed to assess function, 35 to pain presence, 10 scores for gait, 10 scores for the absence or presence of clinical deformities, and 10 scores for range of motion.

X-ray evaluation methods

During the active phase of the disease, patients were classified according to the criteria by Catterall[4] and by Herring et al.[5], which are based on the degree of femoral affection. For prognosis evaluation, the criteria by Mose[6] and by Stulberg et al[7]., which may be applied during the residual (or sequel) phase to the anatomical-radiographic relationship between the reossified femoral head and the acetabular coverage.

Statistical analysis method

The statistical test used for checking for a significant difference between the IOWA scores in both groups assessed was the non-parametric Wilcoxon's test, because, as noticed in the results of the exploratory analysis, the distribution of normal probability does not adjust to data. All statistical analyses were performed using the statistic software R-Package, of public domain.

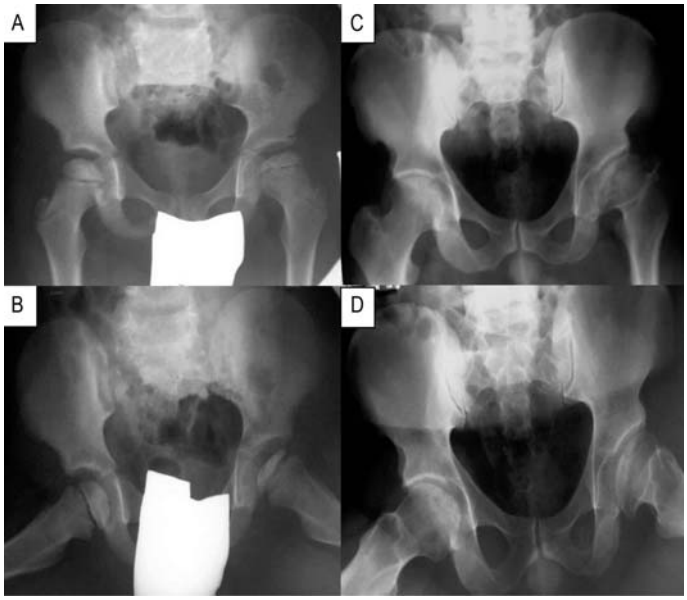

Figure 1. A and B - *Patient in active phase of Legg-Calvé-Perthes' disease, at 7 years old. C and D- After 31 years of follow-up.*

RESULTS

According to Catterall's classification, the outcomes for group I were 30.00%; for group II, 40.00%; for group III, 30.00%; for groups IV and II, 0%; group I, 30.00%; group II, 61.00%; group III and 9.00% group IV. According to Herring's classification, in group I, 34.00% of the group A, 35.00% of group B, and 31.00% of group C, and; in group II, 30.00% of group A, 57.00% of group B, and 13.00% of group C. There was a higher agreement in cases classified as Herring's group C, with the lowest scores according to the IOWA scale. Group I presented, according to the criteria by Stulberg, 23.00% in class 1, 30.00% in class, 2,27% in class 3, 12% in class 4, and 8.00% in class 5. And, for group II, 31.00% in class 1, 30.00% in class 2, 21% in class 3, 18% in class 4, and 0% in class 5. According to the criteria by Mose, in group I there were 15.00% of spherical-type hips, 43.00% pathologic spherical, and 42.00% not spherical. In

group II there was 30.00% of the spherical type, 53.00% pathologic spherical, and 17.00% not spherical (Table 3).

According to Iowa's scale, the average for group I was 90.54 and for group II, it was 88.78. Due to the fact that data regarding Iowa's scores in both groups had not a normal distribution, the Wilcoxon's non-parametric test aiming to test if those groups are different from each other in terms of average values was used. The Wilcoxon's test value, W = 298, with a freedom degree of f.d. = 23, is an evidence that there is no difference between the averages for the groups, being accepted the null hypothesis. The null hypothesis, Nh = difference between averages is equal to zero. It was concluded, thus, that both groups are not different in terms of significance levels, =0.05 and =0.01 (Tables 4 and 5).

