CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2324880

Available online at: http://www.iajps.com ***Research Article***

FACTORS ASSOCIATED WITH LONG POST-OPERATIVE STAY IN SLEEVE GASTRECTOMY

Sufana Amer Alotaibi [1], Hind Ahmed Alnassar [1], Mohammad Abdulaziz Alshaikh [2], Mazen Sanad Alharbi [3], Marwan Ahmed Jaafari [4], Ali Hasan Abdullah [5], Zahra Abdulhadi Ebrahim [5], Abdullah Hassan Assiri [6], Omar Abdulelah Sindi [7], Hamzah Hilmi Sindi [7]

[1] General Surgery Department, King Fahad University Hospital, Al-Khobar, Saudi Arabia, [2] General Surgery Department, Prince Saud Bin Jalawy Hospital, Al-Hofuf, Saudi Arabia, [3] College of Medicine, King Saud bin Abdulaziz University for Health Sciences, Mecca, Saudi Arabia, [4] College of Medicine, Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia, [5] College of Medicine, Zhejiang University, Zhejiang, China, [6] College of Medicine, King Khalid University, Abha, Saudi Arabia, [7] College of Medicine, Ibn Sina National College, Jeddah, Saudi Arabia

Abstract

Background: *The post-operative hospital stay is considered economic, psychologic and stressful event on the patient. In laparoscopic sleeve gastrectomy, there is not many studies in literature assessed the cause of prolonged hospital stay in LSG, so necessary preventive measures would be applied to decrease this*

Methods: *A retrospective cohort study was conducted in Saudi Arabia on all patients undergone the LSG. Correlation analysis and Wilcoxon rank test was conducted on continuous and categorical variables respectively to understand the relation between length of operation and other risk factors. Multivariate linear regression analysis was conducted to understand the significant relation.*

Results: *BMI, age, sex, operative complications or operative time was associated with prolonged hospital stay. the associated risk factors for long post-operative stay was post-operative serum lipase (P-value <0.001) and presence of general post-operative complications. the regression analysis showed that one unit increase in lipase was accompanied by 0.007 increase in the length of post-operative stay while post-operative complications increase the length of post-operative stay by 1.46.*

Conclusion: *The serum lipase level and post-operative complications was the only risk factors for prolonged hospital stay. More studies are needed to assess the risk factors related to prolonged hospital stay in LSG*

Keywords: *Laparoscopic sleeve gastrectomy, obesity, bariatric surgery, hospital stay, postoperative stay*

Corresponding author:

Sufana Amer Alotaibi

General Surgery Department,
King Fahad University Hospital,
Al-Khobar, Saudi Arabia
Email: sufana.a@hotmail.com
Phone (or Mobile) No.: +966544857137

QR code

Please cite this article in press Sufana Amer Alotaibi et al., ***Factors Associated With Long Post-Operative Stay In Sleeve Gastrectomy.,*** *Indo Am. J. P. Sci, 2018; 05(12).*

INTRODUCTION:

The obesity has become a world-wide epidemic with increasing prevalence in the recent years. There is estimated 300 million obese people worldwide and the number is expected to increase twice by 2025 [1-3]. The associated morbidity and mortality of obesity has made it a disease rather than a condition [4]. Despite the management plans of obesity, there are still increasing numbers of obese persons worldwide with the highest prevalence in USA [3]. The search for effective and durable treatment that maintain the weight loss for long duration is considered crucial for preventing this epidemic. The management plans include life style modifications, exercise, behavioural therapy and anti-obesity medication [5, 1, 6]. These treatments failed to produce long time weight loss. That's why there is a recent increase in the bariatric surgery worldwide [7-9]. It is estimated that there are about 200000 to 220000 surgeries in USA and Canada in 2009. Furthermore, in 2011, there is estimated 340000 bariatric surgeries world-wide. The high rate of bariatric surgeries is due to the sustained weight loss, rapid method to lose weight for patients with morbidity and significant decrease of mortality rates [8, 10, 11].

Bariatric surgery is the treatment of choice in morbid obesity (BMI>35 with co-morbidities or more than 40 Kg/m^2) because at this BMI, only 5.8% of weight loss is maintained along eight years [12, 13, 9]. In these population, underlying biological mechanisms of obesity is powerful that the life style modifications or anti-obesity drugs cannot maintain weight loss [11, 14, 15]. The bariatric surgery was divided based on the mechanism of action of the surgery. It is either restrictive, malabsorptive or both [14]. However, this classification introduce bias as other mechanisms are involved in the weight loss including neural or endocrinal signalling pathway [16].

There are many types of bariatric surgery but the most common are Roux-en-Y Gastric Bypass, adjustable gastric binding and sleeve gastrectomy [7]. The choice of the suitable treatment options is dependent upon the patient characteristics and associated perioperative and post-operative complications [10, 8, 11]. Chang et al. compared between the three modalities; they found that the three surgeries were associated with weight loss, but the gastric bypass had the highest weight loss but with more complications [9, 10]. The gastric binding had a higher rate of reoperations and lower weight loss. The laparoscopic sleeve gastrectomy had lower complications and weight loss like gastric bypass. The efficacy of each procedure does not depend solely on the weight loss but also associated perioperative and postoperative complications [9, 10]. That's why the choice of suitable bariatric surgery should be tailored for each patient. In addition, identifying the risk factors associated with each complications help decide the appropriate surgery for the patients [17].

It was reported that the laparoscopic sleeve gastrectomy was associated with less risk of operative and post-operative complications than Roux-en-Y Gastric Bypass [18]. Iranian obese patients who had sleeve gastrectomy had less complication than Roux-en-Y Gastric Bypass but non-significant [19]. A multicentre retrospective study found that sleeve gastrectomy had less complications than Roux-en-Y Gastric Bypass despite the higher weight loss with gastric bypass [20, 21]. However, other studies found that the weight loss among both types of surgery are the same [22, 23]. In addition, Gehrer et al. found that the LSG was associated with less nutritional deficiency, hernias and intestinal obstruction [24]. That's why, there is an exponential increase of laparoscopic sleeve gastrectomy (LSG) worldwide with many surgeons considering it as the standard treatment of obesity due to safer and easier techniques [25, 26]. Determining the risk factors associated with postoperative complication of LSG would help in improving the quality of life after the surgery and avoiding long term post-operative complications [17].

The complications associated with sleeve gastrectomy either acute complications including the haemorrhage, abscess and staple line leak or chronic complications include the stricture, nutritional deficiency and gastroesophageal reflux [27]. Old age more than 50 years and high BMI was found to be associated with higher risk of postoperative complications [27-31]. Increased duration of the operative was considered as alerting factor for the surgeon to increased risk of complications [27]. Increased stapler firings were also associated with high postoperative complications [32]. Hypalbuminaemia and hypertension were found to be a determining factor of the postoperative complications mainly surgical site infections [33]. Previous abdominal operations increased the risk of surgical site infections [34, 33]. Unfortunately, other lab tests or diseases were not thoroughly investigated in literature.

