

Original Article

Percutaneous surgery practice in Brazil: the profile of Brazilian foot surgeons

Paulo Roberto de Assis Silva¹ , Rodrigo Gonçalves Pagnano¹ , Miguel Viana Pereira Filho^{1,2} , Fabio Luis Datti Roque¹ , Daniel Augusto Maranhão¹ , Mauro Cesar Mattos e Dinato¹ 

1. Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil.

2. Instituto Vita, São Paulo, SP, Brazil.

Abstract

Objective: The objective of this study was to evaluate current percutaneous foot surgery practice among Brazilian specialists.

Methods: A cross-sectional observational study was conducted, surveying members of the Brazilian Foot and Ankle Society (ABTPé) by emailing electronic questionnaires in 2017 and 2019. The information requested included demographic data and the profile of their practice with relation to percutaneous foot surgery. A total of 74 participants completed the survey questionnaire in 2017 and 82 in 2019 (response rates of 15 and 14% respectively).

Results: A total of 49 participants in 2017 (65.33%) and 57 in 2019 (69.51%) were performing percutaneous foot surgery. Among respondents who were not performing percutaneous foot surgery, 15 in 2017 (57.69%) and 10 in 2019 (40%) stated that they believed in the method, but had not been trained to perform it. Exclusively spinal anesthesia was used by 19 surgeons in 2017 (38.77%) and 23 in 2019 (40.35%). When correcting Hallux Valgus, 13 surgeons in 2017 (26.53%) and 3 in 2019 (5%) did not use any type of fixation. The most frequently reported complication was poor reduction in both periods, reported by 36 (73.46%) participants in 2017 and 39 (68.42%) in 2019.

Conclusion: In Brazil, a lack of specific training is one factor that limits the practice of percutaneous foot surgery. The technique is used by a greater number of younger surgeons. The most frequent complication is poor reduction and there is a growing trend to employ fixation hardware.

Evidence Level V; Expert Opinion.

Keywords: Minimally invasive surgical procedures; Hallux valgus; Foot; Orthopedic surgeons.

Introduction

Percutaneous surgery is an additional tool for treatment of diseases of the foot, in particular the forefoot⁽¹⁾. Whereas in minimally invasive surgery, corrections are made under direct visualization of structures via small incisions, in percutaneous surgery, corrections are made via minimal incisions, without direct visualization of the structures involved, using tactile sensations and radiology.

The first generation of percutaneous surgery was introduced in the 1970s by Stephen Isham, in the United States, and was later improved upon by Mariano de Prado and the anatomist Pau Golano in Spain, up to the establishment of GRECMIP (*Groupe de reserche et d'enseignement em chi-*

urgie mini-invasive du pied), which today is an international group interested in teaching and developing arthroscopy and percutaneous surgery. The method has attracted interest because of its potential for smaller scars, less postoperative pain, faster recovery and early mobilization, shorter rehabilitation time, and lower risk of complications related to the operating wound⁽¹⁾.

Use of the technique has grown considerably over recent years⁽²⁾, but its use by members of the Brazilian Foot and Ankle Society (ABTPé) has not been surveyed previously. The objective of the present study was to determine the profile of current percutaneous foot surgery practice among foot and ankle surgery specialists in Brazil, using electronic questionnaires sent by email (Google forms).

Study performed at the Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brazil.

Correspondence: Paulo Roberto de Assis Silva. Twenty-Eight St., House 30, Calhau, São Luís, MA, Brazil, Zip Code: 65072-740.

E-mail: pauloroberto_silva@hotmail.com. **Conflicts of interest:** none. **Source of funding:** none. **Date received:** March 30, 2020. **Date accepted:** July 14, 2020. **Online:** August 30, 2020.

How to cite this article: Silva PRA, Pagnano RG, Pereira Filho MV, Roque FLD, Maranhão DA, Mattos e Dinato MC. Percutaneous surgery practice in Brazil: the profile of Brazilian foot surgeons. *J Foot Ankle.* 2020;14(2):163-7.



Methods

This study was approved by the Institutional Review Board and registered on the Plataforma Brasil database under CAAE (Ethics Evaluation Submission Certificate) number: 11311119.4.0000.5404.

