Original Research Article

Functional outcome of surgical management of calcaneal spur by excision and autologous platelet-rich plasma injection

Parvez Ahmad Ganie¹,*, Arun Gulati², Rajendra Pranav Prasad³, Anvith S Shetty³

¹Dept. of Orthopaedics, School of Medical Sciences and Research, Sharda University, Greater Noida, Uttar Pradesh, India
²Dept. of Orthopaedics, Kalpana Chawla Government Medical College, Karnal, Haryana, India
³Dept. of Orthopaedics, JJM Medical College, Davangere, Karnataka, India

A R T I C L E   I N F O

Article history:
Received 07-06-2021
Accepted 17-06-2021
Available online 24-06-2021

Keywords:
Calcaneal spur
Platelet-rich plasma
VAS score

A B S T R A C T

Introduction: The calcaneal spur is also known as an enthesophyte which is a bony outgrowth from the calcaneum at the plantar fascia insertion. Treatment aspect ranges from initial conservative methods, invasive techniques to surgical excision of the spur in cases which are not responding to any other alternative methods. This article aims in evaluating the functional outcome of calcaneal spur excision coupled with a dose of autologous platelet-rich plasma injection in recalcitrant cases of the calcaneal spur.

Materials and Methods: A total of 42 cases of confirmed calcaneal spur cases were recruited for the study. All participants were offered with calcaneal excision with a dose of autologous platelet-rich plasma injection. All patients were evaluated preoperatively and post-operatively with VAS and FFI scores at the end of the 1st, 3rd, and 6th months.

Results: The patients who received calcaneal spur excision along with a single dose of autologous platelet-rich plasma injection reported statistically significant pain relief at the end of 6 months while comparing with the pre-operative VAS score (p = 0.003) and FFI score showed a statistically significant functional outcome between both groups at the end of 6 months (p <0.001).

Conclusion: Surgical removal of calcaneal spur along with a dose of an autologous platelet-rich plasma injection serve the better management for calcaneal spur and improves the functional quality of life.

1. Introduction

One of the most common orthopedic-related complaints in an out-patient setup is heel pain.¹ The causes are multifactorial such as Plantar fasciitis, Retrocalcaneal bursitis, Achilles tendinitis, calcaneal spur, Haglund deformity, chronic Achilles tendinopathy, calcaneal fractures, nerve entrapment such as tarsal tunnel syndrome.² The calcaneal spur can be of two types plantar spur or Achilles spur.³ The calcaneal spur is also known as an enthesophyte which is a bony outgrowth from the calcaneum at the plantar fascia insertion which was first described by a German Physician in 1900 Plettner.⁴,⁵ About 10% of people experience plantar heel pain during their lifetime to seek medical attention.⁶

The cause for the development of calcaneal spur remains controversial. One such being longitudinal traction hypothesis wherein inflammation and reactive ossification of the site of attachment of the plantar fascia to the calcaneum occurs, particularly chondral and intramembranous ossification.⁷–⁹ Another hypothesis being repetitive microtrauma by overloading of the longitudinal arches, which in turn produces focal tears and chronic inflammation at the bone-fascia interface.¹⁰
Activities such as running, jumping and dance are prone to increase the incidence of this condition. Obesity and pes planus are known risk factors associated with the development of calcaneal spur. It occurs in either sex with increasing incidence in middle to elderly age group or younger population who are involved in running, or jumping activities. These patients present with night pain, pain with the initial steps after waking up in the morning which gets relieved with further walking and rest.

Treatment aspect ranges from initial conservative methods such as ice pack, underwater exercises, log roll under the feet, MCR footwear to invasive techniques such as local steroid injection or platelet-rich plasma infiltration to surgical excision of the spur in cases which are not responding to any other alternative methods. Our study was to assess the functional outcome of surgical excision of calcaneal spurs coupled with a dose of autologous platelet-rich plasma injection in symptomatic patients who are recalcitrant to conservative methods of treatment.

2. Materials and Methods

With level IV evidence, a prospective cohort study was performed from January 2017 to December 2018 with 127 clinically diagnosed heel pain patients who were subjected to radiographs of the pathological foot and confirmed the presence of calcaneal spur in 42 patients.

