

# Epidemiological study of foot and ankle fractures among Civil Servants in the State of São Paulo

## Estudo epidemiológico de fraturas em pé e tornozelo que acometem Servidores Públicos Estaduais de São Paulo

Kelly Cristina Stéfani<sup>1</sup>, Miguel Viana Pereira Filho<sup>2</sup>, Rodrigo Ribeiro Lago<sup>3</sup>

### ABSTRACT

**Objective:** The treatment of foot and ankle fractures accounts for a significant portion of orthopedic surgeries performed by the Instituto de Assistência Médica ao Servidor Público Estadual [Medical Care Institute for State Civil Servants] (IAMSPE). The objective of this study was to outline the epidemiological profile of foot and ankle fractures treated surgically, and based on these data, to establish strategies for prevention, in order to decrease the social and economic impact of this injury in the population served by our hospital. **Methods:** Over an eleven-year period, information was gathered prospectively on all patients with foot and ankle fractures treated with surgery. Data were recorded on sex, age, side affected, surgical procedure performed, and immediate and later complications. **Results:** 1028 fractures were operated on, the most frequent site being the ankle, with 740 cases, followed by the calcaneus/heel, tibial pilon, Lisfranc, talus, metatarsus, phalanges/toes, and navicular. The mean age was 51.7 years, and women represented the majority of cases, with 56.4%. One patient required surgical cleaning for treatment of postoperative infection. 43 had removal of synthesis material, and 11 were submitted to surgical treatment of post-traumatic arthrodesis. **Conclusion:** The majority were low-impact fractures, and fractures were particularly prevalent among women during the menopause. Early complications were rare, and later complications, such as post-traumatic arthritis, were more common in high-impact fractures, especially of the talus.

### Keywords:

Ankle fractures/epidemiology; Foot injuries; Epidemiology, descriptive; Hospitals, State/statistics & numerical data

### RESUMO

**Objetivo:** O tratamento de fraturas do pé e tornozelo corresponde a uma parcela importante dentre as cirurgias ortopédicas realizadas pelo Instituto de Assistência Médica ao Servidor Público Estadual (IAMSPE). O objetivo deste estudo é traçar o perfil epidemiológico das fraturas de pé e tornozelo tratadas cirurgicamente e a partir desses dados estabelecer estratégias de prevenção a fim de diminuir o impacto social e econômico dessa lesão na população atendida em nosso hospital. **Métodos:** Durante 11 anos coletamos prospectivamente informações de todos os pacientes portadores de fraturas de pé e tornozelo que foram tratados cirurgicamente. Foram anotados dados como sexo, idade, lateralidade, cirurgia realizada, complicações imediatas e tardias. **Resultados:** Foram operadas 1028 fraturas, sendo que as mais frequentes foram as de tornozelo, com 740 casos, seguidas das de calcâneo, pilão tibial, Lisfranc, tálus, metatarso, falange e navicular. A idade média foi de 51,7 anos e as mulheres representaram a maioria dos casos, com 56,4%. Um paciente necessitou limpeza cirúrgica para tratamento de infecção pós-operatória, 43 realizaram retirada de material de síntese e 11 foram submetidos a tratamento cirúrgico de artrose pós-traumática. **Conclusão:** A maior parte das fraturas foi de baixa energia e atingiu, em especial, mulheres durante a pós-menopausa. Foram raras as complicações precoces, e as tardias, como artrose pós-traumática, foram mais comuns em fraturas de alta energia, especialmente as do tálus.

### Descritores:

Fraturas do tornozelo/epidemiologia; Traumatismos do pé; Epidemiologia descritiva; Hospitais Estaduais/estatística & dados numéricos

<sup>1</sup> Master in Orthopedics and Traumatology, Foot and Ankle Surgery Group, Department of Orthopedics and Traumatology, Hospital do Servidor Público Estadual de São Paulo, São Paulo, SP, Brazil.

<sup>2</sup> Orthopedist, Foot and Ankle Surgery Group, Department of Orthopedics and Traumatology, Hospital do Servidor Público Estadual de São Paulo, São Paulo, SP, Brazil.

<sup>3</sup> Orthopedist and Pursuing Foot and Ankle Specialization with the Foot and Ankle Surgery Group, Department of Orthopedics and Traumatology, Hospital do Servidor Público Estadual de São Paulo, São Paulo, SP, Brazil.

