

# Comparison of Conservative and Operative Treatment of Jones Fracture

Jiri Demel (✉ [demel@seznam.cz](mailto:demel@seznam.cz))

University Hospital Ostrava <https://orcid.org/0000-0003-3385-2974>

Ladislav Planka

Fakultni nemocnice Brno Detska nemocnice

Radek Stichhauer

Fakultni Nemocnice Hradec Kralove

Leopold Pleva

University Hospital Ostrava

---

## Research article

**Keywords:** Jones, Fracture, AOFAS, Herbert screw

**Posted Date:** September 20th, 2019

**DOI:** <https://doi.org/10.21203/rs.2.14565/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

**Background:** A Jones fracture is a transverse fracture of the V. metatarsal bone, without significant dislocation in the diaphysis junction and metaphyseal metaphysis. This type of fracture is usually associated with a minimal injury mechanism, and is characterized with minimal swelling, absence of hematoma and prolonged healing. The aim of the presented study was to compare the surgical and conservative therapy of Jones fracture. The study was registered in the [www.clinicaltrials.gov](http://www.clinicaltrials.gov) database, under the ClinicalTrials.gov ID: NCT04037540 on 27th July 2019.

**Methods:** A total of 27 study subjects were randomized into two groups – Conservative (K): 12, and Operational (O): 15. The study subjects were followed after 6 and 12 weeks using X-ray and the American Orthopedic Foot and Ankle Score (AOFAS). In the absence of X-ray signs of healing and low AOFAS score in Group K, treatment was considered unsuccessful and the patient was indicated for surgical treatment.

**Results:** Five patients in Group K showed no signs of healing on X-ray after 12 to 6 weeks. These patients also manifested poor AOFAS scores and were indicated for surgical treatment and excluded from the study. Fracture failure was observed in seven patients. Their AOFAS scores were at the least satisfactory and, the patients continued in conservative therapy. After 12 weeks, 6 patients manifested fracture healing on X-ray and the AOFAS score of 100. In one patient who refused surgery, the fracture was not healed after 12 weeks. In Group O, seven patients achieved fracture healing on X-ray after 6 weeks, 8 patients did not show fracture healing. The average AOFAS score after 6 weeks was 97 (excellent). After 12 months, 13 patients showed findings of fracture healing on X-ray. The average AOFAS score was 100 points (maximum).

**Conclusions:** The results of the study show that 1) Surgical treatment leads to significantly faster signs of healing on X-ray than the conservative one 2) After six weeks of surgery, 93% (14 out of 15) of patients are able to fully load the limb.

**Keywords:** Jones - Fracture - AOFAS - Herbert screw

Unique protocol ID: FNO-KUCH-01-Jones

## Background

The Jones fracture is a transverse fracture of the V. metatarsal without significant dislocation in the diaphysis junction and metaphyseal metaphysis (Figure 1). This fracture is characterized by minimal injury mechanism, minimal swelling, absence of hematoma and prolonged healing.

The classification of fractures in the proximal part of V. metatarsal area is not definite and entirely evident [13]. Some authors fundamentally distinguish between the so-called true or real Jones fracture and the stress fracture (stress fracture, fatigue fractures) of the proximal V. metatarsal diaphysis.

The treatment of proximal V. metatarsal fracture is either conservative or operative. For conservative therapy, the application of full non-walking plaster cast or plastic fixation, or alternatively a walker orthosis is recommended, together with exclusion of limb strain for the period of 6–8 weeks. The main advantage of this treatment method is the absence of surgery as such; disadvantages include the long-term fixation and associated risk of deep vein thrombosis (DVT), long-term rehabilitation and convalescence. Also, the number of treatment failures is high.

Intramural bolt fixation or traction loop osteosynthesis is used in surgical treatment. Spongioplasty or cortico-spongiosa graft is often used as a method of choice for these fractures [1]. The advantage of this method is the possibility to achieve a stable osteosynthesis, which allows for earlier strain, rehabilitation and recovery. Also, the number of primarily healed patients is reported to be greater.

