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Thermal and vibratory thresholds after liposcution in patients with Dercum's disease.

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Original paper

Running Title: Sensibility after liposuction in Dercum's Disease

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Abstract

Dercum’s disease is characterised by pronounced pain in the adipose tissue and a number of associated symptoms and is, in most patients, accompanied by obesity. Postoperative sensory change after liposuction is a well-known side effect, and probably caused by mechanical trauma to the nerves. The aim of this investigation was to find out whether the thermal and sensory sensation changed after liposuction in patients with Dercum’s disease. The thermal and vibratory thresholds were examined preoperatively, and three and 12 months after, liposuction in affected 39 patients. There were only small differences in thermal and vibratory thresholds three and 12 months after liposuction compared with preoperatively, and none of these was statistically significant.

Key Words: Dercum’s disease, liposuction, sensibility, adipositas dolorosa

Introduction

Dercum's disease is characterised by pronounced pain in the adipose tissue and a number of associated symptoms, and is usually accompanied by obesity. The diagnosis is, like fibromyalgia, based on clinical symptoms [1]. The pain is chronic (>3 months), symmetrical, often disabling and resistant to analgesics such as paracetamol and dextroproxyphen [2,3].

Postoperative sensory change after liposuction is a well-known side-effect, and probably caused by mechanical trauma to the nerves [4]. Only two clinical studies have examined skin sensation after liposuction, and one of them examined the threshold of detection of sensation [4]. The other examined painful skin sensation, two-point discrimination, and light touch [5].

The aim of this investigation was to examine the changes in thermal and sensory sensation after liposuction in patients with Dercum's disease.

Patients and methods

Patients

A total of 39 women who fulfilled the clinical criteria for Dercum's disease were referred to our clinic by the same consultant. The disease is characterised by obesity and chronic pain (> 3 months) in the adipose tissue [1]. The patients were operated on consecutively with liposuction by one of the author (HB). All painful areas were treated in one session. The patients did not have traditional pain medication restricted and were given no particular advice regarding lifestyle. Other treatments, such as lidocaine infusions or steroids, were not used. None of the patients had a history of neurological disorders, neuromuscular conditions, root lesions or drug misuse. Two patients had diabetes. Their mean (SD) age at time of inclusion was 51 (9) years, the mean (SD) height 1.63 (0.06) meters, the mean (SD) weight 92.7 (16.2) kg and the mean (SD) BMI 35.1 (5.8) kg/m^2.

Surgical technique

Patients were operated on under general anaesthesia, epidural anaesthesia, or spinal block. Neither local anaesthetic nor adrenaline was injected locally [6]. All patients were given anticoagulants, usually dextran, during the operation. Painful areas, such as the abdomen; flanks, hips and gluteal regions; proximal thighs, legs and arms; and the medial areas of the knees were, operated on through 4 mm incisions. Bullet-shaped cannulas with two or three openings distally, and an outer diameter of 5-6 mm, were used. A vacuum pump connected to the cannula gave a negative atmospheric pressure of 0.9. After liposuction the treated areas were compressed firmly with compression garments on the legs, elastic bandages on the arms, and an elastic corset on the torso, to achieve haemostasis and to prevent postoperative oedema in the affected areas. Compression was maintained for at least 6 weeks. No symptomatic postoperative deep venous thrombosis was seen.

Quantitative sensory testing

Measurements of the vibratory and thermal thresholds were made preoperatively, and 3 and 12 months after the operation. All sensory laboratory tests were made at the Department of Clinical Neurophysiology. All patients described their abdomen and knees as painful, and so these areas therefore chosen for liposuction and subsequent examination with sensory thresholds. We had the opportunity to test the vibratory and thermal thresholds on the abdomen of 39 patients of whom 28 were also tested on the knee. The subjects were not able to see the results on the computer screen during the testing. The study was approved by the Ethics of Human Investigation Committee at Lund University and all participants gave their informed consent to participate. The procedures followed were in accordance with the Declaration Helsinki of 1964, as revised in 1983.

