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ORIGINAL ARTICLE

Safe Surgical Dislocation of the Hip in the Management of Pediatric and Adolescent Hip Problems

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ABSTRACT

Background: surgical hip dislocation (SHD) allows for 360 degrees view of the acetabulum and femoral head without risking the femoral head blood supply. Since then, this approach has been utilized by many surgeons for correction of the morphological abnormalities of the proximal femur with a reported low rate of complications. This work aims for assessing the outcome of the surgical hip dislocation in pediatric and adolescents with follow up for one year.

Methods: This is a prospective study of 40 hips in 38 patients with intra articular hip pathology of variable causes, managed by surgical hip dislocation. Average age was 15 years old.

Operative indications for the approach in this series were: Slipped capital femoral epiphysis (SCFE) in 18 cases, femoro acetabular impingement (FAI) in 7 cases, acetabular fracture in 4 cases, femoral head fractures in 3 cases, intraarticular hip lesion in 4 cases and intraarticular loose bodies in 4 cases. All patients were followed-up for a period ranging from 12 months to 18 months.

Results: The overall results in 40 hips that were operated by surgical hip dislocation for various indications according to Harris Hip Score were:- 19 hips excellent results (47.5%), 11 hips good results (27.5%), 6 hips fair results (15%) and 4 hips poor results (10%).

Conclusion: SHD by itself is as a safe and reliable technique that is associated with minimal risk of long term morbidity due to minimal, or no disruption of femoral head circulation if it is performed very carefully.

Key words: surgical hip dislocation; SCFE; FAI; adolescent hip deformity.



INTRODUCTION

Hip abnormalities are common in childhood and can lead to persistent hip deformity as the child grows into adulthood [1]. Advances in surgical techniques like periacetabular osteotomy, safe surgical dislocation of the hip, and hip arthroscopy provide us with more effective and safe ways to correct these anatomical problems [2]. Traditionally, surgical hip dislocation (SHD) has been discouraged because of the possible risk to the vascularity of the femoral head. Ganz [3] has clarified the proximal femoral vascular anatomy and has used this knowledge to develop a safe surgical dislocation technique for the hip. This technique has made possible safe and effective treatment of many intra-articular and periarticular pathologies of the hip [2]. Through this technique femoral head-neck osteoplasty, intertrochanteric osteotomy, open reduction and internal fixation of slipped capital femoral epiphysis (SCFE), open reduction and internal fixation (ORIF) of an

acetabular fracture, trapdoor procedure, femoroacetabular impingement management (FAI) and acetabular rim osteoplasty could be performed [4].

METHODS

This is a prospective study of 40 hips in 38 patients with intra articular hip pathology of variable causes, managed surgically using surgical hip dislocation. The mean age of the studied patients was 16.34 ± 2.89 years old, with a range from 12 to 20 years old. Of the studied patients were males (65.8 %) and 34.2% were females.

The procedures were done in Zagazig University Hospitals in the period from 2012 till 2018.

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All patients were followed-up for a period ranging from 12 months to 18 months (average 15

months). The study was conducted with the aim of assessing the short term functional outcome of surgical hip dislocation in managing different hip pathologies. Written informed consent was obtained from all parents. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. All patients were evaluated pre & post operative for pain severity, function, absence of deformity and range of motion. (Harris Hip Score), X rays only were used to for evaluation, CT were done only in selected cases for better planning but not postoperatively. Operative technique:-The patient was prepared and draped in the lateral decubitus position (figure 1) . A straight lateral skin incision is made, and the fascia lata was split in line with skin incision. A greater trochanter flip osteotomy is performed, and the greater trochanter is retracted anteriorly along with the vastus lateralis and the gluteus medius (figure 2). The interval between the gluteus minimus and the tendon of the piriformis was developed, and the gluteus minimus is retracted or sharply elevated superiorly to expose the capsule . A z-shaped capsulotomy is made protecting the supero-lateral capsular retinacular fibers and the posterior superior nutrient arteries. The hip joint then could be subluxated or dislocated anteriorly by flexion-external rotation-adduction (figure 3).

