JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S8

Comparison of Laparoscopic Sleeve Gastrectomy Staple Line Reinforcement Techniques: Buttressing vs. Suturing

Dr. Shaker Abdu Majrashi[1], Dr. Qussay Raed Wazzan[2], Dr. Ibrahim Hazzaa Alshaghath[3], Dr. Rawan Khalid Alkhatabi[4] and Dr. Akram Ebraheem Bardisi[5]

1 Bariatric and General Surgery Consultant , King Fahad General Hospital , Jeddah , KSA, Shakerm@moh.gov.sa
2 General Surgery Resident, King Fahd General Hospital, Jeddah, KSA , Dr.qussay.wazzan@gmail.com
3 General Surgery Resident, King Fahd General Hospital, Jeddah, KSA , DrIbrahimHazzaa@gmail.com
4 Saudi Board General Surgery Resident, King Fahad General Hospital, Jeddah, Saudi Arabia Rawankhalid96@gmail.com
5 corresponding author: General Surgery Consultant, King Fahad General Hospital , Jeddah , KSA, dr.akram.e.f.b@gmail.com

Abstract

Background: Laparoscopic sleeve gastrectomy (LSG) is a widely performed bariatric procedure, with staple line reinforcement techniques playing a crucial role in minimizing complications. This study aimed to compare the outcomes of two common reinforcement methods—Gore SeamGuard® buttressing and suturing—used during LSG at King Fahad General Hospital, Jeddah, Saudi Arabia, between 2021 and 2024.

Methods: A retrospective analysis was conducted using the medical records of 347 patients who underwent LSG. Patients were divided into two groups based on the reinforcement method used: buttressing (n=120) and suturing (n=227). Demographic details, comorbidities, intraoperative data (operative time, blood loss), and postoperative complications (staple line leakage, bleeding, surgical site infections) were collected. Statistical analysis included chi-square tests for categorical variables and t-tests for continuous variables, with significance set at $p<0.05$.

Results: The mean body mass index (BMI) was significantly higher in the buttressing group (44.05 ± 5.99) compared to the suturing group (41.51 ± 6.26) ($p<0.001$). The prevalence of diabetes mellitus was also higher in the buttressing group (28.3% vs. 12.3%, $p<0.001$). The mean operative time was shorter for the buttressing group (73.42 ± 18.48 minutes) compared to the suturing group (90.55 ± 13.75 minutes) ($p<0.001$). Staple line leakage occurred only in the suturing group (3.1%, $p=0.05$). Other complications, including intraoperative and postoperative bleeding, surgical site infections, and reoperation rates, showed no significant differences between groups. No 30-day mortality was reported in either group.

Conclusion: Buttressing with Gore SeamGuard® demonstrated advantages over suturing, including a shorter operative time and the absence of staple line leakage, suggesting improved procedural efficiency and safety. However, the higher prevalence of comorbidities in the buttressing group may have influenced these findings. Both techniques were generally safe, with minimal complications and no mortality. Further prospective studies are recommended to confirm these results and explore the long-term implications of reinforcement methods in LSG.

Introduction

Laparoscopic sleeve gastrectomy (LSG) is one of the most commonly performed bariatric procedures worldwide, offering significant weight loss and improvement in obesity-related comorbidities for patients with morbid obesity [1-4]. The procedure involves the surgical removal of approximately 80% of the stomach along its greater curvature, leaving behind a sleeve-shaped pouch. This not only restricts food intake but also induces hormonal changes that enhance satiety and reduce hunger [3-4].

Despite its proven effectiveness, LSG is not without risks. Staple line leakage (SLL) and staple line bleeding (SLB) are among the most concerning complications, potentially leading to severe outcomes such as peritonitis, sepsis, and reoperation [2-3]. Reinforcement of the staple line during LSG is widely employed to mitigate these risks. However, the optimal reinforcement technique remains a matter of debate, with current practices including the use of suturing or buttressing materials such as Gore SeamGuard® [1-2].

Gore SeamGuard® is a bioabsorbable synthetic material designed to strengthen staple lines by promoting tissue integration and enhancing healing. Initial studies suggest that its use may reduce the incidence of SLL and SLB [1-2]. On the other hand, suturing remains a commonly employed technique due to its familiarity and perceived effectiveness in reinforcing staple lines [3]. While each method has its advocates, direct comparisons of their effectiveness are limited, leaving questions regarding their relative advantages unanswered [5-6].

