metadata, citation and similar papers at core.ac.uk
brought to you by
provided by Repositório Institucional U

INVETERATE DYSPLASIC HIP – A SURGICAL TREATMENT

EIFFEL T. DOBASHI[1], ROBINSON TOSHIMITSU KIYOHARA[2], MARCELO MITSURO MATSUDA[2], CARLO MILANI[3], SÉRGIO SATOSHI KUWAJIMA[4], AKIRA ISHIDA[5]

SUMMARY

We assessed 50 patients (57 hips) with Hip development Inveterate Dysplasia, divided into 2 groups, according to treatments applied. Group A was constituted of 20 patients (24 hips), 2 males and 18 females, with mean age = 65.92m in which preoperative traction was employed for 2-4 weeks, when a bloody reduction, a Salter or Chiari osteotomy and a shortening and rotating-varusing intertrochanteric osteotomy were performed. Group B was formed by 30 patients (33 hips), 1 male and 29 females, with mean age = 52.88m. In those, a diaphyseal femoral osteotomy for shortening, bloody reduction, and Salter or Chiari osteotomy were performed. For X-ray evaluation, the following were analyzed: the Wiberg angle, avascular necrosis; femoral head roundness; discrepancy between lower limbs. For clinical evaluation purposes, we assessed: pain, Trendelenburg, neurological test and range of motion. Clinically, we observed 14 (58.33%) good outcomes and 10 (41.67%) fair outcomes for Group A, and 23 (69.70%) good and 10 (30.30%) fair outcomes for Group B. On X-Ray, outcomes were regarded as good in 9 (37.50%), fair in 5 (20.83%) and bad in 10 (41.67%) for Group A, and good in 23 (69.70%), fair in 5 (15.15%), and bad in 5 (15.15%) patients of Group B. After a statistical analysis, we found better outcomes in Group B.

Keywords: *Hip Dislocation, Congenital; Osteotomy; Radiograph*

INTRODUCTION

Reestablishing anatomical and stability relations of the hip is essential when treatment of Hip Development Dysplasia (HDD) is intended. It is known that, in these conditions, the hip, if not treated, will evolve to a progressive deterioration in its joint structure until an osteoarthritis is established, which, irrefutably, will compromise its function.

Regarding inveterate HDD treatment, there are some authors advocating the use of a bloodless therapy, on the basis of an occurrence of a remodeling of the joints surface in a dislocated hip after its reduction. Those who are favorable to surgical treatment claim that previously established anatomical changes in children above 18 months will not be able to recover their normality condition, unless a bloody reduction and acetabulum reorientation are performed. Regarding this query, when we probed literature in orthopaedics, we are faced with broadly variable surgical techniques strictly following the principles that rule them.

Preoperative traction is used intending to simplify reduction maneuver, from soft tissues stretching, mobilizing femoral epiphysis at caudal direction [1,2].

Nevertheless, we found authors advocating the use of femoral shortening surgeries intending to minimize necrosis rates of femoral proximal epiphysis, showing good outcomes with the application of those adjuvant procedures [3-6]. Furthermore, femoral osteotomies enable, when necessary, a concomitant correction of valgusing and rotation.

Iliac osteotomies combined to surgical process provide an additional stabilization and enough to bloody reduction thereby preventing re-dislocation and promoting an appropriate hip development [1,3,6].

The Salter[7] acetabuloplasty is the one most widely used as treatment adjuvant [1,8-11]. Its principle is to redirect the dysplasic cotyle by rotation, at the level of pubic symphysis, of the osteotomized distal portion of the iliac. Biomechanically, this corrects the acetabulum by fully redirecting it, allowing for joint anterior and lateral surfaces to take adequate positions and directions to give support to body weight [7,12].

Therefore, by trends evidenced in literature showing good outcomes with the combination of femoral shortening with many tectoplasties [4,9,10,11], this study was aimed to evaluate - both clinically and by means of X-ray images - the hips of 50 patients submitted to surgical treatment, with lately diagnosed HDD for systematization of a surgical methodology that could provide the best outcomes towards this complex illness.

MATERIALS AND METHODS

Initially, this study design was submitted to the evaluation of the Committee of Medical Ethics in Research in our institution, under registration number 485/98, and with approval for execution.

Our study is constituted of 57 hips of 50 patients with inveterate HDD who were submitted to surgical treatment in a period between February 1985 and September 1997. These were

Study conducted by the Discipline of Pediatric Orthopaedics, Department of Orthopaedics and Traumatology, Federal University of São Paulo, Medical School of São Paulo.

Correspondences to: Rua Borges Lagoa, 783 – 5º andar – Vila Clementino – CEP: 04038-032 – São Paulo – SP – e-mail: dobashi@uol.com.br

1. PhD in Sciences, Assistant to the Discipline of Pediatric Orthopaedics at DOT/UNIFESP-EPM.
2. Resident, 3rd year. DOT/ UNIFESP-EPM.
3. Associate Professor, Coordinator of Post-Graduation program in Orthopaedics and Traumatology, UNIFESP- EPM.
4. PhD in Sciences, Discipline of Pediatric Orthopaedics at DOT/UNIFESP-EPM.
5. Associate Professor, Head of the Discipline of Pediatric Orthopaedics at DOT/UNIFESP-EPM.