Another importance for determination of post-operative complications was the post-operative hospital stay. It is physical and economic loss for the patients and health care system [35]. It was found that post-operative complications increased significantly the hospital stay [36-39]. Although other risk factors

including age, BMI and fluid intake was associated with the increased hospital stay, all studies agreed that post-operative complications are the most important factor [36, 37, 40, 38, 39].

Unfortunately, there are few studies that discussed this effect specifically for LSG while other studies assessed it in other bariatric surgeries [41].

Thus, in this study, we are going to determine the risk factors associated with postoperative hospital stay in Saudi population.

METHODS:

This study is a part of retrospective cohort in King Fahad University Hospital in Al-Khobar, Saudi Arabia from May 2015 to June 2016 that was approved by the IRB committee of the hospital on January 2015.

Patient recruitments

All the patients consented and IRB approvement. All the procedures were conducted based on the declaration of Helsinki.
The patients were only included in cohort if

Detailed history from each patient was obtained including marital status, nationality, history of diseases and previous cholecystectomy. Pre-operative and post-operative total bilirubin, Amylase, Lipase, Alkaline phosphatase, Cholesterol, Triglycerides, LDL, HDL and haemoglobin A1C were obtained. The study participants were followed-up for four years to assess the body weight, presence of any long term complications.

Statistical techniques

The results were presented as mean ± standard deviation for continuous variables that were normally distributed or as median and interquartile range (IQR) for continuous variables whose distribution was not normal. Categorical variables were presented as frequencies and percentages. The missing data were imputed by K nearest neighbors using K = 5.

We used Kendall's tau correlation for the relationship between two non-normally distributed variables, otherwise the Pearson's correlation was used. A significant correlation is considered when *P-value* is less than 0.05. For pair wise comparisons of continuous variable, Mann Whitney test was used for non-parametric data otherwise, t-test was used to detect the difference between two groups. A regression analysis was conducted to assess the risk factors associated with the long post-operative stay in LSG.

RESULTS:

Patient characteristics

174 patients were included in this cohort; the mean age is 31.82 (8.91) and 123 males were included in the study with median BMI was 46.15 Kg/m^2 Table 1. There was no significant difference between pre-operative and post-operative lab test except for total bilirubin and alkaline phosphatase Table 2. The most common complication is fever, abdominal pain and vomiting Figure 1.

Relationship between personal characteristics and length of post-operative stay

The correlation analysis did not show any significant relationship between length of post-operative stay and BMI (P-value = 0.68), age (P-value = 0.23), and length of operation (P-value = 0.3) Figure 2. There was no significant difference between the sex (P-value = 0.47), marital status (P-value = 0.53), nationality (P-value = 0.14) and finding of preoperative ultrasound Figure 3.

Relationship between history of diseases, complications of laparoscopic sleeve gastrectomy and surgeries and length of post-operative stay

There was no significant relationship between previous cholecystectomy, hypertension, diabetes mellitus and hyperlipidaemia Figure 4. The operative complication did not affect the length of stay after LSG Figure 5. The general post-operative complication was significantly associated with increased length of stay after LSG (P-value = 0.02) Figure 6. It was found that the presence of post-operative complications increased the duration of the post-operative stay by 1.46 minutes.

Relationship between preoperative, post-operative laboratory tests and length of post-operative stay

The only significant factor on the length of post-operative stay was post-operative lipase (r = 0.29, P-value < 0.001) Figure 7,8. Multivariate regression analysis revealed that everyone unit increase of serum amylase was associated with 0.001 hour increase of length of post-operative stay.

DISCUSSION:

This paper was set out to recognize the risk factor for long post-operative hospital stay. Per our results, the first associated risk factors for long post-operative stay was post-operative serum lipase (P-value <0.001); the regression analysis showed that one unit increase in lipase was accompanied by 0.007 increase in the length of post-operative stay. The second risk factor is the presence of systemic post-operative complications which was found to increase the length

of post-operative stay by 1.46.

In this study, the mean length of operative stay is 6.34 days with standard deviation of 2.44. The associated general complications that was found was fever, abdominal pain and vomiting. The most dangerous complications present in our study was chest pain, arm thrombophlebitis and atelectasis. There are few studies in literature that assessed the risk factors of hospital stay. Major et al. found that post-operative events including fever, nausea and vomiting had significantly increased the length of operation. However, in this study, initial BMI was associated with longer hospital length [38]. The authors also found significant association between intraoperative events, operative time and longer hospital stay. Moreover, in this study, the mean duration of hospital stay was 3 days which is less than our study [38]. Based on the recent guideline, the usual hospital stay was less than 24 hours [25, 42]. However, Major et al. found that the hospital length differs according to the perioperative and post-operative protocol as evidenced by different length of hospital stay. Our results were also consistent with Jakob et al. who found that the post-operative admission was associated with post-operative complications including vomiting and fever [42]. Weiner et al. also found that in case of post-operative complications including leak, the hospital stay was prolonged more than three days [43].

There is no much data in literature about the length of stay after sleeve gastrectomy. Other studies did not directly correlate between the length of hospital stay and other risk factor, but we compared it to the results of our study.

A study that compared between techniques used in the surgery found that conventional linear stapling system was associated with prolonged hospital stay (mean stay = 4.8) while the usage of absorbable polymer membrane decreased the length of operative stay [36, 43]. In our study, we could not assess this in our study, but the intraoperative complications were found to be not associated with longer hospital stay. Meanwhile, the studies that assessed the length of hospital stay in other bariatric surgeries was increased by intraoperative complications, conversion and operative time [41, 38, 39]. Unfortunately, no studies in literature investigated this effect. Felberbauer et al. had the same length of stay as in our study and the approximately the same starting BMI [44], however, Givon-Madhala et al had less hospital stay despite the similarities between patients [39]. Serum lipase was not investigated in other studies as a risk factor for prolonged hospital stay. However, in other diseases, serum lipase was associated with longer hospital stay [45, 46].

There are other risk factors for longer hospital stay including oral fluid intake, intravenous fluid intake, tachycardia, and distance between the hospital and site of residence [38]. Unfortunately, this was not assessed in our study.

In conclusion, more studies should focus on the risk factors affecting the hospital stay especially laboratory tests in laparoscopic sleeve gastrectomy.

