

Skin Problems in the Lower Legs of Morbidly Obese Patients and the Possible Role of Bariatric Surgery

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Received: August 21, 2014; Accepted: September 25, 2014; Published: September 30, 2014

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Abstract

Objective: Anecdotally, lower leg skin changes in morbidly obese people appear much improved with weight loss following bariatric surgery. The objective of this study was to compare prevalence of lower leg symptoms in obese patients awaiting, and those who have had, bariatric surgery.

Methods: An audit was undertaken, utilising questionnaires, to identify obesity-associated lower leg symptoms: swelling, itchiness, colour changes, hot/burning feeling, eczema and ulcers. There were three groups: those awaiting surgery ('Obesity Clinic'), those who had surgery ('Post-Surgery'), and those in 'Post-Surgery' recalling pre-operative symptoms ('Pre-Surgery Recall').

Results: Participants totalled 117; 62 in 'Obesity Clinic' and 55 in 'Post-Surgery' (81.8% response rate). Overall prevalence of symptoms was significantly lower in 'Post-Surgery' (36.4%) compared to 'Obesity Clinic' (80.6%) and 'Pre-Surgery Recall' (74.5%) ($p < 0.0001$). Individual symptoms were also similarly less prevalent.

Conclusion: These results establish the high prevalence of lower leg skin changes in morbidly obese patients, which is significantly lower in those who have undergone bariatric surgery, possibly due to improved underlying venous stasis from decreased intra-abdominal pressure and weight. Decreased popliteal vein compression from weight loss, and weight reduction itself may also be contributing factors. This suggests a role for bariatric surgery in the potentially cost-effective treatment of lower leg symptoms in the morbidly obese.

Keywords: Bariatric surgery; Gastric bypass; Obesity; Weight loss; Skin

Abbreviation:

CVI: chronic venous insufficiency

Introduction

Morbidly obese patients often present with skin changes and ulcerations in their legs similar to those found in patients with chronic venous insufficiency (CVI) [1], although its exact prevalence is unknown. These skin changes can include oedema, erythema, haemosiderin pigmentation and lipodermatosclerosis, amongst others (Figure 1). However, there is often no obvious manifestation of venous disease in the form of varicose veins [1], leading to the question of whether these skin changes are part of the CVI spectrum, or if they are caused by other pathologies. The association between obesity and CVI from various epidemiological studies has been previously documented [2,3], with venous stasis shown to be a factor [4]. Consistent with this observation, duplex ultrasound studies in obese individuals have shown decreased femoral vein flow and increased femoral vein diameter, in comparison to non-obese individuals [4]. Obesity is also a known risk factor for lower limb skin ulceration in patients with documented venous disease [5].



Figure 1: Presentation of lower limb skin changes in obesity. Note the area of erythema from a healed ulcer on the left shin.

There are over 500 million people with obesity worldwide [6]. Lower leg skin problems and ulceration appear to be a common, under-recognised co-morbidity of obesity, thus representing a large burden on the health system. They are very difficult to manage in terms of treatment, as the skin changes and ulcers tend to recur, probably due to the persistence of the underlying pathology, resulting in long periods of treatment by various modalities including dressings and topical and oral medications, and ongoing involvement with

nursing and medical practitioners. The cost of treating obesity-related skin problems is likely to be similar to that of venous ulcers in the community.

Interestingly, obesity-related lower leg skin problems have been said to disappear following bariatric surgery, although this has also not been previously documented in the literature. Bariatric surgery, surgery carried out for the primary purpose of weight loss, is now increasingly recognised to procure many health benefits, some of which are independent of weight loss following surgery. There is evidence that bariatric surgery improves type II diabetes mellitus, hypercholesterolaemia, and hypertension, amongst other obesity-related conditions [7]. With regard to weight loss and diabetes in the context of obesity, bariatric surgery has been shown to be more effective than conventional treatments, and more cost-effective as well in the long term [8,9].