Received in: 04/26/06; approved in: 05/05/06

divided into two different groups, named A and B, considering surgical methodology applied.

Twenty-four hips of 20 patients operated between February 1985 and March 1993 (Table 1) were included in group A, and in group B, 33 hips of 30 patients submitted to surgical treatment performed between November 1992 and September 1997 (Table 2) were included. In this group, two (10.00%) patients were males and 18 (90.00%) were females. At the time of surgery, ages ranged from 35 months to 191 months (average = 65.92 months). Regarding race, 14 were Caucasians and 6 were non-Caucasians. Regarding compromising, we observed 15 (75.00%) patients with unilateral disease and 5 (25.00%) bilateral cases, 10 (41.67%) right sided and 14 (58.33%) left sided.

In group B, 1 (3.33%) patient was male and 29 (96.67%) were females, whose ages ranged from 20 months to 148 months at the time of surgery (average = 52.88 months). Regarding ethnicity, 23 were Caucasians and 7 were non-Caucasians. We observed 25 patients with unilateral disease (83.33%) and 5 bilateral cases (16.67%), with 14 (42.42%) right sided and 19 (57.58%) left sided.

We quantified the degree of dislocation on affected hip, according to the methodology selected by us, using the precepts of Zionts and MacEwen[13]. Thus, in group A, we observed 4 (16.66%) grade I dislocations, 7 (29.17%) grade II, and13 (54.17%) grade III. In group B, we had 5 (15.15%) grade I dislocations, 5 (15.15%) grade II, and 23 (69.70%) grade III.

	X-ray Parameters			
Classification	Necrosis	WIBERG's angle	MOSE's rings	Discrepancy
GOOD	0 – I	NL	0 mm	< 20 mm
FAIR	II – III	NL or Dysplasic	0 – 2 mm	20 – 30 mm
BAD	III - IV	Dysplasic or Dislocated	> 2 mm	> 30 mm

Chart 1 – *X-ray classification of results according to the evaluation of avascular necrosis rates; measurement, in degrees, of WIBERG's angle (1939); roundness verified by application of MOSE's concentric rings (1971); and discrepancy between lower limbs, measured in millimeters.*

	Clinical Parameters						
Functional Evaluation	PAIN	FL	ABD	IR	OR	MUSCULAR STRENGTH	Trendelenburg
GOOD	Absent	>90º	> 20º	> 20º	> 40º	Grade 4 or 5	Negative
FAIR	Absent	60º-90º	10º-20º	10º-20º	20º-40º	Grade 3 or 4	Positive
BAD	Present	<60º	< 10º	< 10º	< 20º	< Grade 3	Positive

Chart 2 – *Functional classification, considering: the presence or absence of joint pain; joint range of motion in flexion, abduction, inner and outer rotation; evaluation of muscular strength degree, and; positive or negative Trendelenburg's sign.*

Methodology applied to group A patients

Traction was established at preoperative period, in both lower limbs, keeping thigh-femoral flexion at 90º and the counterweight used would lift gluteus region. The abduction performed in both lower limbs was slow and progressive, until 30º - 45º were achieved on each side. In older children, we used a horizontal traction keeping hips in flexion and abduction position of approximately 45º and 30º, with lower limbs laid on a ferule when the previously described technique could not be applied. We maintained traction for a period between 2 and 4 weeks, aiming to guide femoral head below Gage e Winter[14] level +1 or +2.

N	Gender	Ethnicity	Age	Involvement	Side	Dislocation degree	Femoral shortening	Procedures
1	F	C	88	Unilateral	L	III	30	ST + BR + FS +V + D + C
2	M	C	49	Unilateral	R	III	63	ST + BR + FS + V + S
3	F	C	60	Unilateral	L	III	30	ST + BR + FS + V + D + S
4	F	C	44	Unilateral	L	III	30	ST + BR + FS + V + D + S
5	F	C	35	Unilateral	R	I	30	ST + BR + FS + V + S
6	F	NC	125	Unilateral	L	III	60	ST + BR + FS + V + D + C
7	F	C	92	Unilateral	L	I	35	ST + BR + FS + V + S
8	F	C	39	Bilateral	R	II	35	ST + BR + FS + D + S
9	F	C	37	Bilateral	L	II	35	ST + BR + FS + D + S
10	F	NC	125	Unilateral	L	III	70	ST + FS + D + V +C
11	M	NC	48	Bilateral	R	III	62	ST + FS + V + D + S
12	M	NC	65	Bilateral	L	III	62	ST + FS + V + D + S
13	F	NC	56	Unilateral	R	II	49	ST + BR + FS + V + D + S
14	F	C	191	Unilateral	R	II	50	ST + BR + FS + V + D + C
15	F	C	37	Unilateral	R	III	54	ST + BR + FS + V + D + S
16	F	C	49	Unilateral	L	III	42	ST + BR + FS + C
17	F	NC	50	Unilateral	L	II	52	ST + BR + FS + D + S
18	F	NC	49	Unilateral	L	II	35	ST + BR + FS + V + D + S
19	F	C	82	Unilateral	R	III	55	ST + BR + FS + V + D + S
20	F	C	72	Bilateral	R	I	30	ST + BR + FS + V + S
21	F	C	69	Bilateral	L	I	32	ST + BR + FS + V + D + S
22	F	C	48	Unilateral	L	II	40	ST + BR + FS + S + TA
23	F	C	37	Bilateral	R	III	37	ST + BR + FS + V + D + S
24	F	C	35	Bilateral	L	III	47	ST + BR + FS + V + D + S

