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Surgical Release of Gluteus Maximus Muscle Fibrosis and Its Effect on Hip Function

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Abstract:

Objective: To assess the functional and surgical outcomes of the surgical release of gluteus maximus muscle fibrosis by open conventional technique and to assess its effect on hip joint function. Methods: This study followed a group of cases for 20 months, from November 1, 2022, to June 30, 2024. The case study included ten patients with the diagnosis of GF who were treated surgically in the Department of Orthopedics in Al-Hussein Medical City in Karbala. The study included patients Under 18 years old with moderate (level II) or serious (level III) gluteal fibrosis (GF). And excluded patients with mild (level I) gluteal fibrosis according to Zhao et al.'s classification. Any past or current conditions that affect the hip, such as hip dysplasia, septic arthritis, slipped capital femoral epiphysis, or Legg-Calve-Perthes disease. Past injuries or surgeries to the hip or spine that might impact how the hip moves. The patients have a mental illness that prevents them from following instructions. Patients with neurological diseases that limit hip movement. And patients with a history of frequent muscle injections. Results: Sample's characteristics: The study involved 10 patients with bilateral GF, of which six were men. The participants' ages ranged from 6 to 13 years, with a mean age of 9.8 years. Of the 20 hips examined, 11 were classified as Level III MA GF, while 9 were classified as Level II MA GF. Functional evaluation: Before surgery, all 20 hips had low usable functional scores, with an average score of 3.6. In the follow-up after surgery, there was a noticeable change in how well patients were doing, with all of them achieving great results, averaging a functional score of 9.7. The p-value was under 0.001, which shows this result is very significant. Range of motion: After surgery, there were notable improvements in movement. The average range of motion improved from -3.6 degrees to 21.2 degrees for abduction, with a p-value of less than 0.001. For flexion, it went from 112.9 degrees to 120.3 degrees, also with a p-value of less than 0.001. The surgical outcomes: The results show that 15 hips (75%) had great surgical outcomes, while 5 hips (25%) had good surgical outcomes based on Lui et al.'s criteria. Conclusions: Surgery to release the tight band in

the gluteal muscle using a standard open method can lead to great functionality, good to excellent results from the surgery, and a noticeable increase in range of motion (ROM). Patients with moderate to severe GF (class II and III according to Zhao et al classification) would mostly benefit from this procedure and are good candidates for it.

Introduction.

Gluteal fibrosis (GF), the fibrosis of the gluteal muscles or gluteal muscle contracture (GMC), as referred by some literature, is a clinical condition characterized by the contracture of the gluteal muscles, which may involve varying degrees of the gluteus maximus, medius, and minimus [1]. Fernandez de Valderrama first described it in 1970. In this disease, the gluteal muscles, iliotibial band, and surrounding tissue, as well as the hip's outer rotator muscles and, in serious situations, the hip joint capsule, become stiff and thickened [2]. This leads to problems with hip joint movement and can cause issues with balance and walking [3]. A tight gluteal muscle can cause the pelvis to tilt and may make one leg appear shorter than the other.

- **The pathogenesis of GF**, the definitive cause, has yet to be established. Four potential etiologies have been proposed, namely an idiopathic condition, a congenital collagen disorder, a genetic condition, and an iatrogenic injury [4].
- **Symptoms and signs** can change based on how serious the sickness is. The key signs of this disease are raising the leg out to the side and turning it outward, along with having a limited ability to bend the leg and bring it closer to the body. Patients are unable to get their knees together when they sit or bend down. Crossing or covering your legs can always cause issues. Different writers have created various classifications of GF over the years. In 2009, Zhao and others suggested a way to classify GF based on symptoms and physical changes while also considering how the illness affects function [5].
- Zhao et al.'s classification consists of three levels: level 1 (mild), level 2 (moderate), and level 3 (severe).
- Operative intervention is the definitive treatment modality for all confirmed cases of GF. Various surgical techniques have been developed, including traditional open release, endoscopic release, and minimally invasive release approaches.

Zhao et al.'s classification / Category according to level	
Level I (Mild)	The movement of the lower leg is limited, with an abduction tightness of less than 15° when the hip and knee are bent at 90° or less than 20° when there is no bending. Ober's sign and the frog squatting sign both show slightly good results. The limp walk is not seen when the lateral pelvic tilt on the AP radiograph is less than 10°.
Level II (Moderate)	The lower limb's extorsion is moderate; the abduction contracture ranges from 15° to 60°, with both the hip and knee joints flexed at 90°, but the adduction range is under 10° with no flexion observed. Ober's sign and the frog sitting sign are affirmative. The limping gait is apparent, with the lateral pelvic tilt on the anteroposterior radiograph measuring under 20°.
Level III (Severe)	The lower limb's extorsion is severe, characterized by an abduction contracture beyond 60°, with both the hip and knee joints flexed at 90°, and an adduction range below 0° with no flexion observed. Ober's sign and the frog squatting sign are significantly positive. A significant limp is apparent, accompanied by a lateral pelvic tilt of more than 20° on the anteroposterior radiograph.

