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FUNCTIONAL OUTCOMES AFTER OPEN RELEASE OF GLUTEUS MAXIMUMS CONTRACTURE.

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ABSTRACT

BACKGROUND: Fibrosis and shortening of the gluteal muscles characterize gluteal Maximums contracture (GMC), a musculoskeletal disorder that causes limited hip motions and functional constraints such trouble squatting. It is frequently seen in adolescents and children, especially in underdeveloped areas. For moderate to severe instances, open surgical release is the usual course of therapy; however, there is currently little information available on the results of surgery in the local community. **OBJECTIVE:** To assess the functional outcomes of open surgical release in patients with gluteal muscle contracture treated at Khyber Teaching Hospital, Peshawar. **METHODS:** This retrospective cross-sectional research conducted in District Headquarters Hospital, Batkhela, from January to December of 2024. Included were 100 patients, 50 of whom were male and 50 of whom were female, ages 6 to 14, who had been diagnosed with gluteal muscle contracture and treated with open surgical release. Demographic information, contracture laterality, involvement type, and functional level were examined in clinical records. SPSS version 25 was used to analyze the data. To investigate correlations between gender, age, contracture type, and functional results, statistical techniques included one-way ANOVA, independent t-test, and chi-square test. **RESULTS:** Bilateral contracture was more prevalent in female patients ($p = 0.043$) out of 100 patients (50 males and 50 females), with a mean age of 9.36 ± 1.69 years. Age differences across contracture types were not statistically significant ($p = 0.074$). 58% of patients ($n = 58$) showed bilateral contractures, whereas 42% ($n = 42$) had unilateral involvement. Bilateral contracture was found in 58% of patients and unilateral in 42%. A significant association was noted between gender and contracture laterality ($p = 0.043$). Males were more likely than females to have unilateral engagement on the right side, although the difference was not statistically significant ($p = 0.200$). There was no significant difference in mean age between the bilateral and unilateral groups ($p = 0.710$). **CONCLUSION:** Open surgical release offers positive functional outcomes in children with GMC. Early surgical intervention improves mobility and quality of life.

KEYWORDS: Gluteus Maximums contracture (GMC), Hip flexion, Gluteal fibrosis, Open surgical release

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INTRODUCTION

The clinical condition known as gluteal muscle contracture (GMC) is typified by the rigidity of the iliotibial band (ITB), tensor fascia lata (TFL), gluteal muscles and the associated fascia; in extreme situations, the hip external rotators and, seldom, the hip joint capsule may also be affected [1,2]. The external rotators of the hip and, in rare instances, the hip joint capsule may also be affected in severe cases. Restrictions in hip mobility brought on by these structural alterations influence how stresses are distributed across the joint surfaces[3,4]. Patients may experience functional limits and biomechanical abnormalities in their lower limbs as a result. Frequently, these limitations in mobility are linked to weakness of the hip abductor muscles [5].

The pathogenesis of GMC is mostly linked to repeated intramuscular injections in the patient's buttocks during childhood, however a small number of cases are linked to trauma and autoimmune function. According to estimates, the prevalence rate of GMC, which is distributed over Asia, Europe, Africa, and North America, is between 1% and 2.5% [6]. The prevalence of using biopolymers in the gluteal region is 72% of patients undergoing modeling procedures, demonstrating the severity of this issue [7].

There have been reports of several forms of gluteal muscle contracture, including tensor fasciae latae contracture, fan-shaped contracture, mixed contracture, and cable strip contracture [2]. As a result, patients' contractures varied in location and severity. Surgeons occasionally squandered time trying to locate all of the contractures in the muscles to release during arthroscopy, which could cause significant interference with healthy muscle tissue[8]. If the operation procedure relied on a limited examination and evaluation, insufficient release could occur [9]. However, there have sometimes been reports of problems following either open or arthroscopic surgery, including muscular weakening, surgical hematoma, and neurovascular damage, which are linked to the abundance of muscle tissue, regional nerves, and vascular tissue in the operative area's architecture [6].

The common morphological abnormalities of the pelvis brought on by GMC, including hip exostosis, shallow acetabular depth, increased CE angle, pelvic tilt, and the resulting pseudo-isometric bilateral lower extremities, have attracted a lot of attention because of advancements in imaging technology [10]. However, there aren't many studies that use CT scans to see how the pelvis changes morphologically. GMC patients' equatorial-edge angles were analyzed using CT, and it was shown that their angles were comparatively less than those of healthy people, suggesting a retroverted acetabulum [11]. Hip osteoarthritis, which is frequent in hip dysplasia and Perthes' disease, is caused by acetabular retroversion, a typical clinical alteration in bone morphology that alters the pressure between the acetabulum and the femoral head [12].