C - Chiari's osteotomy; FS - femoral shortening; N - Sequential number; VO - Varusing osteotomy; AO - Anti-rotative osteotomy; BR - Bloody reduction; S - Salter's osteotomy; ST - Skin traction; TA - Adductor muscles tenotomy (intra-operative)

Table 1 – *Data concerning the 20 patients operated (24 hips) from group A, according to a sequential number, patients initials, gender, ethnicity, age (in months) by the time of surgery in each hip, unilateral or bilateral involvement, side addressed, dislocation degree, femoral shortening and procedures.*

N	Gender	Ethnicity	Age	Involvement	Side	Dislocation degree	Femoral shortening	Procedures
1	F	NC	63	Unilateral	L	III	30	FS + BR + SM
2	M	C	33	Unilateral	L	II	30	FS + BR + SM
3	F	C	53	Unilateral	L	II	40	FS + BR + SM
4	F	C	28	Unilateral	L	II	30	FS + BR + SM
5	F	C	28	Unilateral	L	III	39	FS + BR + S
6	F	C	55	Unilateral	L	III	50	FS + BR + SM
7	F	C	113	Unilateral	R	III	80	FS + BR + SM
8	F	C	148	Unilateral	R	I	70	FS + BR + C
9	F	C	58	Unilateral	L	III	40	FS + BR + SM
10	F	NC	20	Unilateral	R	III	30	FS + BR + S
11	F	C	127	Unilateral	L	I	40	FS + BR + C
12	F	NC	30	Bilateral	R	III	55	FS + BR + S
13	F	NC	24	Bilateral	L	III	40	FS + BR + SM
14	F	NC	23	Unilateral	L	III	30	FS + BR + SM
15	F	C	60	Unilateral	L	III	60	FS + BR + SM
16	F	NC	25	Unilateral	L	I	36	FS + BR + S
17	F	C	34	Unilateral	R	III	40	FS + BR + SM
18	F	C	86	Bilateral	R	III	76	FS + BR + SM
19	F	C	96	Bilateral	L	III	70	FS + BR + SM
20	F	C	25	Unilateral	R	I	30	FS + BR + S
21	F	C	26	Unilateral	R	III	30	FS + BR + S
22	F	NC	44	Unilateral	R	III	30	FS + BR + SM
23	F	C	48	Bilateral	R	III	42	FS + BR + SM
24	F	C	36	Bilateral	L	III	48	FS + BR + S
25	F	C	46	Unilateral	R	III	55	FS + BR + SM
26	F	C	102	Unilateral	R	I	65	FS + BR + C
27	F	C	71	Unilateral	L	III	60	FS + BR + S
28	F	C	87	Unilateral	R	III	60	FS + BR + SM
29	F	NC	28	Unilateral	L	II	30	FS + BR + S
30	F	C	38	Unilateral	L	III	43	FS + BR + S
31	F	NC	35	Unilateral	L	III	50	FS + BR + S
32	F	C	27	Unilateral	L	III	30	FS + BR + SM
33	F	C	28	Unilateral	R	II	30	FS + BR + SM

C - Chiari's osteotomy; FS- Femoral shortening; N - Sequential number; BR - Bloody reduction; S - Salter's osteotomy; SM - Modified Salter's osteotomy

Table 2 - *Data concerning the 30 patients operated (33 hips) from group B, according to sequential number, patients' initials, gender, age in months by the time of surgery in each hip, unilateral or bilateral involvement, addressed side, dislocation degree, femoral shortening and procedures.*

Regarding adductor muscles' tenotomy, that procedure preceded the establishment of traction in patients whose dislocations were classified as grade II or III. In the other patients, the protocol determined that tenotomy was to be performed, whenever necessary, conjunctively to main surgical procedure before addressing hip joint.

For performing surgical reduction of the dislocated hip, we adopted the access port and the surgical procedure described by Salter[7].

In 19 of the 24 hips of patients operated in this group, the Salter[7] osteotomy was performed, and, in 5 of the 24 operated hips, the Chiari[15] surgery was applied (Table 3)

An intertrochanteric osteotomy was performed with the purpose of reducing the anteversion angle measurement of femoral neck or promoting a reduction of cervical-diaphyseal angle by varusing. In some situations, femoral shortening was combined and for osteotomy fixation, the Coventry instrument was used.

