

# DIAGNOSTIC EVALUATION OF CHRONIC VENOUS INSUFFICIENCY CASES USING THERMAL IMAGING

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## Introduction:

Four clinical cases of Varicose Veins recommended for saphenectomy are presented. They account for the early stage use of thermography at the Department of Surgery at ULS Bragança Hospital, in Portugal. Thermography functional results, against Eco-Doppler soundings were explored in pre, intra, and post surgery environment.

The results show that complementary information from thermography analysis highlighted venous deficiencies in areas not identified by traditional Eco-Doppler soundings that could lead to different surgical approaches.

**Varicose Veins:** one of the most common manifestations of venous insufficiency. The most extreme cases the surgical option is the removal, or closing off, the affected vein - saphenectomy. Clinical examination is traditionally supported by blood exams, Eco-Doppler soundings in order to accurately assess all of the sites of venous reflux.

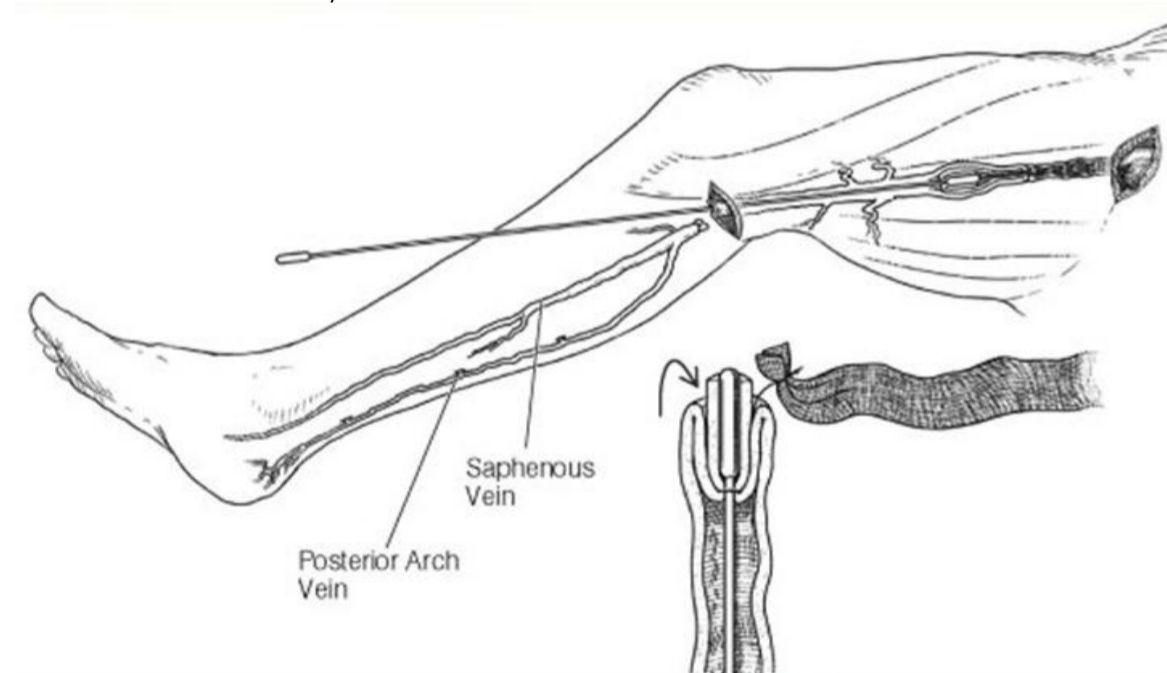


Figure 1. Schematics of a saphenectomy in *Coni et al. 2004*.

## Methods:

An adapted protocol for a FLIR camera (model T365) was developed for this particular pathology based in *Bagavathiappan et al. 2009*, including however functional tests to enhance physical limitations provoked by the disease.

Exploratory tests were made in four healthy female subjects, of approximately 20 years old, providing a reference for neutral situation. The tests were performed in horizontal and vertical positions, where the leg was at rest, and then vertically.