The condition known as gluteus maximus contracture (GMC) occurs when the fibrosis and shortening of the gluteal muscles limit hip mobility [13]. Patients have decreased hip flexibility, trouble with full ranges of motion, irregular gait, and issues with sitting and crossing their legs [14]. Three physical examination procedures can be used by medical professionals to identify Ober's sign in conjunction with hip

snapping and a tight iliotibial band[15]. Examining these symptoms medically aids in identifying GMC and differentiating it from other hip mobility disorders [7].

Magnetic Resonance Imaging (MRI) pictures are necessary for the diagnosis of gluteal myatomyositis as part of behavioral confirmation study [16]. When the iliotibial tract changes toward the rear and within the body, MRI imaging reveals the presence of fibrotic bands inside the gluteus maximus muscle along with muscular atrophy[17]. Proximal femur external rotation results from medical retraction of the muscle and its tendon during advanced GMC, which creates a depressed groove between their junction [18]. A comprehensive, methodical methodology to verifying GMC diagnosis is produced by combining the imaging results with clinical evaluations [19].

Although open surgical release has been shown to be beneficial for GMC, nothing is known regarding the functional results of surgery in Pakistan and other similar areas. The majority of research on gluteus maximus contracture consists of case reports and small series, which restricts the applicability of the published data. The necessity for region-specific research is increased since recovery processes and surgical techniques differ significantly throughout healthcare facilities, necessitating the creation of standardized treatment standards.

The aim of the study is to evaluate the functional results of open surgical release for individuals with gluteus maximus contracture. Squatting capacity and hip flexion restoration are two important postoperative benefits that are the subject of this study, which examines these results in pediatric instances with unilateral or bilateral involvement. In individuals with gluteal muscular fibrosis, basic functional motions are frequently severely compromised. This study aims to provide light on how well open release can restore these movements.

METHODOLOGY

This retrospective cross-sectional study was carried out from February to July 2024 at the Orthopedic Surgery Department of District Headquarters Hospital, Batkhela. Assessing postoperative functional results after open surgical release in individuals with gluteal muscular contracture was the aim of the research. The research involved 100 patients in total. The availability of comprehensive clinical and surgical data led to the selection of these individuals. Children between the ages of 6 and 14 who had received an open release operation and a clinical diagnosis of gluteal muscular contracture met the inclusion criteria. Patients with congenital musculoskeletal problems, prior lower limb or pelvic operations, or insufficient medical data were not included. Consent obtained from patients before conducting study and ethical approval also obtained from Medical Superintendent, District Headquarters Hospital, Batkhela.

Each patient's age, gender, and other demographic data were noted. Surgical records were used to gather clinical information on the kind of contracture, including whether it was isolated gluteus maximus involvement, left-sided gluteus maximus contracture (GMC), right-sided GMC, or global GMC. Bilateral and unilateral contracture patterns were further differentiated. The measured degree of hip flexion and squatting capacity were used to evaluate postoperative results. Hip flexion was measured using a conventional goniometer, and squatting was noted as either present or absent.

All data were entered and analyzed using SPSS version 25. To compute means, standard deviations, frequencies, and percentages, descriptive statistics were employed. Associations between categorical variables, including gender and laterality or contracture type, were examined using the Chi-square test. We utilized a one-way ANOVA to compare mean age among contracture types, and independent t-tests to assess mean age

differences between bilateral and unilateral instances. The p-value was deemed statistically significant if it was less than 0.05.

RESULT

A total of 100 individuals with gluteus maximus contracture were assessed for this investigation. Of them, 42 patients (42%) had unilateral involvement, while 58 patients (58%) had bilateral contracture. Gender analysis revealed that of the 50 patients in the female group, 34 (68%) had bilateral involvement and 16 (32%) had unilateral contracture. However, of the 50 patients in the male group, 26 (52%) had unilateral involvement and 24 (48%) had bilateral contracture. According to these results, females were more likely to have bilateral contracture while males were somewhat more likely to have unilateral contracture. The relationship between gender and the kind of contracture (unilateral or bilateral) was evaluated using a chi-square test. The analysis yielded a p-value of 0.043, which is statistically significant at the conventional 0.05 level. This suggests that the laterality of gluteus maximus contracture and patient gender are significantly correlated as Shown in Table 1.