By the end of surgical procedure, a pelvipodalic cast apparatus was applied so that the operated hip could remain flexed, abducted and internally rotated for six weeks. Immediately after, rehabilitation of operated hip could be started with physiotherapeutic guidance. Kirschner's wires fixing osteotomy in patients operated by Salter[7] technique were removed when X-ray images showed full integration of the graft with the adjacent bone tissue and, from that moment on, supported gait was allowed. When submitted to Chiari[15] surgery, synthesis material removal and supported gait occurred after the full osteotomy union was evidenced.

Methodology applied to group B patients

In group B patients, no previous traction was established on lower limbs, and surgical procedure was performed in a single step, starting by femoral osteotomy.

During preoperative planning, the frame for X-ray images of the pelvic cavity was attached to a millimeter ecran or to a radio-opaque rule (such as the one used in scanning) and X-ray images were taken at anteroposterior plane. Bone segment removal from femoral diaphysis was quantified, by measuring the distance between the upper end of femoral epiphysis and the upper edge of the obturative foramen, that is, at Gage e Winter[14] level +1. Thus, in this patient series, a femoral fragment of 45.12 mm was removed in average, ranging from 30 to 80 mm. A diaphyseal segment of the femur was removed, in its medial portion, and the osteosynthesis was performed with a small fragments plate, with four or six holes, and cortical screws. Rotation or femoral varusing osteotomy was combined in none of the patients in this group.

For achieving reduction on dislocated hips, the same surgical steps described for patients in group A were applied (Table 4).

In 19 of the 33 hips operated, the Salter[7] surgery was performed, employing a modification on the original technique. Instead of using a graft from iliac wing, a dried bone segment of the femur was used [10]. The fixation of the latter was made with threaded Kirschner wires[9,10,16]. In 11 of the 33 operated hips, the Salter[7] osteotomy was performed, according to its original description, and, in 3 or the 33 operated hips, the Chiari[15] surgery was performed.

After 6 or 8 weeks, in average, immobilization was removed and rehabilitation of the operated hip could be initiated. Kirschner wires fixating bone graft were removed after its full integration to adjacent bone tissue, or when the Chiari[15] osteotomy showed evident signs of union. From that moment on, supported gait was allowed.

	Group A	
X-ray result	Num	%
Good	9	37.50
Fair	5	20.83
Bad	10	41.67
Total	24	100.00

Table 3 - *Distribution of the 24 hips of 20 patients, according to the results of X-ray evaluation, absolute and relative frequencies (in percentage) and total sample.*

	Group B	
X-ray result	Num	%
Good	23	69.70
Fair	5	15.15
Bad	5	15.15
Total	33	100.00

Table 4 - *Distribution of the 33 hips of 30 patients, according to the results of X-ray evaluation, absolute and relative frequencies (in percentage) and total sample.*

	Group A		Group B		
X-ray evaluation	Num	%	Num	%	Total
Good	9	37.50	23	69.70	32
Bad	10	41.67	5	15.15	15
Fair	5	20.83	5	15.15	10
Total	24		33		57
Chi-square	$\chi^2 = 6.533$		P < 0.038*		

Table 5 - *Distribution of the 57 hips of 50 patients from groups A and B, according to absolute and relative frequencies (in percentage), chi-squared test application result and total.*

	Group A	
Functional Result	Num	%
Good	14	58.33
Fair	10	41.67
Bad	0	0.00
Total	24	100.00

Table 6 - *Distribution of the 24 hips of 20 patients, according to functional evaluation results, absolute and relative frequencies (in percentage) and total sample.*

	Group B	
Functional Result	Num	%
Good	23	69.70
Fair	10	30.30
Bad	0	0.00
Total	33	100.00

Table 7 - *Distribution of the 33 hips of 30 patients, according to functional evaluation results, absolute and relative frequencies (in percentage) and total sample.*

Method for X-ray evaluation

For quantifying the many kinds of postoperative necrosis on hips of patients operated in group A and B, we employed the classification described by Kalamchi and MacEwen[2], which divide changes into four groups: group I - changes on ossification core; group II - lateral physis compromised; group III - physis central injury; group IV - femoral epiphysis and physis fully injured.

Total measurement of lower limbs determining its length was performed by scanning, measuring the distance between the top edge of femoral head and the medial malleolus of each side, and the anisomelia was evaluated when present.

	Group A		Group B		
X-ray evaluation	Num	%	Num	%	Total
Good	14	58.33	23	69.70	37
Fair	10	41.67	10	30.30	20
Total	24		33		57
Chi-squared	$\chi^2 = 0.788$		P < 0.375		

Table 8 - *Distribution of the 57 hips of 50 patients from groups A and B with absolute and relative frequencies (in percentage), chi-squared test application results and total.*

Measurements of Wiberg[17] angle were achieved by applying the original methodology by that author, combining Mose[18] concentric circles to the technique, according to a modification proposed by Laredo Filho[19]. We used, then, normal measurements of that variable found by him in order to compare them to the measurements achieved for non-affected hips of patients in this study.

The roundness of femoral proximal epiphysis was assessed with the aid of a rule especially made for that end, with concentric rings, with 1-mm increments, according to Mose's [18] principles.