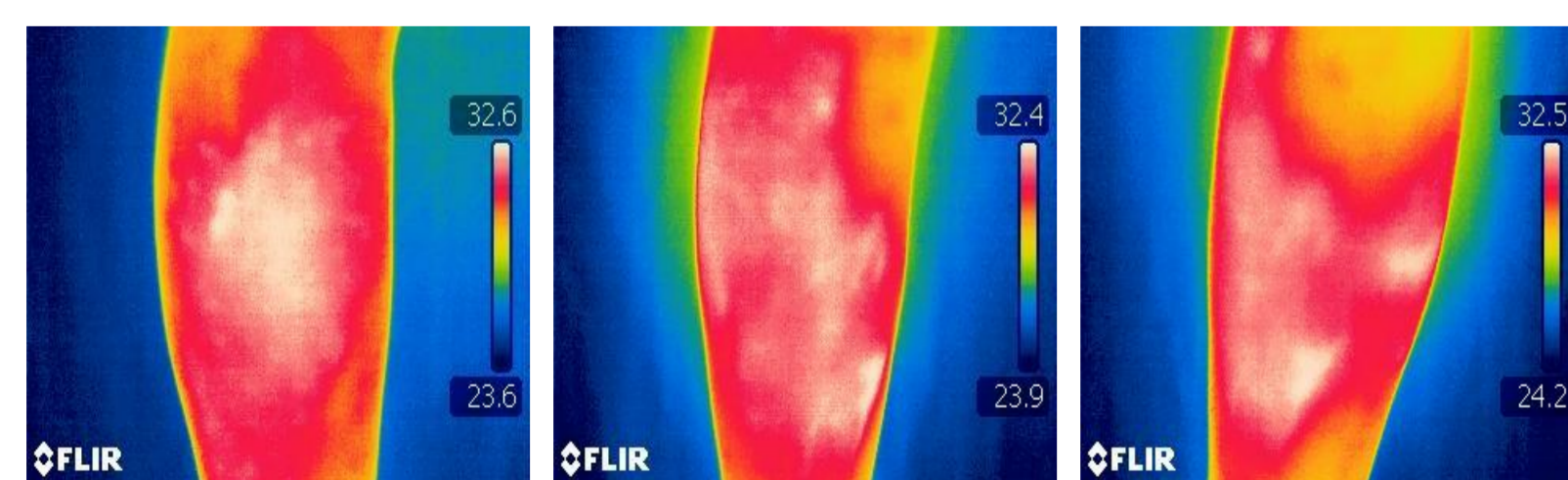


Figure 2. Right inferior limb of a healthy subject in the anterior and lateral views.

## Results:

Four clinical cases were studied: one male (18 y) and three females (60-62 y) with Varicose Veins pathology identified in only one leg – with recommendation for saphenectomy. Figures 3 and 4 show the results of the intra and post-operative for the clinical case 1 (female 61 y) and figures 5 and 6 of the clinical case 2 (male 18 y). These are the only ones presented here for simplicity.

