World Journal of Laparoscopic Surgery

An Official Publication of the World Association of Laparoscopic Surgeons, UK

WJOLS

Also available online at
www.jaypeejournals.com
www.wjols.com

Access Online Resources

For more details, visit
www.wjols.com

Bibliographic Listings:
ProQuest, Scopus, Journals Factor,
EBSCO,Genamics JournalSeek, Emcare, HINARI, Embase,
J Gate, Google Scholar, Ulrich, CiteFactor, SIS,
OAJI, MIAR, SIF, COSMOS, ESJI, SJIF, SJR, IIJIF, ICI

JAYPEE Jaypee Journals

Editorial

The arrival of robotic surgery technology at the turn of the millennium has ushered in a new era in minimal access surgery. The reason behind the use of robotic surgery lies in the inherent advantages over conventional laparoscopic surgery, which include superior ergonomics, remote sensing technology, enhanced magnification, three-dimensional vision, motion scaling, tremor filtering, enhanced dexterity, precision, and control of operating instruments. Nowadays, the rapid adaptation of the technology and technique, together with aggressive marketing by intuitive surgical, has captured the imagination of the doctors and patients alike.

If we think from the patients' perspective, this translates to smaller incisions, decreased blood loss, less pain, and quicker healing time and consequently reduction in hospital stay. Robotic surgery allows the surgeon with less previous laparoscopic training to provide the patients with the advantages of minimal access surgery. For the laparoscopically trained surgeon, it enables operating at a superior level with greater precision and accuracy. Among the surgical fraternity, urologists were one of the earliest to truly realize the immense potential of robotic surgery.

Robotic surgery has initiated a paradigm shift in the fundamental foundations of surgery. Robotic radical prostatectomy has now become a validated treatment option for localized prostate cancer. There are now more than 25 robots in India, and there has been an exponential rise in the utilization rates.

In the present Indian scenario, robotic technology has not entered the mainstream health care system; there is a lack of access to the technology and a deficit in educational opportunities. Young Indian surgeons and gynecologists wishing to specialize in robotic surgery need to go abroad to get trained in robotic surgery. We have started for the first time in Asia the Fellowship of International College of Robotic Surgeons. We are now regularly publishing robotic surgery articles in the World Journal of Laparoscopic Surgery. Robotic surgery in India is here to stay and it is up to us as minimally invasive surgeons across different specialties to lead the way and make maximum use of robotic surgery.

RK Mishra
Editor-in-Chief
World Journal of Laparoscopic Surgery
Chairman
World Laparoscopy Hospital
Gurgaon, Haryana, India

10.5005/jp-journals-10033-1301

RESEARCH ARTICLE

Short- and Long-term Effects of Laparoscopic Sleeve Gastrectomy on Body Weight and Glucose Homeostasis in Diabetic Patients

[1]Mohamed Abdelmohsen, [2]Hazem Badr

ABSTRACT

Introduction: Laparoscopic sleeve gastrectomy (LSG) is being performed more frequently and is currently very "trendy" among laparoscopic surgeons involved in bariatric surgery. Laparoscopic sleeve gastrectomy is associated with a marked reduction of ghrelin secretion, which is produced by the gastric fundus involved in mealtime hunger regulation, and it is also known to extend several diabetogenic effects.

Aim: The aim of this study is to assess the short- and long-term effects of LSG on body weight and glucose homeostasis in morbidly obese diabetic patients.

Materials and methods: This is a prospective study that was conducted on 40 diabetic patients randomly selected suffering from morbid obesity that had type II diabetes mellitus (T2DM). Patients were managed by LSG in AL-Zahraa Hospital, Faculty of Medicine for girls, Al-Azhar University, from January 2012 to December 2015, to assess the short- and long-term effects of the procedure on glucose homeostasis.

Results: The study was conducted on 40 patients of morbid obesity that had T2DM. The preoperative mean fasting blood glucose (FBG) level was 209.3 ± 36.6 (156–299) mg/dL and postoperatively was 172.5 ± 29 (130–250) mg/dL, 125.6 ± 16.7 (99–169) mg/dL, 111.7 ± 20.9 (77–167) mg/dL, 105 ± 18.3 (73–137) mg/dL, and 102.9 ± 21 (70–145) mg/dL at 1 day and 3, 6, 9, and 12 months respectively. Postoperatively, the FBG levels were improved with significant declining at 1 day ($p < 0.001$), 3 months ($p < 0.001$), and 6 months ($p < 0.004$) but nonsignificant declining at 9 months ($p < 0.25$) and 12 months ($p = 1$).