The following have also been evaluated: Acetabular Rate, introduced by Kleinberg and Lieberman[20]; Sharp's Acetabular Angle [21]; Shenton's arc; Hilgenheiner's Line[22]; c/b and h/b Coefficient [23]; center-acetabulum Coefficient; head-acetabulum Coefficient; triple-irradiated cartilage width measurement; head-trochanter ratio [2].

In our methodology, we ruled out the following X-ray parameters (Chart 1):

• The Wiberg angle[17], of which normal values used have been drawn from the research by Laredo Filho [19].

• The avascular necrosis degree of the femoral head, according to Kalamchi and MacEwen[2].

• The evaluation of femoral epiphysis roundness by applying Mose's[18] concentric rings.

• The discrepancy between lower limbs, measured in millimeters by scanning.

We considered the X-ray result as good when all variables are within satisfactory limits, fair when satisfaction is not achieved in a query, and unsatisfactory when at least two variables are changed.

Method for clinical evaluation

Clinical evaluation was performed in all operated patients, from groups A and B, at postoperative period during the last outpatient examination.

Measurements for hip movements were performed by using a conventional plastic goniometer. All measurements were taken by a single examiner, taking care to perform the test with the child naked and relaxed. As a result, the following parameters were assessed: flexion, adduction, abduction, inner and outer rotation at ventral decubitus. The Thomas' Maneuver and the Trendelenburg test were also employed followed by neurological tests, divided into three steps: muscular examination, superficial sensitiveness evaluation, and reflex evaluation.

Flexor muscles were tested with the patient in seated position, keeping legs pending. The results of muscle tests were classified into 6 degrees (Lovett and Martin, 1916). Patellar and calcaneus tendon reflex were tested.

We developed a classification based on the following selected criteria of clinical parameters regarded as important for support and gait function (Chart 2):

- Presence or absence of pain.
- Hip's range of motion, considering flexion, abduction, inner and outer rotation.
- A positive Trendelenburg's test.
- Changes on neurological tests, particularly the degree of muscular strength.

A good result was considered when all normality criteria were achieved; fair, when one criterion was changed, and; unsatisfactory when two or more variables were changed.

Statistical method

For results analysis, parametric and non-parametric statistical tests were used, taking the nature of distributions and variables studied into consideration (Chi-squared test, Fisher's exact test, Mann-Whitney's test, and Kappa's consistency rate). In all tests, the refusal level for a null hypothesis was set at 0.05 or 5%, marking significant results with an asterisk.

	Clinical Result - Group A					
	Good		Fair		Total	
X-ray result	Num	%	Num	%		
Good	8	33.33 88.89 57.14	1	4.17 11.11 10.00	9	37.50
Fair	4	16.67 80.00 28.57	1	4.17 20.00 10.00	5	20.83
Bad	2	8.33 20.00 14.29	8	33.33 80.00 80.00	10	41.67
Total	14		10		24	100.00

Kappa's Consistency rate = 0.100

Table 9 - *Distribution of the 24 hips of 20 patients from group A, according to absolute and relative frequencies (in percentage), functional and X-ray results and Kappa's consistency rate result.*

	Clinical Result - Group B					
	Good		Fair		Total	
X-Ray Result	Num	%	Num	%		
Good	22	66.67 95.65 95.65	1	3.03 4.35 10.00	23	69.70
Fair	1	3.03 20.00 4.35	4	12.12 80.00 40.00	5	15.15
Bad	0	0.00 0.00 0.00	5	15.15 100.00 50.00	5	15.15
Total	23	69.70	10	30.30	33	100.00

Kappa's Consistency rate = 0.5471* (therefore, a good consistency).

Table 10 - *Distribution of the 33 hips of 30 patients from group B, according to absolute and relative frequencies (in percentage), functional and X-ray results and Kappa's consistency rate result.*

RESULTS

Patients were followed up on an outpatient basis, and the follow-up time ranged from 37 moths to 175 months for group A patients (average = 110.25 months) and from 27 months to 96 months for group B patients (average = 62.15 months). By the time of clinical and X-ray evaluation, patients' ages ranged from 74 months to 300 months in group A (average = 176.17 months) and from 47 to 211 months in group B (average = 115.03 months).

Tables 3 and 4 show the results of X-ray studies for patients in group A and B, respectively, according to the result of X-ray evaluation, absolute and relative frequency, and total sample.

Table 5 was prepared with the purpose of comparing the results of X-ray evaluation among patients from groups A and B.

Tables 6 and 7 show the distribution of patients from groups A and B, respectively, according to the results of functional evaluation, absolute and relative frequency, and total sample.

Table 8 was elaborated with the purpose of comparing the results of functional evaluation among patients from groups A and B.

Tables 9 and 10 show the absolute and relative frequencies (in percentage) of patients from groups A and B, according to functional and X-ray results and statistical analysis results.

DISCUSSION

We observed in group A a total of 8 (33.33%) necroses of the proximal portion of the femur and reported rates ranging from 0.0% [8] to 44.0% [24] in literature. This was recognized in 50.00% of the hips presenting bad outcomes on X-ray studies.

