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ARTICLE

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Actualized lower body contouring surgery after bariatric surgery – a nationwide register-based study

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ABSTRACT

Massive weight loss might lead to excess skin folds causing functional, physical, and psychosocial discomfort. Following bariatric procedures, an increasing number of patients are seeking lower body contouring surgery (LBCS). The proportion of bariatric patients who undergo LBCS is largely unknown. The aim of this current study was to analyse the incidence and realization of LBCS in bariatric patients in Finland.

National retrospective register linkage study including all adult patients who received bariatric surgery in Finland during 1998–2016. The data were obtained from the Finnish national health registers maintained by the Finnish Institute for Health and Welfare. Altogether 1089 (14.1%) of 7703 bariatric patients underwent LBCS during the study period. The majority of the LBCS procedures were abdominoplasty (89%). Median latency between bariatric surgery and LBCS was 31 months. The patients with LBCS were younger ($p < 0.001$) and received sleeve gastrectomy ($p < 0.001$). We revealed an annual correlation between LBCS and bariatric procedures ($r = 0.683$). With a two-year latency between the bariatric and post-bariatric operations, the correlation co-efficiency was strong ($r = 0.927$). LBCS operations ranged from 5 to 215 per hospital district. Most LBCSs (97.3%) were performed in public hospitals, and some (41%) were performed in university hospitals. This study shows that only 14.1% of bariatric patients undergo LBCS. There is a correlation between bariatric procedures and succeeding plastic surgical reconstructive procedures.

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Plastic surgery; the lower body contouring surgery; bariatric surgery; register-based study

Introduction

The demand for post-bariatric surgery is becoming increasingly popular in line with the growing numbers of bariatric procedures [1]. Post-bariatric surgery is currently considered to be the fastest growing type of plastic surgery [2]. The target of post-bariatric lower body contouring surgery (LBCS) is to optimize the results obtained from bariatric surgery with surgical removal of the excess tissue. Most patients, over 90% of all patients [3], who have experienced massive weight loss (MWL) after bariatric surgery or after lifestyle change, suffer from redundant excess skin and might face problems due to hanging of the surplus skin [4,5].

The most common anatomic areas for loose excess skin after MWL are mid body, breast, upper arms, and thigh. The resulting deformities cannot be addressed adequately with exercise or diets; the only efficient and durable intervention is surgical removal of excess skin [4]. Previous studies show that up to 85% of bariatric patients desire body contouring surgery due to surplus skin [6–8]. The desire is particularly high for waist, abdomen, upper arm, breast, and buttock contouring [6]. Despite their high desire, only a small number of bariatric patients proceed to undergo body contouring surgery; some studies show that the body contouring procedure is completed in only 3.6–25% of bariatric patients [9,10]. There is a marked discrepancy between the number of subjects who indicate that they desire such surgery and those who go through with it.

In Finland, post-bariatric LBCS is covered by the public health care system [11]. Finland is divided into 21 public hospital districts to providing specialized medical care. Each hospital district includes a central hospital and other smaller regional and local hospitals. There are also five university hospitals which provide highly specialized medical care. Each of the 21 hospital districts belong to one university hospital area. University hospitals and central hospitals are responsible for the most demanding medical operations.

The desire for body contouring surgery after MWL is well reported; however, the proportion of bariatric patients who actually undergo LBCS is unknown. Based on the previous literature on the problems associated with surplus skin and desire for body contouring surgery, we hypothesized that at least 50% of bariatric MWL patients will eventually undergo LBCS. Therefore, the aim of the current study was to examine the incidence and realization of LBCS in bariatric patients in Finland.

Material and methods

In this retrospective register linkage study, the data were obtained from the Finnish national health registers currently maintained by the National Institute for Health and Welfare (THL) and Statistics Finland. The Helsinki University Ethics Review Board approved the study and its plan. The permissions to use the register information in scientific research were obtained from THL National Institute of

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Health and Welfare and Statistics Finland after the data protection authority was consulted. Information from the different registers was merged through record linkages on the personal identity codes (PIC). All citizens and permanent residents in Finland have a unique PIC, which was introduced in 1964–1967. The PIC used in all main registers in Finland allows reliable deterministic record linkage.