Conclusion: Laparoscopic sleeve gastrectomy is an effective surgical treatment for most severely or morbidly obese patients with DM. Weight loss is effective treatment for patients with these medical problems. The SG is associated with a high rate of resolution of T2DM at 12 months after surgery in severely obese patients with T2DM.

Keywords: Body mass index, Laparoscopic sleeve gastrectomy, Morbid obesity, Type II diabetes mellitus.

How to cite this article: Abdelmohsen M, Badr H. Short- and Long-term Effects of Laparoscopic Sleeve Gastrectomy on Body Weight and Glucose Homeostasis in Diabetic Patients. World J Lap Surg 2017;10(2):45-50.

[1]Assistant Lecturer, [2]Consultant

[1]Department of Surgery, Al-Sabah Hospital, Kuwait, Kingdom of Saudi Arabia

[2]Department of Surgery, Al-Azhar University, Cairo, Egypt

Corresponding Author: Mohamed Abdelmohsen, Assistant Lecturer, Department of Surgery, Al-Sabah Hospital, Kuwait Kingdom of Saudi Arabia, Phone: +0096560463440, e-mail: mohsenroom@yahoo.com

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Obesity is defined as body mass index (BMI) > 30 kg/m^2. Obesity is increasing in prevalence worldwide with economic costs. Obesity and its complications lead to other significant costs, such as missed days of work and a decrease in life expectancy.[1]

Body mass index is considered to represent the most practical measure of a person's adiposity. It is calculated by dividing the weight in kilograms by the height in meters squared (kg/m^2). Bariatric surgical procedures affect weight loss through two fundamental mechanisms: Malabsorption and restriction.[2] Selection and follow-up should be carried out by a team including surgeon, internist, dietitian, and psychiatrist.[3] Success includes weight loss of 25% or more, absence of major complications, and reversal of obesity-related diseases like type II diabetes mellitus (T2DM) and sleep apnea. Best results occur with gastric bypass and biliopancreatic diversion. Late weight regain was common with horizontal gastroplasty and is more common after vertical banded gastroplasty than gastric bypass.[4] Some surgeons advocate that a staged procedure is performed in which a sleeve gastrectomy (SG) is performed initially. Later, once some weight loss is achieved a completion gastrectomy is combined with a Roux reconstruction.[5] The laparoscopic sleeve gastrectomy (LSG) is being performed more frequently and is currently very "trendy" among laparoscopic surgeons involved in bariatric surgery. The LSG is not a new operation, as it is the restrictive part of a more complex malabsorptive bariatric procedure.[6]

Nutritional deficiencies can occur after gastric bypass. Deficiency of iron (6–52%), folate (22–63%), and vitamin B12 (3–37%) is common postoperatively and contributes to the development of anemia found in up to 54% of patients. Increased bone resorption after gastric bypass has also been demonstrated and patients should be counseled regarding this potential problem. Routine supplementation with iron, vitamin B12, folate, and calcium following gastric bypass will prevent the majority of these deficiencies. In SG, avoiding the intestinal bypass

almost eliminates the chance of anemia, osteoporosis protein deficiency, and vitamin deficiency.[7] The aim of this study is to assess the short- and long-term effects of LSG on body weight and glucose homeostasis in morbidly obese diabetic patients.

MATERIALS AND METHODS

This is a prospective study which was conducted on 40 diabetic patients randomly selected suffering from morbid obesity (BMI more than 35 kg/m^2). Patients were managed by LSG in Al-Zahraa Hospital, Faculty of Medicine for girls, Al-Azhar University, from January 2012 to December 2015, to assess the short- and long-term effects of the procedure on glucose homeostasis.