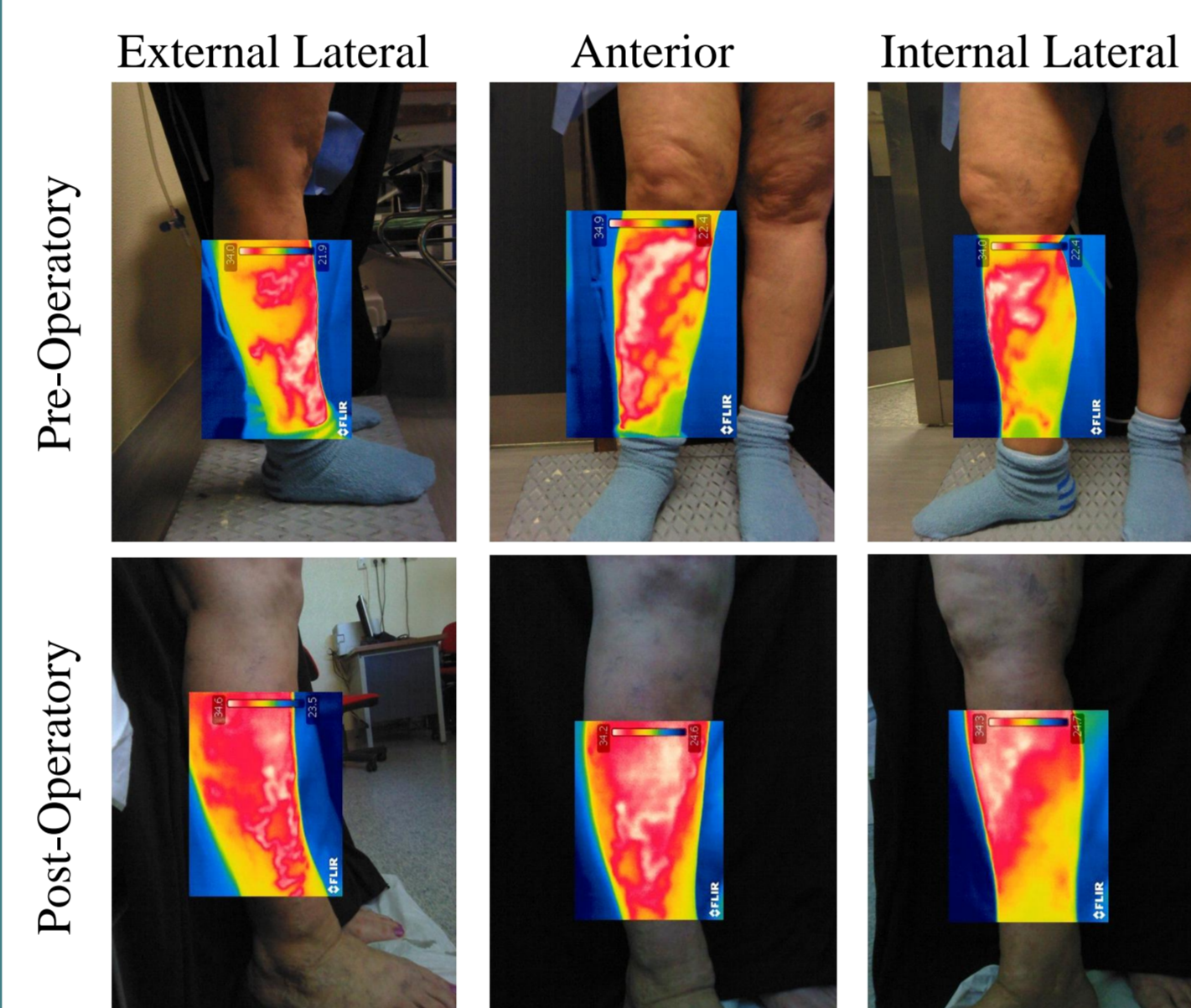


Figure 3. Clinical case 1 – Operated leg.