This study aims to address these gaps by comparing the outcomes of Gore SeamGuard® buttressing and suturing for staple line reinforcement during LSG. Specifically, the study will evaluate their effectiveness in preventing SLL and SLB, along with secondary outcomes such as operative time, blood loss, postoperative complications, hospital length of stay, and readmission rates. By examining these factors in a single-center cohort, this research seeks to provide evidence-based insights into the choice of staple line reinforcement technique, contributing to the ongoing efforts to optimize surgical outcomes in LSG.

Methods

Study Design and Setting

This retrospective study was conducted at King Fahad General Hospital, Jeddah, Saudi Arabia, utilizing the medical records of patients who underwent laparoscopic sleeve gastrectomy (LSG) between 2021 and 2024.

Sample Size

A convenience sampling technique was used, including all patients who underwent LSG at the hospital during the specified period. The minimum required sample size was calculated to be no less than 400 patients using OpenEpi Version 3. The calculation was based on the formula: $n=[DEFF\times N\times p(1-p)][d2/Z1-\alpha/2\times(N-1)+p(1-p)]$. A prevalence rate of 17% for LSG in Saudi Arabia was used for this calculation [7].

Inclusion and Exclusion Criteria

The study included adult patients who underwent LSG during the study period and had complete medical records documenting the use of either Gore SeamGuard® buttressing or suturing for staple line reinforcement. Patients with a history of prior upper abdominal surgery, inflammatory bowel disease, or incomplete medical records were excluded.

Data Collection

Data for this study were collected by reviewing the electronic medical records of patients who underwent laparoscopic sleeve gastrectomy (LSG) at King Fahad General Hospital between 2021 and 2024. The information gathered included demographic details such as age, sex, and body mass index (BMI), along with any pre-existing comorbidities. Intraoperative data were also recorded, including the type of reinforcement technique used (either Gore SeamGuard® buttressing or suturing), operative time, and the amount of blood loss during surgery. Postoperative complications, such as staple line leakage (SLL), staple line bleeding (SLB), surgical site infections, and pneumonia, were documented, along with the length of hospital stay and readmission rates within 30 days. This data was extracted from the hospital's electronic records, ensuring complete and accurate information for the study.

Data Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 23. Initially, the data were tested for normality to determine the appropriate statistical tests for analysis. Descriptive statistics, including means, standard deviations, and percentages, were used to summarize patient demographics and baseline characteristics. To compare categorical variables, such as the presence or absence of postoperative complications, between the two groups (buttressing with Gore SeamGuard® vs. suturing), chi-square tests or Fisher's exact tests were applied. For continuous variables, such as operative time and blood loss, t-tests was used depending on the data distribution. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study adhered to the principles outlined in the Declaration of Helsinki. Patient anonymity was maintained throughout the study. Institutional Review Board (IRB) approval was obtained prior to the initiation of the research.

Results

The study included 347 participants into two groups; 120 in buttressing group (34.6%) and 227 in suture group (65.4%). Table 1 provides characteristics of study participants. Participants in the Buttressing group had a higher BMI (mean 44.05 ± 5.99) compared to the Suture group (mean 41.51 ± 6.26), with a statistically significant difference ($P < 0.001$). The prevalence of diabetes mellitus (DM) was significantly higher in the Buttressing group (34 patients) than in the Suture group (28 patients) ($P < 0.001$). Additionally, overall comorbidities were more frequent in the Buttressing group (35 patients) compared to the Suture group (53 patients) ($P < 0.001$). Other variables, such as age, gender, and hypertension, showed no significant differences between the groups. Figure 1 demonstrates comorbidity distribution by study group.