The authors have been dealing with the surgical treatment of Jones fracture at our department since 1998. We have used both methods as a standard treatment, and have noted a large number of complications in terms of delayed healing during conservative treatment. Therefore, the researchers decided to create a set of patients, randomized into two groups, according to the treatment method used. The Group O includes operated patients, Group K patients treated conservatively.

The authors expected that in the group of operated patients after 6 weeks (after removing the fixation) better healing will be achieved according to X-ray, together with a better functional score. The authors also expected a significantly higher number of fully healed patients in the group of operated patients after 12 weeks, and zero re-operations in Group O, together with a frequent occurrence of necessary conversions in Group K.

## Methods

The studied group included a total of 27 patients with acute Jones fracture. The reference period was between 2006 and 2011. Patients diagnosed and treated at one department were enrolled. In all cases, the patients sustained an acute injury, the age limit was 18–70 years. Patients who had a recurring injury, or their injury was a part of a combined injury, were excluded. Also, patients with fatigue fracture who suffered from long-term problems with the absence of injury process in their anamnesis and signs of advanced healing on X-ray examinations, were excluded. Excluded were also patients with co-morbidities such as diabetes mellitus, chronic renal insufficiency and osteopathy.

The diagnosis was based on the history of a sudden pain or rupture at stumbling and the X-ray of the foot in two projections. These were divided into two groups using the unbalanced coin method [14]. Group O included patients treated surgically with a two-threaded headless screw followed by bandage and full pain load. The patients in Group K were treated conservatively with orthosis OR 15 and the regime of no limb loading.

Patients—candidates for the study were included after a primary 24/7 treatment at

a specialized clinic where the diagnosis was assessed and completed and exclusive and inclusive criteria were applied. The interval from the injury to the definitive diagnosis and inclusion in the sample groups was one week at the most. Immobilization with plaster splint was applied during primary treatment.

Conservative treatment (Group K) consisted of the application of a walker orthosis (Figure 2) and step instructions intended to eliminate the load on the affected limb by using crutches. Patients were given prophylaxis against DVT. The patients were allowed to remove the orthosis in order to perform personal hygiene.

Surgical treatment (Group O) was performed in the operating room under general or regional anaesthesia, at the contralateral flank. Under the control of X-ray amplifier, a guide wire was inserted intrinsically from a 1 cm long incision over the top of the base of the V. metatarsal bone. Along this wire, a channel was drilled for the screw, the distal thread and proximal thread were prepared, and a Herbert-type headless two-threaded bolt was applied (Figures 3 and 4). The screw is not removed after the fracture has healed [12]. A bandage was applied, after the post-operative pain subsided and the wound healed, the patient was allowed to load the limb according to pain tolerance.

Radiographs in two projections were always made the day after the operation, and at intervals of 6 and 12 weeks after the start of treatment. Clinical checks were conducted at the same intervals by determining the AOFAS subjective sensation (Table 1).

The monitored parameters included the healing status based on X-ray at 6 and 12 weeks (healed, not healed), the AOFAS scores at 6 and 12 weeks, the number of necessary reoperations, and the occurrence of possible complications.

X-ray signs of healing were defined as filling the fracture line with ossified matter and the presence of ossified muscle around the fracture line. Accordingly, the absence of ossified muscle and clear fracture line was assessed as not healed during X-ray examination.

The AOFAS questionnaire was always filled in by the patient during the 6th and 12th week examination. The attending physician was always present for possible questions.

In cases when the fracture was not sufficiently healed in conservatively treated patients after 12 weeks, the patients were indicated for surgical treatment and the situation was considered a necessary reoperation, as well as possible reosteosynthesis in the group of operated patients.

The following serious conditions were considered to be complications—osteosynthesis failure, serious infection, such as osteomyelitis or thrombophlebitis, deep vein thrombosis, eventually accompanied with embolism.