Administrative design: Approval was taken from the institutional review board, faculty of medicine, Zagazig university.

STATISTICAL ANALYSIS

Data analysis was performed using the software SPSS (statistical package for the social science) version 25. Quantitative variables were described using their means and standard deviations. Categorical variation were described

using their absolute frequencies and to compare parameters of quantitative data, Wilcoxon signed rank test was used after check of normality. The level of statistical significance was set at 5% ($p < 0.05$). A highly significant difference was present if $p \leq 0.001$.

RESULTS

The operating time from skin incision to hip dislocation ranged from 30 to 65 minutes (average 51 minutes). The mean age of the studied patients was 16.34 ± 2.89 years old, with a range from 12 to 20 years old. Of the studied patients were males (65.8 %) and 34.2% were females. The percentages of cases with history of trauma as well as the percentage of the affected side are shown in (table 1) the most considerable hip problem was stable slipped capital femoral epiphysis (30 %), followed by FAI and unstable slipped capital femoral epiphysis in (17.5% & 15%) respectively, other lesions as Intra articular loose body (10%), Intraarticular osteolytic lesion (10%) and Post wall fracture acetabulum (10%) while Fracture Head femur was found in only 7.5% .

The percentage of each specific operation that was done is shown in (table 2)

Harris hip score (HHS) significantly increased postoperative, as mean of Harris hip score preoperative was $47(\text{poor}) \pm 22.09$, with a range from 14 to 79 vs $84.8(\text{good}) \pm 10.77$ with a range from 64 to 96 post-operative, P-value (< 0.05) .

the most used procedure was Modified Dunn's procedure in about 1/2 of operated joints (45 %), followed by SHD accompanied by either ORIF or offset correction or excision with bone cement in (17.5%, 17.5% & 5%) respectively (figure 4).

The pre and post-operative Range of motion is shown in (table 3)

Table (1): History of trauma and side of hip affected Lesions among the studied group

Item	Studied gr (N=38)	
	No.	%
History of trauma		
▪ No	6	15.8
▪ Yes	32	84.2
‡Side of hip affected (N=40)		
▪ Rt side	18	45.0
▪ Lt side	22	55.0

‡Bilateral hip injury occurred in 2 patients

Table (2): Type of operations done among the studied patients

‡ Types of operation	Studied joints (N=40)	
	No.	%
Excision of loose body	4	10.0
ORIF of fracture Acetabulum and fracture head of femur	7	17.5
Modified Dunn's procedure	18	45.0

‡ Types of operation	Studied joints (N=40)	
	No.	%
offset correction	7	17.5
Excision of a lesion + bone cement	2	5.0
Excision of a lesion + bone grafting	2	5.0

Table (3): pre and post-operative Range of motion.

Range of motions	Pre-operative (N=32)	Post-operative (N=40)	Test	p-value
Flexion				
Mean ± SD	93.75 ± 13.85	121 ± 13.92	-4.881	0.000* (HS)
Median (Range)	100(60-120)	130(90-140)		
Internal rotation				
Mean ± SD	7.81 ± 11.49	30.75 ± 7.75	-4.993	0.000* (HS)
Median (Range)	0(0-30)	30(10-40)		
External rotation				
Mean ± SD	22.81 ± 6.71	36 ± 5.90	-4.902	0.000* (HS)
Median (Range)	20(10-30)	40(20-40)		
Abduction				
Mean ± SD	26.56 ± 6.40	36.25 ± 5.74	-4.573	0.000* (HS)
Median (Range)	30(20-40)	40(20-40)		
Adduction				
Mean ± SD	26.56 ± 6.89	35 ± 7.33	-4.155	0.000* (HS)
Median (Range)	27.5(20-40)	40(10-40)		