Operative Technique

All operative procedures were performed laparoscopically. The first step consists in opening the gastrocolic ligament attached to the stomach, usually starting 10 to 12 cm from the pylorus toward the lower pole of the spleen. Then the gastric greater curvature is freed up to the cardioesophageal junction close to stomach. Meticulous dissection is performed at the angle of His with full mobilization of the gastric fundus. The mobilization of the stomach continues dissecting the greater gastric curve toward the antrum up to 5 to 7 cm from the pylorus. At this time a 36-Fr orogastric tube is inserted direct toward the pylorus, proximal to the lesser curvature of the stomach. Then, the stomach is resected with linear staplers parallel to orogastric tube along the lesser curve starting 5 to 7 cm far from pylorus. The orogastric bougie is replaced by a nasogastric tube, i.e., positioned in the distal stomach to perform a methylene blue test. The transection line is inspected to search blue positively. In case of negative test, the resected stomach is removed by left midabdominal trocar usually without prolonging incision. The gastric residual volume ranged from 60 to 80 mL.

Statistical Analysis

Data were summarized using mean and standard deviation or median and percentile for quantitative variables and frequency and percentage for qualitative variables.

Relative % change was calculated to get the actual change in each time measure.

Relative % change = [(postmeasure – premeasure)/premeasure] × 100

Comparison between groups was done using independent sample t-test for quantitative variables.

Repeated measures analysis of variance test was conducted to compare different measures at different time situation with *post hoc* Bonferroni test for pairwise comparisons.

Pearson correlation coefficient (r) was calculated to test the association between quantitative variables; p-values ≤0.05 were considered significant.

RESULTS

The study was conducted on 40 patients of morbid obesity that had T2DM.

Patient age: The mean age of the studied group was 38.8 ± 7.0 years (25–50) as shown in Table 1.

From the table, 45% of patients' age ranged from 41 to 50, 40% ranged from 31 to 40, and 15% ranged 20 to 30.

Patient gender: 77.5% of patients were women and 22.5% were men as in Table 2.

Patient BMI: The BMI of patients were (35.0–39.9) 2.5%, (40.0–44.9) 22.5%, (45.0–49.9) 32.5%, (50.0–54.9) 40%, and (55.0–59.9) 2.5% as in Table 3.

Preoperatively, the mean fasting blood glucose (FBG) level was (209.3 ± 36.6) (156–299) mg/dL and postoperatively was (172.5 ± 29) (130–250) mg/dL, (125.6 ± 16.7) (99–169) mg/dL, (111.7 ± 20.9) (77–167) mg/dL, (105 ± 18.3) (73–137) mg/dL, and (102.9 ± 21) (70–145) mg/dL at 1 day and 3, 6, 9, and 12 months respectively as in Table 4.

The mean percentage of FBG changes postoperatively were (-16.8 ± 10.3)%, (-38.1 ± 14.1)%, (-45 ± 14.4)%, (–48.6 ± 12)%, and (-49.4 ± 13.8)% at 1 day and 3, 6, 9, and 12 months respectively, as in Table 5.

Postoperatively, the FBG levels were improved with significant declining at one day ($p < 0.001$), 3 months

Table 1: Age (range and mean) and age groups

	Range	*Mean ± SD*
Age (years)	25–50	38.8 ± 7.0
Males	31–50	42.7 ± 6.3
Females	25–49	37.6 ± 6.9
Age groups	n	%
20–30 years	6	15.0
31–40 years	16	40.0
41–50 years	18	45.0

SD: Standard deviation

Table 2: Sex distribution

	Description	
Sex	n	%
Male	9	22.5
Female	31	77.5

Table 3: The body mass index

BMI pre	*Frequency*	*Percentage*
35.0–39.9	1	2.5
40.0–44.9	9	22.5
45.0–49.9	13	32.5
50.0–54.9	16	40.0
55.0–59.9	1	2.5

Table 4: Pre- and postoperative mean FBG

					Percentile		
	Minimum	*Maximum*	*Mean*	*SD*	*25th*	*Median (50th)*	*75th*
FBG 1 day pre	156	299	209.3	36.6	185.3	200.5	229.3
FBG 1 day post	130	250	172.5	29	150.3	170	190
FBG 3 months	99	169	125.6	16.7	115.0	123.0	139.3
FBG 6 months	77	167	111.7	20.9	99.3	104.5	132.0
FBG 9 months	73	137	105.0	18.3	90.5	103.0	119.8
FBG 12 months	70	145	102.9	21.0	87.5	96.0	122.3

SD: Standard deviation

Table 5: Percentage changes of FBG

					Percentile		
	Minimum	*Maximum*	*Mean*	*SD*	*25th*	*Median (50th)*	*75th*
% FBG change 1	–43.5	–2.2	–16.8	10.3	–20.9	–16.4	–8.4
% FBG change 2	–61.5	7.6	–38.1	14.1	–49.1	–38.6	–31.4
% FBG change 3	–66.6	–0.6	–45.0	14.4	–56.8	–44.3	–39.0
% FBG change 4	–69.8	–12.7	–48.6	12.0	–56.3	–50.0	–42.1
% FBG change 5	–74.7	–8.9	–49.4	13.8	–58.7	–50.3	–42.8

SD: Standard deviation

($p < 0.001$) and 6 months ($p < 0.004$) but nonsignificant declining at 9 months ($p < 0.25$) and 12 months ($p = 1$) as in Table 6.