## Statistics

The statistical evaluation was carried out by the Institute of Biostatistics and Analyses. From the tables with results, a total of three hypotheses were tested—the expected better results for X-ray examinations after 6 weeks, the expected better results of AOFAS after 6 weeks, and the overall higher total healing rate in the O group. In order to perform the statistical analyses, the level of significance was set on 5%.

## Results

There were 27 patients in the study. These were divided into two groups. There were 15 study subjects in the Group O group (operated), and 12 patients in the Group K (conservatively treated). All patients were between 18 and 70 years of age and met the inclusive and exclusive criteria.

In Group O, all patients were fully healed within 12 weeks. In Group K, healing occurred within 12 weeks in 6 patients. Healing was not observed in 6 patients. Five patients underwent surgical treatment of the fracture after the 12-week term when the fracture developed into

a chronic stage. One patient refused the operation.

In Group O, seven patients showed signs of full healing after 6 weeks and 8 were not healed, according to the performed X-ray examinations. After 12 weeks, 13 patients were healed and 2 were not healed.

In Group K, no patient was healed after 6 weeks and only 6 patients were healed after

12 weeks according to the X-ray examinations. This corresponds to the subjective evaluation of AOFAS. The results achieved in both groups are summarized Tables 2 and 3.

All the three original hypotheses were confirmed in the present study. Better healing according to X-ray ( $p = 0.001$ ) and better functional score ( $p = 0.011$ ) were observed in the group of operated patients after 6 weeks. Also, there was a clearly higher number of fully healed patients after 12 weeks in the operated group ( $p = 0.036$ ).

Summary statistical data is presented in Table 4.

In Group K, it was necessary to convert to surgical treatment in a significant number of

5 patients. There was no need to reoperate anyone from Group O.

No complications were observed in Group O. In Group K, the complication of DVT was registered in one patient. The patient was treated with anticoagulant therapy for 6 months.

## Discussion

Landorf recommends distinguishing Jones fracture from fatigue fracture of proximal diaphysis due to a different aetiology, although both types of fractures are commonly associated with the occurrence of non-unions [3]. In his work, Quill states that up to 50% of fractures of the proximal diaphysis fractures

and V. metatarsal metaphysis treated conservatively using non-load fixation do not heal, and surgery is needed. For physically the less active patients, the author recommends conservative treatment, and operates only if there are no signs of healing present after 8 weeks.

With athletes, Quill always prefers acute osteosynthesis with an intramedullary bolt [9]. Rosenberg, on the other hand, reports a 72–93% success rate of conservative treatment of Jones fractures [6] immobilization without load. For fatigue fractures, he recommends surgical treatment using intramedullary fixation supplemented with a cortico-spongiosa graft [10]. Kavanaugh reports a large number of refractures after conservative treatment [2]. Dameron presents a study of 20 patients, 5 patients were operated on with spongioplasty and healed after 8 weeks. Fifteen patients were treated conservatively. Twelve out of 15 healed within 12 months, another 3 only after 21 months. [1]. Nunley recommends surgical treatment only for athletes; for the rest of patients he suggests a procedure based upon an agreement with the patient [7]. Minderbo and others operated 9 university athletes with an intramedullary bolt. A load during walking was allowed after 7–10 days, running was allowed on average from 5.5 weeks after surgery. The average period to return full sport activity was 8.5 weeks [6]. Pietropaoli in a biomechanical study performed in 1999 on cadavers proved that the forces required to move in place of Jones fracture with an intramedullary inserted

4.5 mm bolt cannot be achieved in normal load of walking [8]. In the Czech Republic, the topic of Jones fracture has been studied by Malkus. The author recommended the use of a pulling loop accompanied with spongioplasty when conservative treatment fails [4].