Figure 2 - *Patient immobilized with a broom stick*

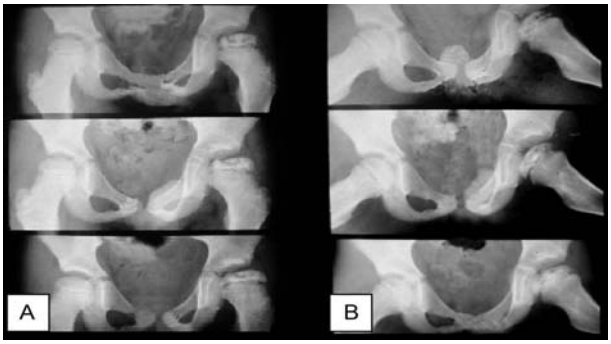

Figure 3. A - *Patient at disease's fragmentation phase. B - Evolving with reossification of the lateral column characterized by the necrosis area disappearing from x-ray image.*

DISCUSSION

The treatment for Legg-Calvé-Perthes' disease remains as a major challenge for researchers. Weinstein[12], after performing a meta-analysis, reported that the objective of treatment is to evaluate the extension to which the femoral head is affected and how to possibly keep it centralized within the acetabulum, thus preventing the development of cephalic deformity. He also reported that there is no consensus regarding the method to be used, regardless if conservative or surgical. Authors such as Pike[13], Harrison and Menon[14], Brotherton and Mckibbin[15], and Thompson and Westin[10], advocate the load release restraint during necrosis and fragmentation phase. The maintenance of affected femoral head and joint motion restraint constitute the basis for treatment. Patients in pain and with motion loss should be submitted to procedures aiming to relax muscle and cease joint irritating phenomena, such as cutaneous traction and/ or rest in bed, until clinical picture is improved.

When we assess the results found in group III, formed by patients treated by a conservative approach only, and we compare them with the results described by Harrison and Menon[14], and Thompson and Westin[10], we note the existence of similar percentages of good and bad results, even when considering that each study has used a different method for clinical evaluation. Among the 35 patients constituting group III, with 15 patients receiving no kind of treatment and 19 for whom load was allowed during the necrosis or fragmentation phase, the mean score as per Iowa scale was 91.6. About 75% of the patients presented with a subtle restraint of motion, but this did not preclude normal daily activities, with a slight worsening after physical work, while for others, sports could be practiced with little, if any, restraint.

Figure 4 - *Patient from Figure 6, after 20 years of follow-up.*

Kelly et al.[8], observed that children, in the early phases of the disease, classified in Catterall's groups 3 and 4, should be treated with femoral head restraining methods, and children with less cephalic involvement can be followed up in an outpatient basis, allowing for the total release of load. Muirhead-Allwood and Catterall[16], noticed that patients with signs of "head at risk" and classified in Catterall's group 4 presented better outcomes when surgical restraint was early indicated.

The most frequently employed techniques, when surgical treatment for restraining femoral head is indicated, are the femoral varusing osteotomy and the supra-acetabular osteotomy for acetabular ceiling reorientation. Sponseler et al.[17], made a comparative analysis of the results achieved in patients submitted to femoral varusing osteotomy and to supra-acetabular osteotomy and noticed no statistical difference regarding the outcomes, although noting that the patients submitted to supra-acetabular osteotomy presented with less shortening, and Wiberg's center-edge and cervical-diaphyseal angles closer to normal. They found an average of 96 scores in IOWA scale, both for patients treated by pelvic osteotomy and femoral osteotomy, after a mean follow-up time of nine years. Leitch et al.[18], assessed three different methods: patients conservatively treated in different manners, patients treated with varusing proximal femoral osteotomy, and patients treated with Salter-type supra-acetabular osteotomy (1961). They reported that the length discrepancy and the joint-trochanteric distance are important factors and should also be assessed in the final results of treatment, just as femoral head roundness. In that study, the best results were seen in patients submitted to supra-acetabular osteotomy. In the present study, we found four patients from group I submitted to Salter's surgery (1961) during the active phase of the disease, this number being too small to be statistically compared to other publications' results. The scores achieved in the IOWA scale, among these patients, range from 87 to 100, with an average of 92.2 scores after a mean follow-up time of 23 years, ranging from 17 to 31 years.