Test: Wilcoxon signed rank test

*P-value <0.05 is significant

HS: highly significant



Figure 1:- patient positioning

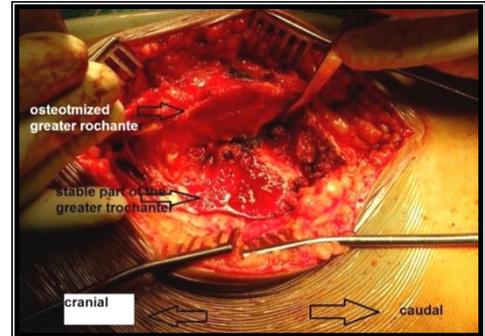


Figure 2:- the greater trochanter is elevated with the gluteus medius attached superiorly and the vastus lateralis attached inferiorly.



Figure 3:- head of the femur after dislocation.

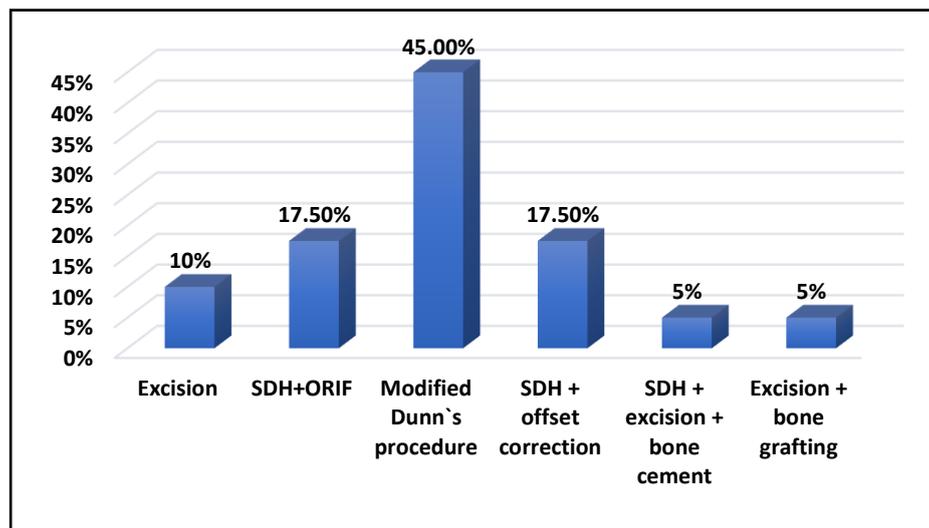


Figure (4): Bar chart showing type of operation done among the studied cases.

DISCUSSION

In this study, we aimed to detect whether adolescent and young adult patients with intra articular hip pathology, in whom we used the surgical dislocation approach, have achieved a short-term pain relief with clinical and radiological improvement of the pathological condition, by assessing the changes in the patients clinical condition, expressed by the Harris hip score after surgery and by the evaluation of the patient serial radiographs. Additionally, we looked at our complication rate to determine whether it was affected by the learning curve of the procedure and the complexity of the reconstruction, which was measured roughly by the number of additional procedures performed on the hip at time of the surgical dislocation approach. Finally we tried to determine whether this approach is truly safe in preserving the femoral head blood supply intra and post operatively. The results of our study suggest that surgical hip dislocation could be safe approach when it is used to perform simple intra articular procedures, such as osteochondroplasty for FAI (cam type), excision of intra articular pathological lesions and exploration and management of femoral head and acetabular cartilage and labral lesions. For treatment of complex hip deformities, such as SCFE, ORIF for acetabular fracture, it may carry a high risk for serious post-operative complications that are directly related to unplanned surgery, un experienced hands, preexisting pathological lesion and complexity of the surgical procedure that is to be performed. In our study, 6 hips (15%) got avascular necrosis (AVN) of the femoral head. 4 of the 6 cases occurred in patients who had undergone modified Dunn's osteotomy for correction of deformity after SCFE (2 stable, 2 unstable). Compared to the other patients groups, AVN

occurred with highest incidence and clinical significance in the SCFE group. The other 2 cases of AVN in our series cases were a trauma cases. The development of AVN could be partially attributed to the surgical procedure and partially to the preexisted femoral head hypo vascularity.