We performed a retrospective analysis of surgeries in patients belonging to group A, whose outcomes were considered as bad in X-ray analysis (patients nr. 1, 2, 4, 5, 6, 7, 10, 13, 21, and 23), in an attempt to find satisfactory justifications for those findings.

We verified an incorrect application of Salter[7] osteotomy, characterized by medialization of the sectioned iliac distal portion, which worsened acetabulum failure (patients 2, 4, 5, 7, and 13). By observing the description of surgeries performed in all patients from group A, we observed that, in those, capsule was addressed and repaired, but excess was not removed after reduction. In our opinion, we think that this surgical time is very important for obtaining a satisfactory joint stability and, currently, we prescribe anterior and inferior excision of its excesses. Reduction instability was recognized in patient number 2, from the moment it was fixated with the use of Kirschner wire, fixating femoral epiphysis from neck throughout the acetabulum. Femoral osteotomy, for being intertrochanteric, may have damaged the branches of medial circumflex artery, which are located surrounding this region, thus causing a worsening of the vascular disorder that helped the complication described, agreeing with Tönnis'[12] and Milani's[9,10] propositions. The excessive proximity of this artery to femoral neck was recognized in the hips of patients number 2 and 4. The perspective of a varusing solution has resulted, for patient number 23, in a change characterized by excessive reduction of the cervical-diaphyseal angle, which determined a re-surgery procedure. As the osteosynthesis applied for femoral osteotomy fixation was performed with Coventry material, the introduction of a screw through femoral neck may have provoked an additional damage to vascularization of femoral proximal portion. We also believe that the diameter and length of screws composing that material should also be considered as an additional aggressive factor.

On group B patients' hips, we observed a total of 7 necroses (21.21%). Rates for this complication ranged from 2.4%[6] to 30.0%[5] with intermediate values of 4.8%[11], 5.5%[12], 7.7%[9], 16.6% [10], 22.2%[12] among the authors in our research. Bad X-ray results were considered for patients numbers 5, 15, 19, 23, and 26. On the hips of patients 5 and 15 in this series, after surgical treatment, problems with the execution of Salter[7] acetabuloplasty during postoperative follow-up period because the graft employed could not keep osteotomized iliac surfaces properly separated due to its reduced size. On patient 19's hip (table 7), surgery was performed in an advanced age (96 months) and, probably, the Salter's[7] osteotomy was not the proper one to redirect the acetabulum and provide an appropriate coverage. On patient 23's hip, we saw a discrepancy of 35.00 mm, which could be justified by the presence of necrosis. Apparently, we did not evidence technical problems regarding the application of surgical steps when we report to the surgical description in that patient's medical files. Perhaps an insufficient release, an excessive dissection, or a reduction under tension would justify the emergence of the ischemic injury. Finally, for patient 26's hip, we observed, at the last evaluation, a grade II necrosis, which may have caused the 35.00 mm anisomelia worsened by femoral shortening, because, in this case, a bone fragment of 65 mm was dried. For that observed discrepancy, we should also consider the age of the child at the time of treatment (102 months). The advanced age may have been determinant of a lower biological response of femoral hyper-growth. We also found that two surgeries had been previously performed, before last treatment.

Due to all exposed facts, we believe that the emergence of avascular necrosis after surgical treatment is the result of lack of experience or adversity, and should not have causes ruled by casualty.

Regarding the evaluation of treatments results, we found in literature that the great majority of authors use the anatomical-radiographic classification by Severin[25] which is considered as easy to reproduce, showing proven prognostic value [1,5,6,11,24]. However, we developed a classification that could gather several X-ray parameters enabling a simple and more reliable judgment about femoral proximal epiphysis and acetabular normality related to HDD.

In order to determine normality limits for Wiberg's[17] CE angle, we applied the X-ray measurements of this variable as obtained by Laredo Filho[19]. We advocate this position, because the coverage provided by acetabulum over femoral head verified by angle measurements for this variable changes according to progressive development and growth of the thigh-femoral joint. This fact refuses the condition that a single angle value, as adopted by Severin[25], could encompass many age groups. Therefore, we believe that the evaluation of results may be performed with a higher level of accuracy when this system is applied.

Several specific classifications for clinical outcomes analysis have been developed and employed to verify the effectiveness of different kinds of treatment [3,7,11,16,18,25,26].

However, those methodologies come from adjustments to classifications originated in experiences acquired by treating adult individuals submitted to total prosthesis implantation or femoral and pelvic osteotomies. Nevertheless, we think than some of those evaluations are difficult to apply in certain situations. Those are ruled by strict standards, not applying to all age groups, such as, for example, the ambulation resistance, considering specific distances to be walked by patients.

Gait functional evaluation regarding limping perception, a parameter usually employed by authors [27,28], has not been considered in our study. We believe that the simple visual analysis of ambulation can be subjectively influenced by examiners, especially in normality threshold situations.