GROUP I	AGE AT DIAG	CURRENT AGE	FOLLOW-UP	SIDE	GENDER	CATTERALL	MOSE	HERRING	STULBERG	IOWA
1	8	26	18	R	Male	3	Path Spher	A	Class 1	95
2	7	22	15	R	Male	2	Path Spher	A	Class 2	97
3	6	23	17	R	Male	3	Path Spher	B	Class 3	93
4	5	30	25	R	Female	3	Path Spher	B	Class 1	100
5	4	19	15	R	Male	4	Path Spher	B	Class 4	91
6	7	38	31	R	Male	3	Path Spher	B	Class 3	93
7	6	39	33	R	Male	3	Spher	A	Class 1	93
	6	39	33	L	Male	4	Non-Spher	C	Class 3	74
8	4	16	12	R	Female	3	Path Spher	B	Class 2	100
9	9	20	11	R	Male	3	Non-Spher	B	Class 3	88
10	8	41	33	L	Male	4	Non-Spher	C	Class 4	88
11	5	22	17	R	Male	4	Non-Spher	C	Class 3	87
	5	22	17	L	Male	4	Non-Spher	C	Class 3	93
12	5	20	15	R	Male	4	Path Spher	B	Class 2	90
13	7	22	15	R	Male	2	Spher	A	Class 1	93
14	8	18	10	R	Male	3	Non-Spher	B	Class 2	93
15	7	26	19	R	Male	4	Path Spher	C	Class 4	91
	7	26	19	L	Male	4	Path Spher	C	Class 5	93
16	4	20	16	R	Male	3	Path Spher	C	Class 2	90
17	7	22	15	R	Female	2	Path Spher	A	Class 2	87
18	9	27	18	R	Male	2	Non-Spher	A	Class 2	87
19	6	21	15	R	Male	3	Non-Spher	B	Class 3	92
20	6	20	14	L	Female	2	Path Spher	A	Class 1	100
21	9	42	33	R	Male	2	Path Spher	A	Class 1	93
22	7	26	19	R	Male	3	Non-Spher	B	Class 5	64
23	6	25	19	L	Male	4	Non-Spher	C	Class 3	89
GROUP II	**AGE AT DIAG**	**CURRENT AGE**	**FOLLOW-UP**	**SIDE**	**GENDER**	**CATTERALL**	**MOSE**	**HERRING**	**STULBERG**	**IOWA**
1	4	25	21	R	Male	2	Spher	A	Class 1	100
2	11	27	16	L	Male	4	Non-Spher	C	Class 2	60
3	5	21	16	R	Male	2	Path Spher	A	Class 2	82
4	8	28	20	R	Male	2	Spher	A	Class 1	100
5	7	30	23	R	Male	3	Path Spher	B	Class 3	87
6	7	26	19	R	Female	3	Path Spher	B	Class 2	93
	7	26	19	L	Female	2	Spher	B	Class 1	93
7	6	26	20	R	Female	3	Non-Spher	B	Class 4	84
8	10	32	22	L	Female	3	Path Spher	B	Class 4	55
9	6	19	13	R	Male	3	Path Spher	B	Class 1	100
	6	19	13	L	Male	2	Spher	A	Class 2	100
10	5	26	21	R	Male	3	Path Spher	B	Class 3	67
11	7	26	19	R	Male	3	Path Spher	C	Class 3	91
12	5	23	18	R	Male	2	Spherical	A	Class 1	100
	5	23	18	L	Male	3	Path Spher	B	Class 2	97
13	5	23	18	R	Male	2	Spherical	A	Class 1	100
14	10	28	18	R	Male	3	Path Spher	B	Class 4	88
15	10	28	18	R	Male	4	Non-Spher	C	Class 5	87
16	5	24	19	R	Female	3	Path Spher	B	Class 1	97
17	10	29	19	R	Male	3	Non-Spher	B	Class 3	84
18	7	27	20	R	Male	3	Spherical	A	Class 2	93
19	8	27	19	L	Male	3	Path Spher	B	Class 2	97
20	7	26	19	L	Male	3	Path Spher	B	Class 3	87