Category according to type	
Type MA	Type of contraction of the gluteus maximus
Type MEI	Type of contraction for the gluteus medius and minimus
Type AGM	Types of contraction for the gluteus maximus, medius, and minimus (All gluteal muscle contraction types)

Patients and Methods:

The design, time, and setting of the study

- A prospective case series type of study that was carried out in a 20-month period, which extended from the 1st of November 2022 to the 30th of June 2024. The case series included ten patients with the diagnosis of GF who were treated surgically in the Department of Orthopedics in Al-Hussein Medical City in Karbala.

Inclusion criteria

- Age below 18 years.
- Moderate (level II) or severe (level III) GF according to the classification by Zhao et al.

Exclusion criteria

- Mild (level I) GF according to the classification by Zhao et al.
- Presence or history of any condition that affects the hip structure, like hip dysplasia, septic arthritis, slipping capital femoral epiphysis, Legg-Calvé-Perthes disease, etc.
- History of trauma or surgery to the hip or the spine that could affect hip movement.
- Presence of mental illness that makes the patient unable to follow commands.
- Presence of neurological disease that affects the hip range of motion.
- History of repeated intramuscular injection.

The diagnosis of GF

It was made through the following clinical criteria in the absence of other conditions that mimic GF, like tendinitis and iliopsoas abscess:

1. The impacted hip is positioned in abduction and external rotation, exhibiting restricted flexion and adduction range of motion.
2. The patient is unable to squat while the knees are close to each other (squat test); he/she would take a frog-like position when squatting.
3. The patient is unable to put his/ her legs in cross of each other.
4. Abnormal gait (out toing) and inability to walk in a straight line.
5. Hearing/feeling a snap when squatting.
6. Presence of the positive Ober's / reverse Ober's test.
7. Presence of dimple in the gluteal area of the affected hip.
8. The buttock is flat or cone-shaped.

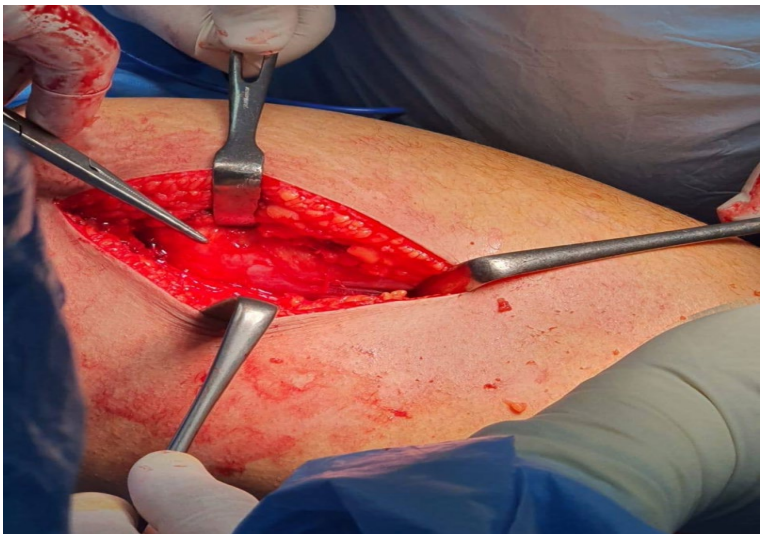

Figure no. 1: The surgical procedure.
The patient was positioned in lateral decubitus with the knee extended to tauten the fascia lata. The skin incision was located across the posterior aspect of the greater trochanter, extending approximately 3 cm proximally and 4 cm distally. The superficial fascia was incised along the line of the incision.