It may be that bariatric surgery also affects a cure on obesity-related skin problems in a clinically- and cost-effective manner. However, because there is currently nothing in the published literature documenting (1) the prevalence of skin changes in the lower legs of obese individuals, and (2) the effect of bariatric surgery on these skin changes, this study first aimed to establish if there is indeed any difference in the prevalence of skin changes in the lower legs of obese individuals before and after bariatric surgery.

Materials and Methods

From December 2010 to February 2011, an audit of obesity-related skin symptoms in the legs of bariatric surgical patients was performed. Patients were identified from the bariatric clinic database and surgical waiting list.

Potential participants were posted a questionnaire, which included questions on current weight, and any problems they were currently experiencing in their legs, such as swelling, itchiness, colour changes, hot or burning feelings, eczema, ulcers or any other symptoms. A freepost envelope was included to facilitate their reply. Participants who had not responded after a month were sent a reminder. If they had not replied within a week of the reminder, they were telephoned, and the questionnaire was completed over the phone.

Two groups of patients were approached. The first group, the 'Obesity Clinic' group, included those awaiting bariatric surgery. The second group, termed the 'Post-Surgery' group, included those patients who had had a bariatric procedure in the three years prior to this study. In addition to filling out the questionnaire to determine current symptoms, patients in the second group were also requested to fill out a second questionnaire recalling the symptoms in their legs prior to surgery. Presence of varicose veins was established clinically from the clinical record in both groups. The recollection of symptoms prior to bariatric surgery was termed the 'Pre-Surgery Recall' group.

Height, pre-operative weight and other demographic information were obtained from clinical records. Body mass index (BMI) was calculated. Statistical analysis was performed using Chi-squared test for categorical data and t-test for continuous variables. This was done using StatView (version 5.0.1, SAS Institute Inc. 92-98). Significance was set at $p < 0.05$.

Results

Clinical and demographic data

In total, 117 patients responded: 62 (86.1%) in the Obesity Clinic and 55 (77.5%) in the Post-Surgery groups. Average age was 47 ± 12.0 years. Female patients made up 77.0% of the participants. Age, gender, pre-operative weight, height and BMI in both the Obesity Clinic and Post-Surgery groups were comparable.

In the Post-Surgery group, all patients had an open Roux-en-Y gastric bypass procedure. The average pre-operative weight was 153.5 ± 29.7 kg, and the average weight loss following surgery was 54.8 ± 20.9 kg, representing a BMI decrease of 19.6 ± 7.1 kg/m². The median time from surgery was 18 (10-36) months (Table 1).

	Obesity Clinic (n=62)	Post-Surgery (n=55)	p-value ^a
Age (years)	45.2 ± 11.0	49.0 ± 11.3	0.07
Gender (male)	15 (24.2%)	12 (21.8%)	0.76
Height (cm)	167.2 ± 8.9	168.2 ± 11.8	0.59
Pre-operative weight (kg)	152.2 ± 28.2	153.5 ± 29.7	0.81
Pre-operative BMI (kg/m ²)	55.3 ± 7.5	53.8 ± 9.2	0.33
Presence of varicose veins	18 (29.0%)	24 (43.6%)	0.10
Post-operative weight (kg)	N/A	94.2 ± 20.5	-
Weight change (kg)			
All	N/A	-54.8 ± 20.9	-
Males (n=12)	N/A	-55.6 ± 23.7	0.89 ^b
Females (n=37)	N/A	-54.6 ± 20.4	-
Post-operative BMI (kg/m ²)	N/A	33.1 ± 6.8	
BMI change (kg/m ²)			
All	N/A	-19.6 ± 7.1	-
Males (n=11)	N/A	-17.8 ± 6.9	0.35 ^b
Females (n=37)	N/A	-20.1 ± 7.2	-
Time since surgery, months	N/A	18 (10-36)	-

Table 1: Clinical and demographic variables for patients in the Obesity Clinic and Post-Surgery groups. Values reported as mean ± standard deviation, number (%) or median (interquartile range); a: chi-squared test and unpaired t-test; b: p value for male vs. female; BMI: body mass index.

