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ORIGINAL ARTICLE

Femoral Varus Osteotomy for Treatment of Legg Calve Perthes Disease in Zagazig University Hospitals

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ABSTRACT

Background: Legg Calve Perthes disease is a juvenile osteonecrosis, where the blood supply of femoral head not sufficient leading to the provisional bone death. It is a main cause of premature osteoarthritis of the hip, and also need hip replacement in early adulthood. Many treatment methods were used in Legg Calve Perthes disease to keep hip joint range of motion. **Aim of the work:** the current study was aimed to evaluate the outcomes of femoral varus osteotomy in the treatment of Perthes disease according to classification and grading schemes. **Patients and methods**: This study was carried out at the Orthopedic Surgery outpatient clinic of Zagazig University Hospital during the period from January 2017 to June 2019 on 12 patients, they were (7 males) and (5 females) with range between 5 to 10 years. **Results:** showed that there was a Significant decrease in the mean epiphyseal extrusion indices, Significant increase mean Wiberg's CE angle, significant decrease in the mean of neck shaft angel and union of osteotomies within 3 months without fixation loss. **Conclusion:** proximal varus osteotomy was a confident treatment in patients without flattening of femoral head, advanced deformation and in case of good containment in abduction and internal rotation especially if their ages ranged between 5-10 years. For older patients and patients with advanced deformity of femoral head the outcomes were not satisfactory.

Keywords: Femoral Varus Osteotomy, Legg Calve, Perthes Disease, osteotomies

INTRODUCTION

Legg–Calve–Perthes disease (LCPD) was defined as an idiopathic osteonecrosis of the femoral head which causing several complications which leading to deformity of the femoral head and osteoarthritis [(1)].

In contrast to healthy bone, the avascular epiphysis bone is not able withstand the stresses on the epiphysis of the femoral head in cases of LCPD. The goal of Perthes disease treatment to decreas the risk of osteoarthritis by preventing from femoral head deformity, which may happen if suitable containment was not obtained[(2)].

To get containment, the head of the femur was centered in the acetabulum during the

fragmentation and reossification phase, which allows the acetabulum to act as a mold during the healing and revascularization phase when the biologically plastic femoral head was at risk of hinged abduction, permanent subluxation and femoral head deformation. At skeletal maturity, acute femoral head deformity and joint incongruity increase the risk of function loss which may lead to osteoarthritis later [(3)].

There are very treatment techniques for treatment Legg–Calve –Perthes disease, and the suitable method depending on the disease grades. This techniques include traction, spica cast immobilization, bed rest and walking with a weight-relieving caliper [(4)].

Surgical approaches were also done in young patients with Legg–Calve–Perthes disease. Many authors were recommended nonoperative methods such as bracing and cast immobilization which recorded satisfactory results for patients [(5)].

Many studies were reported good results for operative methods such as valgus osteotomy and femoral varus, in addition to other types of pelvic osteotomies such as lateral shelf osteotomy, triple osteotomy and innominate (Salter) pelvic osteotomy. [(6)].

AIM OF THE WORK

The current study was aimed to evaluate the outcomes of femoral varus osteotomy in the treatment of Perthes disease according to classification and grading schemes

PATIENTS AND METHODS

This study is a retrospective and prospective cohort study carried out at the Orthopedic Surgery outpatient clinic of Zagazig University Hospital during the period from January 2017 to June 2019. 12 patients were selected during the period (2017 – 2019), they were (7) males and (5) females ranging from (5 to 10 years). The average time for follow-up was 12 months, ranging from (6 to 18). 7 patients affected with right hip and left in 5 patients which was operated by lateral approach. According to Catterall classification we had 5 patients with stage III and other 7 cases in stage IV, according Salter Thompson classification was found that 4 patients in stage A, 8 patients in stage B. open wedge femoral varus osteotomy was done for all patients but degree of varus angulation ranged between 15 to 20 degree according sufficiency of head of femur containment within acetabulum intraoperative.

Written informed consent was obtained from all participants and the study was carried out according to the research ethical committee of Faculty of Medicine, Zagazig University. The work study was carried in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving human.

Inclusion criteria:

- The patients mean age was 7.5 years (range: 5–10 years).
- All patients are in fragmentation stage.

Exclusion criteria:

- All patients are in re-ossification or healing stages
- Age of patient above 10 years or below 5 years.
- Any neurological disorder as cerebral palsy
- Any previous hip surgery.

All participants were subjected to the following:

- Complete history details (Age of onset, Side of distribution, the main complaints.
- Clinical function assessment was done by measure and detect leg length discrepancies and Harris hip score.