Correspondence to:  
Kelly Cristina Stéfani  
Rua Mato Grosso, 306 – cj 1315 – Higienópolis  
Zip Code: 01239-040 – São Paulo, SP  
E-mail: kstefani@institutokellystefani.com.br

**Conflict of interest:**  
none reported.

**Funding:**  
none reported.

**Received on:**  
December 8, 2016

**Accepted on:**  
December 21, 2016

## INTRODUCTION

The Instituto de Assistência Médica ao Servidor Público Estadual [Medical Care Institute for State Government Employees] (IAMSPE) is an autonomous non-profit, self-governing entity with its own equity and legal identity, whose main objective is to provide medical care to state government employees, their dependents and households<sup>(1)</sup>. According to IAMSPE demographics for June 2014, 1,300,000 individuals are entitled to health care, 65% of whom are female and 35% aged over 60<sup>(2)</sup>.

The Hospital do Servidor Público Estadual (HSPE – State Government Employee Hospital), the largest hospital in the IAMSPE network with more than 43 different medical specialties, is located in the city of São Paulo.

The treatment of foot and ankle fractures corresponds to a considerable portion of orthopedic surgeries performed at HSPE, since these fractures affect individuals of both sexes and of all ages. Hospitalization and treatment with medical leave from work represent a significant cost for public health<sup>(3)</sup>.

The aim of this study is to establish the epidemiological profile of foot and ankle fractures operated on in patients treated in the outpatient clinic of the foot and ankle group of HSPE. This information may prove important when conducting other public health studies and developing prevention policies.

## METHODS

It is a prospective cross-sectional study.

In this study, data were collected prospectively from all the patients with foot and ankle fractures who underwent surgical treatment between January 2005 and August 2016 at the Hospital do Servidor Público Estadual (HSPE) in São Paulo, Brazil. Inclusion criteria were all surgically treated fractures of the foot and ankle. The exclusion criterion was the presence of open physis.

Data such as sex, age, laterality, type of surgery performed, immediate and late complications were collected prospectively. Consideration was given to the following immediate complications: wound dehiscence or infection requiring surgical intervention and episodes of deep vein thrombosis (DVT), whether or not accompanied by pulmonary thromboembolism (PTE). Consideration was also given to the following late complications: need for removal of synthesis material and the development of surgically treated posttraumatic arthrosis. Patients who died had their causes of death recorded.

The data were stored in an Excel spreadsheet and subsequently imported to the SPSS 23 for MAC software for statistical analysis. Descriptive statistics of the categorical data were reported by their absolute number of occurrences and respective percentage. Continuous data were described by the mean and respective standard deviation, in addition to data on maximum and minimum values.

## RESULTS

A total of 1027 operations were performed between June 2005 and August 2016. Table 1 shows the information gathered after the surgical procedures.

**Table 1** | Frequency and distribution of foot and ankle fractures

	Frequency	Percentage
Ankle fracture	740	72.0
Calcaneus fracture	110	10.7
Phalanx fracture	6	.6
Lisfranc fracture	44	4.2
Metatarsal fracture	15	1.4
Navicular fracture	3	.3
Tibial plafond fracture	94	9.1
Talus fracture	25	2.4
Total	1027	100.0

Source: SAME HSPE.

The mean age of the patients was 51.7±15.7, with the youngest patient aged 14 and the oldest 89 years. Women accounted for the majority of cases, with 585 (56.4%).

Ankle fractures occurred more frequently in women (488 patients) with a mean age of 60.42 years. There is a statistically significant difference ( $p < 0.001$ ) compared to ankle fractures in men (252 patients) with a mean age of 50.18 years.

Foot fractures were more frequent in men (140 patients) with a mean age of 52.25 years. There is a statistically significant difference ( $p < 0.001$ ) when compared to foot fractures in women (53 patients) with a mean age of 54.22 years.

Of the 193-foot fractures, the distribution in men was fractures of the calcaneus with 84 (84%), phalanx with 4 (67%), Lisfranc with 24 (55%), metatarsus with 13 (87%), tibial plafond with 54 (57%) and talus with 14 (56%). Women were only the majority in ankle fractures with 488 cases (66%) and navicular fractures with 2 cases (67%).

With regard to laterality, 530 (51%) patients had right-sided fractures and 507 (48.8%) left-sided fractures. Two patients (0.2%) with calcaneus fractures, had bilateral fractures.

In the absolute majority of cases, corresponding to 942 patients, the surgery performed was open reduction and internal fixation. In 68 patients, the surgeon opted for external fixation with a linear external fixator. Of these patients, 35 had calcaneus, 29 tibial plafond, 2 Lisfranc, 1 ankle, 1 talus, and 1 metatarsal fractures. Eleven patients, all with tibial plafond fractures, underwent initial external fixation surgery with Ilizarov apparatus.