Prevalence of skin problems data

Obesity clinic vs. pre-surgery recall

The Obesity Clinic and Pre-Surgery Recall groups were very similar in terms of prevalence of skin problems. The overall prevalence of skin problems in the Obesity Clinic group was very high at 80.6%, similar to the 74.5% seen in the Pre-Surgery Recall group. Swelling was

reported to be the most prevalent symptom at 64.5% in the Obesity Clinic group and 67.3% in the Pre-Surgery Recall group. Compared to the Obesity Clinic group, several individual symptoms, including colour changes, eczema, ulcers, and 'other' problems were more prevalent in the Pre-Surgery Recall group ($p < 0.05$ for each of these). The main difference is the prevalence of ulcers, which was found to be 14.5% in the Obesity Clinic group, compared with 50.0% in the Pre-Surgery Recall group (Table 2).

Post-surgery vs. obesity clinic or pre-surgery recall

The prevalence of skin problems was significantly lower in the Post-Surgery group compared to the prevalence in the Pre-Surgical Recall and the Obesity Clinic groups, although once again, swelling was the most prevalent symptom at 20.0%. The number of patients reporting 'any problems' in their legs was 20 (36.4%) in the Post-Surgery group, compared to 50 (80.6%) in the Obesity Clinic group, and 41 (74.5%) in the Pre-Surgery Recall group ($p < 0.0001$). This is reflected as well in the prevalence of individual symptoms, with the difference between the Pre-Surgery Recall group or the Obesity Clinic group compared to the Post-Surgery group achieving a statistical significance ranging from $p < 0.01$ to $p < 0.0001$ (Table 2).

Post-surgery vs. obesity clinic and pre-surgery recall combined

When the Obesity Clinic and Pre-Surgery Recall groups were combined, there remained a significant difference in the combined prevalence of overall and individual symptoms compared to those in the Post-Surgery group. Indeed, the difference in prevalence compared to the Post-Surgery group increased in significance ($p < 0.0001$) when the groups were combined. 'Other' problems, which were reported by 44.4% of the combined group in contrast to 5.5% of the Post-Surgery group, consisted of cellulitis, red spots, diabetes, arthritic pain, infections, dry feet and gout. Treatment received as reported by patients included the use of diuretics, creams, analgesics and district nurse dressings. The prevalence of treatment received in the combined group (46.2%) reflected the high prevalence of overall symptoms noted in this group (77.8%). Equally, the low prevalence of treatment received in the Post-Surgery group (12.7%) reflects the low prevalence of symptoms (36.4%) (Table 2).

	Post-Surgery (n=55)	Obesity Clinic+Pre-Surgery Recall (n=117)	Pre-Surgery Recall (n=55)	Obesity Clinic (n=62)
Any Problems	20 (36.4%)	91 (77.8%)*	41 (74.5%)*	50 (80.6%)*
Swelling	11 (20.0%)	77 (65.8%)*	37 (67.3%)*	40 (64.5%)*
Itchiness	8 (14.8%)	57 (48.7%)*	29 (52.7%)*	28 (45.2%)†
Colour Changes	4 (7.3%)	54 (46.2%)*	31 (56.4%)*	23 (37.1%)*‡
Hot/Burning Feelings	8 (14.6%)	54 (46.2%)*	29 (52.7%)*	25 (40.3%)†
Eczema	2 (3.6%)	37 (31.6%)*	25 (45.5%)*	12 (19.4)†‡
Ulcers	1 (1.8%)	36 (31.0%)*	27 (50.0%)*	9 (14.5%)†‡
'Other'	3 (5.5%)	52 (44.4%)*	32 (58.2%)*	20 (32.3%)†‡
Receiving Treatment	7 (12.7%)	54 (46.2%)*	21 (38.2%)*	33 (53.2%)*

Table 2: Prevalence of skin problems by groups. Results reported as number (%); p-value calculated using chi-squared test; * $p < 0.0001$ vs. Post-Surgery; † $p < 0.01$ vs. Post-Surgery; ‡ $p < 0.05$ vs. Pre-Surgery Recall.