CONCLUSION:

In this study, serum lipase and post-operative complications were associated with significant prolonged post-operative hospital stay

REFERENCES:

1. Formiguera X, Cantón A. Obesity: epidemiology and clinical aspects. Best Practice & Research Clinical Gastroenterology. 2004;18(6):1125-46. doi:https://doi.org/10.1016/j.bpg.2004.06.030.
2. Hruby A, Hu FB. The Epidemiology of Obesity: A Big Picture. PharmacoEconomics. 2015;33(7):673-89. doi:10.1007/s40273-014-0243-x.
3. Kelly T, Yang W, Chen CS, Reynolds K, He J. Global burden of obesity in 2005 and projections to 2030. International journal of obesity (2005). 2008;32(9):1431-7. doi:10.1038/ijo.2008.102.
4. Apovian CM, Mechanick JI. Obesity IS a disease ! 2013:367-8. doi:10.1097/01.med.0000433068.09294.a1.
5. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health. Obesity research. 1998;6 Suppl 2:51S-209S.
6. Hainer V, Toplak H, Mitrakou A. Treatment modalities of obesity: what fits whom? Diabetes care. 2008;31 Suppl 2:S269-77. doi:10.2337/dc08-s265.
7. Braunwald E, Jensen MD, Fahrbach K. Bariatric Surgery. 2004;292(14).
8. Chang S-H, Stoll CRT, Colditz GA. Cost-effectiveness of bariatric surgery: should it be universally available? Maturitas. 2011;69(3):230-8. doi:10.1016/j.maturitas.2011.04.007.
9. Chang S-H, Stoll CRT, Song J, Varela JE, Eagon CJ, Colditz GA. The effectiveness and risks of bariatric surgery: an updated systematic review and meta-analysis, 2003-2012. JAMA surgery. 2014;149(3):275-87. doi:10.1001/jamasurg.2013.3654.
10. Chang S-H, Stoll CRT, Song J, Varela JE, Eagon CJ, Colditz GA. Bariatric surgery: an updated

systematic review and meta-analysis, 2003–2012. JAMA surgery. 2014;149(3):275-87. doi:10.1001/jamasurg.2013.3654.
11. Kang JH, Le QA. Effectiveness of bariatric surgical procedures: A systematic review and network meta-analysis of randomized controlled trials. Medicine. 2017;96(46):e8632-e. doi:10.1097/MD.0000000000008632.
12. NIH conference. Gastrointestinal surgery for severe obesity. Consensus Development Conference Panel. Annals of internal medicine. 1991;115(12):956-61.
13. Gastrointestinal surgery for severe obesity: National Institutes of Health Consensus Development Conference Statement. The American journal of clinical nutrition. 1992;55(2 Suppl):615S-9S. doi:10.1093/ajcn/55.2.615s.
14. Mechanick JI, Kushner RF, Sugerman HJ, Gonzalez-Campoy JM, Collazo-Clavell ML, Guven S et al. American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery Medical Guidelines for Clinical Practice for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient. Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery. 2008;4(5 Suppl):S109-84. doi:10.1016/j.soard.2008.08.009.
15. Paulus GF, de Vaan LEG, Verdam FJ, Bouvy ND, Ambergen TAW, van Heurn LWE. Bariatric surgery in morbidly obese adolescents: a systematic review and meta-analysis. Obesity surgery. 2015;25(5):860-78. doi:10.1007/s11695-015-1581-2.
16. Ochner CN, Gibson C, Carnell S, Dambkowski C, Geliebter A. The neurohormonal regulation of energy intake in relation to bariatric surgery for obesity. Physiol Behav. 2010;100(5):549-59. doi:10.1016/j.physbeh.2010.04.032.
17. Major P, Wysocki M, Pedziwiatr M, Pisarska M, Dworak J, Malczak P et al. Risk factors for complications of laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass. International journal of surgery (London, England). 2017;37:71-8. doi:10.1016/j.ijsu.2016.12.012.
18. Lager CJ, Esfandiari NH, Subauste AR, Kraftson AT, Brown MB, Cassidy RB et al. Roux-En-Y Gastric Bypass Vs. Sleeve Gastrectomy: Balancing the Risks of Surgery with the Benefits of Weight Loss. Obesity Surgery. 2017;27(1):154-61. doi:10.1007/s11695-016-2265-2.
19. Barzin M, Khalaj A, Motamedi MA, Shapoori P, Azizi F, Hosseinpanah F. Safety and effectiveness of sleeve gastrectomy versus gastric bypass: one-year results of Tehran Obesity Treatment Study (TOTS). Gastroenterology and Hepatology From Bed to Bench. 2016;9(Suppl1):S62-S9.
20. Casillas RA, Kim B, Fischer H, Zelada Getty JL, Um SS, Coleman KJ. Comparative effectiveness of sleeve gastrectomy versus Roux-en-Y gastric bypass for weight loss and safety outcomes in older adults. Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery. 2017;13(9):1476-83. doi:10.1016/j.soard.2017.03.011.
21. Lee SK, Heo Y, Park J-M, Kim Y-J, Kim S-M, Park D-J et al. Roux-en-Y Gastric Bypass vs. Sleeve Gastrectomy vs. Gastric Banding: The First Multicenter Retrospective Comparative Cohort Study in Obese Korean Patients. Yonsei Medical Journal. 2016;57(4):956-62. doi:10.3349/ymj.2016.57.4.956.
22. Kehagias I, Karamanakos SN. Randomized Clinical Trial of Laparoscopic Roux-en-Y Gastric Bypass Versus Laparoscopic Sleeve Gastrectomy for the Management of Patients with BMI < 50 kg / m 2. 2011:1650-6. doi:10.1007/s11695-011-0479-x.
23. Peterli R, Wolnerhanssen BK, Peters T, Vetter D, Kroll D, Borbely Y et al. Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial. JAMA. 2018;319(3):255-65. doi:10.1001/jama.2017.20897.
24. Gehrer S, Kern B, Peters T, Christoffel-Courtin C, Peterli R. Fewer nutrient deficiencies after laparoscopic sleeve gastrectomy (LSG) than after laparoscopic Roux-Y-gastric bypass (LRYGB)-a prospective study. Obesity surgery. 2010;20(4):447-53. doi:10.1007/s11695-009-0068-4.
25. Rosenthal RJ, Diaz AA, Arvidsson D, Baker RS, Basso N, Bellanger D et al. International Sleeve Gastrectomy Expert Panel Consensus Statement: best practice guidelines based on experience of >12,000 cases. Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery. 2012;8(1):8-19. doi:10.1016/j.soard.2011.10.019.
26. Gagner M, C FRCS, Erickson AL, A B, Crosby RD, Ph D. Third International Summit : current status of sleeve gastrectomy. SOARD. 2011;7(6):749-59. doi:10.1016/j.soard.2011.07.017.
27. Garofalo F, Pescarus R, Denis R, Atlas H, Garneau P, Philie M et al. Laparoscopic Sleeve