The study was initiated by sending out a questionnaire via email and via a multiplatform instant messaging program (WhatsApp) to all members of the Brazilian Foot and Ankle Society (ABTPé) in 2017 and again in 2019. The questionnaire contained a total of 33 questions on foot and ankle percutaneous surgery practices. Questions were closed, but more than one response was permitted, following a logical sequence, facilitating completion of the questionnaire. Twelve of the questions covered patterns of percutaneous foot surgery practice, such as the number of operations performed per year, aspects related to professionals' training in the method, distribution of practicing surgeons by regions of Brazil, indications and specific techniques employed, use of any type of fixation, type of anesthesia employed, use of tourniquets, and the main complications observed.

Data were analyzed using STATA v14.2 statistical software (StataCor, Texas, United States). Chi-square or Fisher's exact tests were used to compare percentages from 2017 against those from 2019 and a 95% significance level was adopted. Quantitative and qualitative descriptions of the responses to each item are included in the results.

Results

A total of 75 participants out of the total of 504 Society members in 2017 and 82 out of the total of 635 Society members in 2019 completed the questionnaire (response rates of 14.88% and 12.91%, respectively). A majority of the participants were from the Southeast region, with 48 (64%) in 2017 and 55 (67.07%) in 2019, followed by the South, with 15 (20%) in 2017 and 13 (15.85%) in 2019 (Figure 1).

The majority (n=52, 69.33%) of Society members who answered the questionnaire in 2017 had more than 10 years' experience in foot and ankle surgery. In 2019, the number with

more than 10 years' experience was 40 (48.78%). In both surveys, a majority of those who did conduct percutaneous surgery performed from 10 to 30 procedures per year: 14 (28.57%) in 2017 and 21 (36.84%) in 2019 (Figure 2).

In 2017, 75 Society members answered the questionnaire, 49 (65.33%) of whom were performing percutaneous foot surgery. Among the remaining 26 members who were not conducting percutaneous foot surgery, 22 (84.61%) stated that they believed in the method, but lacked either the training or the equipment needed and just 3 (11.53%) stated that they did not believe in the method. In 2019, 57 (69.51%) were conducting percutaneous surgery and 25 (30.49%) were not. Sixteen (64%) of those who were not, did believe in the method, but lacked either the training or the equipment needed, and 6 (24%) did not believe in the method.

Exclusively spinal anesthesia, was used by 19 surgeons in 2017 (38.77%) and 23 in 2019 (40.35%). Locoregional anesthesia with sedation was used by 14 surgeons in 2017 (28.57%) and 14 in 2019 (24.56%), while a further 12 surgeons in 2017 (24.48%) and 18 in 2019 (31.57%) used two types of anesthesia.

In regard to use of a tourniquet, in 2017, 9 (18.36%) surgeons used one and 39 (79.59%) did not. In 2019, just 4 (7.01%) were using a tourniquet and 53 (92.98%) were operating without one.

In both 2017 and 2019, the pathologies most often treated with percutaneous surgery were Hallux Valgus, Metatarsalgia, Bunionette, and deformities of the smaller toes. The least treated condition was arthritis (Figure 3).

The techniques for correcting Hallux Valgus most used by Society members were the Akin and Reverdin Isham in 2017, and the Akin and Chevron in 2019 (Figure 4).

With regard to use of fixation in osteotomies to correct Hallux Valgus, 13 surgeons in 2017 (26.53%) and 3 surgeons in 2019 (5.26%) did not use any kind of fixation, whereas 36 in 2017 (73.46%) and 54 in 2019 (94.73%) used fixation in one or more correction technique, and osteotomy of the base of the first metatarsal was the technique most often performed with fixation in 2017 (42.85%), whereas in 2019 it was the Chevron (87.71%) (Figure 5).

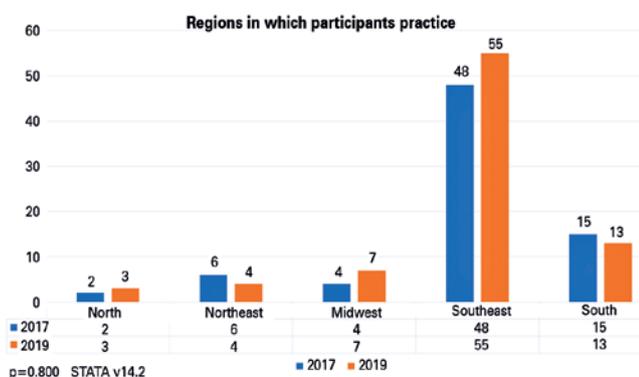


Figure 1. Regions in which participants practice.

