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Objective Assessment of Nerve Injury after Greater Saphenous Vein Stripping

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Aim. *The complication of nerve injury after greater saphenous vein stripping for varicosity is subjective, and a method for objective evaluation has never been established. The aim of this study was to evaluate postoperative sensory changes by quantitative assessment of current perception threshold (CPT), and to clarify the relation between CPT and symptoms.*
Patients and methods. *Between January 2003 and August 2005, 27 limbs in 18 patients were enrolled. Quantitative sensory function was determined through CPT using a Neurometer® (Neurotron, Inc., USA), with which saphenous nerve neural fiber selective minimum sensing values against three electrical stimuli (2000, 250, 5 Hz) were measured. CPT measurements were scheduled on the day before the operation, and 2–7 days, 1, 3, and 6 months after the operation.*
Results. *An increase in CPT value of more than 20% or decrease to below 50% compared to the preoperative value with at least two stimuli was defined as CPT abnormality. Subjective symptoms were observed in 13 limbs in the early postoperative period, and 10 limbs showed CPT abnormality. In 6 limbs with a CPT increase over 20% with all three stimuli, neurological symptoms continued for 6 months.*
Conclusions. *CPT evaluation provides an objective indication of neurological symptoms in the lower limb following varicose vein surgery.*

Keywords: Postoperative complication; Nerve injury; Stripping; Varicose vein surgery; Current perception threshold; Objective assessment.

Introduction

Varicose veins are a common disease entity all over the world. One of the established procedures to treat varicose veins with sapheno-femoral junction reflux is stripping of the great saphenous vein (GSV).[1] Although many patients undergo a stripping operation to relieve symptoms due to varicosities, saphenous nerve injury is a significant postoperative complication.[2] Symptoms of nerve injury sometimes continue for a long time, and are thus not negligible. Many reports have been published about postoperative nerve injury, the incidence of which was 4–50%.[3–7] The symptoms of saphenous nerve injury are numbness, tingling and shooting pain/burning pain. The symptoms also present as hypoaesthesia, paraesthesia and sometimes hyperesthesia. The typical location of the symptoms lies on the medial and lower aspects of the calf. It has been reported that a selective stripping procedure, in which the GSV is stripped from the groin to just below the knee, reduced the incidence of nerve injury,[8,9] although one report did not show a difference between selective stripping and full stripping.[10] However, a method to eliminate this complication has never been reported, perhaps because a method for objective evaluation has not been established. The symptoms of nerve injury are subjective.

The recent application of a unique transcutaneous electrical nerve stimulator, which determines current perception threshold (CPT), provides quantitative assessment of sensory nerve function.[11–14] CPT, which is obtained as the minimum transcutaneous stimulation intensity required to produce sensation, is measured with a Neurometer® (Neurotron, Inc., Baltimore, MD, USA), a neurodiagnostic transcutaneous electrical nerve stimulator. Peripheral nerve function has been evaluated by CPT measurement with the Neurometer® in many conditions with sensory morbidity, such as carpal tunnel syndrome, pruritis

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in atopic dermatitis patients, and diabetic neuropathy.[15–18] The aim of this study was to evaluate postoperative sensory change by quantitative assessment with current perception threshold (CPT) measurements and to clarify the relationship between CPT and subjective neurological symptoms.

Patients and Methods

Forty-seven patients underwent GSV stripping operations at the Tokyo University Hospital between January 2003 and August 2005. Patients were examined and classified according to the CEAP system based on clinical symptoms,[19] The indications for stripping of GSV were decided by the confirmation of GSV reflux by duplex ultrasonography and the patient's desire to undergo an operation. Patients unable to give informed consent, and those with a pre-existing subjective or objective sensory abnormality such as spinal canal stenosis, with diabetes or with a history of lower limb operation were excluded. Thirty-three patients agreed to undergo CPT measurements in association with the stripping operation. After excluding patients who dropped out from the follow-up course, 27 limbs in 18 patients who underwent greater saphenous vein stripping were finally enrolled. The patients' profiles are shown in Table 1.

The surgical procedure was as follows; stripping upward (from calf or ankle to groin), high ligation of the sapheno-femoral junction and ligation of insufficient perforating veins. Sometimes avulsion of varicose veins around the perforating veins was performed at the same time.

Quantitative sensory function was determined through CPT using the Neurometer®. The electrode, by which electrical stimuli were applied, was attached to the skin just proximal to the medial malleolus without skin changes, where neural symptoms are often found. The patient answered whether he or she sensed the electrical stimulus or not. The intensity of the stimulus was varied by the program of the Neurometer®, and CPT was determined as the minimum value that he or she sensed (in milliamperes). With the Neurometer®, neural fibre selective minimum sensing values for three electrical stimuli (2000, 250 and 5 Hz) to the saphenous nerve were measured. Each frequency (2000, 250 and 5 Hz) corresponds to neural Aß, Aδ and C fibres, respectively, and neural-fibre selective assessment can be performed. The Aß fibre corresponds to touch sense, and the Aδ fibre to hot and cold sense and fast pain. C fibres sense slow pain.

CPT measurements were performed on the day before operation, and 2–7 days (early postoperative period), 1, 3, and 6 months after the operation. CPT values were measured for each stimulus frequency. The percent change in CPT value compared to the preoperative value was calculated for each stimulus and used as an index (CPT change rate). The neurological symptoms were recorded at each time of CPT measurement. Symptoms reported as discomfort or a feeling that something was wrong were regarded as numbness. Spontaneous strong pain was regarded as burning pain. The severity of neurological symptoms was classified as ''asymptomatic'', ''mild'' and ''moderate or severe'' based on the patient's subjective evaluation.

CPT values and CPT change rates are represented by the mean and standard deviation. Statistical analysis was performed by paired t-test. A p value <0.05 was considered significant.

Table 1. Patients' characteristics

Patients (*n*)		18
Limbs (*n*)		27
Age (years; mean, SD)		55 SD 11
Sex (M/F)		6/12
Preoperative CEAP	Clinical grade	Number of limbs
	2	0
	3	16
	4	7
	5	4
	6	0
Stripping area, to groin from:		
	just below knee	13
	upper half of calf	9
	lower half of calf	2
	ankle	3

Results

The measured CPT values and CPT change rates are shown in Table 2. For each stimulus, the mean CPT compared to the preoperative value increased in the early postoperative period.

The limbs were classified by the CPT change rate into three groups for each stimulus; limbs with an increase in CPT greater than 20% were classified as the high group, limbs with a decrease in CPT to less than 50% as the low group, and limbs with a CPT change from −50% to +20% as the normal group. The number of limbs in each group (low, normal, high) is shown in Fig. 1. At 2000 Hz stimulus, at 6 months after the operation, more than half of the limbs (56%) were in the normal group. About one-third of limbs were classified in the high group during the observation period. At 250 Hz stimulus, the number of limbs in the high group increased at 3 months after