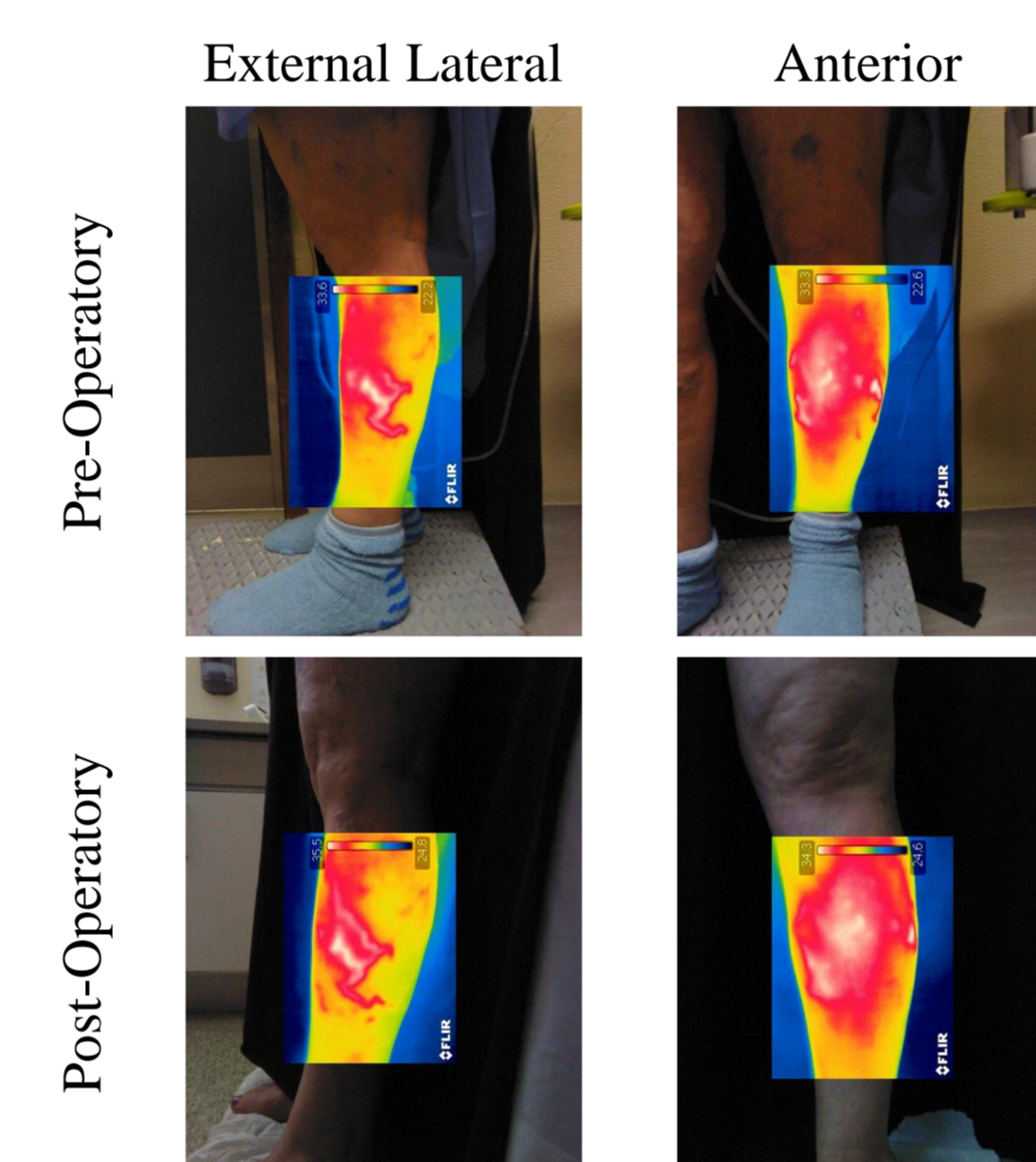


Figure 4. Clinical case 1 – Non-operated leg. Aggravation of 232%.

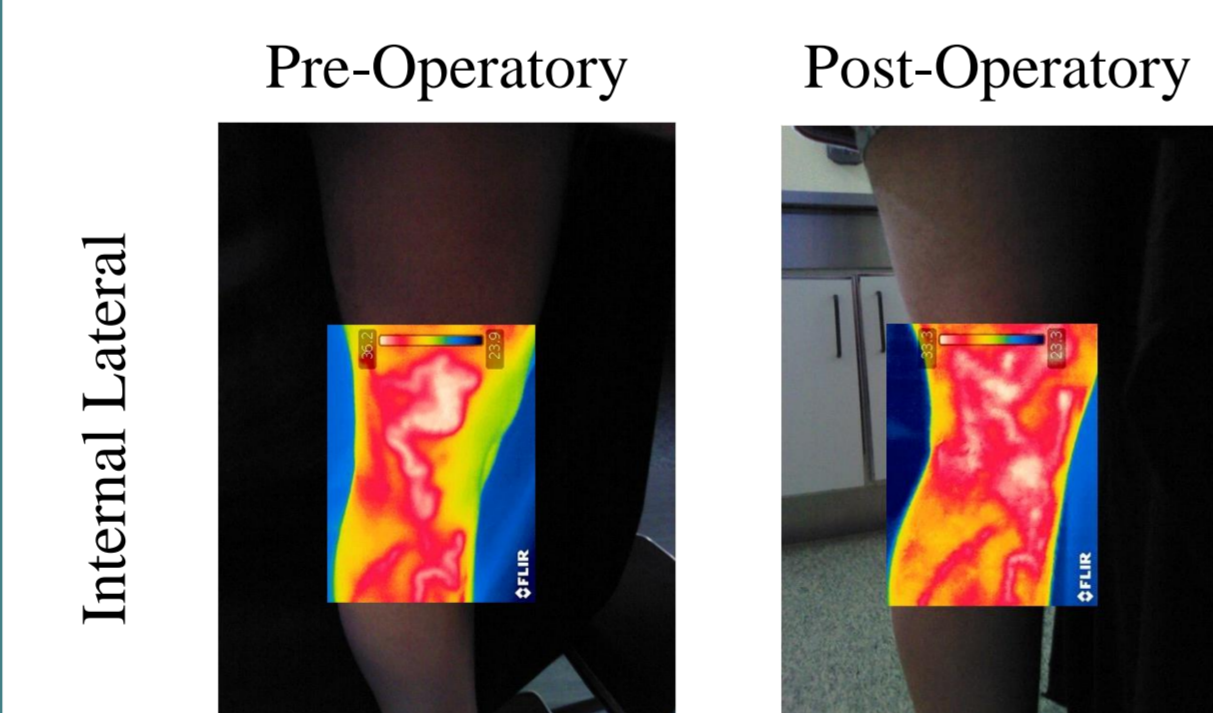


Figure 5. Clinical case 2 – Operated leg.