The patients above the age of 18 years, patients with the confirmed calcaneal spur on radiographs, and patients who were willing for management as per our protocol were included in the study. The patients aged less than 18 years, patients with positive septic screen, and patients who are not willing and unfit for surgical management according to our protocol were excluded from the study.

| 127 cases of heel pain were identified |
|---------------------------------------|
| Subjected for radiographic investigation |
| 42 cases of confirmed calcaneal spur cases identified |
| Surgical excision of calcaneal spur performed |
| After suture removal, all 42 cases were given a dose of autologous platelet-rich plasma injection |
| Followed up as per our protocol |

After getting IEC clearance and informed & written consent, for all 42 patients, pre-operative evaluations were done and explained the need for autologous platelet-rich plasma injection after suture removal from the surgical site.

Surgical procedure: A longitudinal linear incision was taken over the medial aspect of the foot of around 3 – 4 cm just above the junction of plantar skin over spur under fluoroscopic guidance as shown in Figure 1. Blunt dissection done till plantar fascia and subcutaneous layer separated from the fascia. Flexor digitorum brevis was resected from the spur. Using osteotome, the spur was transected under fluoroscopic guidance and removed with a rongeur. Edges were smoothened and bone wax was applied to achieve hemostasis. A sterile dressing and below knee POP slab were applied until suture removal.

Fig. 1: Surgical images of calcaneal spur excision

2.1. PRP injection

A total of 30 ml of venous blood was withdrawn in the vial containing sodium citrate from the patient and subjected to soft spin centrifugation of 3000 rpm for 10 minutes. The resultant plasma was transferred to a plain vial for hard spin centrifugation of 5000 rpm for 10 minutes as shown in Figure 2. 5 to 6 ml of autologous platelet-rich plasma separated and 10% calcium gluconate was added in the ratio of 10:1 before injecting into the plantar fascia as shown in Figure 1. The patient was advised not to consume any NSAIDs and not to bear weight in the same foot for 24 hours following which staged physiotherapy and plantar fascia strengthening exercises were started.

Fig. 2: Platelet-rich plasma preparation
2.2. Follow-up protocol

The VAS for pain and FFI for functional outcome were evaluated to study participants pre-operatively and post-operatively at the end of 1st, 3rd, and 6th months. The descriptive-analytical statistics were evaluated statistically with IBM SPSS Statistics for Windows, Version 24.0, IBM Corp, Chicago, IL. Paired ‘t’ test was used to compare the outcomes before and after the procedure and a p-value less than 0.05 was considered significant.

3. Results

Among 42 patients in this study, 25 patients (59.52%) were males and 17 patients (40.47%) were females. All the patients belong to age between 18 to 75 years, with the mean age being 37.12±14.77 years. The sex difference among both groups was statistically insignificant (p=0.963). The patients reported statistically significant pain relief at the end of 6 months while comparing with the pre-operative VAS score (p = 0.003) and FFI score showed a statistically significant functional outcome between both groups at the end of 6 months (p <0.001) as shown in Table 1.

4. Discussion

Most of the patients presenting to an orthopedics OPD with heel pain are due to plantar fasciitis, which is inflammation of the plantar fascia at the insertion site to the medial calcaneal tuberosity. This is also associated with the development of calcaneal spur, there is no clear evidence regarding their association.19,20 According to the available literature, 30% of the calcaneal spurs are asymptomatic and are associated with plantar fasciitis in 80% of the cases.1,21

A total of 15.5% of the normal population can reveal a calcaneal spur and there is no clear evidence regarding their association with the size and direction of the spur with heel pain.22,23

Systemic conditions associated with calcaneal spur formation are rheumatoid arthritis, ankylosing spondylitis, Reiter syndrome, diffuse idiopathic skeletal hyperostosis, psoriatic arthritis, also obesity, aging, biomechanical abnormalities in the foot such as tight Achilles tendon, pes cavus, & pes planus, occupational causes such as dance, sports, and prolonged standing are also contributing to the formation of the spur. These patients usually present with bilateral spur.2-6 But unilateral presentation is the most common form seen in around 70% of the subjects.4 Irving et al reported a strong association between high body mass index and calcaneal spur formation in non-athletic populations.7 Kuyucu et al reported a major linear correlation between the length of the spur with the severity of pain, body mass index, morning stiffness, and worst foot functional scores.5 Johal et al described a method of measuring the calcaneal spur length based on the lateral radiographs of the calcaneum where the first line corresponds to the calcaneal border and the second line from the calcaneal border to the tip of the spur and this length had a positive correlation with the severity of pain and also the chances of failure of conservative methods to alleviate the pain were high and need for surgical intervention were warranted.8 The diagnosis of plantar fasciitis is mainly clinical, based on the typical history, site of tenderness, in our study we found a statistically significant number of patients associated with calcaneal spur based on radiographs. Various authors postulated that plantar fasciitis is a triggering factor for the development of calcaneal spur.9-24 Surgical treatment of the spur is the last attempt to treat the pain and discomfort of the patient, but it has its complications such as infection, plantar