Radiological evaluation:

- primary radiologic outcomes, recent anteroposterior and lateral view of frog-leg were observed.
- Determined stage of disease by Catterall classification
- Parameters which were evaluated include: femoral neck shaft angle, central edge angel, epiphyseal extrusion index.

Operative technique

- Varus femoral osteotomy was performed with lateral technique in the supine position, osteotomy was done at lesser level of

trochanteric where the great trochanteric apophysis did not disturbed.

- internal fixation was done using Plate.
- varus angulation of 15-20° is sufficient to obtain adequate containment by a femoral varus osteotomy.
- Surgical aimed to get a neck shaft angle of 110-120 degree to confirm formal head was centered concentrically in the acetabulum.
- Spica casting was performed for Six weeks for all participants as a slandered postoperative treatment after surgery.
- After this period, allowing a partial weight bearing until osteotomy union

Technique of Femoral Varus De-rotational Osteotomy

Positioning and Preparation

- General anesthesia was done for all participants. The cases were putted in the supine position on a radiolucent orthopedic table.
- Patients draped from lower ribs until mid-leg.

Preoperative planning was determined degree of angle that was needed for varus osteotomy where under fluoroscopy abduction of diseased limb from neutral position until head of femur full contained within acetabulum and calculated the angle.

Surgical Approach for VDRO

1. A longitudinal incision was done over the lateral proximal femur extended from the trochanteric flare or slightly above down along the femoral shaft 10 -12 cm. suitable length must be done to accommodate the plate length taking in consideration shortening from the Varus with or without removal of additional bone wedges.
2. Dissect subcutaneous tissue down to the level of the fascia lata. The fascia lata was divided in line with the skin incision. A self-retaining retractor was placed in the fascia lata.
3. Incised the fascia overlying the vastus lateralis longitudinally in approximately 5 mm anterior to the intramuscular septum. The muscle was teased off the posterior fascia until the visualization of periosteum then the periosteum was incised to subperiosteally expose the proximal femur. This cuff of remaining posterior fascia is used for the repair.
4. nearly, the origin of the vastus lateralis was incised transversely (perpendicular at the longitudinal cut of the fascia) along the trochanteric flare and distal to the trochanteric apophysis, to permits the muscle reflected anteriorly. Care was done to plunge posteriorly with the cautery as the sciatic nerve is very close.
5. The periosteum was incised for exposing the femur subperiosteally. Hohman retractors were placed anteriorly and posteriorly for protection.

Osteotomy Technique with DCP

Lateral open-wedge subtrochanteric varus osteotomy was used and insert plate:

1. Leg was held in full internal rotation, at least a small 4-5 holed Sherman bone plate is chosen, two long 2.7 Kirschner wires were inserted in the two proximal plate holes and in both femoral cortices and left there, the plate removed and then pre-bent in the middle to the required osteotomy angle.
2. Lateral opening wedge osteotomy was performed, while the extremity is held in internal abduction and rotation, the bone was divided with an oscillating saw at the previous marked level, the proximal fragment was held in internal rotation and abduction and the distal fragment externally rotated until the patella points straight forward to reach the suitable wedge which was preoperatively planned.
3. After that, the pre-bent plate slipped over the drilled points and fixed to the distal and proximal fragments by 5-6 screws and control the position of plate and screws under fluoroscopy
4. Good irrigation was done with normal saline, drain inserted, muscle approximated, hemostasis secured, skin stitched in layers
5. A suction drain used double spica plaster cast applied with at least 20 degrees of hip abduction and drain removed after 48-72 hours. A systemic antibiotic used in all cases before induction of anesthesia and continued for 72

hours with doses determined according to age and body weight.

Postoperative follow up:

P.O.P. spica is applied for 6-8 weeks then it is discarded and patient is allowed to resume gradual weight bearing as tolerated. The patients were evaluated by clinical examination every one month for the first 3 months and then after 6 up to 12 months, radiological assessment after 3,6,12 months after surgery.

The evaluation and follow up of patients depend on mainly the Harris hip score which evaluates the patient clinically preoperatively and postoperatively.

The Harris hip score consists of many items including (limp, pain, support, sitting, distance walked, using stairs, using public transportation, putting shoes and socks, absence of deformity and range of motion) Each item as pain has grades and each grade is representative by value or points which differs according to the clinical status of the patients.

Clinical assessment

We evaluated the clinical results in the patients group by modified Harris hip score for function, gait, pain, deformity absence, strength of muscle and the Trendelenburg signs.

Modified Harris Hip score: The clinical situation was analyzed pre- and post-operatively using the modified Harris Hip Score (mHHS).