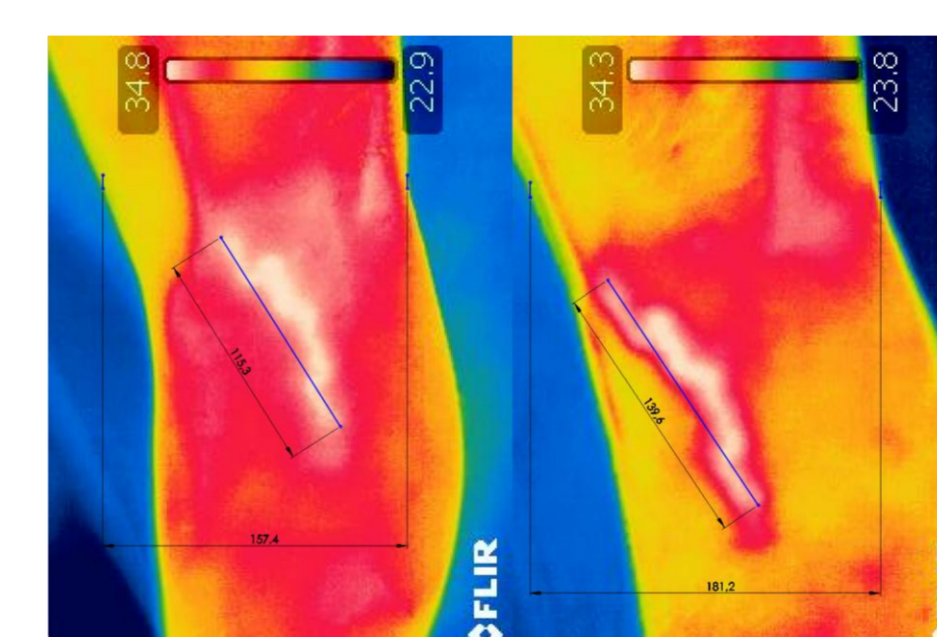


Figure 6. Clinical case 2 – Non-operated leg (before and after). Aggravation of 4,3%.

In Figure 7 we observe a surgeon tagging the leg with a marker, being the markings consistent with the warmer spots of the leg surface.

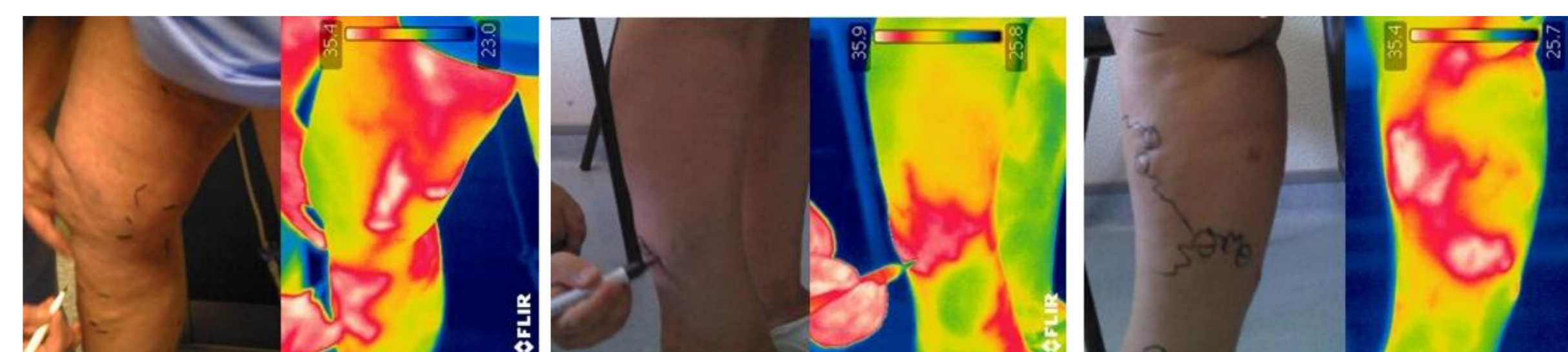


Figure 7. Marking of the varicose veins in the pre-operative exam.

## Discussion and Conclusions:

1. Even in horizontal position it was found that the pathology could be detected. That was not perceptible in healthy subjects because there was no underlying pathology. However, in a standing position the pathology is better visualized: the blood flow increases, and so the pressure in the veins due to poor venous return.
2. In the post-operative images we observe residual veins that are common complications of the surgical treatment (Figs. 3 and 5).
3. In the non-operated leg it was unveiled additional varicose veins, and the aggravation of the pathology 39 days after the surgical treatment. That may be due to overloading the leg (Figs. 4 and 6). In one case there was an estimated increase of over 200% on the varicose vein dimension.
4. The creation of thermography protocol was effective in collecting data, and the result of the captured images and the diagnosis using this technique - satisfactory.
5. The technique proved to be reliable for the diagnosis of the pathology being possible to assess the success of the surgery and the skill of the surgeon. Through this way it was also possible to identify varicose veins that were not previously detected by Eco-Doppler exam.

## References:

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