The main causes of complications of healing of the lateral fracture in the proximal diaphysis and metaphyseal metaphysis may be seen in its anatomical order and its relation to the surrounding skeleton of the leg. Marshall reports that the compression between fragments by Herbert's screw is 2.5 times less than the washer screw [5]. Stewart reports a large amount of prolonged healing or nonunion after Jones's fracture in a conservative treatment procedure. However, his collection contains precisely a large number of fatigue fractures of the V. metatarsal body [11]

The base of the V. metatarsal is firmly fixed by the tendon of the peroneus longus on the outer side and fixed by intermetatarsal ligaments to the base of the IV. metatarsal on the medial side. The proximal fracture fragment is fixed to the surrounding skeleton. The distal fragment formed by the diaphysis and the head remains free. Its only fixation to the surrounding skeleton is the free hinge of the transverse metatarsal ligament between the heads. It is

a primarily unstable fracture where dorsal interosseous muscle and short flexor of the little toe tend to result in permanent fracture disorder. Therefore, with the correct conservative procedure of immobilization, toes are fixed. It is necessary to eliminate tread load on the limb. Not complying with these principles leads to failure of the conservative approach. Jones fracture is an uncommon injury that affects predominantly athletes. Due to the poor results of conservative therapy, we recommend an active surgical approach to the treatment of these fractures. The osteosynthesis using Herbert bolt has proved successful at the Traumatology Centre, University Hospital Ostrava. It is a mini-invasive procedure

without the need of spongioplasty. Also, later extraction of the material is not required. When treated with this method, professional athletes are able to return early to sporting activities.

## **Conclusion**

Based on the obtained results and statistical evaluation of the group of patients we can state that in patients operated with the technique of intramedullary self-compression screw, the fracture healed fully after 12 weeks, with no need for further surgery. With patients treated with the intramedullary self-screw bolus method, significantly better functional scores were achieved after 6 and 12 weeks, together with better X-ray results after 6 weeks. Based on these claims, it is possible to recommend this method as the first choice method.

## **Abbreviations**

AOFAS—American Orthopedic Foot and Ankle Society

DVT—deep venous thrombosis

## **Declarations**

### **Ethics approval and consent to participate**

The Ethics Committee of the University Hospital Ostrava approved the study; all study subjects signed an Informed Consent with participation in the study.

### **Consent for publication**

The presented material contains no individual participant data; no consent for publication was required.

### **Availability of data and materials**

All supporting materials and raw data are stored with the authors of the manuscript, and are available upon request.

### **Competing interests**

The authors of the manuscript declare that there exists no conflict of interest.

### **Funding**

The study was financially supported with the grant project “Innovative Therapeutic Methods of Musculoskeletal System in Accident Surgery”, Registration No. CZ.02.1.01/0.0/0.0/17\_049/0008441, financed from the grant scheme “Operational Programme for Research, Development and Education” financed by the European Union and the state budget of the Czech Republic. The financial means were used for covering expenses related to the study and dissemination of the study results.

## Authors' Contributions:

JD designed the study and provided treatment for study all subjects in both studied groups; LP<sup>2</sup> was the supervisor, played the control role throughout the study, and performed statistical processing; RS prepared the References; LP<sup>1</sup> performed oversight over the whole course of the study and provided scientific advice

## Acknowledgements

The authors would like to thank colleagues from the Institute of Biostatistics and Analyses for their valuable advice, contribution, and assistance with processing of the statistical results.

