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Percutaneous mini open fasciotomy for impending acute compartment syndrome of leg: A study of 25 patients

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Abstract

Background: Compartment syndrome can complicate any fracture and is a challenge for orthopedic surgeons. It is an emergency condition which can lead to profound functional disability, ischemia and gangrene of limb if not promptly diagnosed and treated early. The fasciotomy procedure used widely for compartment syndrome of leg fracture is an open fasciotomy. Delay in fasciotomy wound healing, infection, need of secondary procedures may delay definite fracture fixations.

Materials and Methods: We performed a prospective study of post traumatic tibia fractures with impending compartment syndrome treated by mini open percutaneous compartment fasciotomy. Results in terms of arrest of progression of the condition, wound complications, need for secondary procedure for wound healing and cosmetic appearance were evaluated Twenty five patients who were operated between 2010 and 2015 were selected for the study. 25 patients with fracture leg with impending compartment syndrome were treated with mini-open fasciotomy. Patients were reviewed post surgically and data was collected regarding symptoms and outcome assessment using specific parameters.

Results: In all of our patients we were able to relieve the compartment pressure by this mini-open approach with pain relief in all (n=25) the patients within 6 hours. Mean healing time of the wound was 7 days and there was no wound infection. Percutaneous mini-open fasciotomy can arrest the progression of compartment syndrome. Need for secondary wound procedure like flap cover, skin grafting, vacuum assisted closure is not required. Definitive management of fracture can be done early with less hospital stay with good cosmetic results.

Conclusion: Percutaneous mini-open fasciotomy can be used as a definitive procedure for impending compartment syndrome of leg with minimum surgical complications.

Keywords: Percutaneous mini, fasciotomy, compartment syndrome

1. Introduction

Compartment syndrome is an orthopedic emergency with clinical and medicolegal implications. Approximately 40% of all compartment syndromes occur after fractures of the tibia shaft. Early diagnosis and treatment are of the utmost importance in order to avoid long term disability.

The criteria for impending compartment syndrome are:

1. Mild to moderate increase in circumference of the leg,
2. Firm swelling on palpation, appearance of multiple fluid filled blisters (Fig 1),
3. Mild to moderate pain on stretching the tendons of muscles passing through the compartment involved and no vascular, sensory or motor deficit^[1]

Impending compartment syndrome is commonly treated by fasciotomy and external bone stabilization followed by definitive fixation in the second stage. Single staged fasciotomy with open reduction and internal fixation is a controversial subject. The major disadvantage of conventional fasciotomy were difficulty in skin closure, delay in internal fixation and need of secondary procedures. The aim of this study is to evaluate the outcomes of percutaneous mini-open fasciotomy for acute compartment syndrome of tibia fractures.

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2. Material and Methods

2.1 Design of study: Prospective Study

2.2 Study Setting: Government. T.D. Medical College, Alappuzha, Kerala, India

We studied 25 patients with closed tibia fractures between 2010 and 2015. Only those patients presenting within six hours of injury were included in the study. Informed consent was taken from each individual patient. There were 17 male and 8 female patients with the majority in the age group of 20-50 years, the mean 15 patients with tibial plateau fracture, 8 patients with fracture tibial shaft, 1 with type 2 epiphyseal injury proximal tibia. 19 patients having right side involved, 6 having left side involved.

All the patients were evaluated under ATLS protocol. After initial stabilization extremity was examined for signs and symptoms of impending compartment syndrome.

Serial clinical examinations were done to identify the signs of impending compartment syndrome including progressive increase in severity of pain, increase in girth of the calf [5cm distal to tibial tuberosity] (Fig.2) and early onset of stretch pain. Oxygen saturation checked with pulse oximeter before and after the procedure.



Fig 1: a case of leg compartment syndrome with skin blebs



Fig 2: Girth measurement

Diagnostic imaging techniques like USG, MRI, DOPPLER were done only when required. No direct intra-compartmental pressure monitoring was done

2.3 Procedure

The senior author performed all procedures in minor operation theatre. Patient is positioned in supine position and after povidone iodine skin preparation sterile drapes were applied For anterior compartment release three transverse incisions measuring about 2 cms are made one inch lateral to the shin. Skin and subcutaneous tissues are incised and retracted using retractors and fascia of anterior compartment is visualized. (Fig 3)



Fig 3: Arrow showing white tense deep fascia.