The premise for this current study was to examine how many patients who had undergone bariatric procedure have plastic surgical LBCS in Finland. The data from Hospital Discharge Register are maintained by the Finnish Government (https://thl.fi/en/web/thlfi-en/statistics/information-on-statistics/register-descriptions/care-register-for-health-care) and its purpose is to collect data on the activities of health centres, hospitals and other institutions providing inpatient care for the purposes of statistics, research and planning. The register includes basic data on service provider, patient, the treatment received by the patient, for example, diagnoses, procedures, interventions, and discharge from care. The data include no free text from patient files such as indications or decisions for certain type of operation or procedure.

Data were obtained from the Hospital Discharge Register (NHDR) for all bariatric procedures performed in Finland between 1 January 1998 and 31 December 2016. The coverage of the registry is nearly 100% from 1987 onwards [12]. The included bariatric operations were identified based on appropriate surgical procedure codes: The NOMESCO Classification of Surgical Procedures (NCSP) which was published first in 1996. We used the following codes for the surgery for obesity including open and laparoscopic gastric banding, bypass, sleeve gastrectomy, and biliopancreatic diversion with or without duodenal switch defined previously used by Bockelman et al. [13]: JDF00-01, JDF10-11, JDF20-21, JDF96-98, JFD00, JFD03- 04, JFD96. We included only patients who were 18 years of age or older at the time of the bariatric procedure.

In this study, we focused on the post-bariatric LBCS, but we also gathered the data of other plastic surgery procedures due to surplus skin: liposuction, brachioplasty, tight lift, and breast reshaping after bariatric surgery. The focus of this study is to examine the utilization of two common lower body contouring procedures: abdominoplasty (QBJ30) and body lift (QBJ05) after bariatric surgery. Patients with LBCS without previously bariatric surgery were excluded.

Entry fields were patients' age and sex, the year of the bariatric surgery, type of bariatric surgery procedure, the year of the LBCS and type of procedure, length of hospital stay after LBCS, postoperative complications' procedures after LBCS, place of residence and other post-bariatric contouring procedures.

Length of hospital stay came from the NHDR. This register has been administered since 1967, currently by the THL. NHDR includes the PIC, discharge diagnoses, the first diagnosis being the principal cause of hospital stay, dates of admission and discharge, and the hospital code. The data on death after operations came from the Cause-of-Death Register, maintained by Statistics Finland. The main and other causes of death are recorded in ICD-10 codes.

Statistical methods and analysis

Differences between bariatric surgery patients with and without subsequent post-bariatric LBCS were tested by using chi-square test, the test of relative proportion and *t*-test, where appropriate. All analyses were done by SAS, version 9.3. Survival curves were constructed according to the Kaplan–Meier method and compared with the log rank test.

Results

A total of 7703 patients underwent bariatric surgery in Finland during 1998–2016. The most common bariatric procedures were gastric bypass (5687, 73.8%) and sleeve gastrectomy (1992, 25.9%). Most of the patients did not have intestinal bypass together with gastric operations; only 17 had both operations. Intestinal bypass operations were the only bariatric procedures in 24 patients.

Subsequently, lower body contouring surgery was performed on 14.1% (1089) of these bariatric patients. Only four had both gastric and intestinal bypass operations before LBCS and none of the solitary intestinal bypass patients had subsequent LBCS. Most of the lower body contouring patients had abdominoplasty (970 patients, 89%) and only 129 patients (11%) had a body lift.

Our study cohort was thus comprised of 1089 patients: 184 (16.9%) men and 905 (83.1%) women with a gender ratio 1:4.9. The patients who had subsequent LBCS after bariatric surgery were younger (47.8 and 44.9 years respectively $p < 0.001$), had more rarely sleeve gastrectomy ($p < 0.001$). Table 1 illustrates the demographic and operation data of these patients in detail.

Table 2 presents the other plastic surgery procedures recorded after bariatric procedure. The most common procedure with and without LBCS was reduction mammoplasty with transposition of areola: 137 and 160 operations, respectively. It was followed by trunk liposuction: 79 and 15 cases respectively. Operations focusing on the breasts were recorded for 367 cases: with LBCS for 177 cases and without LBCS for 190 cases.

During the study period, there was a notable rise in both bariatric and subsequent LBCS operations. In Figure 1, we show a correlation between the number of post-bariatric LBCS and bariatric procedures, with a latency of a few years. The correlation co-

Table 1. Demographic characteristics of the bariatric procedures and lower body contouring surgery (LBCS) after bariatric procedure in Finland 1998–2016.