Regarding early complications, only one patient with an ankle fracture required debridement due to postoperative infection. Nine patients, 8 with ankle fractures and 1 with a navicular fracture, underwent osteosynthesis review. One patient had to have the wound re-sutured and another with a calcaneus fracture that progressed with dehiscence and tendon exposure required debridement.

Four women with ankle fractures presented with DVT in the postoperative period, with 3 progressing to PTE. None of the cases was fatal.

The most common late complication was the need for removal of synthesis material, with 43 cases. Of these, 27 had ankle fracture, 10 tibial plafond fractures, 3 calcaneus fractures, 2 Lisfranc fractures, and 1 a metatarsal fracture. In terms of the number of cases undergoing surgery, tibial plafond fractures, with 11.9%, were the type of fracture in which synthesis material had to be removed the most frequently. Only procedures performed in a surgical center were counted. Removal of syndesmotomic screws under local anesthesia was not included in the outpatient setting.

Eleven patients developed posttraumatic arthrosis and required surgery for pain management. Four had ankle fractures, 3 of whom underwent arthrodesis and 1 total ankle arthroplasty. The others were also treated with arthrodesis; 4 of these patients had talus fractures, 3 sustained calcaneus fractures and 1 a tibial plafond fracture. Talus fractures were those that progressed with a need for arthrodesis most frequently, with 16%.

Two patients, both with ankle fractures, developed pseudarthrosis and had to undergo further surgery.

One patient who underwent Lisfranc osteosynthesis developed an incisional neuroma that required surgical exploration.

Eight patients died during follow-up. The cause of death was not related to the fractures in any of these cases.

## DISCUSSION

Ankle fractures, which correspond to 72% of operated cases, will be discussed in a separate specific study. Women accounted for most of the ankle fractures, with 66%.

Foot fractures, however, affected men more than women, with 67% of the operated cases. We believe that foot fractures with surgical indication such as talus, calcaneus, and Lisfranc fractures are more common in men because there is a tendency for exposure to high-risk situations such as using motorcycles and walking in places with a risk of falling from heights among male individuals.

Among men, the mean age of individuals with foot fractures was 52.25 years, while in women the mean age was 54.22 years. In ankle fractures, men were also younger with a mean age of 50.18 years, while in women the mean age was 60.42 years. An Australian epidemiological study produced similar results in terms of the difference between mean age and sex, with women presenting with fractures in an older age group<sup>(4)</sup>. Some authors have found a correlation between low bone mineral density and foot fractures<sup>(5)</sup>, which may explain why foot fractures predominate in older women, even though most osteoporosis-related foot fractures are treated conservatively and were not included in this study.

Ankle fractures usually affect individuals with higher body mass indexes and greater risk of falls<sup>(6)</sup>, which helps to justify the increase in the incidence of these fractures at more advanced ages. However, the incidence of fractures among older women is significantly higher than among men, suggesting that osteoporosis also plays an important role<sup>(7)</sup>.

In the hindfoot, the most frequent surgical fractures were those of the calcaneus, with 100 patients, followed by talus fractures in 25 patients. In 2014, Shibuya et al., when analyzing the records of the United States national trauma data bank, indicated that calcaneus fractures represented 9.3% of all foot and ankle fractures, a number slightly higher than that of talus fractures, which was 7.9%<sup>(8)</sup>.

With regard to laterality, the right side was slightly more predominant than the left with 51%, but without statistical significance.

Sixty-eight patients underwent external fixation with a linear fixator. Thirty-five of them had a calcaneus fracture and underwent minimal internal fixation in combination with external fixation, using a technique similar to that described by Fu et al. (2013)<sup>(9)</sup>. The others underwent external fixation to improve soft tissue conditions and later underwent conversion to internal fixation. Eleven individuals with tibial plafond fractures were treated with a circular external fixator.

Only one patient required wound cleaning to treat postoperative infection, a surprisingly low number. Neither su-

perforial infections treated with topical or oral antibiotics that did not require surgery nor cases of serous secretion treated satisfactorily with the removal of synthesis material have been counted. The use of staged treatment with external fixator in fractures associated with poor soft tissue conditions<sup>(10,11)</sup>, use of circular external fixator as definitive treatment in high-energy tibial plafond fractures<sup>(12,13)</sup>, and the profile of patients treated at HSPE help explain the small number of cases of deep infection. Most tibial plafond and ankle fractures affected patients over 50 years of age and are low-energy fractures.

Four patients, all with ankle fractures, had deep vein thrombosis as an immediate complication. Three of these patients developed PTE but none of these cases were fatal. Exclusive complications of ankle fractures will be discussed in a specific study.

