



Reduced Need for In-hospital Care After Sleeve Gastrectomy: a Single Center Observational Study

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Abstract

Setting Private clinic, Stockholm, and nation-wide in-hospital care, Sweden.

Objectives The use of sleeve gastrectomy (SG) for treatment of morbid obesity has increased worldwide, but information about long-term outcome is still limited. Our objective was to evaluate the need for additional in-hospital care after SG for obesity (body mass index [BMI] > 30) in 862 patients, all operated at a single center.

Methods Two national registries, the Inpatient Registry and the Death Registry, were used to collect long-term data on in-hospital care, grouped by the International Statistical Classification of Diseases and Related Health Problems (ICD-10) and mortality, respectively.

Results In-hospital care for SG-operated females was decreased for four groups of obesity-related ICD-10 diagnoses: endocrine and metabolic diseases and circulatory, digestive, and genitourinary diseases, as well as injuries and poisoning ($p < 0.001$ for all). However, female SG patients still required in-hospital care above the national level for women of corresponding ages.

Conclusions Although a significant reduction in in-hospital care was observed, SG patients did not reach national levels.

Keywords Sleeve gastrectomy · Class I obesity · Complications · Reoperations · Long-term · In-hospital care

Introduction

Surgery is the most effective modality for the treatment of obesity [1], ameliorating obesity-related comorbidity [2, 3] and reducing mortality [4]. One of the recent methods, sleeve gastrectomy (SG), has shown promising results [5–7]. SG is therefore becoming more popular as a surgical tool against obesity both worldwide [8] and in the USA where it surpassed all other techniques in 2014 [9]. The mechanism of SG is not fully elucidated, but it involves restriction, hormonal, and adaptational mechanisms [10]. Three-year weight loss after SG is comparable to the golden standard of obesity surgery, gastric bypass (GBP) [11], and the resolution of comorbidity is encouraging [12, 13].

It is calculated that surgical management of obesity leads to decreased public costs [14], but additional medical care for

complications may negate this advantage. There are so far only a few published papers on in-hospital care utilization after bariatric procedures. Recently, Gribsholt et al. found that 23% of GBP-operated Danish patients were admitted within 4 years because of surgical complications [15], while in contrast, Morgan et al. found reduced all-cause hospitalization rates in Australia [16]. Furthermore, an American study revealed that SG had higher hospital patient admission rate compared to laparoscopic GBP [17]. The Swedish health care system is well suited for studying differences regarding in-hospital care, as all hospital admissions are reported to the National Patient Registry. Variables possible to link with the individuals' unique 10-digit personal identification number include age, gender, dates of stay, discharge diagnosis, and surgical procedure, if applicable, for all types of in-hospital care.

Our aim with this study was to investigate the need for in-hospital care and additional surgical or endoscopic interventions during the first post-operative years after SG.

Materials and Methods

A total of 862 consecutive patients (89% women) underwent SG between April 2007 and March 2012 at the Centre for

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laparoscopic surgery, Stockholm, Sweden, which is a private center dedicated to laparoscopic surgery for benign conditions. Median age was 42 years (range 19–70), median BMI was 34.9 (range 30.0–49.7), and 489 patients (56%) had class I obesity. Informed consent was obtained from all individual participants included in the study.

Our operative technique has been described earlier [18]. In short, after pneumoperitoneum was established, division of the blood supply of the larger curvature was performed with the Ligasure (Covidien, Minneapolis, MN, USA) to the left crus, which was mobilized. Stapling started at 6 cm from the pylorus using one green and then 4 to 5 blue cartridges (Covidien, Minneapolis, MN, USA) while a 32F tube was inserted along the lesser curvature of the remaining stomach [18]. A coexisting hiatal hernia was repaired with 2–0 non-absorbable crural sutures posterior to the esophagus [19].

After approval from the Regional Ethical Review Board (Dnr 2010-238) and the National Board of Health and Welfare, we crosschecked our patient data during the 9 years of observation, with those of the in-patient registry, in order to identify all patients who received in-patient care, both before and after the SG. Diagnoses were classified according to the International Classification of Diseases and Related Health Problems (ICD-10). In ICD-10, the principal diagnoses are divided into 22 anatomically oriented chapters. In our 768 women, differences in pre- and post-operative in-hospital care for 15 main ICD-groups (A–O and S–T) were studied and compared to national data for corresponding age groups. As national data is grouped in 5-year intervals, the three age groups around our median age (42 years) were used (35–39, 40–44, and 45–49 years). To reduce the impact of early complications, all in-hospital care occurring during the first three post-operative months was excluded from the analysis.