Varicose veins

The prevalence of varicose veins appeared to be increased in the Post-Surgery group (43.6%), compared to the Obesity Clinic group (29.0%), but this did not achieve statistical significance ($p = 0.10$).

Discussion

This is, we believe, the first study to assess prevalence of skin problems in the legs of patients awaiting, and patients who have had, bariatric surgery. This study confirms the clinical observation that morbidly obese people have a high prevalence of skin problems in their legs. Over three quarters ($n = 91$, 77.8%) of the people in the combined Obesity Clinic and Pre-Surgery Recall groups reported having at least one obesity-related leg problem, with 36 (31%) reporting having an ulcer. This is much higher than the prevalence of ulcers in the normal population, which ranges from 0.06% to 2% in the overall population, and exceeds 4% in those over the age of 65 [10].

A major finding in this study is the observation that the prevalence of obesity-related skin problems was markedly lower in the Post-Surgery group, in comparison to the Obesity Clinic and Pre-Surgery Recall group. It may be inferred that bariatric surgery appears to be a factor in resolving skin changes that are often seen in the morbidly obese. Whether this is an effect that can be attributed to significant weight loss following surgery is not discoverable from our study.

However, given that improvements in skin changes were seen 10 to 36 months following surgery, when maximal weight loss is expected to be achieved (reflected in the average decrease in weight in the Post-Surgery group by 54.8 ± 20.9 kg), it may be that these improvements occur as a result of weight loss. Indeed, a study investigating the basis of CVI in obesity has shown that the decrease in femoral vein flow and increase in femoral vein diameter that is seen in obese individuals, is replicated consistently by increasing intra-abdominal pressure in lean adults [11]. This suggests that high intra-abdominal pressure being transmitted to lower limb veins may be a component of the venous

hypertension (and consequent skin problems in the lower legs) that is seen in obesity. Following on from this is that weight loss occurring after bariatric surgery leads to decreased intra-abdominal pressure, leading to decreased venous hypertension in the lower limb by improving femoral vein outflow, and the improvement in lower leg skin problems. Other studies investigating the link between obesity and lower limb symptoms have shown that obesity itself, separate from its link to CVI, plays a major role in the development of lower limb ulceration [12]. In addition, a reduction in calf muscle pump function, and popliteal vein compression, particularly in the setting of obesity, have also been demonstrated to contribute to lower limb skin changes [1,13]. These studies support the postulated mechanism that a reduction in obesity following bariatric surgery may directly affect lower limb skin changes.

Because bariatric surgery potentially deals with the underlying pathology of skin changes, it is expected that it prevents recurrence of the skin problems—a definite benefit as they are often difficult to treat by conventional means using dressings, medications and compression stockings, and often recur. However, there is no current literature documenting the long-term effect of bariatric surgery on recurrence of lower leg skin problems.

The prevalence of varicose veins appears to be increased in the Post-Surgery group, compared to the Obesity Clinic group. This was an unexpected finding; given that the underlying presumed venous insufficiency that is potentially improved by bariatric surgery should in theory also decrease the prevalence of varicose veins, which is caused by the same underlying process. It may be that varicose veins that are already present become more visible as the patient loses weight. One way to investigate this further would be to perform duplex ultrasounds on the legs of obese individuals, to determine the sonographic prevalence of varicose veins in these individuals as compared to self-reporting by patients.

Ongoing treatment for obesity-related skin problems are a burden on the health system. The lower prevalence of those receiving treatment in the Post-Surgery group in our study, coupled with the observation that bariatric surgery seems to improve skin changes, suggests that in the long run, bariatric surgery may prove to be the cost-effective way to treat lower limb skin changes that occur with obesity.