Removal of synthesis material was necessary in 43 patients, and was more frequent in tibial plafond fractures, occurring in 11.9% of the patients undergoing surgery. The main indication for removal of synthesis material in plafond fractures was pain and discomfort caused by the anteromedial plates and persistent serous secretion.

Eleven patients developed posttraumatic arthrosis and required surgical intervention, with total ankle arthroplasty performed in 1 case and arthrodesis in 10.

Sixteen percent of patients with talus fractures required surgery to treat secondary pain due to arthrosis, the highest percentage of all fractures. Several studies conducted with patients with talus fractures have identified high rates of complications such as osteonecrosis, vicious consolidation, posttraumatic arthrosis and the need for secondary surgery<sup>(14-16)</sup>.

The strong points of this study are the large number of patients and the long follow-up time. As a weak point, we believe that late complications may be underestimated if patients have chosen to undergo follow-up at another service.

## CONCLUSION

Fractures represent an important part of the foot and ankle surgeon's practice. In our series, high-energy fractures mainly affected men, but most cases were low-energy

fractures predominantly affecting postmenopausal women. Early complications were rare, and late complications such as posttraumatic arthrosis were more common in high-energy fractures, especially those of the talus.

## REFERENCES

1. Instituto de Assistência Médica ao Servidor Público Estadual [Internet]. São Paulo: IAMSPE; 2016. Disponível em: [www.iamspe.sp.gov.br](http://www.iamspe.sp.gov.br)
2. Companhia de Processamento de Dados do Estado de São Paulo [Internet]. São Paulo: Prodesp; 2016. Disponível em: [www.prodesp.gov.br](http://www.prodesp.gov.br)
3. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. *Injury*. 2006;37(8):691-7.
4. Holloway K, Moloney D, Brennan S, Kotowicz M, Bucki-Smith G, Timney E, et al. Foot and ankle fracture incidence in South-eastern Australia: an epidemiological study. *Clin Res Foot Ankle*. 2014;2:148.
5. Hasselman CT, Vogt MT, Stone KL, Cauley JA, Conti SF. Foot and ankle fractures in elderly white women. Incidence and risk factors. *J Bone Joint Surg Am*. 2003;85(5):820-4.
6. Urruela A, Egol K. Foot and ankle fracture in the elderly patient. *Aging Health*. 2011;7(4):591-605.
7. Biver E, Durosier C, Chevalley T, Herrmann FR, Ferrari S, Rizzoli R. Prior ankle fractures in postmenopausal women are associated with low areal bone mineral density and bone microstructure alterations. *Osteoporos Int*. 2015;26(8):2147-55.
8. Shibuya N, Davis ML, Jupiter DC. Epidemiology of foot and ankle fractures in the United States: an analysis of the National Trauma Data Bank (2007 to 2011). *J Foot Ankle Surg*. 2014;53(5):606-8.
9. Fu TH, Liu HC, Su YS, Wang CJ. Treatment of displaced intra-articular calcaneal fractures with combined transarticular external fixation and minimal internal fixation. *Foot Ankle Int*. 2013;34(1):91-8.
10. Sirkin M, Sanders R, DiPasquale T, Herscovici D. A staged protocol for soft tissue management in the treatment of complex pilon fractures. *J Orthop Trauma*. 1999;13(2):78-84.
11. Blauth M, Bastian L, Krettek C, Knop C, Evans S. Surgical options for the treatment of severe tibial pilon fractures: a study of three techniques. *J Orthop Trauma*. 2001;15(3):153-60.
12. McDonald MG, Burgess RC, Bolano LE, Nicholls PJ. Ilizarov treatment of pilon fractures. *Clin Orthop Relat Res*. 1996;325:232-8.
13. Zarek S, Othman M, Macias J. The Ilizarov method in the treatment of pilon fractures. *Ortop Traumatol Rehabil*. 2002;4(4):427-33.
14. Weston JT, Liu X, Wandtke ME, Liu J, Ebraheim NE. A systematic review of total dislocation of the talus. *Orthop Surg*. 2015;7(2):97-101.
15. Annappa R, Jhamaria NL, Dinesh KV, Devkant, Ramesh RH, Suresh PK. Functional and radiological outcomes of operative management of displaced talar neck fractures. *Foot (Edinb)*. 2015;25(3):127-30.
16. Stake IK, Madsen JE, Hvaal K, Johnsen E, Husebye EE. Surgically treated talar fractures. A retrospective study of 50 patients. *Foot Ankle Surg*. 2016;22(2):85-90.