Fig 4: Incision on deep fascia

A transverse cut in the deep fascia and then using a long mayo scissors elevate the fascia form underlying muscle keeping the blades of scissors crossed. (Fig 4). Then pass half open scissor with edge of fascia between blades and advance to next incision. The fascia proximal to the proximal incision and distal to distal incision can be incised blindly after elevating the fascia. (Fig 5, 6)



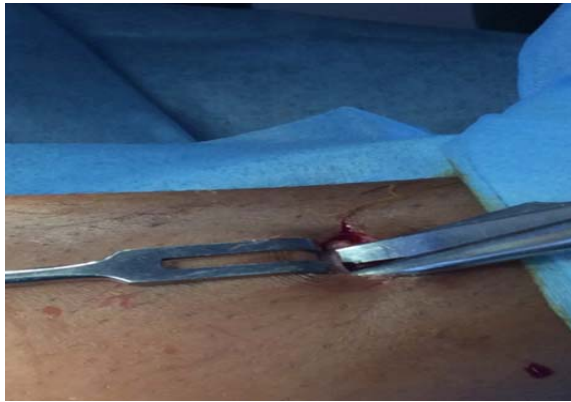


Fig 5: Arrow showing tip of scissors passed from one incision to other.

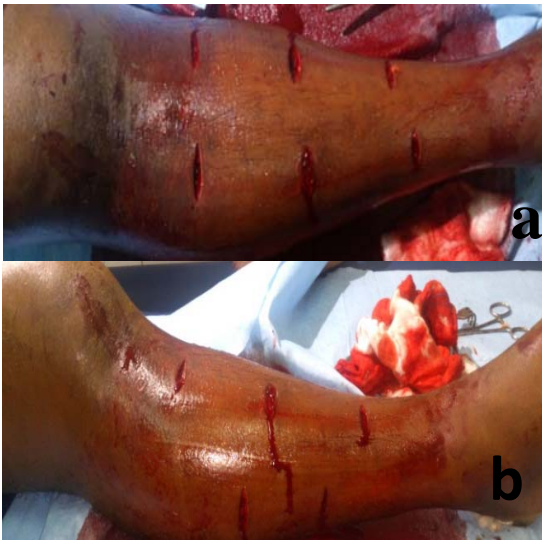


Fig 6 (a, b): Skin incisions after fasciotomy release

For lateral compartment 2 transverse incisions are made about 10 cms apart just posterior to fibula and the fascia is released in the same way as mentioned above.

For Posterior compartment a 2cm Incision at One inch behind posterior margin of tibia. Same technique followed to incise fascia. Deep posterior compartment fascia can be palpated attached to the posterior tibial border. Once superficial compartment is released deep compartment fascia can be released by periosteal elevator from the tibial attachment or carefully by scissors. Skin sutured with 2-0 proline and for better cosmetic result subcuticular method of closure can be used. (fig.7) Oxygen saturation measured with pulse oximeter. Limb elevated over Bohler-Braun splint



Fig 7: Subcuticular suturing & skin suturing

Post operatively patients were evaluated for compartment syndrome after 12 hrs. of fasciotomy with stretch-pain, pulse, oxygen, saturation, circumference of calf compared to normal fellow limb. Fracture fixation is done once the swelling subsides and wrinkle sign appears.