Table 1: Characteristics of study participants

Variable		Buttressing (N= 120)	Suture (N= 227)	P value
Age (mean ± SD, min-max)		34.58 ± 10.61 (14-60)	36.55 ± 10.97 (15-69)	0.110
BMI (mean ± SD, min-max)		44.05 ± 5.99 (31-63)	41.51 ± 6.26 (30-66)	<0.001
Gender	Male	37	51	0.059
	Female	83	176	
DM	Yes	34	28	<0.001
	No	86	199	
Hypertension	Yes	19	30	0.304
	No	101	197	
Comorbidity	Yes	35	53	<0.001
	No	85	174	
Anticoagulant use	Yes	0	1	0.654
	No	120	226	
NSAID use	Yes	1	0	0.346
	No	119	227	

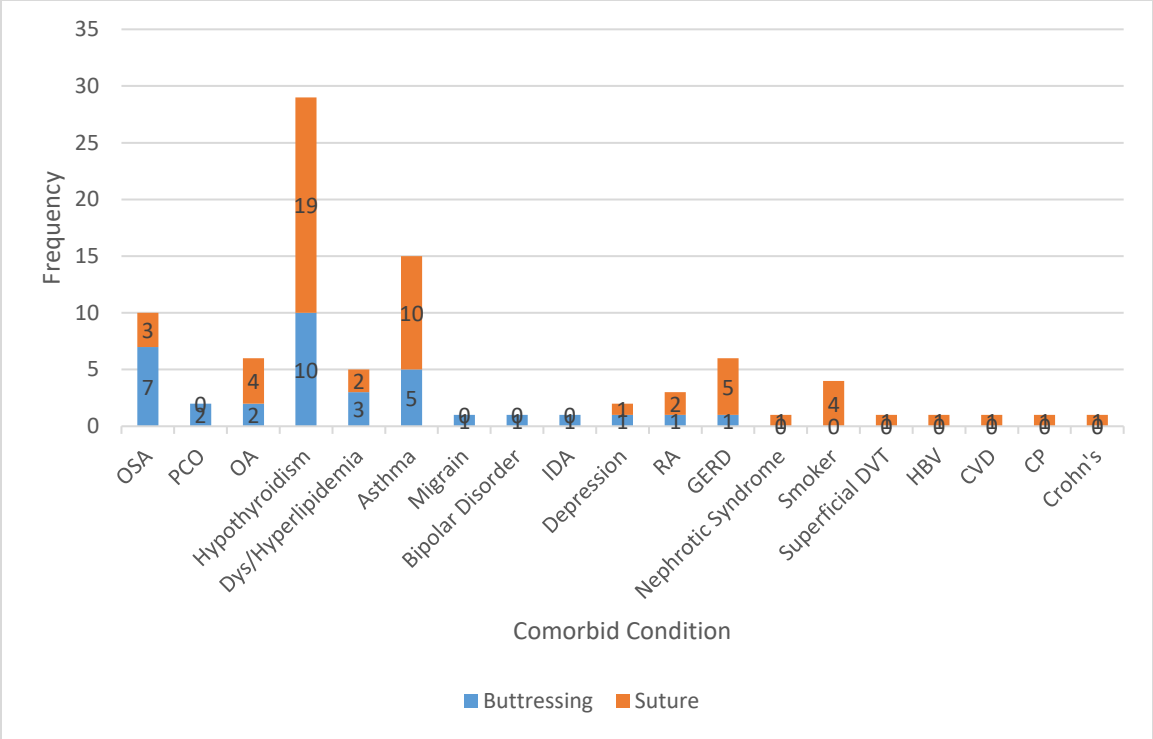

Figure 1: Comorbid conditions among study participants

Table 2 outlines surgery-related characteristics among participants in the Buttressing and Suture groups. The operation duration was significantly shorter in the Buttressing group (mean 73.42 ± 18.48 minutes) compared to the Suture group (mean 90.55 ± 13.75 minutes) (P < 0.001). Intraoperative and postoperative bleeding were rare and showed no significant differences between groups. Leakage was observed only in the Suture group (7 cases), nearing statistical significance (P = 0.050). No significant differences were noted for surgical site infections (SSI), reoperations, overall complications, or 30-day mortality. Postoperative complications were stenosis among suture group and vitamin deficiency, PRES syndrome, hematoma, and collection among buttressing group.