Measurements of vibratory threshold

Electronically-generated mechanical stimulation was produced by a Goldberg-Lindblom vibrometer (Somedic AB, Hörby, Sweden) that was applied to the subjects' skin. The vibration threshold was determined by the method of limits: that is, the intensity of the vibrations was steadily increased until the subject first perceived vibration (vibration perception threshold); upon which the intensity was increased a further 50%, followed by a gradual reduction until the subject no longer felt vibrations (vibration disappearance threshold). The patient was asked to report when the vibratory sensation started and stopped. The vibration thresholds were defined as the points (μmeters from peak to peak) where the perception appeared and disappeared [7].

Measurements of thermal thresholds

To determine the warm and cold detection thresholds a contact thermode thermostimulator (Thermotest, Somedic, AB Hörby, Sweden) was applied to the skin. The perception threshold of cold and warmth induced by contact application was assessed by the method of limits. The baseline temperature of the thermode was set 32.5°C. The rate of the temperature change was linear and 1°C/second. The subject was instructed to press a switch whenever she felt an onset of a change in temperature (cold or warmth). She was asked to push a button when she felt sensations of warm and cold, respectively, at which moment the temperature of the probe returned to baseline [8,9].

Calculations and statistical methods

The values of the thresholds were based on the mean of three consecutive measurements on the knees and abdomen, respectively. There was no significant difference between the left and right knee or the left and right side of the abdomen, and so mean values for the left and right side of the abdomen and the left and right knee, respectively, were calculated and used for analysis. Histograms drawn to examine the distribution of the material indicated that the series was not normally distributed. The significance of differences in intra-individual changes in vibratory and thermal sensation with time and postoperatively was analysed using non-parametric paired Wilcoxon test. The Bonferroni correction was applied. Probabilities of less than 0.05 were accepted as significant.

Results

The vibratory thresholds are shown in Table I and the thermal thresholds in Table II. There were only small differences after three and 12 months compared with preoperatively, and none of these was statistically significant. No patient withdrew during the course of the study.

Discussion

A strength of the present study is that the diagnosis of Dercum's disease was made by the same consultant, and that the same surgeon operated on all the patients. An inherent weakness of any clinical study is that there are always missing data. However, we had the opportunity to measure the thresholds in the abdomen of all the patients, even though there were some missing values from the knee.

Different methods have been proposed to assess sensory loss and somatosensory function - for example, thermal and vibratory detection thresholds [10]. Both these methods are included in the guidelines for quantitative sensory testing proposed by the American Academy of Neurology [11]. Thermal detection thresholds evaluate the function of afferent small myelinated A-delta fibres (cold sense) and unmyelinated C-fibres (warm sense), and vibration detection thresholds the function of large myelinated type A-beta fibres [12].

Vibration and thermal thresholds are subjective testing methods and demand co-operation from the subjects [10]. Sensory thresholds can also be altered by different uncontrollable variables, such as systolic blood pressure [13], age [14], and psychological factors [15], and by painful stimuli [16]. However, we made intra-individual comparisons and so such factors should have less influence. In addition, previous studies have shown that the reliability of the tests used can be poor if they are not given in a standardised fashion [10]. However, great care was taken to give them in the same way and by the same trained personnel in all cases.

Previous research has suggested that liposuction can cause nerve damage, and different mechanisms have been suggested. Suction-assisted liposuction seems to cause direct mechanical nerve trauma by the cannula, whereas ultrasound-assisted liposuction could cause cavitation and demyelination of peripheral nerves as a result of direct exposure of the nerves to ultrasound energy [4]. The mean threshold for pressure perception is lower for the suction-treated areas than for the ultrasound-treated areas [4]. A prospective study of 50 healthy patients reported a decreased sensitivity to painful stimuli after liposuction. However, one month postoperatively sensation started to return to its preoperative sensitivity [5].