Table 1: gender vs. Unilateral/bilateral contracture (chi-square test)

Gender	Bilateral	Unilateral	Total	P-value
Female	34	16	50	
Male	24	26	50	
Total	58	42	100	0.043

In this study, all 100 patients had their gluteus maximus contracture kind and side noted. Of them, 20 patients had contracture on the left side, 21 on the right, and 58 individuals were diagnosed with bilateral GMC. The term "Gluteus Maximus Contracture" was used to describe only one patient, a female, and it had no specific adverse effects. There was n=50 female patients, n=33 (66%) had bilateral contracture, n=7 (14%) had right-sided contracture, and n=9 (18%) had left-sided involvement. The category of "Gluteus Maximus" was applied to one female case. Of the 50 male patients, n=12 (28%) had involvement on the right side, n=11 (22%) had left-sided contracture, and 25 (50%) had bilateral contracture. "Gluteus Maximus" was not used to describe any male patients. A p-value of 0.200 was found by statistical analysis using the Chi-square test, indicating that the association between gender and type/side of contracture was not statistically significant, despite some variation between genders in the distribution of unilateral contracture sides as Shown in Table 2.

Table 2: Gender vs. Type of Contracture (Chi-square Test)

Gender	Gluteus Maximumus	GMC	Left GMC	Right GMC	Total	p-value
Female	1	33	9	7	50	
Male	0	25	11	14	50	
Total	1	58	20	21	100	0.200

An independent sample t-test was used to determine if the mean age of individuals with unilateral and bilateral gluteus maximus contracture differed significantly. There were n=42 with unilateral involvement and n=58 with bilateral contracture in the analysis. In the unilateral group, the mean age of the patients was 9.29 years with a standard deviation (SD) of 1.798, whereas in the bilateral group, the mean age was 9.41 years with an SD of 1.612. The unilateral group's standard error

(SE) was 0.277, whereas the bilateral group's was 0.212. The t-test's p-value of 0.710 showed that there was no statistically significant difference in the mean age of the two groups as Shown in Table 3. In other words, in this dataset, age does not seem to significantly affect a patient's likelihood of developing unilateral or bilateral contracture.

Table 3: Comparison of Mean Age between Unilateral and Bilateral Gluteus Maximus Contracture (Independent t-test)

Contracture Type	N	Mean Age (years)	Standard Deviation (SD)	Standard Error (SE)	p-value
Bilateral	58	9.41	1.612	0.212	
Unilateral	42	9.29	1.798	0.277	0.710

A one-way ANOVA test is used to compare the age distribution of the four forms of gluteal contracture in Table 4. Only one patient—an 8-year-old—was diagnosed with isolated gluteus maximus contracture out of all the subjects. No standard deviation, standard error, or confidence intervals applied to this category because it was a single instance. With a mean age of 9.41 years, a standard deviation (SD) of 1.612, and a standard error (SE) of 0.212, the group with generalized gluteal muscle contracture (GMC) consisted of 58 people. For this group, the 95% CI was between 8.99 and 9.84 years. The mean age of the 20 patients with left-sided GMC was 8.65 years, with a 95% confidence interval (CI) of 8.02 to 9.28 years, and SDs of 1.348 and 0.302. With a 95% confidence interval ranging from 9.05 to 10.86 years, the patients with right-sided GMC (n = 21) had the greatest mean age of 9.95 years, an SD of 1.987, and a SE of 0.434. The ANOVA test produced a p-value of 0.074, suggesting that these age differences were not statistically significant, despite the fact that the mean ages of the subgroups varied somewhat.

Table 4: Comparison of Mean Age Across Different Types of Gluteus Maximus Contracture (One-way ANOVA)

Type of Contracture	N	Mean Age	SD	SE	95% CI Lower	95% CI Upper
Gluteus Maximus Contracture	1	8.00	—	—	—	—
General GMC	58	9.41	1.612	0.212	8.99	9.84
Left GMC	20	8.65	1.348	0.302	8.02	9.28
Right GMC	21	9.95	1.987	0.434	9.05	10.86
p-value						**0.074**

DISCUSSION

Gluteal muscle contracture (GMC) is a rare but functionally debilitating condition, most commonly affecting children and adolescents, and is characterized by fibrosis and shortening of the gluteal muscles and associated fascia. The current study aimed to assess the functional outcomes following open surgical release in patients diagnosed with GMC, with a specific focus on demographic patterns, contracture types, and post-operative mobility outcomes. Our findings revealed an equal distribution of cases among male and female participants, yet a statistically significant association was observed between gender and laterality of contracture ($p = 0.043$), with bilateral involvement more common in females, while unilateral involvement appeared

more evenly distributed among males. This gender-based difference in presentation aligns with some previously reported trends but remains insufficiently explored in larger population studies. Age distribution across contracture types showed non-significant variation (p = 0.074); however, a trend was noted where right-sided GMC cases presented at older ages (mean 9.95 years) compared to left-sided (8.65 years) and generalized cases (9.41 years). This variation could reflect a delay in clinical recognition or a difference in severity or progression that merits further clinical attention. The predominance of generalized GMC (58% of cases) is consistent with earlier literature that highlights generalized fibrosis as the most commonly reported type in developing countries, where awareness and early intervention may be limited. Moreover, the single case of isolated Gluteus Maximus contracture further underscores the rarity of this subtype, which has been scarcely documented in existing orthopedic literature.