Table 2: Surgery-related characteristics among study participants

Variable		Buttressing (N= 120)	Suture (N= 227)	P value
Operation duration (mean ± SD, min-max)		73.42 ± 18.48 (45-160)	90.55 ± 13.75 (60-180)	<0.001
Intraoperative bleeding	Yes	4	2	0.111
	No	116	225	
Bleeding site	No	116	225	0.126
	Stapler line	1	2	
	Liver	2	0	
	Short gastric vessels	1	0	
Postoperative bleeding	Yes	4	4	0.283
	No	116	223	
Bleeding site	No	116	223	0.209
	Stapler line	3	1	
	Port site	1	0	

	Abdominal wall	0	1	
	Trocar site	0	1	
Leak	Yes	0	7	0.050
	No	120	220	
SSI	No	118	220	0.448
	Superficial	2	4	
	Deep	0	3	
Reoperation	Yes	2	7	0.344
	No	118	220	
Complications	Yes	4	1	0.193
	No	116	226	
30-Day mortality	Yes	0	0	-
	No	120	227	

Discussion

The findings of this study reveal critical insights into the outcomes of laparoscopic sleeve gastrectomy (LSG) with buttressing versus suture techniques. The shorter operation duration in the Buttressing group suggests a procedural efficiency advantage, which could be beneficial in reducing surgical fatigue and operating room resource utilization. Furthermore, the absence of leakage in the Buttressing group, compared to its occurrence in the Suture group, though not statistically significant, underscores the potential safety benefits of using buttressing techniques in minimizing one of the most serious complications of LSG. Despite these advantages, postoperative complications in both groups were minimal, with no significant differences in bleeding, surgical site infections, reoperations, or 30-day mortality, indicating that both techniques are generally safe and effective.

However, the higher prevalence of diabetes mellitus and comorbidities in the Buttressing group may have implications for patient selection and outcome interpretation. The increased complexity of cases in this group might reflect a tendency to use buttressing in higher-risk patients. These differences emphasize the need for further studies, including randomized controlled trials, to establish whether the observed advantages of buttressing are attributable to the technique itself or patient-related factors. Overall, the results provide a basis for considering buttressing as a potentially advantageous option in LSG, particularly for high-risk patients, but larger-scale studies are needed to validate these findings.

Between the intra-operative visit and day 30, a single-center randomized research found that patients using PSD-V had a considerably lower risk of staple-line bleeding compared to those in the control group who did not get staple-line reinforcement [8]. There was less severe bleeding at the staple line in the PSD-V group as well. The use of bovine pericardium as buttress material in sleeve gastrectomy has been associated with a lower risk of staple-line failures, which is supported by our data [9-10].

In general, the incidence of staple-line bleeding was unaffected by body mass index. Patients with a BMI ≤43 and those who got PSD-V had fewer staple-line bleeding compared to the control group, according to subgroup analyses according to BMI [8]. However, for patients with a BMI >43, there was no difference between treatment groups. When trying to make sense of these findings, it's vital to keep in mind that male gender and a body mass index (BMI) more than 50 kg/m2 were linked to antrum tissue thickness in a recent research that examined the thickness of excised sleeve gastrectomy specimens [11]. Since the current research recruited more men than women, this is especially pertinent. It is our understanding that no prior research has investigated

the impact of body mass index on staple-line reinforcement experiments; hence, more research is necessary to validate the current study's findings.

The group that had sutures experienced staple-line leakage. Patients who had sleeve gastrectomy and received PSD-V had similar rates of staple-line leakage, according to research by Stamou et al. (2011) [13]. It is possible that this may be clarified in the future, as Chen et al.'s literature evaluation cast doubt on the usefulness of staple-line reinforcing in lowering leak rates [13]. About fifteen minutes less time was spent on the procedure in the buttressing group compared to the suture group during surgery. Additionally, PSD-V greatly reduced the need for hemostatic clips and surgical sutures. Future research can look at the exclusion of induction and reversal of anesthetic times as a drawback of the study [8] that aimed to show actual surgical time disparities for sleeve gastrectomy. Adverse bleeding events, as well as the need of suturing and cutting, might lengthen the duration of the operation. This is very important because patients who need sleeve gastrectomy often have other health issues in addition to severe obesity, which increases their risk of complications after surgery. Keeping high-risk patients under anesthesia for shorter periods of time decreases the likelihood of further surgical problems, which is why any measure that might lessen intraoperative bleeding is welcome [8].

The tiny sample size is due, in part, to the fact that this research only used data from one surgical team at one facility. To back up the findings, it would be helpful to do more research with bigger samples.

