



Gluteal compartment syndrome

Jeff T. HENSON, Craig S. ROBERTS, Peter V. GIANNOUDIS

From the University of Louisville, Louisville, Kentucky, USA

A systematic review of the literature on gluteal compartment syndrome was performed using Medline Ovid and PubMed search engines. Publications were included if they described the causes, diagnosis, treatment, and functional outcome of this syndrome. Seven articles with a total of 28 cases met the eligibility criteria, all of which were retrospective case studies. The most common cause of gluteal compartment syndrome was prolonged immobilization. Diagnosis was based on either clinical presentation or measurement of compartmental pressures. Treatment most commonly involved surgical decompression (71% of cases). Functional outcome was assessed differently among the various studies.

Keywords : gluteal ; compartment syndrome.

INTRODUCTION

The gluteal region has been described in cadaveric studies as compartmentalized (14). Only a limited number of case studies have reported a gluteal compartment syndrome and no investigation has systematically reviewed the literature on this diagnosis. The purpose of this systematic review was to assess the causes, diagnoses, treatment, and functional outcomes of gluteal compartment syndrome.

MATERIALS AND METHODS

This was an Institutional Review Board-exempt study performed at a Level one trauma center. A PubMed

search was performed to evaluate our research objectives with the key words *gluteal compartment syndrome*, which lead to a total of 53 articles. A Medline Ovid search was then performed with the same key words which yielded 32 articles. One reviewer selected potentially high-yield abstracts and obtained full copies of the articles. Studies selected were original articles that contained two or more cases of gluteal compartment syndrome. Only articles written in English were included. Papers were analyzed for the following parameters : cause of the compartment syndrome, diagnosis, treatment, and functional outcomes.

Articles that did not meet these criteria or that did not focus primarily on gluteal compartment syndrome were excluded. Relevant information regarding gender, average age, causes of the compartment syndrome, diagnosis, treatments, and functional outcomes were carefully extracted.

■ Jeff T. Henson, Medical Student.

■ Craig S. Roberts, MD, Orthopaedic surgeon, Professor of orthopaedic surgery.

Department of Orthopaedic Surgery, University of Louisville Hospital, Louisville, KY, USA.

■ Peter V. Giannoudis, MD, Orthopaedic surgeon, Professor of orthopaedic surgery.

Department of Trauma and Orthopaedic Surgery, University of Leeds, Leeds General Infirmary University Hospital, Leeds, UK.

Correspondence : Craig S. Roberts, MD, Department of Orthopaedic Surgery, University of Louisville, 210 E. Gray Street, Suite 1003, Louisville, KY 40202 USA.

E-mail : craig.roberts@louisville.edu

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Table I. — Causes of gluteal compartment syndrome

Study citation	Patients	Vascular surgery	Trauma	Prolonged level of immobilization*	Post joint arthroplasty following epidural analgesia	Infection	IM drug use
Owen <i>et al</i> (14)	3	—	2	1	—	—	—
Lachiewicz & Latimer (10)	6	—	—	6	—	—	—
Yoshioka (18)	4	—	1	3	—	—	—
Bosch & Tscherne (2)	6	—	3	1	—	2	—
Schmalzreid <i>et al</i> (16)	3	—	—	3	—	—	—
Pacheco <i>et al</i> (15)	2	—	—	—	2	—	—
Kumar <i>et al</i> (9)	4	—	—	—	4	—	—
Total	28	—	6 (21%)	14 (50%)	6 (21%)	2 (7.1%)	—

* Secondary to alcohol or drug overdose and surgical positioning.

RESULTS

Seven articles met our search criteria (2,9,10,14-16,18). All studies were retrospective case reports ; there were no large series or prospective, randomized studies. A total of 28 cases were reported, 26 of which provided functional outcomes (2,9,10,14-16,18). Six articles reported the gender of the patients ; 82% were male and 18% were female (9,10,14-16,18). The average age was 45 years (range, 25-72 years).

Causes

Our review revealed that gluteal compartment syndrome may be caused by trauma (1,3), vascular surgery (4,5), intramuscular drug abuse (6), altered level of consciousness from alcohol ingestion or drug overdose, prolonged immobilization, epidural analgesia after joint arthroplasty, and infection (7,8,10).

The 28 cases were compiled and sorted according to these causes (table I). Fifty percent were due to a prolonged level of immobilization, alcohol or other drugs, or surgical positioning (10,14,16,18). Twenty-one percent were post-joint arthroplasty where the patients had epidural analgesia (9,15) and 21% were due to traumatic causes (2,14,18). Two cases (7%) were due to infection, in which both cases showed necrotizing fasciitis as the cause (2).