Radiography

- primary radiologic outcomes, recent anteroposterior and lateral view of frog-leg were observed.
- Parameters which evaluated include: femoral neck angle, central edge angel, epiphyseal extrusion index.

Statistical analysis

Data were collected, tabulated and analyzed by SPSS 20, software for Windows. The level of significance was < 0.05.

RESULTS

Table (1), showed that the mean age was 7.083±1.56 with minimum 5 and maximum 10 and regarding sex male represented 58.3% and female 41.75. **Table (2),** showed that 58.3% were right side and 41.7% were left, 25% were positive family history. **Table (3),** showed that the preoperative mean Leg shortening was 9.25±1.54 mm while it was 2.7±1.30 mm postoperatively. **Table (4),** showed that there was a statistical significant decrease in Neck shaft angel from 146.33±6.31 preoperatively to 120.66±4.65 postoperatively. **Table (5),** showed that there was a statistical significant decrease regarding Epiphyseal extrusion index from 16.08±2.23 preoperatively to 8.41±1.56 postoperatively. **Table (6),** showed that the Central edge angel was significantly increase from 19.66±2.46 preoperatively to 35.08±3.11 postoperatively. **Table (7),** showed that Harris score significantly increased from 64.08±4.64 preoperatively to 85.16±2.65 postoperatively. **Table (8)**, showed that regarding to Harris hip score results, 3 cases (25%) were excellent results, 8 patients (66.7%) had good results and one patient (8.3%). Table (9) showed that there was a highly statistical Significant improvement in group patients regarding all parameters study. **Table (10),** showed that there was no statistical significant difference according to postoperative complications; where only one patient (8.3%) had infection postoperatively and one case had subcutaneous hematoma (8.3%).

Table 1: Age and Sex distribution among studied group (N=12)

		Age	
Mean± SD		7.083±1.56	
Median (Range)		7.0 (5-10)	
Sex	Male	7	58.3
	Female	5	41.7
	Total	12	100.0

Table (2): Basic characters distribution among studied groups

		N	%
Side	Left	5	41.7
	Right	7	58.3
FH	No	9	75.0
	Yes	3	25.0
	Total	12	100.0

Table (3) : preoperative and post operative Leg shortening distribution

	Preoperative Shortening / mm	Post-operative Shortening / mm
Mean ±SD	9.25±1.54	2.7±1.30
Median (Range)	9.0 (5-10)	2.00(0-10)

Table 4:Neck shaft angle pre and postoperative

	Neck shaft angel pre	Neck shaft angel post
Mean ±SD	146.33±6.31	120.66±4.65
Median (Range)	148.0 (137-155)	119.0 (116-132)

Table (5) :Epiphyseal extrusion index distribution

	EEI_PRE	EEI_POST
Mean ±SD	16.08±2.23	8.41±1.56
Median (Range)	15.5 (13-20)	8.0 (7-13)

Table (6): Central edge angel distribution among studied group

	CEA_PRE	CEA_POST
Mean ±SD	19.66±2.46	35.08±3.11
Median (Range)	19.5 (15-23)	35.5 (28-39)

DISCUSSION

The current study demonstrated that Leg shortening distribution preoperatively was as 9.25±1.54 mm where postoperative improved and distributed as to 2.7±1.30 mm. 12 patients was had limp length discrepancy preoperatively ranged from 0.5cm and 1 cm then 1 month postoperative discrepancy increase up to 2 cm due to varus osteotomy where 9 patient improved and was no length discrepancy and 3 patient were had around 1 cm limp length discrepancy after 1 years, which in agreement with the study of **Elzohairy,** [(1)] who reported that the limb length discrepancy mean was 0.9 cm (range: 0.0–2 cm) shortening at the operated side compared to the normal side after plate removal at the last follow-up. Also the with the study **Bulut et al.** [(7)] who stated that preoperatively, 10 patients with an average iscrepancy length d of 1.2 cm, while the final examination of 6 patients the average length discrepancy was 0.7 cm.

Shah and Joseph [(8)], illustrated that the average lower limb shortening in the operated patients was 5.05 ± 6.74 mm while in non-operated patients it was 9.03 ± 7.68 mm with non statistical significant difference.

Wie et al., [(9)] who measured lengths of both legs on tele roentgenogram, found that the average value of LLD was 9.2 mm, with a range of 31 mm shortening to a 13 mm lengthening.

Rowe et al., [10] verified that the amount of the shortening of the affected legs in LCPD depends on the inhibition severity of endochondral ossification in the growth of proximal femoral plate. Also, the epiphyseal height loss, disuse atrophy of diseased limb, and FVO performance in older children may to contributed to the the affected leg shortening.