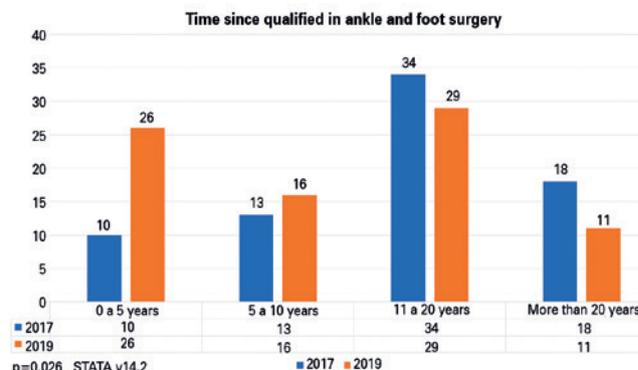


Figure 2. Time since qualified in ankle and foot surgery.

The majority of participants, 24 (48.97%) in 2017 and 28 (49.1%) in 2019, prescribed from 4 to 6 weeks with dressings. In conjunction with dressings, 7 (14.28%) participants in 2017 and 9 (15.78%) in 2019 stated that they also used a silicone spacer.

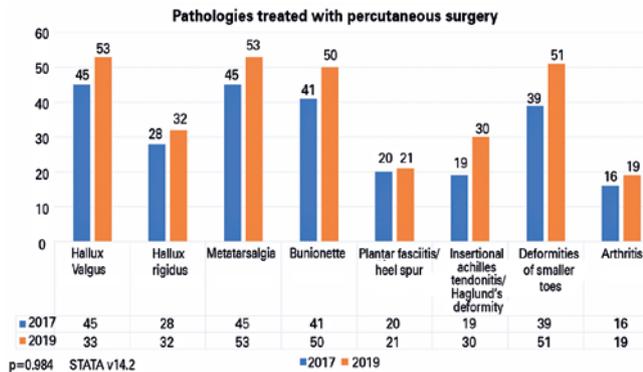


Figure 3. Pathologies treated with percutaneous surgery.

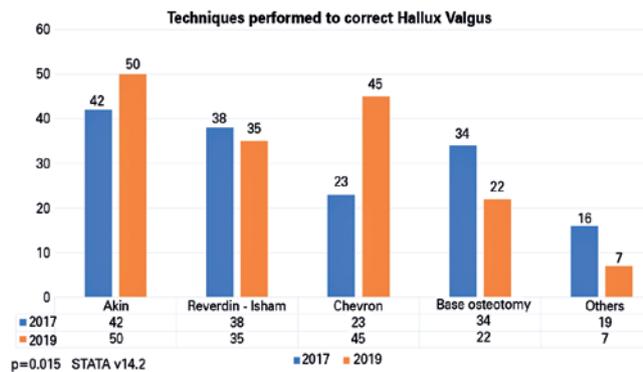


Figure 4. Techniques performed to correct Hallux Valgus.

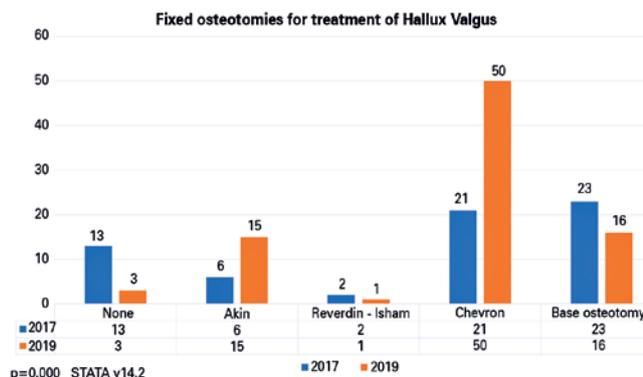


Figure 5. Fixed osteotomies for treatment of Hallux Valgus.

The most frequently reported complication was poor reduction in both survey years: 36 (73.46%) in 2017 and 39 (68.42%) in 2019. Pseudarthrosis was the least frequently reported complication in both years, with 7 (14.28%) reports in 2017 and 19 (33.33%) in 2019 (Figure 6).

