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Original article

# Hemi-Castaing ligamentoplasty for the surgical treatment of chronic lateral ankle instability in young athletes: our 7 years experience

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**Summary.** *Background and aim of the work:* in this study we report our 7-years experience (from January 2011 to December 2017) of 35 patients with chronic lateral ankle instability treated with the Hemi-Castaing reconstruction procedure, all performed in our clinic. *Methods:* thirty-five patients (F12-M23; median age around 31 yrs, range 18-52 yrs). All patients used to practice amateur sports at competitive level. The procedures were performed in 19 cases on the right ankle whereas in 16 cases on the left ankle. The average follow-up was 54.2 months. *Results:* of the 35 patients included in our study, all of them were able to practice sport as the same level as before from 80 to 100 days after intervention. Optimal functional results were achieved in all patients and no further episodes of ankle sprain occurred. All patients rated their outcome as good/excellent. No intra-operative complications were observed, whereas we noticed a case of surgical wound dehiscence after surgery. The Hemi-Castaing procedure provided a high lateral ankle stability, with excellent clinical and functional results. In our study, no significant difference in evertor strength was found according to side, and there was no significant change in E/I ratio. Moreover, joint position sense was not impaired. *Conclusion.* According to us, this surgical technique is efficient and safe, providing remarkable outcomes in the treatment of chronic lateral ankle instability. (www.actabiomedica.it)

**Key words:** ankle, chronic lateral instability, Hemi-Castaing

## Introduction

Ankle sprain is very common in those who play a sport such as volleyball, basketball, football and resistance running (1, 2).

In most cases (90% approx.), the traumatic mechanism consists in forced stress in varus and supination of the foot – called "inversion" – which causes variable extents of damage to the external compartment (3).

Anatomically, the external (or lateral) district is formed by the external collateral ligament with its three fasciae (anterior peroneal astragalus, calcaneal peroneal, posterior peroneal astragalus) and by the anterior and posterior peroneal-tibial ligament (4).

The lesions, caused by the dynamics of inversion described above, can vary from the simple sprain, to the more or less extended fracture of the external capsular-ligament.

Many cases obtain a discrete functional recovery thanks to conservative treatments such as medical and physical therapies, mobilisation and kinesitherapy (5, 6).

Nevertheless, in a small number of subjects, chronic ankle instability remains and requires surgical treatment.

The surgical techniques available include anatomic repair of the injured ligament through direct suture (7), and techniques called tenodesis reconstruction, where several tendons are used as a means to contain the articular deficiency. The tendon most frequently used for the treatment of chronic ankle instability is the peroneus brevis (8).

In 1984 the surgeon Castaing devised a technique in which this tendon was sectioned and used entirely to recreate lateral ankle stability (9, 10).

This technique was later modified using only half of the tendon, leaving the other half anchored to the base of the fifth metatarsal, and for this reason it was given the name of Hemi-Castaing technique (11-13).

The purpose of this study is to assess the outcomes from the use of the Hemi-Castaing procedure using the hemi-tendon of the peroneus brevis, on a population of patients who are engaged in sports activities and suffer from chronic ankle instability.

## Materials and methods

35 patients (12 females and 23 males) with an average age of 31 years (range: 18-52), took part in this observational study conducted in the Casa di Cura "Prof. Nobili" between January 2011 and December 2017.

All patients played sport at a competitive non-professional level. The study was approved by the ethical committee of the Institute in which the research was carried out and the patients gave their informed consent.

The surgery was conducted on the right ankle in 19 patients and on the left ankle in 16 patients. In one patient both ankles were operated, at different times.

The follow-up protocol in our facility consisted of a control at 30, 60, 90 and 180 days with a clinical examination, and then every year.

The average follow-up was 54.2 months.

The pre-surgery diagnosis was chronic lateral ankle instability in all cases for which conservative treatments had not been effective.

At the physical examination, all patients presented a positive anterior drawer sign and a positive Tilt test, with a history of frequent episodes of sprain in inversion.

### *Surgery*

On the lateral side of the ankle, a retromalleolar curvilinear incision of 8 cm of length was made centred at the apex of the peroneal mallelous.

Having identified and cut the sheath, the long and short peroneal tendons were identified.

At the upper end of the cutaneous incision, the peroneus brevis tendon was sectioned longitudinally in half, forming two hemi-tendons of equal diameter.