Table 1: Patient Characteristics and Outcomes

| Parameters         | Results | p-value |
|--------------------|---------|---------|
| Gender             |         |         |
| Male               | 25 (59.52) |        |
| Female             | 17 (40.47) |        |
| Follow-up duration |         |         |
| Pre OP             | 8.40±0.98 |        |
| Post OP (1st Month)| 6.40±0.98 | 0.249   |
| Post OP (3rd Month)| 5.33±0.72 | 0.002   |
| Post OP (6th Month)| 2.87±0.74 | 0.003   |
| VAS                |         |         |
| Pre FF1            | 47.87±2.99 |       |
| Post OP (1st Month)| 58.13±4.91 | 0.0631  |
| Post OP (3rd Month)| 72.47±4.30 | <0.001  |
| Post OP (6th Month)| 83.37±6.01 | <0.001  |
fascia rupture leading to flat foot and inciting degenerative arthritis in the subtalar and tarsometatarsal joints due to altered biomechanics, pain not relieved on spur excision as the cause of pain is multifactorial in most of the subjects, fat pad necrosis.

5. Conclusion
Surgical removal of calcaneal spur along with a dose of an autologous platelet-rich plasma injection serves to be better management for calcaneal spur with improved functional quality of life.

6. Acknowledgments
None.

7. Conflict of Interest
The authors declare that there are no conflicts of interest in this paper.

8. Source of Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References
1. Bartold SJ. The plantar fascia as a source of pain—biomechanics, presentation and treatment. J Bodywork Mov Therap. 2004;8(3):214–26. doi:10.1016/s1369-4907(03)00087-2.
2. Menz HB, Zammit GV, Landorf KB, Munteanu SE. Plantar calcaneal spurs in older people: longitudinal traction or vertical compression? J Foot Ankle Res. 2008;1(1):7. doi:10.1186/1751-148X-1-7.
3. Kuyucu E, Koçyiğit F, Erdil M. The association of calcaneal spur length and clinical and functional parameters in plantar fasciitis. Int J Surg. 2015;21:28–31. doi:10.1016/j.ijsu.2015.06.076.
4. Kuman T, Benjamin M. Heel spur formation and the subcalcaneal enthesis of the plantar fascia. J Rheumatol. 2002;29(9):1957–64.
5. Kosmahl EM, Kosmahl HE. Painful Plantar Heel, Plantar Fasciitis, and Calcaneal Spur: Etiology and Treatment. J Orthop Sports Phys Ther. 1987;9(1):17–24. doi:10.2519/jospt.1987.9.1.17.
6. Benjamin M, Touni H, Suzuki D, Hayashi K, McGonagle D. Evidence for a distinctive pattern of bone formation in enthesophytes. Ann Rheumatic Dis. 2009;68(6):1003–10. doi:10.1136/ard.2008.101184.
7. Irving DB, Cook JL, Menz HB. Factors associated with chronic plantar heel pain: a systematic review. J Sci Med Sport. 2006;9(1-2):11–22. doi:10.1016/j.jsams.2006.02.003.
8. Johal KS, Milner SA. Plantar fasciitis and the calcaneal spur: Fact or fiction? Foot Ankle Surg. 2012;18(1):39–41. doi:10.1016/j.jfas.2011.03.005.
9. Prichasuk S, Subhadrabandhu T. The relationship of pes planus and calcaneal spur to plantar heel pain. Clin Orthop Relat Res. 1994;306(1):192–6.
10. Ligaments and Tendons: Research and Clinical Practice. Advances in Muscles. 2011;5(4):1–41.