Gastrectomy : A Radiological Guide to Common Postsurgical Failure. 2018:1-13. doi:10.1016/j.carj.2017.10.004.
28. Sanni A, Perez S, Medbery R, Urrego HD, McCready C, Toro JP et al. Postoperative complications in bariatric surgery using age and BMI stratification: a study using ACS-NSQIP data. Surgical endoscopy. 2014;28(12):3302-9. doi:10.1007/s00464-014-3606-7.
29. Sarkhosh K, Birch DW, Sharma A, Karmali S. Complications associated with laparoscopic sleeve gastrectomy for morbid obesity: a surgeon's guide. Canadian Journal of Surgery. 2013;56(5):347-52. doi:10.1503/cjs.033511.
30. Shepherd R, Raker CA, Savella GM, Du N, Matteson KA, Allen RH. The effect of obesity on intraoperative complication rates with hysteroscopic compared to laparoscopic sterilization: a retrospective cohort study. Contraception and Reproductive Medicine. 2016;1(1):1-. doi:10.1186/s40834-016-0008-3.
31. Stenberg E, Szabo E, Agren G, Naslund E, Boman L, Bylund A et al. Early complications after laparoscopic gastric bypass surgery: results from the Scandinavian Obesity Surgery Registry. Annals of surgery. 2014;260(6):1040-7. doi:10.1097/SLA.0000000000000431.
32. Ito M, Sugito M, Kobayashi A, Nishizawa Y, Tsunoda Y, Saito N. Relationship between multiple numbers of stapler firings during rectal division and anastomotic leakage after laparoscopic rectal resection. International journal of colorectal disease. 2008;23(7):703-7. doi:10.1007/s00384-008-0470-8.
33. Husain F, Jeong IH, Spight D, Wolfe B, Mattar SG. Risk factors for early postoperative complications after bariatric surgery. Annals of Surgical Treatment and Research. 2018;95(2):100-10. doi:10.4174/astr.2018.95.2.100.
34. Coblijn UK, Karres J, de Raaff CAL, de Castro SMM, Lagarde SM, van Tets WF et al. Predicting postoperative complications after bariatric surgery: the Bariatric Surgery Index for Complications, BASIC. Surgical Endoscopy. 2017;31(11):4438-45. doi:10.1007/s00464-017-5494-0.
35. Borghans I, Hekkert KD, den Ouden L, Cihangir S, Vesseur J, Kool RB et al. Unexpectedly long hospital stays as an indicator of risk of unsafe care: an exploratory study. BMJ Open. 2014;4(6).
36. Consten ECJ, Gagner M, Inabnet WB. Decreased Bleeding after Laparoscopic Sleeve Gastrectomy with or without Duodenal Switch for Morbid Obesity using a Stapled Buttressed Absorbable Polymer Membrane. 2004:1360-6.
37. Weiner RA, Theodoridou S, Weiner S. Failure of Laparoscopic Sleeve Gastrectomy – Further Procedure ? 2011;4(suppl 1):42-6. doi:10.1159/000327343.
38. Major P, Wysocki M, Torbicz G, Gajewska N. Risk Factors for Prolonged Length of Hospital Stay and Readmissions After Laparoscopic Sleeve Gastrectomy and Laparoscopic Roux-en-Y Gastric Bypass. 2018:323-32. doi:10.1007/s11695-017-2844-x.
39. Givon-madhala O, Spector R, Wasserberg N, Beglaibter N, Lustigman H, Stein M et al. Technical Aspects of Laparoscopic Sleeve Gastrectomy in 25 Morbidly Obese Patients. 2007(January 2006):722-7.
40. Shi X, Karmali S, Sharma AM, Birch DW. A Review of Laparoscopic Sleeve Gastrectomy for Morbid Obesity. 2010:1171-7. doi:10.1007/s11695-010-0145-8.
41. Reames BN, Bacal D, Krell RW, Birkmeyer JD, Birkmeyer NJO, Finks JF. Influence of Median Surgeon Operative Duration on Adverse Outcomes in Bariatric Surgery. Surgery for obesity and related diseases : official journal of the American Society for Bariatric Surgery. 2015;11(1):207-13. doi:10.1016/j.soard.2014.03.018.
42. Jakob T, Cal P, Deluca L, Fernandez E. Shorter than 24-h hospital stay for sleeve gastrectomy is safe and feasible. Surgical endoscopy. 2016;30(12):5596-600. doi:10.1007/s00464-016-4933-7.
43. Weiner RA, Weiner S, Pomhoff I, Jacobi C, Makarewicz W. Laparoscopic Sleeve Gastrectomy – Influence of Sleeve Size and Resected Gastric Volume. 2007:1297-305.
44. Felberbauer FX, Langer F, Shakeri-manesch S, Schmaldienst E, Kees M, Kriwanek S et al. Laparoscopic Sleeve Gastrectomy as an Isolated Bariatric Procedure : Intermediate-Term Results from a Large Series in Three Austrian Centers. 2008(December 2002):814-8. doi:10.1007/s11695-008-9483-1.
45. Cornett DD, Spier BJ, Eggert AA, Pfau PR. The causes and outcome of acute pancreatitis associated with serum lipase >10,000 u/l. Digestive diseases and sciences. 2011;56(11):3376-81. doi:10.1007/s10620-011-1752-5.
46. Kamil Faiz FZ, Mehrabian S, Saad M, Aisenberg GM. Prognostic value of serum lipase levels in patients with small bowel obstruction. Proceedings (Baylor University Medical Center). 2018;31(3):276-9. doi:10.1080/08998280.2018.1446637.

Table 1. the characteristics of included patients

		Overall
n		174
Post-operative stay (mean (SD))		6.34 (2.44)
Age (mean (SD))		31.82 (8.91)
Sex (%)	Female	123 (70.7)
	Male	51 (29.3)
Marital status (%)	Married	77 (44.3)
	Single	97 (55.7)
Nationality (%)	Egypt	10 (5.7)
	Jordan	4 (2.3)
	KUWAIT	1 (0.6)
	NON-SAUDI	1 (0.6)
	PALESTINE	1 (0.6)
	SAUDI	152 (87.4)
	SUDAN	1 (0.6)
	SYRIA	3 (1.7)
	YEMEN	1 (0.6)
BMI (median [IQR])		46.15 [42.50,52.08]
Diabetes mellitus (%)	NO	153 (88.4)
	YES	20 (11.6)
Hyperlipidemia (%)	NO	157 (90.2)
	YES	17 (9.8)
Hypertension (%)	NO	156 (90.7)
	YES	16 (9.3)
Previous cholecystectomy (%)	NO	162 (94.2)
	YES	10 (5.8)
Preoperative gallstone (%)	No	107 (90.7)
	Yes	11 (9.3)
Bilirubin (median [IQR])		0.30 [0.30, 0.40]
Amylase (median [IQR])		43.00 [33.50, 56.00]
Lipase (median [IQR])		95.00 [28.00, 126.00]
Alkaline phosphatase (median [IQR])		90.00 [73.00, 104.75]
Cholesterol (median [IQR])		181.00 [166.00, 205.00]
Triglyceride (median [IQR])		105.00 [65.00, 142.00]
LDL (median [IQR])		123.00 [105.50, 142.50]