Characteristic	All bariatric patients	No LBCS after bariatric procedure	LBCS after bariatric procedure	*p* Value
n	7703	6614 (85.9%)	1089 (14.1%)	
Mean Age (SD)	47.4 (10.3)	47.8 (10.3)	44.9 (9.7)	<0.001
Men	2174 (28%)	1990 (30%)	184 (16.9%)	<0.001
Women	5529 (72%)	4624 (70%)	905 (83.1%)	
Sleeve gastrectomy (JDF01)	1992 (25.9%)	1777 (27%)	215 (19%)	<0.001
Gastric bypass (JDF11)	5687 (73.8%)	4813 (73%)	874 (83%)	
Jejunoileal bypass (JFD00)	19 (0.2%)	19	0	
Duodenoileal bypass with biliopancreatic diversion (JFD03)	3 (0.04%)	3	0	
Another intestinal bypass operation (JFD96)	2 (0.03%)	2	0	
Abdominoplasty (QBJ30)			970 (89%)	
Body lift (QBJ05)			129 (11%)	

The *p* values denote the statistically significant difference between the groups with and without lower body contouring surgery.

Table 2. Demographic characteristics of bariatric patients, $n = 7703$, who underwent lower body contouring surgery (LBCS) with and without other contouring surgery.

	n. (% of all bariatric patients)	LBCS + other plastic surgery procedure (%)	Other plastic surgery procedure without LBCS	*p* Value
Liposuction of trunk	94 (1.2)	79 (84.0)	15 (16.0)	<0.001
Excision of loose skin or fold of skin from trunk	40 (0.5)	15 (37.5)	25 (62.5)	<0.001
Liposuction of upper limb	14 (0.2)	10 (71.4)	4 (28.6)	<0.001
Correction of loose or redundant skin of upper limb	29 (0.4)	21 (72.4)	8 (27.6)	<0.001
Excision of loose skin or fold of skin from upper limb	11 (0.1)	8 (72.7)	3 (27.2)	<0.001
Liposuction in lower extremity	35 (0.5)	27 (77.1)	8 (22.9)	<0.001
Correction of loose or redundant skin of lower extremity	37 (0.5)	33 (89.2)	4 (10.8)	<0.001
Excision of loose skin or fold of skin from lower limb	10 (0.1)	7 (70.0)	3 (30.0)	<0.001
Liposuction of breast	7 (0.1)	2 (28.6)	5 (71.4)	0.261
Reduction mammoplasty with transposition of areola	297 (3.9)	137 (46.1)	160 (53.9)	<0.001
Reduction mammoplasty with transplantation of areola	22 (0.3)	8 (36.4)	14 (63.6)	0.008
Augmentation mammoplasty	1 (0.01)	1 (100)	0 (0)	0.142
Augmentation of breast using prosthesis	5 (0.1)	1 (20)	4 (80)	0.535
Mastopexy	35 (0.5)	28 (80.0)	7 (20)	<0.001

p-values denote the correlation between with and without LBCS.