Relative ratio (RR) was calculated by dividing the observed number of in-patient admissions after SG with those before SG (for SG patient comparison) and by dividing the observed number of in-patient admissions after SG per 100,000 patient years compared with those from the national data. A 95% confidence interval (CI) was calculated for each RR. The *p* value was calculated by log likelihood techniques and normal approximations. To adjust for the multiple comparisons ($n = 30$), a Bonferroni correction was applied, resulting in a *p* value of < 0.0017 for statistical significance. Since the cohort consisted of almost 90% female patients, we limited the RR analyses of in-hospital care to female gender. Moreover, surgical and endoscopic sleeve-related procedures performed in-hospital following the initial SG were studied separately and as most abdominoplasties are performed in private care, we have not included this procedure in the present study. Mortality was crosschecked with the Death Registry.

Results

Overall Need for In-hospital Care Besides the SG

In total, 1385 episodes of in-hospital care were noted in 643 individuals (1–43 episodes/person) during an observation period of 7758 person years. Pre- and post-operative observation time was 4.8 and 4.2 years, respectively. After SG, overall in-hospital admissions were reduced by 31.1%, from 180 annual episodes (864/4.8 years) to 124 annual episodes (521/4.2 years). In our studied females, the following main ICD diagnoses occurred less often after SG: endocrine and metabolic diseases (Chapter E), circulatory diseases (I), digestive diseases (K), and genitourinary diseases (N), as well as injury and poisoning (S–T) ($p < 0.0017$ for all). However, for most main ICD diagnoses, SG patients still needed more in-hospital care than women in corresponding ages in the general population Table 1.

Additional Sleeve-Related Surgical and Endoscopic Procedures

Four sleeve-related procedures were performed due to dysphagia or reflux: three sliding hernias (of which one was later converted to gastric bypass) and removal of crural sutures placed because of a hiatal hernia during the original operation in one patient. Late complications included 18 stenoses, successfully treated with endoscopic balloon dilatation, except in four cases requiring seromyotomy ($n = 1$) or conversion to GBP ($n = 3$). Moreover, 12 patients (1.4%) underwent a laparoscopic revisional procedure due to inadequate weight loss after SG with the following methods: gastric plication ($n = 5$), gastric bypass ($n = 5$), gastric plication combined with re-sleeve ($n = 1$), and duodenal switch (DS) ($n = 1$). In addition, 33 patients (3.8%) had a cholecystectomy due to cholecystitis; out of these, 3 were operated after an episode of biliary pancreatitis. Finally, some incisional hernias and various acid related-conditions (esophagitis, Barrett's esophagus, gastritis, and gastric ulcers) were noted in the clinical follow-up; however, data are incomplete as most of these diagnoses are treated on an out-patient basis.

Mortality

Eight mortalities were noted, of which one was related to the SG: a 34-year-old female developed a stenosis at the incisura angularis; she was re-operated with a seromyotomy, which resulted in a leak and a long period of hospital stay, involving stent placement and two laparotomies. After conversion to gastric bypass, and subsequent revision of both anastomoses, she had a massive and fatal hematemesis from a stomal ulcer. In the remaining seven patients, disseminated cancer ($n = 2$), intoxication ($n = 2$), one sepsis after duodenal perforation, and two unknown causes were noted several years after the primary operation.

Table 1 In-hospital care, divided on the main chapters in ICD-10, before and after sleeve gastrectomy for the studied 768 women and compared to the national incidence for women in corresponding ages. The *p* value was set at <0.0017 due to multiple comparisons (*n* = 30)

ICD-10 group, Type of disease	SG, female patients					SG versus national data, per 100,000 females and year				
	Pre-op (<i>n</i>)	Post-op (<i>n</i>)	Rate ratio*	95% CI	<i>p</i> value	After SG	National data	Rate ratio*	95% CI	<i>p</i> value
A00–B99 Infectious and parasitic	6	12	1.73	0.65–4.61	0.273	323	205	8.68	4.93–15.28	<0.001
C00–D48 Neoplasms	36	18	0.43	0.25–0.76	0.004	485	922	2.90	1.83–4.6	<0.001
D50–D89 Blood and immune system	11	15	1.18	0.54–2.57	0.678	404	75	28.71	17.3–47.7	<0.001
E00–E90 Endocrine and metabolic	28	6	0.19	0.08–0.45	<0.001	161	433	2.27	1.02–5.04	0.045
F00–F99 Mental and behavioral	48	37	0.67	0.43–1.02	0.063	997	1296	4.17	3.02–5.75	<0.001
G00–G99 Nervous system	15	11	0.63	0.29–1.38	0.251	297	364	5.48	3.03–9.89	<0.001
H00–H95 Eye and ear	4	1	0.22	0.02–1.93	0.170	27	111	1.52	0.21–10.77	0.678
I00–I99 Circulatory system	36	4	0.10	0.03–0.27	<0.001	108	422	1.58	0.59–4.22	0.357
J00–J99 Respiratory system	22	22	0.87	0.48–1.56	0.630	593	327	11.41	7.51–17.23	<0.001
K00–K93 Digestive system	133	45	0.37	0.21–0.41	<0.001	1536	948	7.83	5.84–10.49	<0.001
L00–L99 Skin and subcutis	7	0	NA	NA	NA	0	83	NA	NA	NA
M00–M99 Musculoskeletal system	44	23	0.45	0.27–0.75	0.002	620	591	6.44	4.28–9.70	<0.001
N00–N99 Genitourinary system	64	38	0.51	0.34–0.77	0.001	1024	771	8.35	6.08–11.48	<0.001
O00–O99 Pregnancy and childbirth	141	196	1.20	0.97–1.49	0.096	5284	3514	9.36	8.14–10.77	<0.001
R00–R99 Symptoms and signs	77	36	0.40	0.27–0.60	<0.001	971	1082	5.59	4.04–7.76	<0.001
S00–T98 Injury and poisoning	75	23	0.27	0.17–0.42	<0.001	620	752	5.10	3.39–7.67	<0.001