The mean postprandial blood glucose (PPBG) level was (280.7 ± 45.4) (216–406) mg/dL and postoperative values were (240.3 ± 30.9) (201–301) mg/dL, (172.7 ± 37.4) (106–270) mg/dL, (144.5 ± 30.7) (93–224) mg/dL, (133 ± 32) (92–214) mg/dL, and (128.5 ± 36.4) (91–231) mg/dL at 1 day and 3, 6, 9, and 12 months respectively, as in Table 7.

The postoperative levels of PPBG showed an improvement with a significant declining at 1 day ($p < 0.01$) and 3 ($p < 0.001$), 6 ($p < 0.001$), and 9 ($p = 0.02$) months but nonsignificant at 12 months ($p = 1.0$), as in Table 8.

Table 6: Improvement of FBG by time

FBG	*Mean ± SD*	*Step p-value*	*Global p-value*
1 day pre	209.3 ± 36.6		<0.001
1 day post	172.5 ± 29	<0.001	HS
3 months	125.6 ± 16.7	<0.001	
6 months	111.7 ± 20.9	0.004	
9 months	105.0 ± 18.3	0.25	
12 months	102.9 ± 21.0	1.0	

SD: Standard deviation; HS: Highly significant

Postoperative improvement of glycated hemoglobin levels was observed with a significant declining at 1 day ($p < 0.001$), 3 months ($p < 0.001$), 6 months ($p < 0.001$), 9 months ($p < 0.001$) and nonsignificant at 12 months ($p = 0.16$), as in Table 9.

Table 7: Mean postprandial blood glucose

					Percentile		
	Minimum	*Maximum*	*Mean*	*SD*	*25th*	*Median (50th)*	*75th*
PPBG 1 day pre	216	406	280.7	45.4	241	296.5	307
PPBG 1 day post	201	301	240.3	30.9	217.5	229	260
PPBG 3 months	106	270	172.7	37.4	144.5	170.0	198.3
PPBG 6 months	93	224	144.5	30.7	125.8	138.5	155.0
PPBG 9 months	92	214	133.0	32.0	111.3	128.5	139.3
PPBG 12 months	91	231	128.5	36.4	105.0	116.5	135.8

SD: Standard deviation

Table 8: Improvement of PPBG by time

PPBG	*Mean ± SD*	*Step p-value*	*p-value*
1 day pre	280.7 ± 45.4	–	<0.001
1 day post	240.3 ± 30.9	<0.001	HS
3 months	172.7 ± 37.4	<0.001	
6 months	144.5 ± 30.7	<0.001	
9 months	133.0 ± 32.0	0.02	
12 months	128.5 ± 36.4	1.0	

SD: Standard deviation; HS: Highly significant

Table 9: Improvement of HbA1C "H" by time

HbA1C "H"	*Mean ± SD*	*Step p-value*	*p-value*
1 day pre	10.3 ± 0.9	…	<0.001
1 day post	9.1 ± 0.9	<0.001	HS
3 months	7.0 ± 0.8	<0.001	
6 months	6.3 ± 0.7	<0.001	
9 months	6.0 ± 0.7	0.001	
12 months	5.8 ± 0.6	0.16	

SD: Standard deviation; HS: Highly significant; HbA1C: Glycated hemoglobin

Table 10: The BMI (minimum, maximum, mean ± SD, and percentile)

					Percentile		
	Minimum	*Maximum*	*Mean*	*SD*	*25*th	*Median (50th)*	*75*th
BMI 1 day pre	39.8	56.1	48.4	3.5	45.0	49.4	50.7
BMI 3 months	34	43.5	39.2	2.6	37.0	39.8	41.0
BMI 6 months	30.2	39.1	34.9	2.3	32.6	35.8	36.3
BMI 9 months	27	37.2	32.1	2.3	30.2	32.0	34.0
BMI 12 months	25	35.8	30.2	2.3	29.0	30.0	32.3