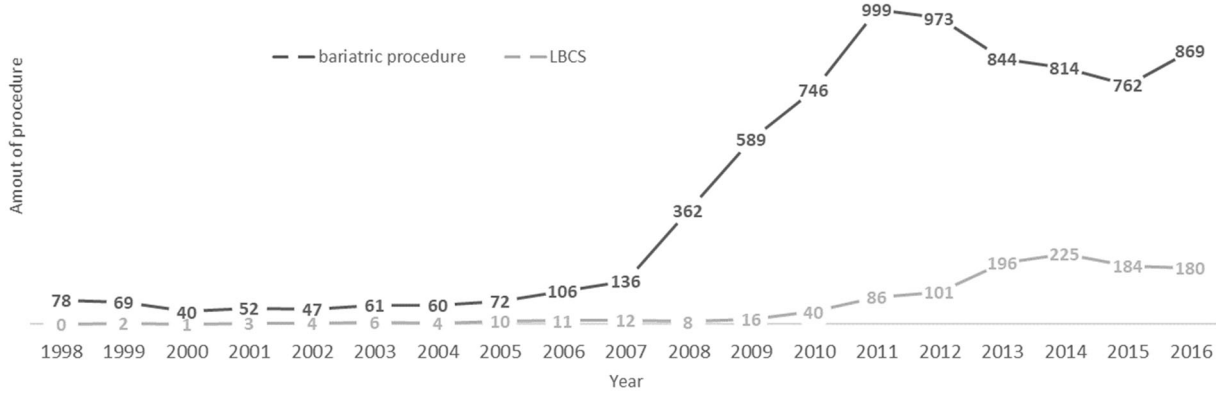

Figure 1. The numbers of bariatric and post-bariatric lower body contouring surgery in Finland during 1998–2016.

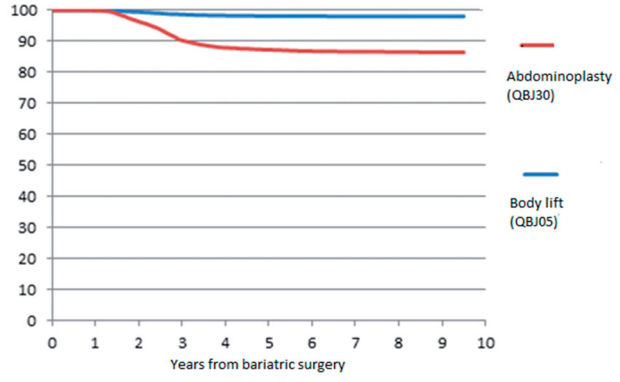

Figure 2. Risk for lower body contouring surgery in bariatric surgery patients after bariatric surgery stratified by operation type; abdominoplasty (QBJ30), $n = 970$ and body lift (QBJ05), $n = 129$, by Kaplan–Meier ($p < 0.001$, log rank test).

efficiency for bariatric and post-bariatric procedures yearly is $r = 0.683$. However, with a two years latency between the bariatric and post- bariatric operations, the correlation co-efficiency is even stronger ($r = 0.927$).

In Figure 2, we show the operation probability stratified by latency between bariatric and LBCS for bariatric patients according to abdominoplasty and body lift operations. Latency between bariatric and post-bariatric LBCS ranged from 5 months to 14 years, with a median latency of 31 months, in Figure 3.

There were 60 patients who had body contouring surgery before bariatric surgery. These patients were not included in the study cohort. This group of patients was mostly women ($n = 52$, 86.7%) with mean age of 49.9 years and had mostly abdominoplasties (91.7%). Most of these operations were performed in public hospitals. The latency between LBCS and bariatric surgery in this group was a mean of 6.3 years (SD 4.2 years).

Length of hospital stay and outpatient clinic visits

Most patients, 931 (85.5%), recorded only with one hospital stay. A synopsis of the details regarding the hospital stay and re-admittances and outpatient clinic visits is presented in Table 3.

Complications

Re-operations were recorded for 31 (2.8%) cases. Of these, 27 (2.8%) were after abdominoplasty and four (3.1%) were after body lift. The most common reason for re-operation was post-operative bleeding ($n = 24$, 2.2%) followed by wound dehiscence ($n = 5$, 0.5%). Only one (0.1%) in-hospital death was recorded, following abdominoplasty within one month after the procedure (Table 3).

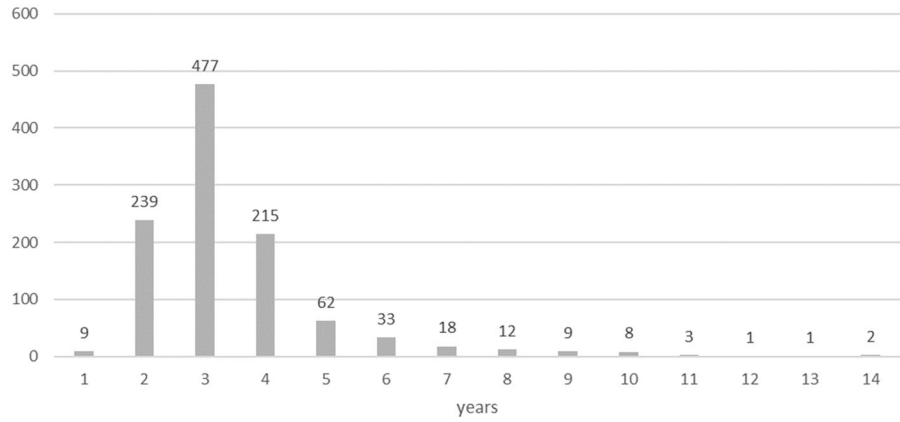

Figure 3. Latency – in years – between bariatric surgery and lower body contouring surgery in Finland during 1998–2016. The numbers include abdominoplasty, $n = 970$ and body lift $n = 129$ operations.