## References

1. Dameron TB Jr. Fractures and anatomical variations of the proximal portion of the fifth metatarsal. *The J Bone and Joint Surg.* 1975;6:788–92.
2. Kavanough JH, Brower TD, Mann RV. The Jones fracture revisited. *J Bone Joint Surg Am.* 1978;60(6):776–82.
3. Landorf KB. Clarifying proximal diaphyseal fifth metatarsal fractures. The acute fractures versus stress fractures. *J Am Podiatr Med Assoc.* 1999 Aug;89(8):398–404.
4. Malkus T., Soukup B. [Jones fracture.]. *Acta Chir Orthop Traumatol Cech.* 1999;66(1):15–21.
5. Marshall PD, Evans PD., Richards J. Laboratory comparison of the cannulated Herbert bone screw with ASIF cancellous lag screws. *J Bone Joint Surg Br.* 1993 Jan;75(1):89–92.
6. Mindrebo N., Shelbourne KD, Van Meter CD, Rettig AC. Outpatient percutaneous screw fixation of the acute Jones fractures. *Am J Sports Med.* 1993 Sep-Oct;21(5):720–3.
7. Nunley JA. Fractures of the base of the fifth metatarsal: the Jones fracture. *Orthop. Clin North Am.* 2001 Jan;32(1):171–80.
8. Pietropaoli MP, Wnorowski DC., Werner FW, Fortion MD. Intramedullary screw fixation of Jones fractures: a biomechanical study. *Foot and Ankle Int.* 1999 Sep;20(9):560–3.
9. Quill GE Jr. Fractures of the proximal fifth metatarsal. *Orthop Clinic North Am.* 1995 Apr;26(2):353–61.
10. Rosenberg GA, Sferra JJ. Treatment strategies for acute fractures and nonunions of the proximal fifth metatarsal. *J Am Acad Orthop Surg.* 2000 Sep-Oct;8(5):332–8.

11. Stewart IM: Jones' fracture: Fracture of fifth metatarsal. Clin Orthop. 1960;16:190–8.
12. Triana SM, Mcelhibbey JP. Tips of the trade #38. The Herbert screw in closed reduction and internal fixation of the Jones fracture. Orthop Rev. 1991 Aug; 20(8):713, 716–7.
13. Turco VJ. Injuries to the Foot and Ankle. In: Nicholas JA. Lower extremity and spine in sports medicine. Mosby 2 edition; 1994. pp. 1244–1246
14. Smith MD. Biased coin randomization. In: Balakrishnan N, editor. Methods and applications of statistics in clinical trials, Volume 1: concepts, principles, trials, and designs. Wiley; 2014. pp. 90–104.

## Tables

Table 1

American Orthopedic Foot and Ankle Score (AOFAS) - clinical rating system used to determine subjective sensation of patients after 6 weeks and 12 weeks.

1 American Orthopedic Foot and Ankle Society. Ankle Hind-Foot Scale.

<http://www.aofas.org/i4a/pages/index.cfm?pageid=3494>. Accessed 24 March 2012.

AOFAS clinical rating system		Points
100 total points		
A/PAIN (40 points)		
None		40
Mild, occasional		30
Moderate, daily		20
Severe, almost always present		0
B/FUNCTION (50 points)		
<b>Activity limitations, support requirement:</b>		
No limitations, no support		10
No limitation of daily activities, limitations of recreational activities, no support		7
Limited daily and recreational activities, cane		4
Severe limitation of daily and recreational activities, walker, crutches, wheelchair		0
<b>Maximum walking distance, blocks:</b>		
Greater than 6		5
4-6		4
1-3		2
Less than 1		0
<b>Walking surfaces:</b>		
No difficulty on any surface		5
Some difficulty on uneven terrain, stairs, inclines, ladders		3
Severe difficulty on uneven terrain		0
<b>Gait abnormality:</b>		
None, slight		8
Obvious (walking possible but gait abnormality obvious)		4
Marked (walking difficult and gait abnormality obvious)		0
<b>Sagittal motion (flexion plus extension):</b>		
Normal or mild restriction (30 degrees or more)		8
Moderate restriction (15 degrees -29 degrees)		4
Severe restriction (less than 15 degrees)		0
<b>Hindfoot motion:</b>		
Normal or mild restriction (75-100 % normal)		6
Moderate restriction (25-74 % normal)		3
Marked restriction (less than 25% normal)		0
<b>Ankle-hindfoot stability:</b>		
Stable		8
Unstable		0
C/ALIGNMENT (10 points)		
Good, plantigrade foot, midfoot well aligned		10
Fair, plantigrade foot, some degree of midfoot malalignment observed, no symptoms		7
Poor, nonplantigrade foot, severe malalignment, symptoms		0
Results		
90-100 points = Excellent result		
75-89 points = Good result		
60-74 points = Satisfactory result		
Less than 60 points = Bad result		

Table 2

Results of AOFAS and X-ray for operated patients (Group O) after 6 weeks and 12 weeks.