The anterior hemi-tendon was then sectioned proximally and separated from the posterior half for the entire length of the tendon, up to 4 cm from its insertion at the base of the 5th metatarsal (Figure 1A).

On the distal end of the fibula, a tunnel with a diameter of approx. 0.5 cm was created in a caudocranial direction (Figure 1B).

The free proximal end of the hemi-tendon of the peroneus brevis, prepared in advance, was then passed through the fibular tunnel (Figure 1C).

Maintaining the ankle at 90° and slightly in eversion, tension was applied to the neo-ligament forming a "loop" with the fibula, and this was then sutured with the distal tendon, assessing the stability during surgery (Figure 1D).

The area was then sutured in layers, using metal stitches for the skin.

All patients were operated using spinal anaesthesia and the procedure lasted 30 min on average.

### *Postoperative period*

The limb was immobilised in a cast and the patient was not allowed to put load on it for at least 30 days.

The patients were submitted to anti-thrombotic prophylaxis with low molecular weight heparin (Enoxaparin Sodium, 4000 U.I. 1 fl/dy sc) for 30 days and antibiotic coverage with amoxicillin-clavulanate 2 tablets/day for 7 days and NSAIDs if required.

The use of PEMF (Pulsating Electro Magnetic Fields) was also recommended for the ankle, for 6-8 hours a day.

During the surgical procedure and in the follow-up period the intra and post-operative complications were assessed.

## Results

After 30 days, the cast and stitches were removed.

The patient was then allowed to apply total load assisted by two crutches for 7 days, and subsequently