Table 3. Summary of re-operations, deaths and length of hospital stay as well as outpatient visits stratified by the type of lower body contouring surgery MLOS mean length of hospital stay.

	All. LBCS (%) $n = 1089$	Abdominoplasty (%) $n = 970$	Body lift (%) $n = 129$
Any re-operation	31 (2.8%)	27 (2.8%)	4 (3.1%)
Repair of wound dehiscence in surgery of skin	5 (0.5%)	5 (0.5%)	0 (0.0)
Reoperation for superficial infection in surgery of skin	1 (0.1%)	1 (0.1%)	0 (0.0)
Reoperation for superficial haemorrhage in surgery of skin	24 (2.2%)	20 (2.1%)	4 (3.1%)
Reoperation in surgery of skin	1 (0.1%)	1 (0.1%)	0 (0.0)
Death, within one month after operation	1 (0.1%)	1 (0.1%)	0
Mean length of hospital stay	3.1 days (range 1–68 days)	3.1 days (1–68 days)	3.6 days (1–11 days)
Re-admittance	$n = 39$ (3.6%); MLOS 4.2 days	$n = 32$ (3.3%); MLOS 3.8 days	$n = 7$ (5.4%); MLOS 6.1 days
first week after discharge	$n = 119$ (10.9%); MLOS	$n = 102$ (10.5%); MLOS 4.8 days	$n = 17$ (13.2%); MLOS 5.4 days
8–30 days after discharge			
Outpatient visits within 30 days	676 (62.1%)	595 (61.3%)	93 (72.1%)

National distribution

Most bariatric procedures ($n = 6901$, 89.6%) were performed in public hospitals. Most of the bariatric operations ($n = 4018$, 58%), were done in the five university hospitals and rest in the central or local hospitals. The numbers of bariatric surgery ranged from 28 to 1804 during 1998–2016 in Finland per hospital district.

Most of the LBCS ($n = 1060$, 97.3%) were done in public hospitals, and only 2.7% in private hospitals. LBSC operations ranged from 5 to 215 per hospital district and 449 (41%) of all 1089 were done in the university hospitals. A vast majority ($n = 835$; 78.8%) of all public LBCS were done in the five university hospitals or in the five hospital districts with larger volume central hospitals. The share of LBCS was greater than 20% compared with national mean of 14.2% in only three hospital districts.

There were altogether 16 out of 21 hospital districts where less than 50 LBCS operations were executed during the whole study period. The number of operations in the central or local hospitals ranged from 2 to 39. Altogether 225 (21.2%) of all LBCS operations were performed in smaller hospital districts regarding population, (Figure 4). Characteristics of hospitals, with bariatric and post-bariatric lower body contouring operations in Finland during 1998–2016.

Discussion

This study reviews the national registry data on bariatric patients who had LBCS during 1998–2016 in Finland. We found an increasing rate of both bariatric and post-bariatric procedures during the study period; however, the mean percentage of bariatric patients who underwent LBCS during the study period –18 years – was only 14.1%. This figure is in concordance with the previous literature [9,14]. A previous Finnish study by Giordano et al. (2014) showed that only 15.5% of bariatric patients did not desire any post-bariatric plastic surgery procedure [6]. Most of the patients in this Finnish study desired body contouring surgery for several areas of the body [6]. Numerous studies have showed that 25–85% of bariatric patients desire body contouring surgery [6,15,16], but only 6% to 25% actually underwent those procedures [1,9,16]. Despite the desire for body contouring surgery after bariatric procedures, it seems that only a minority of patients actually undergo post-bariatric surgery. The results of this national study correlate with our previous publication [17]; there are no differences in terms of complication between abdominoplasty and body lift. We therefore suggest that maximal correction of lower body deformities should be performed whenever possible.