One of the limitations of the study is the retrospective component of the Pre-Surgery Recall group, potentially leading to recall bias, as patients were asked to recall symptoms from up to 36 months prior to the study. It may be that patients in the Pre-Surgery Recall group were recalling ever having had an ulcer in the years leading up to surgery, compared to the Obesity Clinic group that had to state if they were currently having an ulcer at the time of filling out the questionnaire (not taking into account if they had an ulcer in the past). This may explain the differences in the prevalence of some of the individual symptoms between the Pre-Surgery Recall and the Obesity Clinic groups. Alternatively, selection bias may account for the differences, reflecting the greater likelihood of patients with more severe obesity-related symptoms being selected for surgery. Another limitation is the

modest number of participants in the study. Even so, the differences were marked and achieved statistical significance.

This study investigated the prevalence of self-reported skin problems in the legs of morbidly obese patients and the impact of bariatric surgery. It confirmed that morbidly obese people have a high prevalence of skin problems in their lower legs. Bariatric surgery significantly lowers the prevalence of these symptoms. These findings result in the conclusion that bariatric surgery helps in the resolution of lower leg skin problems, particularly ulcers, in morbidly obese people, possibly by improving chronic venous insufficiency by reduction in intra-abdominal pressure and body weight.

Acknowledgements

WP was funded by an Otago Medical Research Foundation scholarship.

References

1. Lane RJ, Cuzzilla ML, Harris RA, Phillips MN (2009) Popliteal vein compression syndrome: obesity, venous disease and the popliteal connection. *Phlebology* 24: 201-207.
2. Jawien A (2003) The influence of environmental factors in chronic venous insufficiency. *Angiology* 54 Suppl 1: S19-31.
3. van Rij AM, De Alwis CS, Jiang P, Christie RA, Hill GB, et al. (2008) Obesity and impaired venous function. *Eur J Vasc Endovasc Surg* 35: 739-744.
4. Willenberg T, Schumacher A, Amann-Vesti B, Jacomella V, Thalhammer C, et al. (2010) Impact of obesity on venous hemodynamics of the lower limbs. *J Vasc Surg* 52: 664-668.
5. Robertson L, Lee AJ, Gallagher K, Carmichael SJ, Evans CJ, et al. (2009) Risk factors for chronic ulceration in patients with varicose veins: a case control study. *J Vasc Surg* 49: 1490-1498.
6. World Health Organization (2014) Obesity and overweight.
7. Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, et al. (2004) Bariatric surgery: a systematic review and meta-analysis. *JAMA* 292: 1724-1737.
8. Picot J, Jones J, Colquitt JL, Gospodarevskaya E, Loveman E, et al. (2009) The clinical effectiveness and cost-effectiveness of bariatric (weight loss) surgery for obesity: a systematic review and economic evaluation. *Health Technol Assess* 13: 1-190, 215-357, iii-iv.
9. Keating CL, Dixon JB, Moodie ML, Peeters A, Playfair J, et al. (2009) Cost-efficacy of surgically induced weight loss for the management of type 2 diabetes: a randomized controlled trial. *Diabetes Care* 32: 580-584.
10. Abbade LP, Lastória S, Rollo Hde A (2011) Venous ulcer: clinical characteristics and risk factors. *Int J Dermatol* 50: 405-411.
11. Willenberg T, Clemens R, Haegeli LM, Amann-Vesti B, Baumgartner I, et al. (2011) The influence of abdominal pressure on lower extremity venous pressure and hemodynamics: A human in-vivo model simulating the effect of abdominal obesity. *Eur J Vasc Endovasc Surg* 41: 849-855.
12. Padberg F Jr, Cerveira JJ, Lal BK, Pappas PJ, Varma S, et al. (2003) Does severe venous insufficiency have a different etiology in the morbidly obese? Is it venous? *J Vasc Surg* 37: 79-85.
13. Araki CT, Back TL, Padberg FT, Thompson PN, Jamil Z, et al. (1994) The significance of calf muscle pump function in venous ulceration. *J Vasc Surg* 20: 872-877.