Our patients were all operated on with suction assisted liposuction, and so should have had direct mechanical nerve trauma, and as a consequence raised thresholds for sensory perception. However, the first postoperative measurement was made three months postoperatively, when sensitivity could have returned almost to normal. In other words, the trauma generated by the suction cannulas during liposuction does not seem to cause permanent nerve damage [4]. Furthermore, in the previously mentioned study [5] the sensation was measured with Vitapul, a device that generates electric current on the skin. In our study vibratory stimulus was used. The vibratory stimulus could also spread to deep or adjacent, normally innervated, tissue and so these measurements do perhaps not detect local nerve lesions [7].

In subjects with other disorders, for example diffuse upper limb pain disorders [17], chronic whiplash [18] and different unilateral muscoskeletal disorders that encompass diffuse pain, such as frozen shoulder and epicondylitis [19], previous studies have shown decreased pain thresholds but raised detection of vibration and thermal thresholds both ipsilaterally and contralaterally to the affected limb. Such findings have suggested a common generalised disturbance of somatosensory processing and changed central nervous perception, rather than peripheral nerve dysfunction in patients with such chronic pain syndromes [17, 20]. In contrast to this, it has been shown that patients with fibromyalgia have hypersensitivity to pain, but normal perception thresholds [21,22], which indicates that different mechanisms are involved in the various pain syndromes. In other words, an influence on both pain and the perception threshold suggests that both central and peripheral mechanisms are responsible for the perception of pain in certain conditions [18]. As regards Dercum's disease, the aetiology of the pain is unknown, and there are no data that compare these patients' sensory thresholds with those of healthy obese controls. We have observed that the thresholds vary among different areas. The present study does not provide us with any further information on this, as its objective was to investigate the effect of liposuction on individual patients with Dercum's disease.

In conclusion, the results of this study suggest that there are no significant differences in vibratory and thermal sensation after liposuction in patients with Dercum's disease. Case reports [23-25] have suggested that liposuction may have the potential to ameliorate that pain. Nociception is conducted by two types of nerve fibres: the myelinated A-delta fibres, that also conduct the cold sense; and more slowly conduction C fibres, that also conduct the warm sense. The pain experienced therefore has two phases, the first of which is mediated by the fast-conduction A-delta fibres and is associated with an initial sharp pain, and the second of which is mediated by the more slowly conduction C-fibres and gives rise to a prolonged, less intense feeling of pain [12]. Based on this, an elevation of the thermal thresholds could be expected after liposuction. However, that was not the case which indicates that further research is needed to clarify the mechanism by which liposuction alleviates pain.

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Declaration of interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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Table I. The vibratory thresholds. Median and range. VPT=Vibratory perception threshold. VDT=Vibratory disappearance threshold.

Time	Abdomen (n=39)		Knee (n=28)	
	VPT (μm)	**VDT** (μm)	**VPT** (μm)	**VDT** (μm)
Pre-op	9.9 (0.4-55.0)	8.5 (0.4-47.0)	7.8 (0.35-73.0)	7.6 (0.3-61.7)
After 3 months	10.1 (1.0-70.0)	8.7 (0.5-102.5)	7.5 (1.1-72.0)	5.5 (0.2-66.0)
After 12 months	10.5 (1.5-55)	10.2 (1.3-62.5)	5.1 (2.1-53.0)	5.3 (1.4-47.0)

Table II. The thermal thresholds. Median and range. WDT= Warm detection threshold. CDT= Cold detection threshold.

Time	Abdomen (n=39)		Knee (n=28)	
	WDT (°C)	**CDT (**°C)	**WDT (**°C)	**CDT (**°C)
Pre-op	5.5 (2.8-13.5)	2.3 (1.3-8.0)	5.1 (1.3-9.3)	2.0 (1.0-4.8)
After 3 months	6.5 (3.3-15.8)	2.8 (1.0-9.8)	5.4 (1.3-11.0)	2.3 (1.3-5.8)
After 12 months	5.8 (2.5-14.8)	2.5 (1.0-9.5)	5.0 (2.0-10.0)	2.5 (1.0-9.0)