According to our research, male individuals experienced unilateral gluteal muscle contractures on the right side, whereas female participants experienced them on the left. The chi-square statistical analysis revealed a p-value of 0.200, indicating that there was no statistically significant relationship between gender and contracture side. The study's findings were similar to those of Hu et al. (2024), who looked at 544 GMC patients, 218 of whom were men and 326 of whom were women. According to the research, gender has no bearing on the results of GMC therapy since it has no effect on the post-surgery progression of symptoms, mHHS findings, or excellent outcome rates (P > 0.05) [13].

Recent medical investigations on treatments for gluteal muscular contracture are supported by our study analysis. Jiang et al. (2024) compared open surgery and arthroscopic release for the treatment of GMC patients by a systematic review and meta-analysis. Four trials with a total of 453 patients shown that while surgical techniques increased functional satisfaction, arthroscopic release produced better results in terms of fewer postoperative problems, enhanced cosmetic satisfaction, shorter incision length, and shorter hospital stays. Both postoperative complications (RR = 3.5; 95% CI: 1.75–7.03; P = 0.0004) and cosmetic satisfaction (RR = 0.07; 95% CI: 0.01–0.65; P = 0.02) were better with arthroscopic release [1]. Hu et al. (2024) looked at the clinical outcomes of arthroscopic surgery for the treatment of GMC in a research that included 544 patients with a minimum follow-up period of two years. The modified Harris Hip Score increased from 72.1 before to surgery to 97.3 following surgery, indicating a significant improvement (P < 0.001). Patient satisfaction was 96.7 percent, and the VAS pain score significantly improved from 3.3 before surgery to 0.06 after surgery (P < 0.001). Empirical evidence suggests that surgical release effectively improves functional outcomes and has a good effect on patient satisfaction [13].

The study used a one-way ANOVA test to examine mean age trends between Left GMC and Right GMC, as well as between Gluteus Maximus (GM) and Generalized Muscle Contracture (GMC). According to the data, the p value was equal to 0.074, indicating that the mean age demographic for the various GMC kinds was similar Zhang et al. (2023) looked at CT-based morphological pelvic alterations in GMC patients. Their study findings indicate that there is no correlation between the severity of pelvic structural abnormalities and age in adult populations [20]. When treating grade II GMC patients, Zhang et al. (2018) compared arthroscopic procedures with open operations. When compared to open surgical techniques, arthroscopic treatments resulted in smaller incision sizes, fewer bleeding indicators, shorter hospital stays, and lower postoperative painkiller use. While the overall benefits showed superiority across minimally

invasive surgical techniques, the surgery time rose in arthroscopic instances [21].

Gender influences which side of the body exhibits laterality patterns, but not the type of contracture itself, according to the study's findings. Gluteus maximus contracture can arise from a variety of sources. The age distribution indicates that, even in the absence of statistical significance, various forms of gluteus maximus contractures may be impacted by underlying anatomical or developmental variables. The study's defined cohort contributes important regional data to the little research on this outcome and shows why appropriate surgical therapies for best functional recovery should follow early identification. While expanding our understanding of disease progression and treatment response, further multi-center studies with larger patient populations and longer follow-up times could help address unanswered medical problems.

CONCLUSION

This study assessed the functional outcomes and demographic data of individuals who underwent open surgery to relieve gluteus maximus contracture. According to research findings, bilateral contractures were more common than unilateral involvement across the patient group, with female patients being particularly impacted. The study's findings revealed variances between young and elderly individuals, as well as between male and female participants, although these differences did not significantly affect the location or kind of contracture. Increased hip flexion and the capacity to squat following surgery demonstrate that open release remains a successful strategy for impacted patients' functional rehabilitation. The information demonstrates the necessity of early diagnosis and surgical procedures to prevent the development of irreversible impairment. To improve medical judgments on patient care and treatment results, more thorough research combining longer follow-up periods and functional scoring systems has to be carried out.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

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AUTHORS' CONTRIBUTIONS:

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

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