Source: SAME: Medical and Statistical Files Service, Santa Casa de São Paulo

Table 3 - *Distribution of patients from groups I and II, according to age at diagnosis and current age*

We saw that the majority of the patients comprised in group III, treated by a conservative approach only, presented, at physical examination, signs of medium gluteus failure, certainly due to a functional varus thigh, patent in the residual phase of the disease. These data are opposite to the observations by Sponseler et al.[17], in which only 4% of operated patients presented the Trendelenburg's sign. Those patients have been submitted to supra-acetabular osteotomy, and the authors concluded that if surgery for restraint is performed at the early phase of the disease, thigh-femoral varusing is precluded, as well as the resultant medium gluteus failure.

In our opinion, an additional challenge to the lack of knowledge about the etiopathogenesis and the best treatment approach for this disease is to obtain a classification that could be reproducible and could correlate with the prognosis in each specific case, being this fact crucial for providing a treatment that could be closer to optimal.

With the aim of studying the inherent severity in each hip and of assessing the prognostic value among the different kinds of classifications, the criteria by Catterall[4] and by Herring et al.[5] were used in the present study during the active phase of the disease, and the classifications by Mose[6] and Stulberg et al.[7] were used and the IOWA scale were employed after the phase of skeletal maturity. Evaluations were performed by a single researcher, and no statistical analysis was performed upon the agreement of classifications used during the active phase of the disease with the clinical and x-ray methods employed on the updated re-assessment. However, patients' complaints were compared to the results seen at the classification by Stulberg et al.[7]. After clinical evaluation according to the criteria by IOWA scale, we found 53% of the patients presenting minor complaints and practicing some kind of sports with little, if any, restraint. Those patients were classified as Stulberg's class 1 and 2. In the 27% of the patients classified as Stulberg's class 3, we found some limitation, but that did not interfere in daily activities, although worsened upon physical work. And 20% of the patients classified as Stulberg's classes 4 and 5 corresponded to those with the worst clinical outcomes. We noticed, thus, that in 80% of the assessed patients, results are good and satisfactory, and the best correlation is established between assessments made at skeletal maturity and the long-term clinical outcomes.

Among the methods used during the active phase of the disease, the x-ray classification according to the criteria by Herring et al.[5] was seemingly the one presenting the highest agreement with the results seen in the classification by Stulberg et al[7]. The method by Mose[6] presented a good correlation with the IOWA method in the most severe cases, although, surprisingly, some patients with non-spherical femoral heads presented excellent

clinical results according to the scale. Maybe this is due to the fact that, although not spherical, those heads presented a very good congruency to the corresponding acetabulum, or even that a follow-up time below 20 years is still insufficient to evidence signs of joint degeneration.

McAndrew and Weinstein[20] reassessed patients with the Perthes' disease after a mean follow-up time of 47.7 years. Patients have been affected between 1920 and 1940 and were assessed according to the Iowa scale and as per whether total arthroplasty was required or not. They verified that only 40% of the patients presented a good hip function, achieving more than 80 scores in the Iowa scale, with no need of total arthroplasty. On the other hand, 50% of all patients reassessed by the age of 60, already presented severe hip arthrosis. Weinstein[12], noticed that after 15 to 20 years, with any kind of treatment, the majority of the patients - from 70% to 90% - were active, painless and presenting a good range of motion in the affected hip. However, 40 years after treatment, this percentage dropped to 40% to 50% of good results and 50% of patients presenting severe hip osteoarthrosis. In the present study, the results found in patients from group I and II, after an approximate average of 30 years of follow-up, were similar to those found by Weinstein[12], potentially showing that the results of many hips deteriorate with a longer follow-up time.