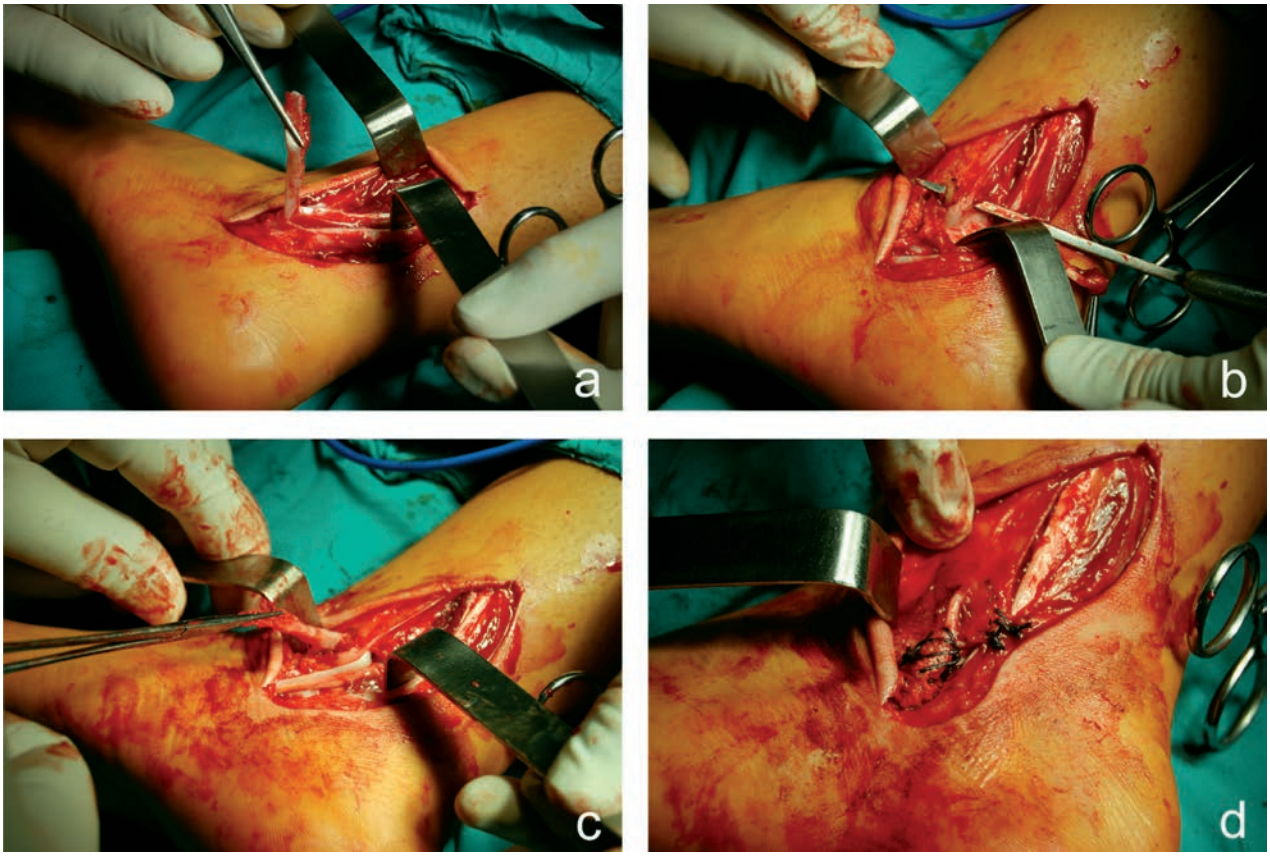


**Figure 1.** Procedure of reconstructive tenodesis according to Hemi-Castaing. The details are set out in the section entitled "Surgery"

to walk with a single crutch for another 7 days and then without assistance.

NSAIDs were prescribed as needed, low molecular weight heparin for 7 days and anti-oedema medications for 15 days.

The patients then undertook a rehabilitation-physiotherapy programme, which included:

- exercises for proprioceptive re-education;
- methods of gait re-education;
- assisted active and passive ankle mobilisation;
- isometric and isotonic enhancement of the triceps surae muscle and of the tibial and peroneus muscles;
- manual lymph drainage;
- tecar therapy.

After 30 days, following a new check-up, the patients undertook a program of isokinetic enhancement and sport specific re-education.

No complications occurred during surgery, but one case of wound dehiscence occurred in the post-operative period.

Of the 35 patients included in our study, all returned to play sport at a competitive non-professional level between 80 and 100 days from the procedure.

The stability recreated with the methods has been excellent in all cases and patient satisfaction is high, and in no case have new distortions occurred.

## Discussion

Assessing the results emerged from our study, we have noted how the Hemi-Castaing procedure was able to contribute elevated lateral stability to the articulations submitted to the surgical procedure.

Literature presents several studies in which the original Castaing technique has been used (11, 14, 15).

Among these, the work by Mabit *et al*. has examined the outcomes from the use of this technique, but

the results have been relatively unsatisfactory (from good to excellent in 70% of patients treated) (11).

Furthermore, in the study by Cañadell *et al.*, out of the 13 patients analysed with a follow up of 2.4 years and submitted to the Castaing procedure, 92% underwent to the new surgical procedure (14).

These results, judged of lower quality to the other non-anatomic reconstructions available, could be due to the reduced capacity of resistance to inversion (approx. 8-9%), caused by sacrificing the peroneus brevis envisaged by the original Castaing technique (16).

This tendon is responsible for the lateral stability of the ankle and subtalar joint.

It is for this reason that it was decided to modify the original technique, maintaining a hemi-tendon of the peroneus brevis in its journey to the bone insertion on the 5th metatarsal (17).

Though the tendon is not completely sectioned, some authors have raised doubts on the effective lateral stability following surgery and on the possible reduction in the eversion force provided by the peroneus muscles (18, 19).

Nonetheless, in our facility, using the modified technique of Hemi-Castaing, we noted that all the patients operated had good to excellent results.

In no case was it necessary to undergo a new surgical procedure for recurrence of the instability or for proprioceptive problems with the ankle.

These results concur with what is set out in literature: in a study by Baray *et al.*, who retrospectively assessed 21 patients who underwent Hemi-Castaing surgery, the results were good or excellent in more than 85% of patients (20).

In agreement with what is described in this last article, we have also noted a reduction in the eversion force of the peroneus muscles, and no alterations in the eversion/inversion ratio (E/I ratio), independently of the side treated (Figure 2, 3).

In conclusion, analysing the data presented in 2011 at the Symposium of the French Society of Or-

**Figure 2.** Post surgery clinical check-up

**Figure 3.** Post operative clinical check-up

thopaedic surgery and Traumatology (*Societé française de chirurgie orthopedique et traumatologique* – SoFCOT), 92% of the 51 subjects treated with this technique of ligamentoplasty has attained a score from good to very good (11).

## Conclusions

From the results of our 7 years case studies, we can state that the technique of reconstructive tenodesis by Hemi-Castaing has appeared safe and effective, providing excellent functional results.