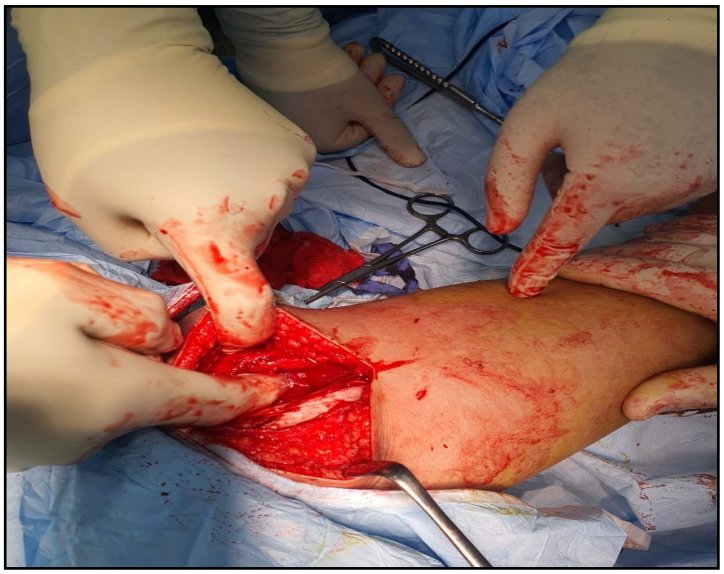

Figure no. 2: The surgical procedure.
The resilient, white, contractile fibrotic band was identified and aligned with the orientation of the muscle fibers. Subsequently, these bands were released using a blade positioned perpendicularly to the direction of the muscle fibers.

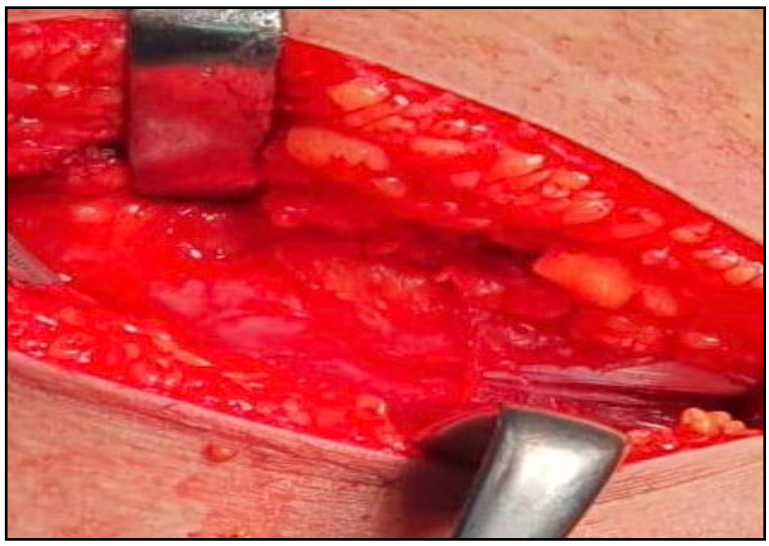

Figure no. 3: The surgical procedure.
The fibrous band was cut sequentially, starting from superficial structures and proceeding to deeper structures according to the extent of the tissue involved (the gluteus maximus, iliotibial band, and tensor fascia lata).

Figure no. 4: The surgical procedure.
Until the satisfactory hip range of motion was achieved (adduction, flexion, and internal rotation), all the signs of GF (Ober's sign, cross leg sign, and palpable click) disappeared intra-operatively. A thorough assessment for any residual deformities was performed, and after the confirmation of the complete release of the fibrotic band was done,

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Figure no. 5: The surgical procedure.
Appropriate hemostasis was maintained, irrigation of the wound with normal saline, placement of drainage tube, and closure of the wound was done. Both hips were treated in the same surgical setting.

Outcome Measurement

The functional evaluation of the patients was done according to the criteria of Ye et al., which consisted of 4 **parameters [6]** :

1) closing the knees together
2) crossing the legs while both the hip and the knee flexed at 90˚
3) ambulation (gait**(**
4) Gliding of fibrotic bands in the iliotibial tract**.**

- A score was given to each parameter, and if the patient scored 9-10, the outcome would be considered excellent, 7-8 would be considered good, and 0-6 would be considered poor**.**

The surgical outcome was done according to the criteria set by Lui et al. The parameters used in this assessment were [7], [8]:

1. Wound healing
2. Presence of residual GF signs
3. Gait
4. leg-length discrepancy (LLD)
5. Pelvic tilt
6. Hip range of motion (ROM)
7. Muscle strength
8. Surgical complication
9. Recurrence of pathology

Depending on these parameters **,**the surgical outcome was labeled excellent, good, fair or poor

Results:

Sample's characteristics

The series included ten patients with bilateral GF, six of whom were male. The participants' ages ranged from 6 to 13 years old, with a mean of 9.8. Of the 20 hips included, 11 were classified as Level III MA GF and 9 as Level II MA GF, as shown in table no. 1.

Table no.1: Shows the sample's characteristics.