3. Results

68% of patients in our study were males and the fractures are more common in young subjects (20-30yrs) (Fig 8)

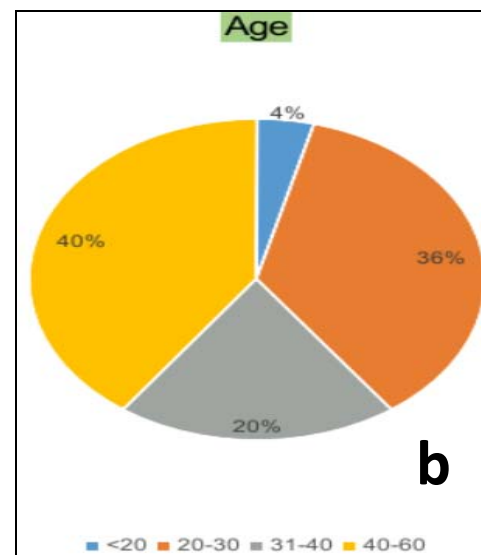
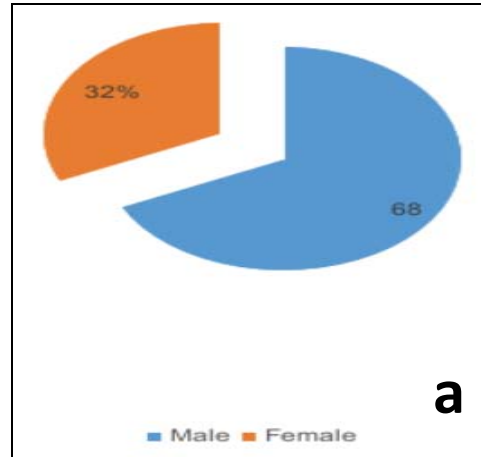


Fig 8 a): Sex distribution b). Age distribution

Postoperatively three parameters were assessed to assess the effectiveness of mini open fasciotomy in relieving compartment pressure. ie.1) pain 2) changes in girth of leg 3) skin tension. These were assessed at an interval of 12 hrs apart till the third day after fasciotomy. These parameters are known to be indirect indicators of compartment pressure.

Pain relief occurred in all (25) patients with in initial 12 hour of fasciotomy as assessed by Visual analog scale (VAS). Girth of leg found to be decreased in 14 of patients and unchanged in 11 of patients during the initial 12 hour period where as a decrease in skin tension was felt in 9 patients and in 8 patients there was no change in tension. Rest 7 patients had an increase in blebs even though there pain was significantly decreased. The patients whose girth found to be unchanged during the initial period were found decreasing from the second day itself. On the third day it's found that there is decrease in swelling of average of 3.4 cm in circumference (Fig 9)



Fig 9 (a). Leg condition after 12 hrs. of fasciotomy (b). After 72 hours of fasciotomy

Outcome assessment is done by giving specific points to the above said parameters and by adding the values result can be classified to good, fair and poor. (Table 1)

Table 1

Outcome Assessment		
Pain	VAS	0-10
Change in Girth	increase	2
	No change	1
	decreased	0
Skin tension	Increase with appearance of new blebs	2
	No change	1
	Decrease in tension	0

Outcome Assessment	
Good	1-3
fair	4 -6
poor	More than 6

Good results were seen in 15 patients but it increased to 25 after 60 hours. Fair result is obtained in 10 of patients but gradually the improved to good at 60 hour of follow-up. None had poor result. (Table 2)

Mean healing time of the wound was 7 days. No patient required secondary procedure for soft tissue management. No post op skin necrosis or infection noted. No neurological injury noted. (One patient developed saphenous neuropraxia which fully recovered in 14 days)

Table 2

	At 12 hrs	24 hrs	36 hrs	48 hrs	60 hrs	72 hrs
Good	15	15	22	22	25	25
Fair	10	10	3	3	0	0
Poor	0	0	0	0	0	0

4. Discussion

Regardless of the cause, the increased intracompartmental pressure must be promptly decompressed by surgical fasciotomy. Missed diagnosis and late decompression are associated with significant morbidity due to irreversible ischemic necrosis of the muscles and nerves in the compartment.