Bariatric surgery is currently considered the most, and probably the only effective long-term therapy for the management of severe obesity and reducing the risk of major complications of obesity-related co-morbidities [18]. The numbers of bariatric surgeries have increased dramatically over the past two decades [18]. The gastric bypass procedure and sleeve gastrectomy are the most performed bariatric procedure worldwide, because of greater weight loss and lower weight regain compared to purely restrictive interventions [19]. According to the literature, these procedures cover 45–85% of all bariatric procedures [13]. Biliopancreatic diversion/duodenal switch and another intestinal bypass operation yield only under 3% worldwide [13,19]. These operations are less common because of the increased risk of malabsorptive complications [19].

Women report significantly more problems and amounts of excess skin than men [7,20]. Women are also more likely to undergo contouring procedures than men [3,20]. In our study,

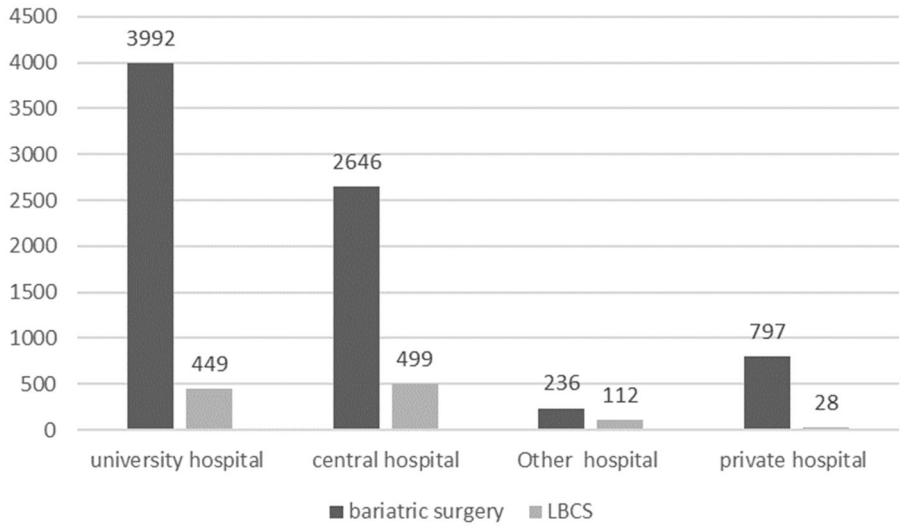

Figure 4. Characteristics of hospitals, with bariatric and post bariatric lower body contouring operations in Finland during 1998-2016.

most patients (83.1%) that underwent post-bariatric LBCS were women, which is consistent with other studies [9,21]. In our current study, the patients who underwent LBCS after bariatric surgery were statistically younger than the comparison bariatric group without LBCS ($p < 0.001$). This is also in concordance with previous studies [6,7]. However, one study presented an interestingly opposite result where the mean age of body contouring surgery patients was higher [21].

In our current study setting, however, we were unable to solve the discrepancy between the desire for plastic surgical LBCS after MWL and the actualization of the procedure. Patients that were more than six months post-bariatric procedure were more likely to desire plastic surgery than those that had undergone a more recent bariatric surgery [22]. The reasons for the discrepancy, between desire and realization of the contouring procedures, might be attributable to social status [23], costs [14] or unclear inclusion criteria for post-bariatric surgery. Younger, divorced, and female patients were twice as likely to desire plastic surgery after laparoscopic gastric bypass [23].

Post-bariatric plastic surgery aims to treat both the functional and aesthetic problems caused by surplus skin, increasing the patient's quality of life and self-esteem [24]. Many previous studies showed that body contouring surgery also decreases the patient's physiological dysfunction [25]. The post bariatric LBCS patients also felt more positive and satisfied with their appearance. Furthermore, the patients present with significantly better long-term weigh control [21]. The rate of complication after post bariatric procedures is relatively high [17]. The fear of complications in further surgeries could be one possible reason for the difference between the desire and the actualization for LBCS. In this study, we demonstrated that the number of post-operative complications needing surgical intervention is low, only 2.8% among all patients stratified by operation type, there were no difference is complications. Most of the complications after plastic surgical LBCS surgery are minor and resolve without surgical intervention [17].