HDL (median [IQR])		41.00 [36.00, 50.00]
HBA1C (median [IQR])		6.10 [5.57, 6.85]
Concomitant cholecystectomy (%)	NO	162 (93.1)
	YES	12 (6.9)
Intraoperative complication (%)	NO	171 (98.8)
	YES	2 (1.2)
Conversion (%)	NO	172 (99.4)
	YES	1 (0.6)
Duration of operation (median [IQR])		85.50 [70.00, 110.00]
Local postoperative complications (%)	NO	165 (95.9)
	YES	7 (4.1)
General postoperative complications (%)	NO	151 (87.3)
	YES	22 (12.7)
Post-operative total bilirubin (median [IQR])		0.50 [0.30, 0.70]
Post-operative Amylase (median [IQR])		47.50 [36.00, 57.75]
Post-operative Lipase (median [IQR])		115.00 [76.50, 168.50]
Post-operative Alkaline phosphatase (median [IQR])		78.00 [65.50, 97.00]
Post-operative Cholesterol (median [IQR])		180.00 [162.50, 222.00]
Post-operative Triglyceride (median [IQR])		81.00 [59.50, 129.00]
Post-operative LDL (median [IQR])		118.00 [96.00, 149.00]
Post-operative HDL (median [IQR])		49.00 [34.00, 57.00]
Post-operative HBA1C (median [IQR])		6.05 [5.65, 6.55]
Follow-up Duration (mean (SD))		41.78 (41.90)
Gall stones (%)		8 (100.0)

Table 2. the difference between pre-operative and post-operative lab tests

	Pre-operative	Post-operative	P-value
total bilirubin (mean (SD))	0.41 (0.41)	0.60 (0.56)	<0.0001
Amylase (mean (SD))	49.32 (36.14)	52.37 (34.57)	0.38
Lipase (mean (SD))	89.96 (53.45)	147.83 (137.15)	0.13
Alkaline phosphatase (mean (SD))	91.69 (25.11)	84.49 (32.76)	0.001
Cholesterol (mean (SD))	187.87 (37.68)	184.87 (37.57)	0.76
Triglycerides (mean (SD))	118.88 (69.21)	99.15 (56.25)	0.077
LDL (mean (SD))	124.10 (32.07)	118.02 (37.21)	0.50
HDL (mean (SD))	43.37 (10.58)	47.59 (19.77)	0.10
HBA1C (mean (SD))	6.65 (1.96)	6.32 (1.03)	0.85

Table 3. the results of multivariate regression analysis

	B-coefficient	Std. Error	P-value
Post-operative Lipase	0.007306	0.001798	0.0007
General Post-Operative Complications	1.465967	0.374845	0.000132

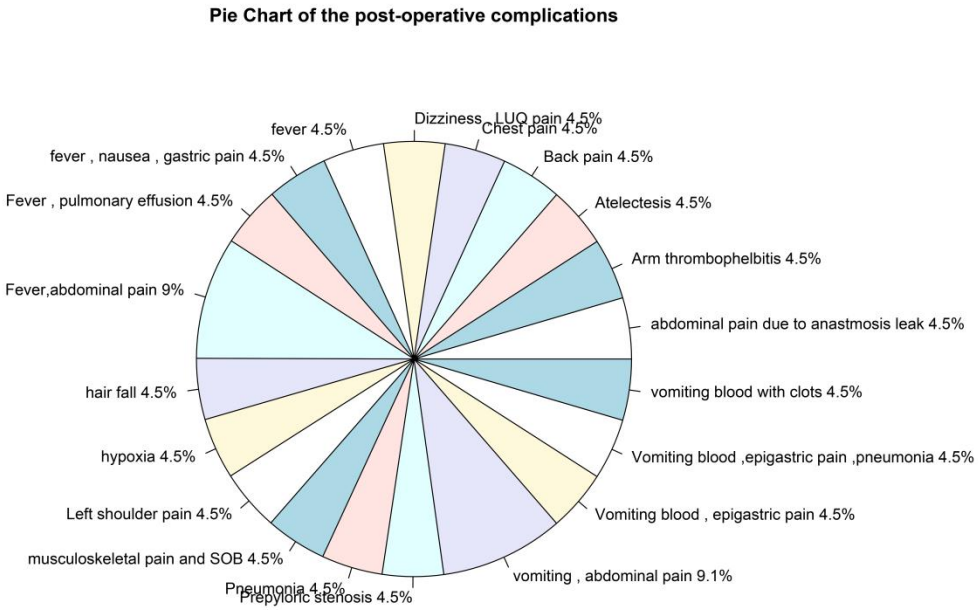

Figure 1. the pie chart showing the percent of each reported general post-operative complications

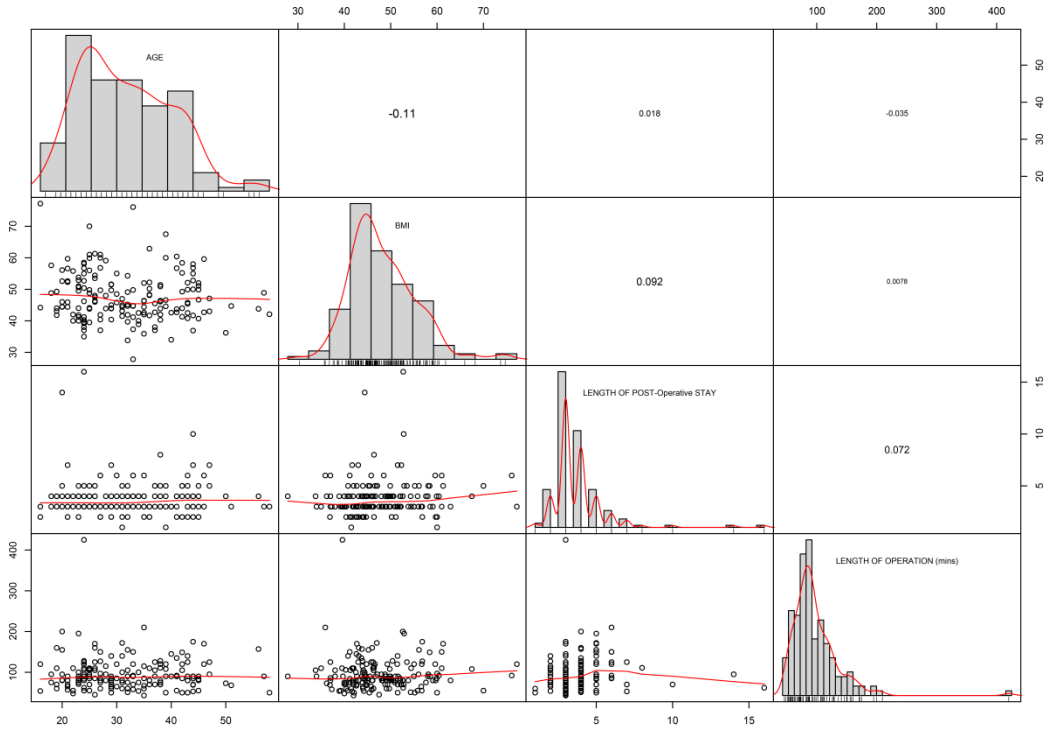

Figure 2. the scatter plot shows the correlation between the duration of post-operative stay, age, BMI and duration of the surgery. The figure also shows the distribution of each variable. The regression line is considered horizontal