Furthermore, preparation of the hemi-tendon of the peroneus brevis caused neither a reduction in the eversion force of lateral muscles nor an alteration to the proprioceptive ability of the ankle.

For these reasons, our facility increasingly proposes the Hemi-Castaing surgical procedure to treat chronic lateral ankle instability.

## Reference

1. Brand RL, Collins MD. Operative management of ligamentous injuries to the ankle. Clin Sports Med 1982; 1: 117-30.
2. Burks RT, Morgan J. Anatomy of the lateral ankle ligaments. Am J Sports Med 1994; 22: 72–7.
3. Rasmussen O. Stability of the ankle joint. Analysis of the function and traumatology of the ankle ligaments. Acta Orthop Scand Suppl 1985; 211: 1-75.
4. Baumhauer FJ, O'Brien T. Surgical Considerations in the Treatment of Ankle Instability. Journal of Athletic Training 2002; 37(4): 458-62.
5. Freeman MA. Treatment of ruptures of the lateral ligament of the ankle. J Bone Joint Surg Br 1965; 47: 661-8.
6. Moller-Larsen F, Wethelund JO, Jurik AG, de Carvalho A, Lucht U. Comparison of three different treatments for ruptured lateral ankle ligaments. Acta Orthop Scand 1988; 59: 564-6.
7. Brostrom L. Sprained ankles. Treatment and prognosis in recent ligament ruptures. Acta Chir Scand 1966; 132: 537-50.
8. DiGiovanni CW, Brodsky A. Current concepts: lateral ankle instability. Foot Ankle Int 2006; 27: 854-66.
9. Castaing J, Falaise B, Burdin P. Ligamentoplasty using the peroneus brevis in the treatment of chronic instabilities of the ankle. Long-term review. Rev Chir Orthop Reparatrice Appar Mot 1984; 70: 653-6.
10. Jarde O, Havet E, Gabrion A, Meire P, Vives P. Long-term outcome following surgical repair of ruptures of the fibular collateral ligament of the ankle. A report of 50 cases. Acta Orthop Belg 1999; 65: 340-5.
11. Mabit C, Tourné Y, Besse JL, Bonnel F, Toullec E, Giraud F, et al. Chronic lateral ankle instability surgical repairs: the long term prospective. Orthop Traumatol Surg Res 2010; 96: 417-23.
12. Solana J, Pons M, Guinot C, Viladot R. Tenodesis of the peroneus brevis and ligament capsuloplasty in chronic ankle instability. 2005; In: SECOT, Sociedad Espanola de Chirugia Ortopedica y Traumatologia. Seville, Spain
13. Lorenzo G, Calafiore V. Trattamento chirurgico Secondo Castaing nelle instabilita laterali di caviglia. Acta Orthop Ital 2009; 34: 11-4.
14. Cañadell JM, Valenti JR, Martinez A, de Pablos J, Villas C. Chronic lateral instability of the ankle. Arch Orthop Trauma Surg 1982; 99: 189-93.
15. Jarde O, Duboille G, Abi-Raad G, Boulu G, Massy S. Ankle instability with involvement of the subtalar joint demonstrated by MRI. Results with the Castaing procedure in 45 cases. Acta Orthop Belg 2002; 68: 515-28.
16. Paterson R, Cohen B, Taylor D, Bourne A, Black J. Reconstruction of the lateral ligaments of the ankle using semitendinosis graft. Foot Ankle Int 2000; 21: 413-9.
17. Schepers T, Vogels LMM, Van Lieshout EMM. Hemi-Castaing ligamentoplasty for the treatment of chronic lateral ankle instability: a retrospective assessment of outcome. Int Orthop 2011; 35(12): 1805-12.
18. Pontaga I. Ankle joint evertor-invertor muscle torque ratio decrease due to recurrent lateral ligament sprains. Clin Biomech 2004; 19 (7): 760-2.
19. Edouard P, Chatard JC, Fourchet F, Collado H, Degache F, Leclair A, et al. Invertor and evertor strength in track and field athletes with functional ankle instability. Isokinetics Exerc Sci 2011; 19(2): 91-6.
20. Baray AL, Philippot R, Farizon F, Boyer B, Edouard P. Assessment of joint position sense deficit, muscular impairment and postural disorder following hemi-Castaing ankle ligamentoplasty. Orthop Traumatol Surg Res 2014; 100(6 Suppl): S271-4.

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