11. Chinn L, Hertel J. Rehabilitation of Ankle and Foot Injuries in Athletes. Clin Sports Med. 2010;29(1):157–67. doi:10.1016/j.csm.2009.09.001.
12. Lim AT, How CH, Tan B. Management of plantar fasciitis in the outpatient setting. Singapore Med J. 2016;57(04):168–71. doi:10.1162/smed.2016.57.04.5390.
13. LeMont H, Ammirati KM, Usen N. Plantar fasciitis: a degenerative process (fasciosis) without inflammation. J Am Podiatr Med Assoc. 2003;93(3):234–7.
14. Beeson P. Plantar fasciopathy: Revisiting the risk factors. Foot Ankle Surg. 2014;20(3):160–5. doi:10.1016/j.fas.2014.03.008.
15. Moroney PJ, O’Neill BJ, Khan-Bhambo K, O’Flanagan SJ, Kenny PJ, et al. The Conundrum of Calcaneal Spurs. Foot Ankle Spec. 2014;7(2):95–101. doi:10.1177/1938640013517699.
16. Kane D, Greaney T, Shanahan M, Duffy G, Bresnihan B, Gibney R, et al. The role of ultrasonography in the diagnosis and management of idiopathic plantar fasciitis. Rheumatology. 2001;40(9):1002–8. doi:10.1093/rheumatology/409.1002.
17. Wilson JJ, Lee KS, Miller AT, Wang S. Platelet-Rich Plasma for the Treatment of Chronic Plantar Fasciopathy in Adults. Foot Ankle Spec. 2014;7(1):61–7. doi:10.1177/1938640013509571.
18. Ibrahim MI, Donatelli RA, Schmitz C, Hellman MA, Buxbaum F. Chronic Plantar Fasciitis Treated with Two Sessions of Radial Extracorporeal Shock Wave Therapy. Foot Ankle Int. 2010;31(5):391–7. doi:10.1177/1071100710031007.
19. Kirkpatrick J, Yassaie O, Mirjalili SA. The plantar calcaneal spur: a review of anatomy, histology, etiology and key associations. J Anat. 2017;230(6):743–51. doi:10.1111/j.1469-5809.1997.
20. Alattas R, Alajlan A, Almalki T. Bizarre calcaneal spur: A case report. Int J Surg Case Rep. 2018;49:37–9. doi:10.1016/j.ijscr.2018.05.069.
21. Zhou B, Zhou Y, Tao X, Yuan C, Tang K. Classification of Calcaneal Spurs and Their Relationship With Plantar Fasciitis. J Foot Ankle Surg. 2015;54(4):594–600. doi:10.1053/j.jfas.2014.11.009.
22. Zhang L, Cheng H, Xiong L, Xia Z, Zhang M, Fu S, et al. The Relationship between Calcaneal Spur Type and Plantar Fasciitis in Chinese Population. BioMed Res Int. 2020;2020.
23. Kullar JS, Kullar KK, Randhawa GK. A study of calcaneal enthesophytes (spurs) in Indian population. Int J Appl Basic Med Res. 2014;4(3):13. doi:10.1016/j.ijabmr.2014.06.003.
24. Onuba O, Ireland J. Plantar fasciitis. Ital J Orthop Traumatol. 2015;54(4):594–600. doi:10.1053/j.jfas.2014.11.009.
25. Williams PL, Smibert JT, Cox R, Mitchell R, Klenerman I. Imaging Study of the Painful Heel Syndrome. Foot Ankle. 1987;7(6):345–9. doi:10.1177/107110078700700504.
26. Sadat-Ali M, Plantar Fasciitis/Calcaneal Spur among Security Forces Personnel. Mil Med. 1998;163(1):56–7. doi:10.1093/milmed/163.1.56.

Author biography
Parvez Ahmad Ganie, Senior Resident https://orcid.org/0000-0002-6002-4683
Arun Gulati, Senior Resident https://orcid.org/0000-0001-8799-2118
Rajendra Pranav Prasad, Junior Resident
Anvith S Shetty, Junior Resident

Cite this article: Ganie PA, Gulati A, Prasad RP, Shetty AS. Functional outcome of surgical management of calcaneal spur by excision and autologous platelet-rich plasma injection. IP Int J Orthop Rheumatol 2021;7(1):34–37.