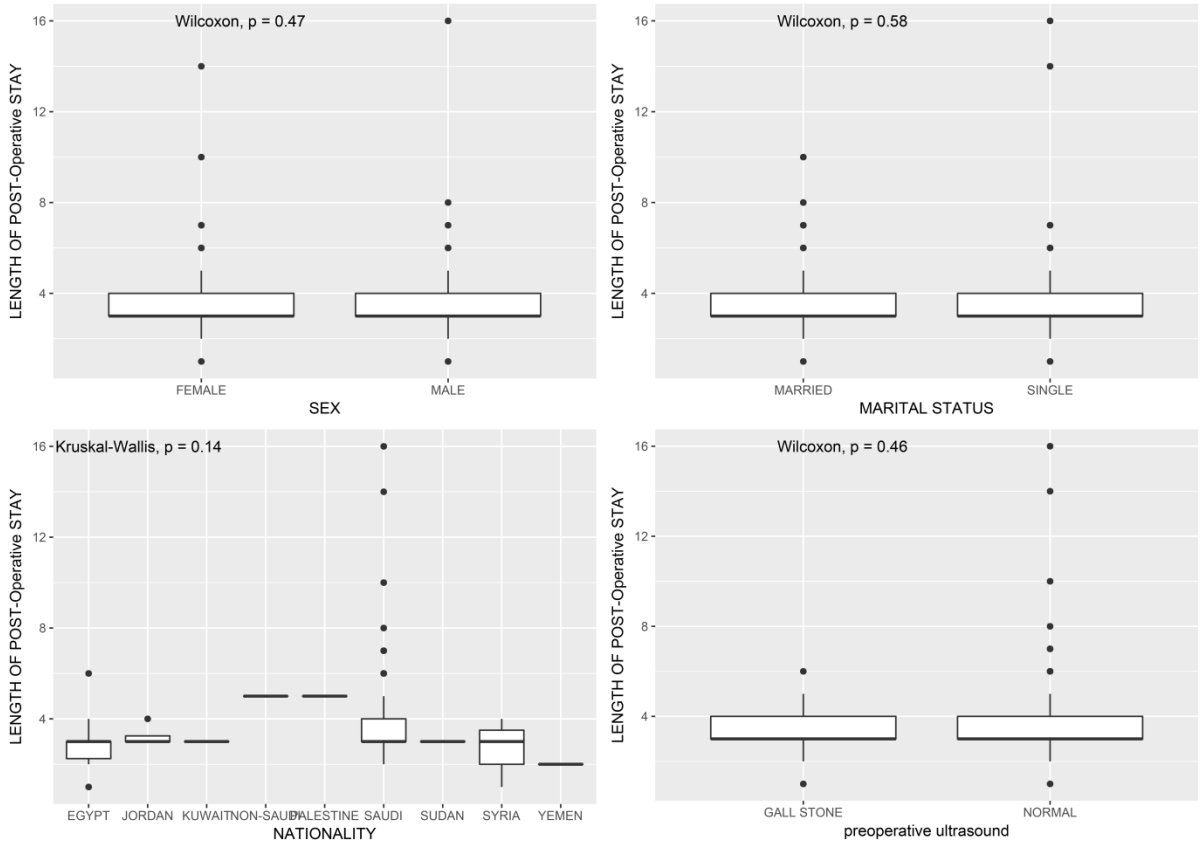

Figure 3. box plots showing the median and IQR of the duration of post-operative stay between different sex, nationality, marital status and preoperative ultrasound.

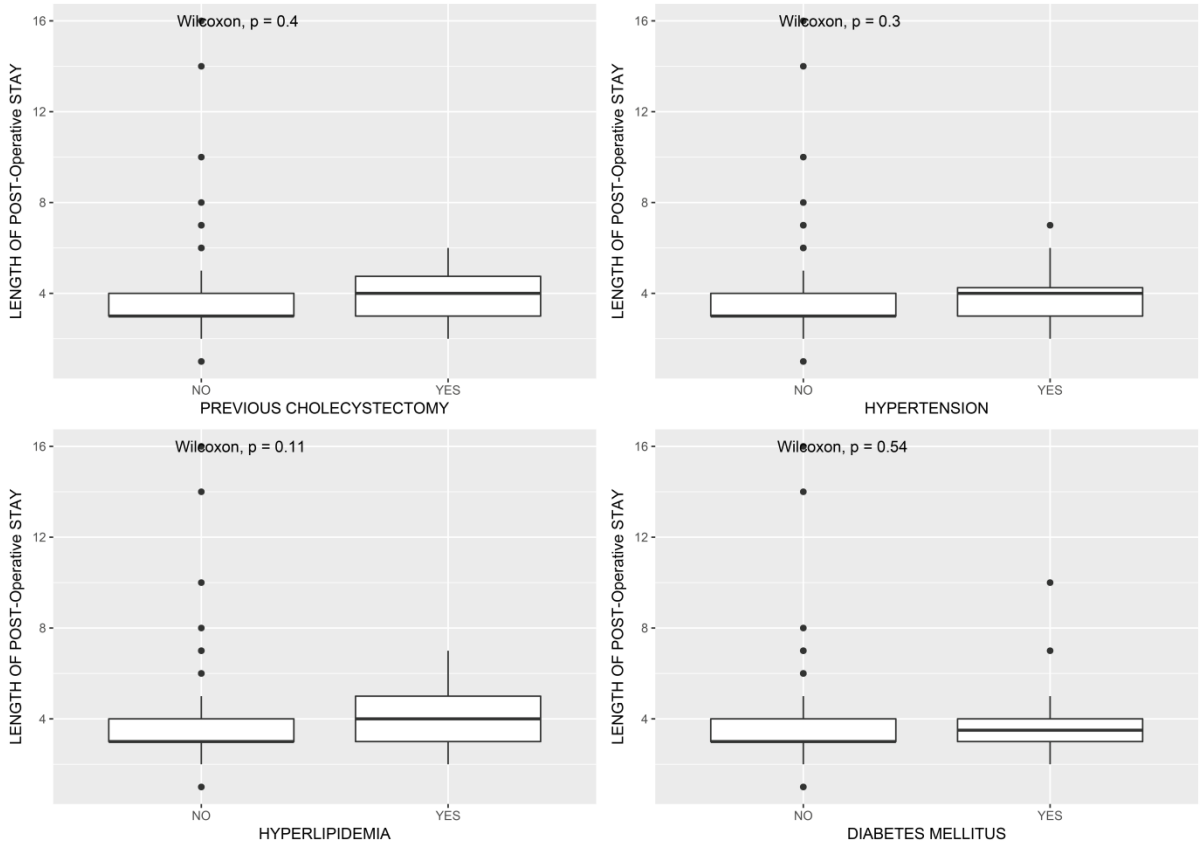

Figure 4. box plots showing the median and IQR of the duration of post-operative stay between those of have history of diabetes, hypertension, previous cholecystectomy and hyperlipidaemia