Variable		Result
Age (mean ± SD)		1.9 ± 9.8
Gender	Male	(60 %) 6
	Female	(40 %) 4
Classification of GF	Level II MA	(45 %) 9
	Level III MA	(55 %) 11

Functional evaluation

Preoperatively, all 20 hips had poor functional scores; their functional score mean was 3.6. In the postoperative evaluation, there was a significant improvement in the functional grading where all the patients had excellent functional outcomes with a mean of 9.7; the p-value was less than 0.001, as shown in Table No. 2.

Table no.2: Shows functional evaluation.

Variable	No. of hips	Mean	P value
pre-op functional score	20	3.6	0.001 >
post-op functional score	20	9.7	

Range of motion

Significant improvements in the range of motion were observed post-operatively, where the mean increased from (-3.6˚) to (21.2˚), the p-value was < 0.001 for the abduction, and from (112.9 ˚) to (120.3˚), the p-value was < 0.001 for the flexion, as shown in table no. 2.

Table no.3: Shows Range of motion.

Adduction ROM	No. of hips	Mean	P value
pre-op	20	3.6-	0.001 >
post-op	20	21.2	
Flexion ROM			
pre-op	20	112.9	0.001 >
post-op	20	120.3	

The surgical outcomes

No residual signs of GF were present after the operation. All the patients had a normal gait, equal leg length, and an absence of pelvic tilt. Only 5 hips (25%) had a loss of less than 10 % of hip ROM and grade 4 muscle strength. Complications after the surgery, such as hematomas, infections, nerve injuries, and abductor weakness, were not reported. The recurrence of pathology was not observed during the follow-up period.

According to these results, 15 hips (75 %) were reported to have excellent surgical outcomes, and 5 hips (25%) were found to have good surgical outcomes as set by the criteria of Lui et al. [9].

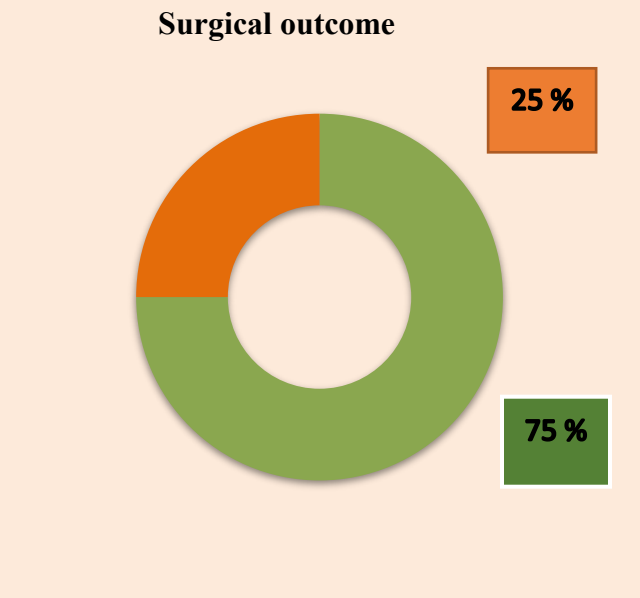

Figure no. 6: The surgical outcomes

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Discussion.

- Our result aligns with prior research indicating that GF mostly impacts school-aged children and exhibits a greater prevalence in boys compared to females.
- In comparing the functional assessment results of this study with those of Rai et al. [10], it was noted that among their patients treated with open conventional surgery, an excellent functional score, as per Ye et al.'s criteria [11], was reported in nearly 92% of cases. Al Bayati, Kraidy, and Reilly et al. [12] also documented substantial enhancement in hip functionality among their patients regarding sitting and squatting.
- The authors Al Bayati, Kraidy, and Reilly et al. also reported significant improvement in hip ROM of all the patients treated by open surgical release [12].
- Studies by Cheng and Yang [13], Al Bayati and Kraidy [12], and Fu et al. [14] also reported that no surgical complications were encountered in their patients who underwent open surgical release. While the study by Liu et al. [9] reported a complication rate of 3.7% in the form of abductor weakness, the author Zhao et al. [3] had a complication rate of 5.4% in the form of infection and hematoma.
- the results of the surgical outcomes of our study were like the results reported by other studies by Zha et al. and Liu et al. and better than those of Fu et al. and Xu et al. [15].

Conclusion:

- The surgical release of the fibrotic band of gluteal muscle by the open conventional procedure would result in excellent functional outcomes, good to excellent surgical outcomes, and significant improvement in the ROM. Patients with moderate to severe GF (class II and III according to Zhao et al. classification) would mostly benefit from this procedure and are suitable candidates.
- The present study recommends that the surgical release of gluteal muscle fibrotic band by open technique be used in the treatment of patients with class II and III GF. Further studies on the prevalence of GF in Iraq and comparison between open and arthroscopic techniques of surgical release are required.

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