Diagnosis

Out of 28 cases (table II), 46.4% were diagnosed based on measuring compartmental pressures (2,10,14-16,18) and 54%, according to patient symptoms and clinical findings (2,9,10,15,18). There were no guidelines that dictated how to diagnose gluteal compartment syndrome. Measuring compartment pressures may be useful in the diagnosis, but the pressure threshold is unknown (17). Therefore, the diagnosis remains clinically based. The clinical findings are similar to those of other compartment syndromes such as excessive pain (usually out of proportion to the injury), paraesthesia, and tense compartments (5,11,12) (table II).

Treatment

The most common method of treating gluteal compartment syndrome was surgical fasciotomy (71.4%) (2,9,10,14-16,18) (table III). Non-operative treatment was used in 28.6% of cases (2,10,14,18). The decision to use surgery or a non-operative approach was based mostly on compartmental pressures, although the ideal compartmental pressure for carrying out a fasciotomy is unknown. However, many of the authors suggested fasciotomy for pressures greater than 30 mmHg using a wick catheter method (10,14,16,18), based on a study by Mubarak *et al* (13) which reviewed various acute compartment

Table II. — Diagnosis of gluteal compartment syndrome

Author	Patients	Compartmental pressures used in diagnosis	Clinical presentation used in diagnosis
Owen <i>et al</i> (14)	3	3	–
Lachiewicz & Latimer (10)	6	1	5
Yoshioka (18)	4	3	1
Bosch & Tscherne (2)	6	2	4
Schmalzried <i>et al</i> (16)	3	3	–
Pacheco <i>et al</i> (15)	2	1	1
Kumar <i>et al</i> (9)	4	–	4
Total	28	13 (46.4%)	15 (53.6%)

Table III. — Treatment of gluteal compartment syndrome

Author	Patients	Surgical decompression	Conservative treatment
Owen <i>et al</i> (14)	3	2	1
Lachiewicz & Latimer (10)	6	1	5
Yoshioka (18)	4	3	1
Bosch & Tscherne (2)	6	5	1
Schmalzried <i>et al</i> (16)	3	3	–
Pacheco <i>et al</i> (15)	2	2	–
Kumar <i>et al</i> (9)	4	4	–
Total	28	20 (71.4%)	8 (28.6%)

syndrome cases. Nonetheless, no equivalent guidelines for surgical decompression of gluteal compartment syndrome have been determined. Owen *et al* (14) described a posterior approach for surgical decompression of gluteal compartment syndrome that required multiple epimysiotomies. Bosch and Tscherne (2) described a posterior incision in one case.

Functional outcomes

A total of 26 cases from 7 studies reported functional outcomes (2,9,10,14-16,18) (table IV). Various methods were used because a universal rating system is not available.

Owen *et al* (14) reported that 2 patients fully recovered and one had a mild abductor limp. Lachiewicz and Latimer (10) evaluated functional outcome using as criteria muscle strength and sensory status. Four of the patients in their report

recovered fully, while two patients had paraesthesia along the dorsum of the foot with normal muscle strength.

Yoshioka (18) reported that three patients recovered fully, whereas one patient had a normal gait but mild weakness of the external rotators of the hip and numbness of the foot. Bosch and Tscherne (2) used a much more detailed examination on follow-up, considering patient subjective feeling of recovery, skin appearance, presence or absence of muscle atrophy, sensory status, reflexes, and leg strength. Three of the four patients reported they had a reduced state of health. One patient had a striated skin depression over the area of injury, one patient had a 1 cm dehiscent scar over the injury site, and two patients had healed scars. Three patients showed gluteal atrophy, and three reported some form of dysaesthesia. Two patients had absent anterior tibial reflexes on the ipsilateral side of the injury and one also had a reduced patellar reflex.