Both in 2017 and in 2019, the most common source searched for information was textbooks, endorsed by 40 (81.63%) and 49 (85.96%) participants respectively.

With regard to the professionals' training or qualifications, just 7 (14.28%) participants in 2017 reported being trained during specialty residency, increasing to 22 (38.59%) in 2019. The most frequent type of training was courses attended in Brazil and abroad, with 30 (61.22%) and 33 (57.89%) in 2017, and 31 (63.26%) and 28 (49.12%) in 2019, respectively. Additionally, 17 participants (34.69%) in 2017 and 21 (36.84%) in 2019 described training supervised by professionals with experience in the technique (p=0.190).

Discussion

Many different open techniques have been described for treatment of Hallux Valgus and deformities of the toes, but we do not yet have consensus on which of them is the most effective^(3,4). Although the initial results of percutaneous techniques are encouraging, there is a lack of randomized studies comparing them with open techniques. In a systematic review, Trnka et al. showed that the majority of published studies have level IV evidence. They found one level II study and three level III studies in a total of 21 studies, including reviews⁽⁵⁾. The literature still lacks studies with control groups⁽⁶⁾, although several studies have substantial sample sizes and long follow-up periods, such as one by Giannini et al. (1000 feet followed-up for 5 years) and another by Faour-Martín et al. (115 feet followed-up for 10 years)^(7,8).

Percutaneous surgery offers certain advantages over conventional techniques, such as, for example: ambulatory surgery with locoregional anesthesia, small incisions or punctures, fixation hardware not employed as routine, immediate mobilization, and lower intensity of postoperative pain. Di-

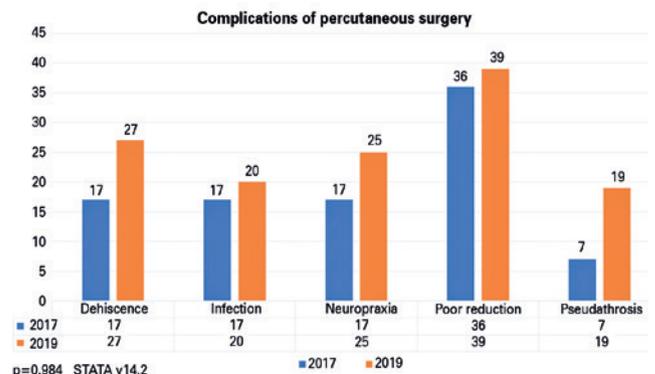


Figure 6. Complications of percutaneous surgery.

sadvantages originate from the fact that the technique is performed without direct visualization of the structures involved, the need for intraoperative fluoroscopy, the need for specific materials, and the long learning curve^(9,10).

Complications include: undercorrection or overcorrection, thermal injuries, transference metatarsalgia, nonunion or pseudarthrosis, and rigidity or limited movement of the first metatarsophalangeal joint. This last appears to be more frequent when the Reverdin Isham technique is used, precisely because this is an intracapsular osteotomy^(1,9,4,11). Many of the complications reported may be more related to incorrect application of the technique, rather than being a true limitation of the technique, since it has a long learning curve and a specific protocol for postoperative dressings and rehabilitation must be followed^(12,13).

In our study, the most frequently reported complication was poor reduction, endorsed by 73.46% in 2017 and 68.42% in 2019. These values were not statistically significant when the two survey years were compared ($p=0.255$). The high values for this complication are an important finding. Poor reduction is a complication that also occurs with traditional techniques, but which is not necessarily correlated with patient satisfaction.

Indications have been increasing and now include treatment for Hallux Valgus, Hallux Rigidus (except for cases of revision, prior infection, or inadequate bone stock), deformities of the smaller toes, hindfoot pathologies (Haglund syndrome) and soft tissue disorders (plantar fasciitis)^(14,15).

For the traditional Reverdin - Isham technique, there is still a lack of studies to show the efficacy of adding a fixation⁽¹⁶⁾.

This is the first survey of percutaneous surgery conducted in Brazil. We achieved response rates of 14.88% and 12.91% in 2017 and 2019, respectively.