Table 3

Symptoms/Signs after fasciotomy (initial 12 Hrs)	No of patient(out of 25)
Pain relief	25
Decrease in girth	14
Decrease in Skin tension	9

The essential clinical feature of compartment syndrome in conscious patients is severe pain out of proportion to the injury, aggravated by passive muscle stretch. Although intracompartmental pressure can be measured easily by using readily available devices, wide variation in the intracompartmental pressure value is accepted as diagnostic [2] The difference between the diastolic pressure and the intracompartmental pressure has been suggested as a more sensitive indicator of tissue perfusion pressure, and a value of 30 mm Hg or less has been recommended as the threshold for fasciotomies. But treatment based on this measurement alone may lead to unnecessary surgery. Increased specificity can be achieved by combining the reduced perfusion pressure with the presence of clinical symptoms, but at the expense of a much reduced sensitivity [2] in our study no direct compartment pressure monitoring and we used certain parameters to assess the impending compartment syndrome. Measurements of intracompartmental pressure are not necessary if the diagnosis of a compartment syndrome is clinically apparent and are probably best reserved for uncooperative patients or equivocal cases, where serial measurements may be required [3].

Serial measurement of limb girth will definitely help to detect the “impending compartment syndrome”. This is true in the presence of very early stretch pain. Limb girth measurement is also significant when other symptoms of ACS are masked due to head injury, peripheral nerve injury, sedation and uncooperative patients

Though fibulectomy through a single lateral incision was considered a popular technique for four-compartment fasciotomy of the leg, now it is replaced by two-incision fasciotomies due to less morbidity [4] The single incision technique is successful in experienced hands but it is less popular [5].

Despite the problems associated with long skin incisions, open fasciotomy by incision of the skin and fascia is the most reliable method for adequate compartment decompression. According to our study when detected early a very simple procedure “percutaneous fasciotomy” under local anesthesia can save a lot of morbidity related to an open fasciotomy. Procedure also saves lot of time in hospital stay and definitive fracture management. It is equally effective in relieving compartment pressure as compared to an open procedure. If muscles found frankly ischemic and necrotic procedure can be converted to an open fasciotomy for the surgical management of the necrotic muscles.

Pain is supposed to be the single most predictor showing efficacy of fasciotomy during initial 12 hours. In almost all our cases even if the skin tension or girth remained unchanged there was a significant decrease in pain after fasciotomy (Table

3). Management of the fasciotomy wounds remains controversial. The exposed tendons, periosteum, and the muscles should be kept moist to avoid desiccation of the tissues and prevent infection [7]. Wound complications were recorded in 51% of patients who had primary or delayed primary closure compared with 5% who had split skin grafts [7-9]. In our study we did not require any form of secondary wound coverage for our fasciotomy wounds. In our observation cosmetic results after percutaneous fasciotomy is much better when compared to conventional open fasciotomy. Non-availability of long follow-up and limited number of cases are our limitation.

5. Conclusion

Percutaneous Mini-open fasciotomy is simple, safe yet effective way of treating impending compartment syndrome.

6. References

1. McQueen MM, Gaston P, Court –Brown CM, Acute compartment syndrome; Who is at risk ? J Bone Joint Surg Br 2000; 82:200-3.
2. Pearse MF, Harry L, Nanchahal J. Acute compartment syndrome of the leg Fasciotomies must be performed early, but good surgical technique is important BMJ 2002; 325(7364):557-558.
3. Janzig HJM, Broos PLO. Routine monitoring of compartment pressure in patients with tibial fractures: beware of overtreatment! Injury. 2001; 32:415-421.
4. Mubarak SJ, Owen CA. Double-incision fasciotomy of the leg for decompression in compartment syndromes. JBJS Am. 1977; 59:184-187.
5. Maheshwari R, Taitsman LA, Barei DP. Single-incision fasciotomy for compartmental syndrome of the leg in patients with diaphyseal tibial fractures, JOT, 2008; 22(10):723-730.
6. Tiwari A, Haq AI, Myint F, Hamilton G. Acute compartment syndromes. Br J Surg. 2002; 89:397-412.
7. Fowler JR, Kleiner MT, Das R, Gaughan JP, Rehman S. Assisted closure of fasciotomy wounds: a descriptive series and caution in patients with vascular injury, Bone and Joint Research, 2012; 1(3):31-35.
8. Asgari MM, Spinelli HM. The vessel loop shoelace technique for closure of fasciotomy wounds,” Annals of Plastic Surgery, 2000; 44(2):225-229.
9. Johnson SB, Weaver FA, Yellin AE, Kelly R, Bauer M. Clinical results of dermatomy-fasciotomy. Am J Surg. 1992; 164:286-290.