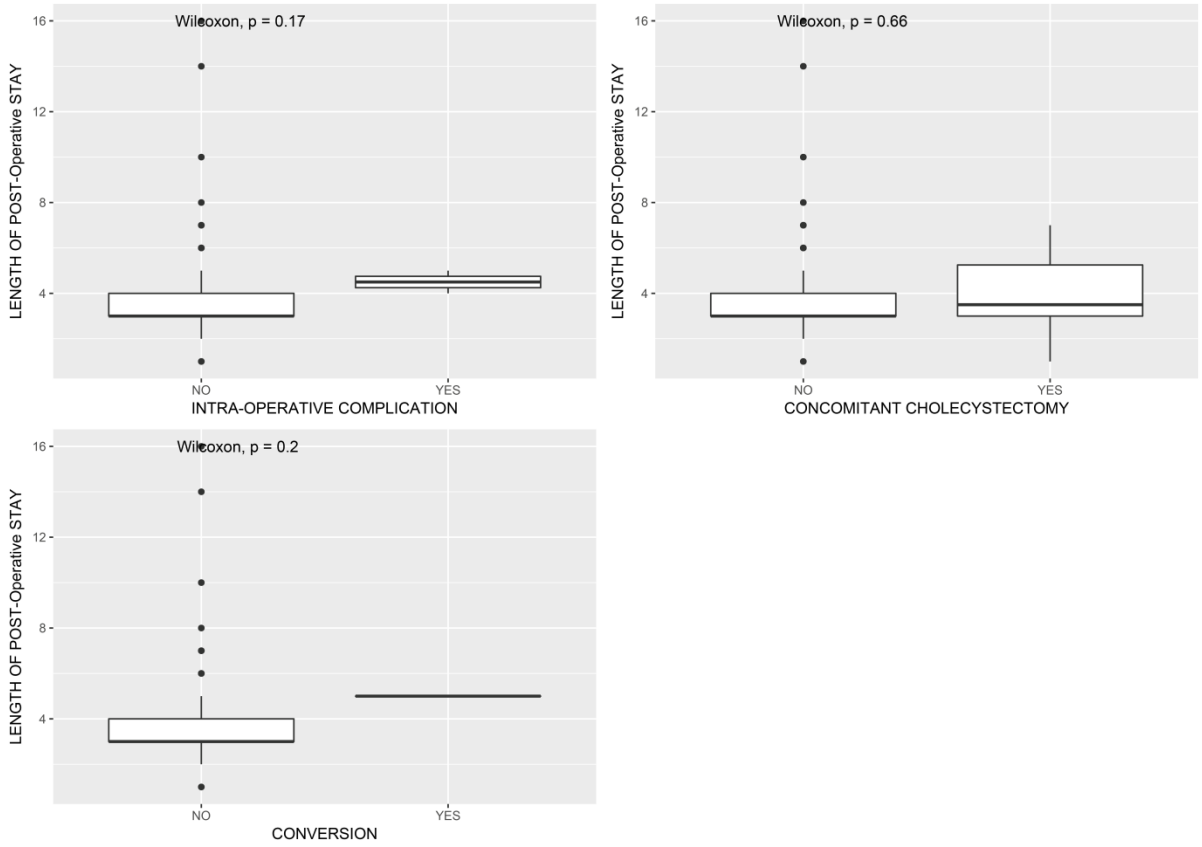

Figure 5. box plots showing the median and IQR of the duration of post-operative stay between those of have intraoperative events

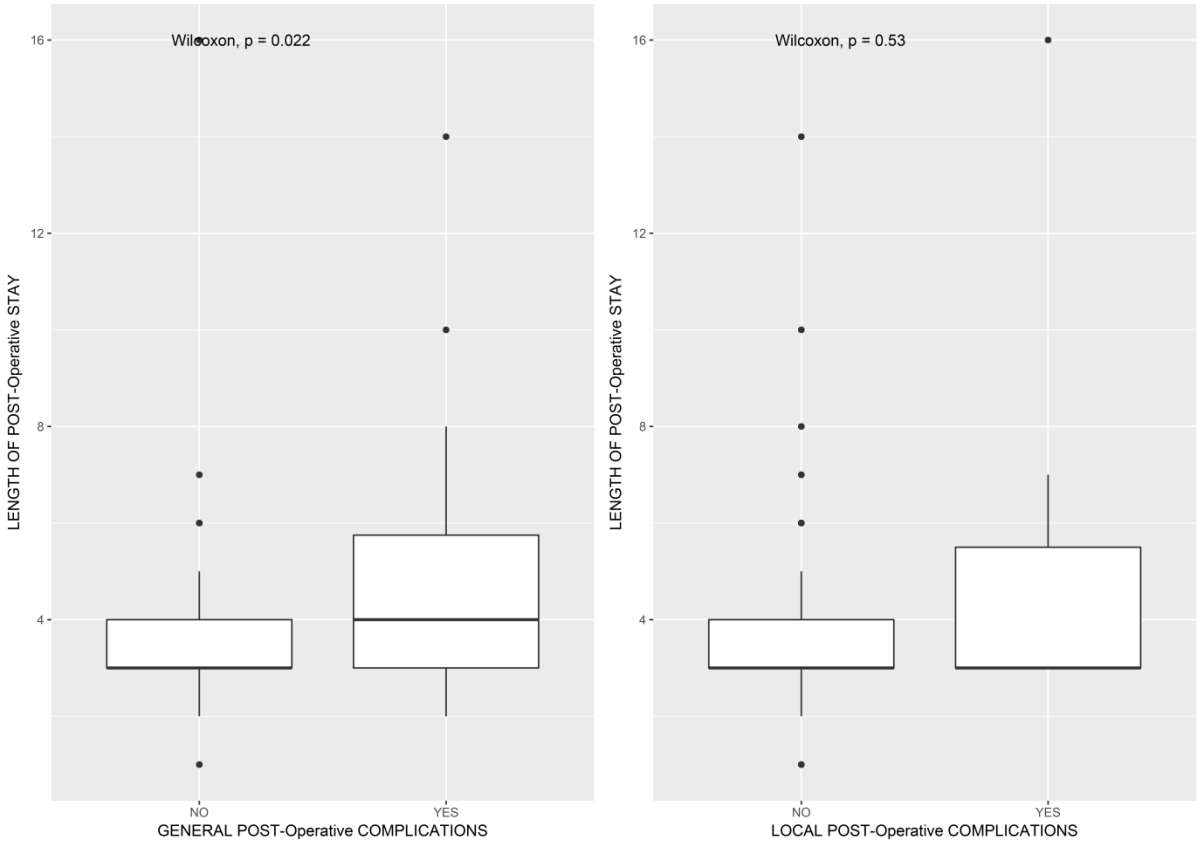

Figure 6. box plots showing the median and IQR of the duration of post-operative stay between those who have general or local post-operative complications