Surveys conducted by sending questionnaires by e-mail are faster and cost an estimated 5 to 20% of the cost of postal surveys. The response rates are generally low using this type of method, at approximately 20%. However, it is believed that the responses provided may be more trustworthy than with surveys conducted by telephone or by post^(17,18). Our response rate was lower than expected for this type of survey. In view of the impersonal nature of this survey format, we believe that the principal reason is that the Society members were not interested in answering this type of questionnaire.

The majority of participants were concentrated in the Southeast region of Brazil, with 48 (64%) in 2017 and 55 (67.07%) in 2019, followed by the South region. Although this is similar to the distribution of Society members across Brazil, this finding was not statistically relevant ($p=0.800$).

In our study, the percutaneous technique was used by a greater number of younger surgeons ($p=0.026$). Although there was a considerable increase in the number of respondents who were trained in the technique during their specialty re-

sidency in the 2019 survey, when the majority of participants had less than 10 years' experience, we cannot conclude that this was statistically important for this group's use of the technique. The technique was primarily learnt on courses attended in Brazil and abroad, or by observing colleagues who already used these methods.

Nowadays, the techniques have evolved and there is a trend to fix certain osteotomies such as osteotomies of the base of the first ray, Chevron and Akin osteotomies, and the combination of these two to correct moderate and severe Hallux Valgus (Minimally Invasive Chevron and Akin - MICA)⁽¹⁹⁾. This runs counter to the principles described by Mariano de Prado⁽¹⁴⁾, but is in alignment with the AO (*Arbeitsgemeinschaft fur Osteosynthesefragen*) group's principles of rigid internal fixation and preservation of soft tissues inviolate⁽²⁰⁾. Other techniques, such as that described by Bosh and modified by Giannini (SERI - simple, effective, rapid, and inexpensive) always employ fixation, a Kirschner intramedullary wire^(8,21), as does the technique described in 2014 by Brogan et al., which is a mixture of the MICA and original Bosh techniques, which also obligatorily uses fixation hardware^(22,23).

With regard to Hallux Valgus, majorities of the participants do not use a tourniquet during surgery, most often use the Chevron technique ($p=0.015$), and fix osteotomies according to the current model ($p=0.000$). We believe that these changes reflect evolution of knowledge about the subject, and that the study participants are in tune with current tendencies in percutaneous treatment of pathologies of the foot. The only point that runs counter to the technique described is use of spinal anesthesia, since the majority of services abroad use locoregional blocks⁽¹⁴⁾. However, this finding was not statistically relevant ($p=0.831$).

The majority of participants believe in the method and among those who do not use it, a lack of adequate training and access to equipment appear to be the greatest factors limiting growth of the practice.

The major limitation of this study is the low number of participants in the survey, below the rate expected for this method. As the first survey of the practice of Percutaneous Surgery in Brazil, the study contributes epidemiological and technical information and profiles the trend among surgeons in Brazil, providing a reference point for future studies of the subject.

Conclusion

The majority of foot surgeons who responded to the survey believe in the percutaneous surgery method. The lack of specific training in the percutaneous technique is a factor that may limit its growth in Brazil. Poor reduction was the most common complication. The technique is conducted by a greater proportion of younger surgeons and there is a trend to employ fixation.

Authors' contributions: Each author contributed individually and significantly to the development of this article: PRAS ^{*}(<https://orcid.org/0000-0002-4818-3438>) wrote the article, interpreted the results of the study, participated in the review process, approved the final version; RGP ^{*}(<https://orcid.org/0000-0002-6064-2017>) wrote the article, participated in the review process; MVPF ^{*}(<https://orcid.org/0000-0002-2320-9769>) conceived and planned the activities that led to the study, wrote the article; FLDR ^{*}(<https://orcid.org/0000-0002-2940-5883>) wrote the article, interpreted the results of the study; DAM ^{*}(<https://orcid.org/0000-0002-3893-0292>) interpreted the results of the study, participated in the review process, MCMD ^{*}(<https://orcid.org/0000-0001-6572-1771>) conceived and planned the activities that led to the study, wrote the article, participated in the review process, approved the final version. ^{*}ORCID (Open Researcher and Contributor ID) .