Therefore, there is no optimal and absolute classification that meets all requirements and, of course, each author advocates his/ her own ideas and points of view. There are individual factors making each patient to give a different response to surgical aggressions suffered by him/ her. Thus, there is a lot of difficult in establishing vary strict standards to evaluate a therapy employed and its results. This perhaps justifies the reason why there is no consensus about the way to evaluate the joint function in operated hips. Those facts encouraged us to search for a system that could reliably reflect our results. The clinical variables applied in this study have not been randomly chosen. We gathered those most commonly mentioned by researched authors and added important parameters that could indicate motor function, of which changes are known to interfere on functional pattern of patients. Another considered issue was to develop a methodology that could be easily applicable and reproducible.

Especially for pain verification, either associated to joint motion restraints or not, it makes final clinical evaluation to be considered as unsatisfactory [26]. Joint stiffness may also be found and it is possibly justified by capsule and adjacent tissues adherences [4,16] or as a result of avascular necrosis or condhrolysis. In 49 of the 57 hips operated, we chose the osteotomy procedure, as described by Salter[7]. Redirection, from the biomechanical point of view, is a positive factor for thigh-femoral joint, producing an adequate development of the femoral epiphysis and of the acetabulum. The concurrent femoral shortening, when employed, provides the necessary relax to adjacent soft tissues, which mitigate the relative shortening effect of an operated lower limb [1,3, 6,29].

When this surgical step is added, femoral epiphysis reduction becomes simpler because this action provides a reduced muscular tension and, consequently, a reduction of vascular meshwork, not requiring previous traction. Thus, femoral head repositioning at the pelvic cavity would be performed so that the pressure applied on joint surfaces is not excessive.

Femoral osteotomy, when performed at the proximal region, enables the concurrent correction of femoral neck rotation and its valgusing, providing a smooth reduction, thus reducing ischemic necrosis risks [9]. We noticed, by our experience, that those surgical supplementations can only be performed, whenever necessary, after a reduction evaluation during intra-operative period and once its stability is tested. As a result, varusing and excessive femoral anteversion correction are performed within reliable safety limits.

However, the influences caused by femoral torsion and valgusing are still questionable because their correction are often considered as spontaneous, and since the acetabulum is redirected and the reduction is stable, such procedures are no longer required [1,6,7,12].

In 8 of the 57 hips operated, we used the Chiari's[15] capsular arthroplasty. although this is considered as a saving osteotomy, it is indicated for patients in whom a concentric reduction of the hip cannot be achieved by Pemberton's[26] or Salter's[7] surgeries anymore, as mentioned by Utteback and MacEwen[29] and Mellerowicz et al.[30], with its own limitations, because it uniquely promotes coverage for a lateral portion of the femoral epiphysis. Thus, so far, we have successfully performed the placement of a graft removed from iliac wing, associated to the original Chiari's[15] technique, with the purpose of overcome previous coverage defect, thus promoting a better coverage for anterior region over femoral head.

We stress again the idea that we should not have illusions in the presence of a good result upon clinical analysis of a patient if the X-ray analysis results do not show the same condition as well, because, according to a natural development, a progressive drop will be obviously perceived on hip joint function. As we observed, the perception of a consistency between clinical and X-ray results is not unanimous in literature [5,23]. However, we believe that the statistically significant consistency seen in group B patients should be considered, because we noticed high levels of satisfaction, simultaneously, at functional and X-ray evaluations. (Table 7)

But, for a definitive evaluation of patients, according to the opinions of the many researchers we agree with, only a longer follow-up period and the conduction of further studies will be able to reveal the truthfulness of our opinions [7,26].

CONCLUSIONS

1. Patients from group B show better X-ray results when compared to patients from group A.
2. The clinical evaluation at the moment of patients' evaluation does not show any statistically significant difference between both groups.
3. Functional and X-ray results show marginal statistical consistency in patients from group A.
4. Functional and X-ray results show significant statistical consistency in patients from group B.