The LBCS took place approximately two to three years after bariatric surgery in this current study, which corresponds well with the time of weight stabilization. This present study shows that the numbers of LBCS start to grow after two years of the bariatric procedures, which has also been reported previously [9]. The post-bariatric LBCS should not be performed earlier because the patient's body mass index (BMI) may not have been stabilized and the results of LBCS would not be optimised. The timing of LBCS is individual. In 2010, the Finnish Plastic Surgical Society developed a guideline for indications for post-bariatric surgery [11]. LBCS should not be executed until weight loss is complete and weight has been stable, usually at the earliest 12 to 18 months after bariatric surgery [26]. It is also recommended that patients' BMI should not exceed 32 and preferably be lower [26]. Post-operative complications in lower body contouring surgery due to massive MWL are frequent [17]. Previous studies show that pre-operative BMI over 30–32 is a significant risk factor for post-operative complications [27]. The lower the BMI at the time of LBCS, the better is the cosmetic result [28]. Based on the results of our study, the mortality after post-bariatric surgery is low. However, we cannot recommend or comment who is the ideal MWL patient regarding lower complications.

The European Surgical Association (ESA) made a review of centralization for highly specialized surgeries [29] as the care for obese patients is usually organized into multidisciplinary teams. Large centres usually offer fully functioning multidisciplinary teams of specialists capable of tackling all aspects of the diseases. The typical members of this team include abdominal surgeons, endocrinologists, dieticians, nurse specialities, and psychiatrics. It is strange that plastic surgeons have not been routinely involved in this structure considering that patients advance to reconstructive surgery to remove the hanging excess skin after MWL. In one study, post-bariatric patients reported that body contouring surgery was an inevitable step in the process of losing weight by bariatric surgery [30]. Plastic surgeons must have the ability to manage the unique medical and psychological issues of the massive weight loss patient [28]. The bariatric surgeon must also be aware and inform bariatric patients for potential reductant skin problems after MWL and direct the patients for plastic surgeon consultation. One study reported that only 25.4% of bariatric patients reported discussing post-bariatric body contouring procedures with their bariatric surgeon perioperatively, 14.1% were referred for plastic surgeon consultation, and only 11.6% underwent post-bariatric procedures. The main point of this study was that 39% of bariatric patients reported that they might have chosen differently if they had received more information [14]. Thus, overall, further efforts toward improving both patients and surgeon education regarding post bariatric body contouring options are warranted.

Over half of hospital districts in Finland have less than 50 LBCS operations during the study period. Therefore, it must be carefully considered the centralization of LBCS in specialized centres. Post-bariatric surgery should be a part of multidisciplinary obesity teams. The centralization would also result in economic benefits in the long run.

Our study showed that post-bariatric operations are unevenly distributed nationwide. One reason could be differing indications and criteria for body contouring surgery varying form hospitals and hospitals district. The solution for this discrepancy might be the national and uniform criteria for lower body contouring surgery operations for patients who had bariatric operation.

In some other countries, socioeconomic factors play an important role in the decision to pursue post-bariatric body-contouring surgery. Many patients desire body-contouring surgery, but the cost of the procedure may be a limiting factor. In Finland, the public health care system covers the surgeries considered to be reconstructive procedures that are determined to be medically necessary [11]. The procedures are not dependent on patients' insurance or own funding. Everyone who suffers and has medical problems because of surplus skin after massive weight loss should be evaluated equally for LBCS. Therefore, the reasons for the discrepancy among patients' desires and real practice in Finland could not be the costs of plastic surgery.

This current register-based study might be limited in validity of the National Hospital Discharge Register [12]. Register-based studies have some inherent limitations that are important to recognize. When using data from registers for research purposes the research is limited to use the variables recorded and included in the registers. Coded diagnoses are not the most relevant and there may be variation in coding practice between persons, departments or institutions [31]. Recording of secondary operations and other rarely used items are the most obvious, but this does not compromise the value of data in this register in being used in studies that are not feasible to conduct otherwise. Therefore, technical incompleteness does not cause bias in the results. A main strength of our study is the use of two nationwide registries that allow reliable assessment of the incidence and outcome of LBCS among a large population of bariatric patients in both public and private hospitals.

To conclude, we verified in large national registry-based study, that the actual number of bariatric patients who undergo LBCS is relatively small. However, we found a strong correlation between bariatric surgery and two-year latency for LBCS.

Disclosure statement

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