Values	Scorelowa1	Scorelowa2
Minimum	64.00	55.00
1st quartile	88.25	85.50
Median	92.50	93.00
Mean	90.54	88.78
3rd quartile	93.00	98.50
Maximum	100.00	100.00
Standard Deviation	7.52	12.72
Samples Number	26	23

Table 4 - *Statistical summary of assessed data*

	Scorelowa1	Scorelowa2
Degrees of Freedom	25	22
Estimated Variance	56.50	161.90

Null Hypothesis: quotient between variances is equal to zero.
Alternative Hypothesis: quotient between variances is different from 1.
Significant F Test for = 0.05
Null hypothesis is rejected
F value calculated among groups – F = 0.349

Table 5 - *F Test for assessing if variances between both groups are different*

Patients from group III were selected upon the criterion of not presenting any sign of "head at risk" or not requiring surgical treatment during the disease or post-cure period. As opposite to expectations, those patients presented various forms and degrees of affection and not only mild degrees of the disease, so that we found 20 to 25% of patients classified as group C according to Herring et al.[5] and as groups 3 and 4 according to Catterall[4]. At endpoint evaluation, if assessing outcomes only, we found the same percentage of satisfactory results as in the sample as a whole, and they are also comparable to what is seen in literature. On the other hand, those data may indicate that classifications do not present trustworthiness in estimating prognosis, and that x-ray signs used at the active phase of the disease - theoretically also indicating predictive signs of progression - are not trustful or absolute indicatives for evaluating the prognosis and treatment for Legg-Calvé-Perthes' disease yet. By comparing it to the method by Stulberg et al.[7], it was seen that many cases classified as class 4 or 5 - theoretically with worse prognosis - present scores above 85 at the IOWA scale. Values above 80 scores in this scale are predictors of good or excellent results, which are not correlated to the expectations for classes 4 and 5 of Stulberg et al.[7], because they constitute results with joint incongruence and should present greater limitation and worse clinical outcomes. Thus, the IOWA scale using subjective aspects of the questionnaire comprised in the answers of the patients and applying values also questionable on investigated topics scores, definitely, does not seem to be the best method for evaluating the results of a given treatment for Perthes' disease.

Patient's age at the onset of the disease has shown to be a very important factor for prognosis. Patients younger than 4-5 years old seldom progress badly. As opposite, patients older than 9 years old seldom progress well. There are authors reporting that patients with the worst outcomes are those whose disease onset occurred when they were older than 9 years old, while the best outcomes are those achieved in children whose disease onset occurred when they were younger than 6 years old, probably due to the increased ability of bone remodeling in younger patients[12]. In our study, there was no patient older than 9 years in group I, while in group II five patients were between 10 and 11 years old at the onset of the disease. The average of the scores in the IOWA scale obtained from these patients presenting the disease above ten years old was 74.8, ranging from 55 to 88. In this small subgroup, composed of five patients, three of them progressed regarding the IOWA scale scores, although presenting the disease when older than 10 years old, to 84, 87, and 88 scores. We can see, therefore, that an older age at the onset of the disease is an important prognostic predictive factor, but, if taken separately, cannot be established as an unchangeable paradigm of a bad evolution.

By analyzing our results, we can conclude that the evaluation of the degree of femoral head affection associated to the age of the patient at disease onset, and not the load release or restraint, characterized a sign or trend of correlation with the disease prognosis. In the present study, the mean follow-up time for both groups was 19 years after the onset of the disease, and, for group I, the IOWA scale average score was 90.53, while for group II, it was 88.78. According to the statistical analysis, data obtained from IOWA scale scores do not represent a significant difference among the assessed groups. It is worthy to emphasize that the results are similar to those found in other studies with a long follow-up time, analyzing different kinds of treatment. When focusing the analysis of the results achieved in patients not requiring surgery to date, which were included in group III, still the average scoring in the IOWA scale remained within the variability range found in groups I and II, reaching 91.6 scores.

CONCLUSIONS

Whereas data obtained from the scores in the IOWA scale, there was no significant difference in the statistical analysis among the averages of both groups of patients conservatively treated by different methods.

The application of the IOWA scale did not present correlation with the severity of affection, showing that a method for clinical and x-ray evaluation should be further investigated so it could be more trustworthy and applicable in sequels of the Legg-Calvé-Perthes' disease.

ACKNOWLEDGEMENT

We acknowledge the Publication Support Nucleus, of the Medical Sciences College, Santa Casa de São Paulo – NAP-SC for the technical-scientific support to the publication of this manuscript.

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