Table IV. — Functional outcomes after gluteal compartment syndrome

Author	Patients	Functional outcome
Owen <i>et al</i> (14)	3	Two patients fully recovering, one patient having a mild abductor limp.
Lachiewicz <i>et al</i> (10)	6	Four of the patients recovered fully. Two patients reported paraesthesia along the dorsum of the foot with normal muscle strength. Two patients had expired and could not be evaluated.
Yoshioka (18)	4	Three patients recovered fully whereas one had a normal gait but with mild weakness of the external rotators of the hip and numbness of the foot.
Bosch <i>et al</i> (2)	6	Three of the four patients reported themselves in a reduced state of health. One of the patients had a striated skin depression over the area of injury, One of the patients had a 1 cm dehiscent scar over the injury site, and two of the patients had healed scars. Three of the four patients showed gluteal atrophy. Three of the four patients reported some form of dysaesthesia. Two of the patients had absent anterior tibial reflexes on the ipsilateral side of the injury with one patient also having a reduced patellar reflex. Hip range of motion was near normal in all patients. Two of the four patients on strength evaluation had decreased plantar flexion or plantar extension on the ipsilateral side of where the compartment syndrome was diagnosed.
Schmalzried <i>et al</i> (16)	3	Three patients had decreased function, one patient having a slight weakness in hip abductors and one patient having significant motor and sensory loss.
Pacheco <i>et al</i> (15)	2	One of two patients complained of gluteal discomfort with sitting. One patient was not evaluated.
Kumar (9)	4	Three of four patients making a good recovery but giving no data for evaluation. One of four patients had weak hip abductors with a Trendelenburg gait and residual limp with walking.

Hip range of motion was near normal in all patients. Two patients had decreased plantar flexion or plantar extension on the ipsilateral side.

Schmalzried *et al* (16) reported on three patients who all had decreased function: one had slight weakness in hip abductors, one had significant motor and sensory loss requiring an ankle foot orthosis for ambulation, and one had a slight motor and sensory loss.

Pacheco *et al* (15) reported that one of two patients complained of gluteal discomfort with sitting. The other patient was not evaluated. Kumar *et al* (9) reported three of four patients had a good recovery, but did not provide data for evaluation. One of four patients had weak hip abductors, with a Trendelenburg gait and residual limp during walking.

DISCUSSION

Seven articles met our search criteria and were the basis of this systematic review. All of the studies

were retrospective case studies. This review focused on the causes, diagnosis, treatment, and functional outcomes of patients with gluteal compartment syndrome. The majority of patients were males (82%) and the average age was 45 years. Gluteal compartment syndrome was mostly caused by prolonged immobilization (50% of cases). This finding highlights the importance of heightened clinical surveillance and careful surgical positioning of patients undergoing lengthy orthopaedic procedures who might be at increased risk of gluteal compartment syndrome.

The clinical expression of gluteal compartment syndrome mimics that of other compartment syndromes. Pain, paraesthesia, and tense compartments are some of the major diagnostic clues. This review shows that 53.6% of cases were diagnosed using clinical criteria alone. In the other 46.4% of cases, compartment pressures were used in conjunction with the clinical presentation to determine a diagnosis. Measurements of the compartment pressures may be performed, but the pressure threshold for

diagnosis remains unknown. Most authors in this review used a pressure threshold of 30 mmHg to aid in determining treatment, but clinical presentation remains the best criterion in evaluating the patient. Invasive pressure catheter monitoring may not be the best choice given that gluteal compartment syndrome is a rare entity, and the majority of cases had clinical evidence of compartment syndrome.

Gluteal compartment syndrome was treated either conservatively or with surgical decompression. Seventy-one percent of the cases had a surgical decompression, whereas 28.6% were treated non-operatively with careful monitoring. This review points out a very important observation. With surgical treatment employed in the majority of cases, one may conclude that gluteal compartment syndrome should be considered a surgical emergency. However, we were unable to ascertain precise indications for surgery. The lack of information in the studies regarding the decision process for surgical treatment should be addressed in further research. Prospective studies focused on the surgical treatment of this syndrome are required.

Twenty-five cases were evaluated for functional outcome, 12 of which fully recovered. Thirteen patients had some form of either motor or sensory deficit. The functional outcomes highlight two important considerations. First, gluteal compartment syndrome is a significant cause of decreased function for the patient. This supports the statement that this syndrome should be considered an emergency, if not a surgical emergency, to prevent loss of function. The second important point is the lack of a universal evaluation system. Each author used different rating systems and examination parameters to evaluate the patients. A universal evaluation system needs to be developed in order to better understand the outcomes of patients with gluteal compartment syndrome. We were unable to determine any differences in outcome between cases treated surgically and those treated nonoperatively.

Our study represents the first systematic review of gluteal compartment syndrome. We found that this is a serious clinical problem that could have detrimental effects on patient outcome. Our study is limited to a small number of cases ; however, the literature itself is so limited. Ideally, prospective

multicentre studies would provide the surgeon with more insight into the diagnosis and treatment of gluteal compartment syndrome, which would help in treatment and to prevent loss of function for the patient.

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