* *rate ratio* ratio of 2 incidence rates, *SG* sleeve gastrectomy, *CI* confidence interval, *ICD* International Classification of Diseases, *NA* not applicable

Discussion

In the present cohort of 862 patients having had a sleeve gastrectomy at a single center, we could demonstrate a reduced need for in-hospital care post-operatively; however, female SG patients did not reach the national level for women in corresponding ages in the general population.

In-hospital care for the main ICD groups concerning endocrine and metabolic, circulatory, digestive, and genitourinary diseases was reduced after SG. The positive effect of bariatric surgery on these diseases is well known [20, 21]. However not statistically different, we could see a reduction in some of the expected subgroups: obesity, (E65), cardiac arrhythmia (I44–49), cerebrovascular lesions (I60–69), and although still common, biliopancreatic diagnoses (K80–85). The present overall reduction of in-hospital care for injuries and poisoning is contradicted by a recent paper from Canada reporting increased emergencies due to trauma [22], possibly because of an increased physical activity after weight loss.

Although in-hospital care was reduced, the present female SG patients still needed more in-hospital care during the first four post-operative years than females of corresponding ages in the general population. In the literature, Christou compared a cohort of 1035 bariatric patients with a matched cohort in Canada and observed a reduction in comorbidities, death rate, and thus health care utilization after non-SG bariatric procedures [23]. In line with the present study, Morgan et al. in Australia found reduced all-cause hospitalization rates when following 12,062 patients

for a mean of 3.4 years after their bariatric operation [16]. On the contrary, using data from insurance companies, Bleich followed 7806 diabetic patients 6 years after bariatric surgery, and found that postsurgical care cost after the index operation (non-SG) was not lower than pre-operatively [24]. In the earlier mentioned American study of 22,139 bariatric patients, SG had a higher hospital patient admission rate compared to laparoscopic GBP [17]. In turn, laparoscopic GBP patients (*n* = 9985) in Denmark had a 2-fold increased risk of hospitalization before their operation and a 3.4-fold increase post-operatively, when comparing to a large general population cohort [15].

In certain cases, where a reoperation for unsatisfactory weight loss was deemed necessary [25], patients underwent reoperation with or without re-sleeve [26], conversion to duodenal switch [27], or conversion to GBP [28]. The type of operation selected was based upon patient preference, eating habits, prevalence of gastroesophageal reflux disease (GERD), and degree of weight regain.

Among the strengths of the present study are the rather high number of patients, all operated at a single center by two surgeons (first and second author) and the extended follow-up by crosschecking data with the two national registries, both considered complete since 1998. Moreover, as the Swedish health care system is publicly funded, it increased our possibility to evaluate the use of in-hospital care without taking the patients' economic status in concern. The mandatory reporting to the Death Registry provides 100% follow-up concerning mortality data. A drawback of this study is that certain day–surgery procedures,

such as laparoscopic cholecystectomies and abdominoplasties performed in private care, are not included in the in-patient registry, which could explain the rather low number of surgical procedures after the SG [22]. Also, minor long-term complications, treated in out-patient care, as well as potential patients, wanting, but not seeking, additional surgical care, cannot be found in the registries. However, we believe that in our rather generous health care system, most unsatisfied patients would not hesitate to seek, and receive, medical attention.

Conclusion

This paper provides evidence for reduced need of in-hospital care for several obesity-related diagnoses after sleeve gastrectomy in our females, however, not reaching the level of women in corresponding ages in the general population.

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Compliance with Ethical Standards

Conflict of Interest DA was CEO of the private clinic in which the SG was performed. The remaining authors have no commercial associations that might be a conflict of interest in relation to this article.

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