Suba and Yildirim, [11] demonstrated that shortening at the operated side in the last follow-up was approximately about 0.8 cm. (range, 0.0 to 2.3 cm.). Trendelenburg's test was positive in the studied patients.

Our study stated that neck shaft angel pre significantly decrease from 146.33±6.31 to 120.66±4.65. In our study Epiphyseal extrusion index distribution Significantly decrease from 16.08±2.23 to 8.41±1.56.

Al Central edge angel distribution among studied group Significantly increase from 19.66±2.46 to 35.08±3.11postoperatively.

In our study Harris score significantly increase from 64.08±4.64 to 85.16±2.65 where 8 cases in score good condition and 3 cases in excellent score and one was fair.

Elzohairy, [1] don't reported any progressive changes during the follow-up period, after removal of hardware and in the younger children. There was a relation between limping and limb length discrepancy and the gluteal weakness was recoded for the patients, but this improvement obtained through 8 months course of the operation. The osteotomies union was achieved within 3 months without fixation loss[1]

Bulut et al. [7] observed that the average preoperative CE angle was 14.9 ± 4.9˚, while the early postoperative angle was 32.9 ± 4.9.

Shah and Joseph [8], demonstrated that many patients (either operated ornon-operated) presented moderate reduction of the range of passive internal rotation of the hip comparing to the normal side (average internal rotation of operated hips was 28.57 ± 13.88; average internal rotation of non-operated hips was 26.77 ± 16.15; t: 0.60 (p> 0.5) with no statistical significant difference between the preoperative and final examination postoperatively.

Moghadam et al., [12] illustrated in their study that the femoral neck angel abnormality was recorded in 22 patients (75.9%).

Glard et al., [13] stated that the varus angulation degree at the osteotomy site was limited to 20 . Some studies suggested to angulate the FVO to the most extent.

On the contrary **Herring et al.,** [14] verified that there was no differences between the hips treated using femoral varus osteotomy and whom treated with an innominate osteotomy.

Joseph et al., [15] studied how a femoral osteotomy changes the natural evolution of Perthes disease by studying records and radiographs of 640 patients of Perthes disease. The records of 314 patients whom performed femoral osteotomy were compared with nonoperated patients. It was noted that a varus osteotomy changed the natural evolution of Perthes disease. Of patients whom were operated in the stage of avascular necrosis, 34% of studied patients bypassed the fragmentation stage. The disease duration was shorter in these patients. The duration of the fragmentation stage was decreased in operated children which they passed through the fragmentation stage. The femoral head extrusion extent was minimum at the stage when it was most vulnerable for deformation.

Our study showed that only one case had infection post OP and one case subcutaneous hematoma.

While in the study of **Voplon,** [16] who used arthrodistraction as a primary treatment for active forms of LCP disease and prospectively compared the outcomes obtained by Salter innominate osteotomy, although this technique gave similar final radiological outcomes, morbidity was higher in arthrodistraction compared to innominate osteotomy. So, don not recommend arthrodistraction as a primary method for treating the early stages of Legg–Calve´–Perthes disease.

Leunig and Ganz, [17] showed that 14 patients performed surgical dislocation of the hip and advanced trochanteric with a minimum follow-up of about 3 years. They reported that gait, pain, and hip mobility were achieved high

improvement in the patients group without major complications noted.

Lloyd-Roberts et al., [18] demonstrated that in his controlled study of the FVO in 48 LCPD patient's containment by FVO was the best technique in patients with "at risk "signs confirming the non occurrence of severe deformity.

The limits of this study were the the variable nature of Perthes disease (which cause the difficulty of condition study) and the using different classification systems and results measurements (which cause confusion). surgical procedures analysis was hampered by using small subject groups, the unsteady use of control group, the unmatched patients selection of different ages, and the different severity of the disease process.

Our results suggest that treatment of severe Legg Calve Perthes disease was not well-defined. The surgeon has to take his own decision according to characteristics of patient's. We think that proximal varus osteotomy is a reliable treatment in patients without advanced deformation or femoral head flattening and patients with good containment in abduction and internal rotation especially if their age ranged between 5-10 years. For older patients and for those with advanced deformity of the femoral head the outcomes were not satisfactory.

Conclusion : proximal varus osteotomy was a confident treatment in patients without flattening of femoral head, advanced deformation and in case of good containment in abduction and internal rotation especially if their ages ranged between 5-10 years. For older patients and patients with advanced deformity of femoral head the outcomes were not satisfactory.

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