Across all treatment groups, the frequency of adverse events was modest, and the research did not record any fatalities. The lack of safety concerns is consistent with previous research showing that buttressing with bovine pericardium is easily done and well-tolerated [10]. Patients who underwent sleeve gastrectomy spent fewer days in the hospital when PSD-V was used, according to Stamou et al. [12]. It is vital to consider this for future research because, while using reinforcement may result in greater expenses, these costs might be compensated by fewer days in the hospital.

Conclusion

The results demonstrate notable differences between the Buttressing and Suture groups. Participants in the Buttressing group had significantly higher BMI and a greater prevalence of diabetes mellitus and overall comorbidities compared to the Suture group. Operation duration was significantly shorter in the Buttressing group, highlighting a potential procedural advantage. While intraoperative and postoperative bleeding, as well as complications such as surgical site infections and reoperations, were rare and comparable between groups, leakage occurred exclusively in the Suture group, nearing statistical significance. Postoperative complications varied slightly, with unique occurrences of stenosis in the Suture group and specific conditions like vitamin deficiency and hematoma in the Buttressing group. No 30-day mortality was observed in either group.

References

1. Sugerman HJ, Kellum JM, Ryan CM, et al. Biologic versus suture staple line reinforcement in laparoscopic sleeve gastrectomy: A randomized controlled trial. Surg Obes Surg. 2016;10(1):131-137.
2. Buchwald H, Oien M, Sjöström L, Mingrone A, Todoran G, Stackelberg T, et al. Sleeve gastrectomy as a bariatric operation: A systematic review and meta-analysis. Ann Surg. 2005;241(2):241-254.
3. Schauer PR, Suttner S, Wierer G, Bellinger MH, Müller JM. A review of laparoscopic sleeve gastrectomy for morbid obesity. Obes Surg. 2010;20(3):362-370.
4. Maggard MA, Ryan LM, Gagner MJ, Maggionetta M, Hutter J, Renner C, et al. Long-term results of laparoscopic sleeve gastrectomy: A review of studies reporting 10+ years outcomes. Obes Surg. 2023.

5. Csendes A, Tschuschnig A, Rudofsky G, Gohr H, Jurecka W, Jaksch W. Laparoscopic sleeve gastrectomy with Gore® SeamGuard® bioabsorbable staple line reinforcement: A prospective, multicenter trial. Surg Endosc. 2013;27(2):532-537.
6. Ninh TN, Tuan TQ, Vu DH, Van Son N, Van Loc P, Giang HD. A prospective randomized controlled trial on the use of Gore® SeamGuard® in laparoscopic sleeve gastrectomy. Int J Surg. 2017;119:282-287.
7. Elhady HA, Ashour HS, Almazyad AB, Shaban OA, Wali MB, Alrashidi AA, et al. Prevalence of gastroesophageal reflux disease among laparoscopic sleeve gastrectomy patients in Saudi Arabia. Int J Med Dev Ctries. 2020 Feb 20;3(9):784.
8. Shah SS, Todkar JS, Shah PS. Buttressing the staple line: a randomized comparison between staple-line reinforcement versus no reinforcement during sleeve gastrectomy. Obesity Surgery. 2014 Dec;24:2014-20.
9. Shikora S. The use of staple-line reinforcement during laparoscopic gastric bypass. Obes Surg. 2004;14(10):1313–1320.
10. Hajj G, Haddad J. Preventing staple-line leak in sleeve gastrectomy: reinforcement with bovine pericardium vs oversewing. Obes Surg. 2013;23(11):1915–1921.
11. Rawlins L, Rawlins MP, Teel D., 2nd Human tissue thickness measurements from excised sleeve gastrectomy specimens. Surg Endoc. 2014;28(3):811–814.
12. Stamou K, Menenakos E, Dardamanis D, et al. Prospective comparative study of the efficacy of staple-line reinforcement in laparoscopic sleeve gastrectomy. Surg Endosc. 2011;25(11):3526–3530.
13. Chen B, Kiriakopoulos A, Tsakayannis D, Wachtel M, Linos D, Frezza E. Reinforcement does not necessarily reduce the rate of staple line leaks after sleeve gastrectomy. A review of the literature and clinical experiences. Obes Surg. 2009;19(2):166–172.