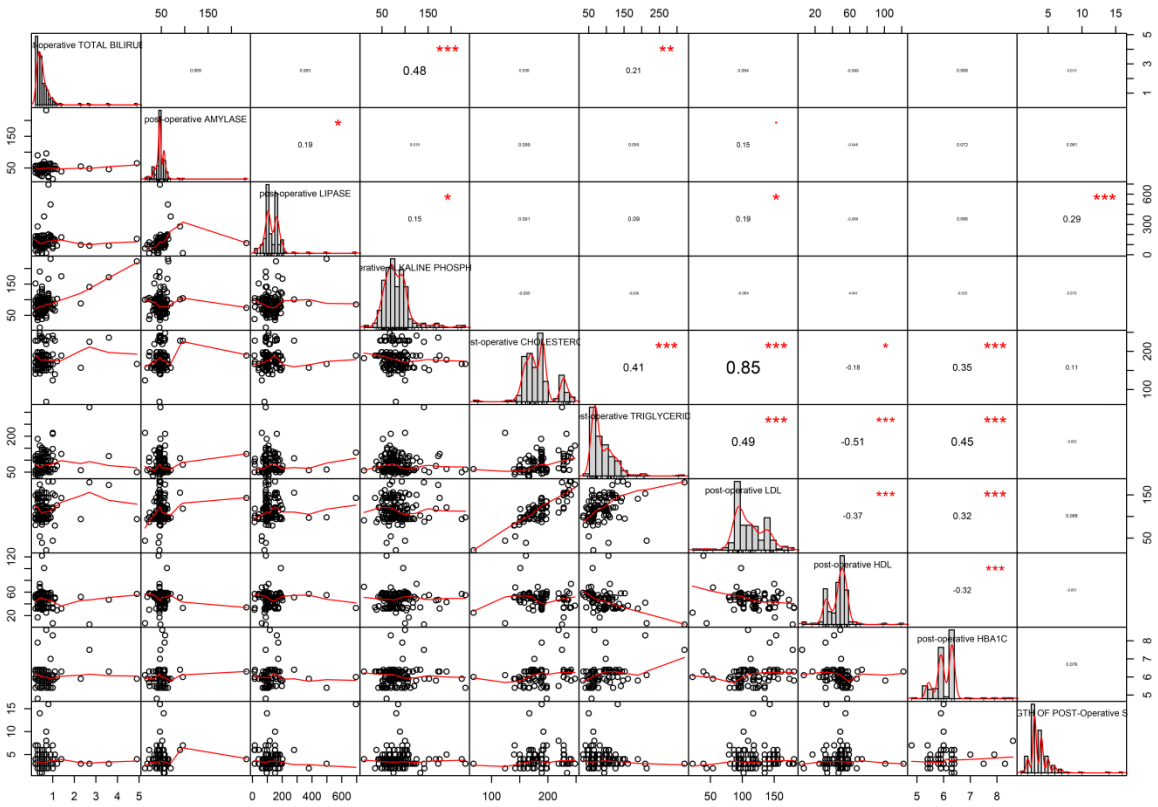

Figure 7. the scatter plot shows the correlation between the duration of post-operative stay an post-operative laboratory tests. The figure also shows the distribution of each variable. The regression line is considered horizontal

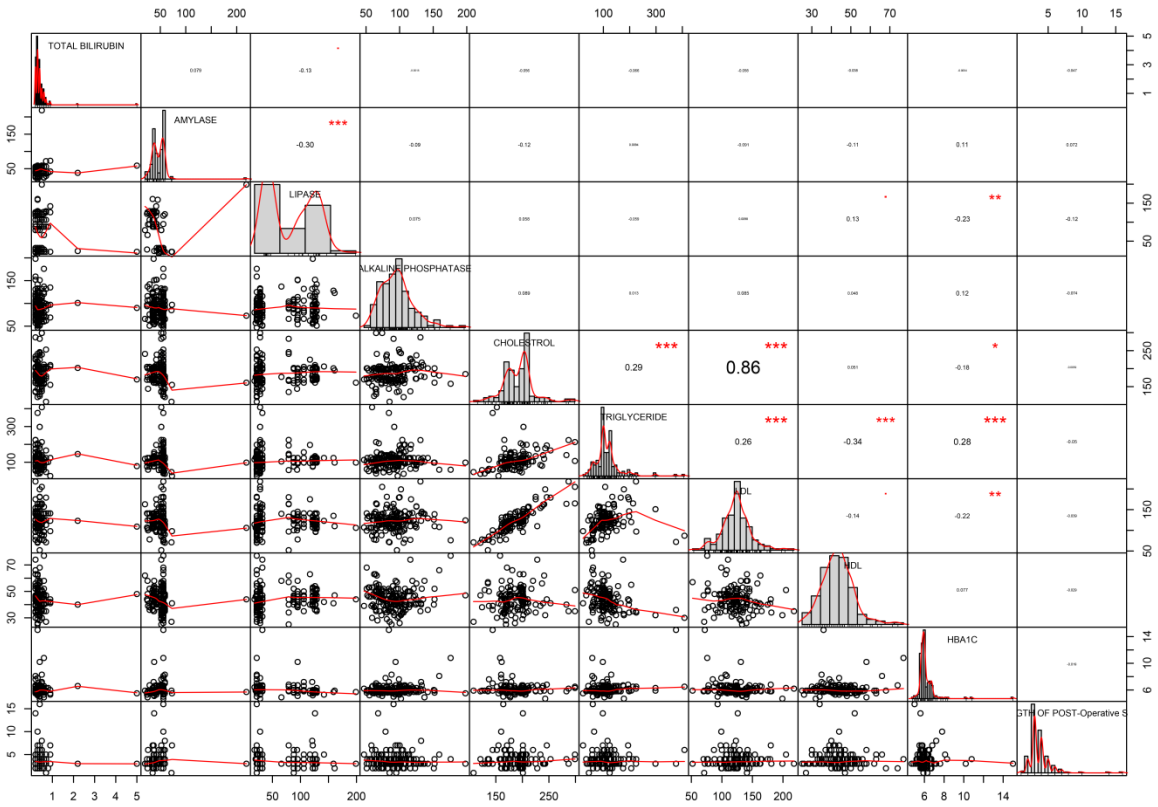

Figure 8. the scatter plot shows the correlation between the duration of post-operative stay, and pre-operative laboratory tests. The figure also shows the distribution of each variable. The regression line is considered horizontal