REFERENCES

1. Forlin E. Avaliação dos resultados da redução cruenta e osteotomia de Salter no tratamento da luxação congênita do quadril [dissertação]. São Paulo: Universidade Federal de São Paulo – Escola Paulista de Medicina, 1995.
2. Kalamchi A, MacEwen GD. Avascular necrosis following treatment of congenital dislocation of the hip. J. Bone Joint Surg Am. 1980; 62:876-88.
3. Bertol P, Monteggia GM. Luxação congênita do quadril após o início da marcha. Rev Bras Ortop. 1990; 25:253-8.
4. Galpin RD, Roach JW, Wenger DR, Herring JA, Birch JG. One-stage treatment of congenital dislocation of the hip in older children, including femoral shortening. J Bone Joint Surg Am. 1989; 71:734-41.
5. Klisic P, Jankovic L. Combined procedure of open reduction and shortening of the femur in treatment of congenital dislocation of the hips in older children. Clin Orthop. 1976; 119:60-9.
6. Prado JCL, Santili C, Baptista PPR. Tratamento da luxação e subluxação congênita do quadril pela técnica de Salter associada ao encurtamento do fêmur. Rev Bras Ortop. 1984; 19:203-8.
7. Salter RB. Innominate osteotomy in the treatment of congenital dislocation of the hip. J Bone Joint Surg Br. 1961; 43:518-39.
8. Bertol P. Tratamento da luxação congênita do quadril por redução aberta e osteotomia do inominado: estudo de 125 quadris [tese]. São Paulo: Universidade Federal de São Paulo – Escola Paulista de Medicina, 1997.
9. Milani C. Necrosi post riduttiva nella lussazione congenita inveterata dell'anca: Comparazione fra due metodiche di trattamento [thesi]. Padova: Facoltà di Medicina e chirurgia istituto di clinica ortopedica, Università Degli Studi Di Padova, 1995.
10. Milani C, Ishida A, Lourenço A, Kuwajima SS, Dobashi ET, Damaceno FL. Estudo comparativo da freqüência da necrose avascular da cabeça femoral no tratamento cirúrgico da luxação congênita do quadril com e sem osteotomia de encurtamento do fêmur. Rev Bras Ortop. 1995; 30:21-4.
11. Santili C. Tratamento da subluxação e luxação congênitas do quadril pelo método associado da operação de Salter com o encurtamento ósseo femoral - análise dos resultados a longo prazo [tese]. São Paulo: Faculdade de Ciências Médicas da Santa Casa de São Paulo, 1996.
12. Tönnis D. Surgical treatment of congenital dislocation of the hip. Clin Orthop. 1990; 258:33-40.
13. Zionts LE, MacEwen GD. Treatment of congenital dislocation of the hip in children between the ages of one and three years. J Bone Joint Surg Am. 1986; 68:829-46.
14. Gage JR, Winter RB. Avascular necrosis of the capital femoral epiphysis as a complication of closed reduction of congenital dislocation of the hip. J Bone Joint Surg Am. 1972; 54:373-88.
15. Chiari K. Beckenosteotomie zur pfannendachplastik. Wien Med Wochenschr. 1953; 103:707-14.
16. Milani C, Ishida A, Pinto JÁ, Dobashi ET, Viveiros MEM. Avaliação clínica e radiográfica de pacientes com luxação congênita inveterada do quadril submetidos ao tratamento cirúrgico. Rev Bras Ortop. 1999; 34:27-36.
17. Wiberg G. Studies on dysplastic acetabula and congenital dislocation subluxation of the hip joint: with special reference to the complication of osteoarthritis. Acta Chir Scand. 1939; 83(suppl.58):1-135.
18. Mose K. Methods of measuring in Legg-Calvé-Perthes disease with special regard to prognosis. Clin Orthop Relat Res. 1980; (150):103-9.19.
19. Laredo Filho J. Estudo Populacional do ângulo CE de Wiberg e sua aplicação na pesquisa genética da luxação congênita do quadril [tese]. Campinas: Faculdade de Ciências Médicas, Universidade Estadual de Campinas; 1985.
20. Kleinberg S, Lieberman HS. The acetabular index in infants in relation to congenital dislocation of the hip. Arch Surg. 1936; 32:1-49.
21. Sharp IK. Acetabular dysplasia: The acetabular angle. J Bone Joint Surg Br. 1961 ; 43:268-72.
22. Hilgenreiner H. Zur fruhdiagnose und fruhbehandlung der angeboren hüftgelenkverrenkung. Med Klin. 1925; 37:1385-5.
23. Smith WS, Badgley CE, Orwig JB, Harper JM. Correlation of post reduction roentgenograms and thirty-one-year follow-up in congenital dislocation of the hip. J Bone Joint Surg Am. 1968; 50:1081-98.
24. Ryan MG, Johnson LO, Quanbeck DS, Minkowitz, B. One-stage treatment of congenital dislocation of the hip in children three to ten years old. J Bone Joint Surg Am. 1998; 80:336-44.
25. Severin E. Contribution to the knowledge of congenital dislocation of the hip joint: late results of closed reduction and arthrographic studies of recent cases. Acta Chir Scand. 1941; 84(suppl.63):1-141.
26. Pemberton PA. Pericapsular osteotomy of the ilium for treatment of congenital subluxation and dislocation of the hip. J Bone Joint Surg Am. 1965; 47:65-86.
27. Bassett GS, Engsberg JR, MCalister WH, Gordon JE, Schoenecker PL. Fate of the psoas muscle after open reduction for developmental dislocation of the hip (DDH). J Pediatr Orthop Am. 1999; 19:425-32.
28. Romanò CL, Frigo C, Randelli G, Pedotti A. Analysis of the gait of adults who had residua of congenital dysplasia of the hip. J Bone Joint Surg Am. 1996; 781468-79.
29. Utterback TD, Mac Ewen GD. Comparison of pelvic osteotomies for the surgical correction of the congenital hip. Clin Orthop. 1974; 98:104-10.
30. Mellerowicz HH, Matussek J, Baum C. Long-term results of Salter and Chiari hip osteotomies in developmental hip dysplasia: a survey of over 10 years follow-up with a new hip evaluation score. Acta Orthop Trauma Surg. 1998; 117:222-7.