Kargin, D. et al reported only one case of AVN after retrospective study in 45 hips for complications following surgical hip dislocations for various indications between 2006 -2013. This patient was unstable SCFE [5]. 2 cases of hip instability occurred in our series. They were cases of chronic SCFE. They were managed conservatively with physiotherapy and activity modification. In our study, we have one case of osteoarthritis progression, secondary to severely damaged posterior wall acetabulum. The patient is currently under follow with physical therapy, activity modifications with possibility of conversion to THA whenever the symptoms became severe. The cause of OA progression obviously not attributed to the technique itself. In this patient the technique helped for near anatomical reduction and fixation of the posterior wall fracture, which would have been sufficiently done with the classic posterior approach. However, the technique helped to get more precise reduction with documentation of articular damage with safe placement of screws.

In our study, 4 patients (10%) developed postoperative sciatic nerve palsy. 2 of them occurred following modified Dunn's procedure for unstable SCFE. The other two cases occurred following posterior wall fracture acetabulum. Sciatic nerve affection improved after 3 months of physiotherapy. *kargin et al* reported no cases of neurologic affection related to the sciatic nerve at early or late postoperative follow up [5].

In our series, the incidence of heterotopic

ossification (HO) (25%)(10 patients) was lower than the reported incidence of this approach in the previously mentioned studies, but still being within the reported range of HO after major hip surgeries. Being a major hip procedure, the reported results of HO in our series and in other literature seemed to be acceptable.

In the original Ganz et al study that described the SHD approach, the incidence of HO was 37% with only two patients had severe ectopic bone formation needed excision (0.9%)[6]. Similarly, the incidence of HO in Sink et al study was 5.4% without any severe cases [7]. Our case series included 4 (10%) cases had persistent trochanteric regional pain and 2 of them needed screw extraction. We also have another 2 cases of delayed union of the trochanteric fragment that were healed completely within 5 months. No cases of loss of reduction, non-union or failure of fixation were recorded in our series. Trochanteric fixation in all of our cases was performed with 4.5 screws. This may explain for the absence of fixation failure, loss of reduction and non-union. We have avoided using bone wax at the trochanteric bed and we think that the use of electric saw might allow for micro chanceling of the trochanteric osteotomy surfaces which might enhance union. In our series, residual intra articular impingement was the only cause for the cases that needed revision hip preservation procedure. We have 12 (30%) cases. All of them were from the SCFE group that had persistent mild hip pain in specific movements secondary to residual FAI that would eventually need further intervention. This is high incidence comparable to the incidence of revisions in other literature discussing the general complications of the SDH approach, which ranges 1-14% [6,7,8]. In our series, 14 patients (35%) complained of cosmetically unacceptable surgical scar with saddle back deformity of the surgical incision. These patients would be possibly managed with cosmetic surgical intervention.

In the original study of *Ganz et al* about the technique, they have reported an incidence of 7 cases (3.3%) of saddle back and 5 of them requested plastic surgery to improve the cosmetic appearance. They recommended the straighter incision of the Gibson's approach rather than the modified the Kocher-Langenbeck approach in women with weak subcutaneous tissue and claimed better results[6] We were limited greatly by the variation in the pathological types for which we use the technique. It presented a great challenge in results interpretation. We were also limited by

the prospective nature of the research in which all patients should have been followed up using the same or as much similar follow up system in each case. We studied the outcomes in the short term but a longer follow up would be definitely needed to refine and confirms our present findings.

CONCLUSION

The SHD technique provides comprehensive deformity correction, with access to both the intra-articular and extra-articular structures, and without the limitations and difficulties that are encountered during hip arthroscopy. Strict adherence to proper technique, in addition to a sound knowledge of the anatomy of the hip, allows the surgeon to minimize complication rates while treating the deformity.

Conflict of interest: Nothing to declare.

Financial Disclosure: Nothing to declare.

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