References

- Bauer T. Percutaneous forefoot surgery. *Orthop Traumatol Surg Res.* 2014;100(Suppl 1): S191-S204.
- Botezatu I, Marinescu R, Laptou D. Minimally invasive-percutaneous surgery - recent developments of the foot surgery techniques. *J Med Life.* 2015;8 Spec Issue(Spec Issue):87-93.
- Finney FT, Gossett TD, Hu HM, Waljee JF, Brummett CM, Talusan PG, Holmes JR. New persistent opioid use following common forefoot procedures for the treatment of hallux valgus. *J Bone Joint Surg Am.* 2019;101(8):722-9.
- Maffulli N, Longo UG, Marinozzi A, Denaro V. Hallux valgus: effectiveness and safety of minimally invasive surgery. A systematic review. *Br Med Bull.* 2011;97:149-67.
- Trnka HJ, Krenn S, Schuh R. Minimally invasive hallux valgus surgery: a critical review of the evidence. *Int Orthop.* 2013;37(9):1731-5.
- Brogan K, Lindsfarne E, Akehurst H, Farook U, Shrier W, Palmer S. Minimally invasive and open distal chevron osteotomy for mild to moderate hallux valgus. *Foot Ankle Int.* 2016;37(11):1197-204.
- Faour-Martín O, Martín-Ferrero MA, Valverde García JA, Vega-Castrillo A, de la Red-Gallego MA. Long-term results of the retrocapital metatarsal percutaneous osteotomy for hallux valgus. *Int Orthop.* 2013;37(9):1799-803.
- Giannini S, Faldini C, Nanni M, Di Martino A, Luciani D, Vannini F. A minimally invasive technique for surgical treatment of hallux valgus: simple, effective, rapid, inexpensive (SERI). *Int Orthop.* 2013;37(9):1805-13.
- de Prado M. Complications in minimally invasive foot surgery. *Fuß & Sprunggelenk.* 2013;11(2):83-94.
- Botezatu I, Marinescu R, Laptou D. Minimally invasive-percutaneous surgery - recent developments of the foot surgery techniques. *J Med Life.* 2015;8(Spec Issue):87-93.
- Bauer T, de Lavigne C, Biau D, De Prado M, Isham S, Laffenêtre O. Percutaneous hallux valgus surgery: a prospective multicenter study of 189 cases. *Orthop Clin North Am.* 2009;40(4):505-14.
- Roukis TS. Percutaneous and minimum incision metatarsal osteotomies: a systematic review. *J Foot Ankle Surg.* 2009; 48(3):380-7.
- Bauer T, Biau D, Lortat-Jacob A, Hardy P. Percutaneous hallux valgus correction using the Reverdin-Isham osteotomy. *Orthop Traumatol Surg Res.* 2010;96(4):407-16.
- Prado M, Ripoll L, Golano P. *Minimally Invasive Foot Surgery: Surgical Techniques, Indications, Anatomical Basis.* Bilbao, Spain: About Your Health; 2009.
- Fanous RN, Ridgers S, Sott AH. Minimally invasive arthrodesis of the first metatarsophalangeal joint for hallux rigidus. *Foot Ankle Surg.* 2014;20(3):170-3.
- Sato AD, Nakato RM, Bolsi BC, Zigoovski TP, Silva JLV. Reverdin-Isham technique with and without fixation. *Sci J Foot Ankle.* 2018;12(3):226-32.
- Kelley K, Clark B, Brown V, Sitzia J. Good practice in the conduct and reporting of survey research. *Int J Qual Health Care.* 2003;15(3):261-6.
- Sheehan KB. E-mail survey response rates: a review. *J Comput Mediat Commun.* 2006;6(2).
- Vernois J, Redfern DJ. Percutaneous Surgery for Severe Hallux Valgus. *Foot Ankle Clin.* 2016;21(3):479-93.
- Redfern D, Perera AM. Minimally invasive osteotomies. *Foot Ankle Clin.* 2014;19(2):181-9.
- Giannini S, Bevoni R, Vannini F, Cadossi M. Hallux valgus surgery: the minimally invasive bunion correction. In: Scuderi G., Tria A editors. *Minimally invasive surgery in orthopedics.*, New York, NY: Springer; 2020. p. 463-47.
- Brogan K, Voller T, Gee C, Borbely T, Palmer S. Third-generation minimally invasive correction of hallux valgus: technique and early outcomes. *Int Orthop.* 2014;38(10):2115-21.