Table 2: Group(O)

Patient	AOFAS 6	AOFAS 12	X-ray 6	X-ray 12
1	100	100	0	0
2	100	100	0	1
3	100	100	0	1
4	100	100	1	1
5	79	100	0	1
6	97	100	0	1
7	100	100	1	1
8	100	100	0	0
9	97	100	0	1
10	87	100	1	1
11	100	100	0	1
12	100	100	1	1
13	97	100	1	1
14	100	100	1	1
15	97	100	1	1

**AOFAS clinical rating system (100 points total)**

Results

90-100 points = Excellent result

75-89 points = Good result

60-74 points = Satisfactory result

Less than 60 points = bad result

**X-ray**

Results

0 - Not healed

1 - Healed

Table 3

Results of AOFAS and X-ray for conservatively treated patients (Group K) after 6 weeks and 12 weeks.

Table 3: Group (K)

Patient	AOFAS 6	AOFAS 12	X-ray 6	X-ray 12
1	75	surgery	0	surgery
2	82	100	0	1
3	77	100	0	1
4	93	100	0	1
5	79	87	0	0
6	56	surgery	0	surgery
7	77	surgery	0	surgery
8	92	100	0	1
9	95	100	0	1
10	97	100	0	1
11	78	surgery	0	surgery
12	78	surgery	0	surgery

**AOFAS clinical rating system (100 points total)**

Results

90-100 points = Excellent result

75-89 points = Good result

60-74 points = Satisfactory result

Less than 60 points = bad result

**X-ray**

Results

0 - Not healed

1 - Healed

Table 4

Summary statistic shows AOFAS results and X-ray results after 6 weeks and 8 weeks for all patients together, conservatively treated patients, and operated patients. Table also shows the statistic if patient was fully healed or not.

Table 4: Summary Statistic

		Total	Conservatively treated patients	Operated patients	p
Results after 6 weeks	Bad	3.7% (N=1)	8.3% (N=1)	0.0% (N=0)	0.011
	Good	33.3% (N=9)	58.3% (N=7)	13.3% (N=2)	
	Excellent	63.0% (N=17)	33.3% (N=4)	86.7% (N=13)	
Results after 12 weeks	Good	3.7% (N=1)	8.3% (N=1)	0.0% (N=0)	0.003
	Excellent	77.8% (N=21)	50.0% (N=6)	100.0% (N=15)	
	Operation	18.5% (N=5)	41.7% (N=5)	0.0% (N=0)	
X-ray 6 weeks	Not healed	74.1% (N=20)	100.0% (N=12)	53.3% (N=8)	0.001
	Healed	25.9% (N=7)	0.0% (N=0)	46.7% (N=7)	
X-ray 12 weeks	Not healed	11.1% (N=3)	8.3% (N=1)	13.3% (N=2)	0.080
	Healed	70.4% (N=19)	50.0% (N=6)	86.7% (N=13)	
	Operation	18.5% (N=5)	41.7% (N=5)	0.0% (N=0)	
Fully healed	No	29.6% (N=8)	50.0% (N=6)	13.3% (N=2)	0.036
	Yes	70.4% (N=19)	50.0% (N=6)	86.7% (N=13)	

## Figures



Figure 1



Figure 2

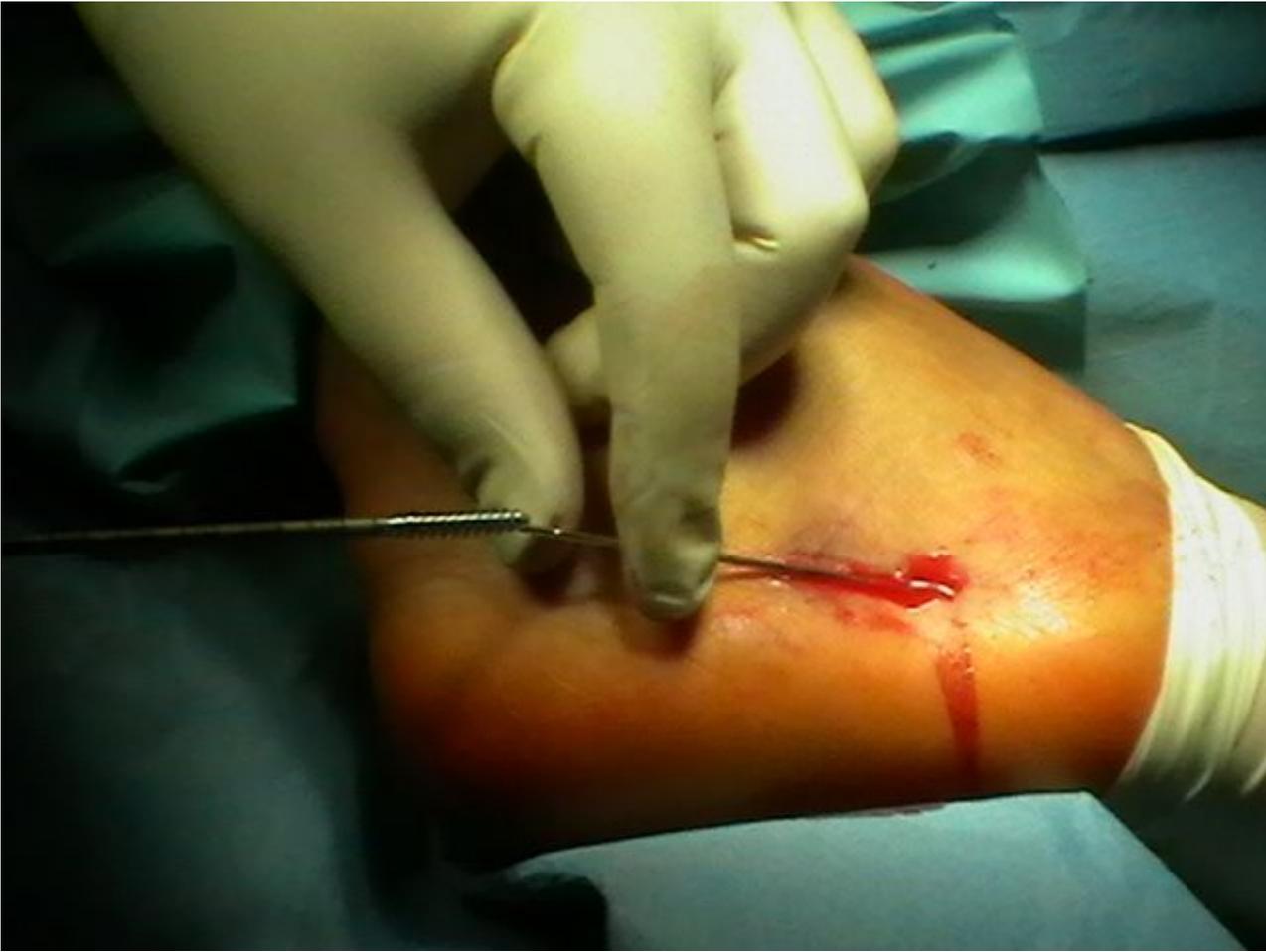


Figure 3



Figure 4

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [CONSORT2010Checklist.docx](#)