SD: Standard deviation

Table 11: Improvement of BMI by time

BMI	*Mean ± SD*	*Step p-value*	*p-value*
1 day pre	48.4 ± 3.5	…	<0.001
3 months	39.2 ± 2.6	<0.001	HS
6 months	34.9 ± 2.3	<0.001	
9 months	32.1 ± 2.3	<0.001	
12 months	30.2 ± 2.3	<0.001	

SD: Standard deviation; HS: Highly significant

Preoperatively, the mean BMI was (48.4 ± 3.5) (39.8–56.1) kg/m^2 and postoperative values were (39.2 ± 2.6) (34–43.5) kg/m^2, (34.9 ± 2.3) (30.2–39.1) kg/m^2, (32.1 ± 2.3) (27–37.2) kg/m^2, and (30.2 ± 2.3) (25–35.8) kg/m^2 at 3, 6, 9, and 12 months respectively, as in Table 10.

Postoperative improvement of BMI occurred with a significant declining (weight loss) at 3, 6, 9, and 12 months ($p < 0.001$) as in Table 11.

DISCUSSION

The risk of developing DM increases with the severity and duration of obesity and a central distribution of body fat.[8] Currently, bariatric surgery is the only interventional method proved to induce significant long-term weight reduction.[9] Studies have demonstrated that Roux-en-Y gastric bypass,[10] vertical banded gastroplasty,[11] and laparoscopic adjustable gastric banding[12] can result in significant clinical improvement in DM after weight loss. Other studies have compared the different types of bariatric surgery options and their efficiencies in the management of obesity-related T2DM.[13] Limited data are available evaluating the effect of SG on the control of DM. Some studies have even suggested that SG is as effective as gastric bypass in inducing remission of T2DM and the metabolic syndrome (MS).[14]

Recent studies have shown that LSG is associated with a marked reduction of ghrelin secretion, which is produced by the gastric fundus involved in meal time hunger regulation and it is also known to extend several diabetogenic effects (increase in growth hormone, cortisol, and epinephrine); therefore, its suppression could contribute to improved homeostasis.[15] The LSG is a safe procedure in terms of nutritional status at odds with malabsorptive or mixed surgical procedures, which often lead to multiple nutritional consequences due to the bypass of duodenum and Jejunum.[16]

Several studies done on effect of LSG on amelioration of T2DM, in 2011, Nosso et al[17] with 25 obese T2DM patients with a mean age (45 ± 9 years) and in 2010, Rizzello et al[18] with 17 obese T2DM patients with a mean age 51.1 ± 8.6 years (38–64) were submitted to LSG. While in our study the number of subjects was 40, patients with a mean age of 38.8 ± 7 years (25–50) were submitted to LSG.

In 2009, Rosenthal et al[2] had 30 obese patients, 21 (70%) were women and 9 (30%) were men, and in Nosso et al[17] had 25 (obese T2DM) patients, of which 15 (60%) were women and 10 (40%) were men and all were submitted to LSG. While in our study the number of patients were 40, 31 (77.5%) were women and 9 (22.5%) were men and were submitted to LSG. In 2008, Vidal et al[14] had 39 (obese T2DM) patients with a mean BMI (51.9 ± 1.2) submitted to LSG and had 52 (obese T2DM) patients with a mean BMI (47.7 ± 0.7) submitted to GBP. At 12 months after surgery the % estimated weight loss (EWL) was (63 ± 2.89%) (66.06 ± 2.34%); p = 0.413 respectively, and in 2011, Nosso et al[17] had 25 (obese T2DM) subjects with a mean BMI was (48.8 kg/m^2) and were submitted to LSG. The mean BMI decreased to (39 ± 8 kg/m^2) ($p < 0.001$) and (34 ± 6 kg/m^2) ($p < 0.001$) at 3 months and (9–15) months after surgery respectively. While in a comparison with our study, the mean of the BMI was (48.4 ± 3.5 kg/m^2) at the baseline and decreased to (39.2 ± 2.6 kg/m^2) at 3 months and (30.2 ± 2.3 kg/m^2) at 12 months postoperatively ($p < 0.001$), and the % EWL was (36.5 + 3.1%) and (65.6 ± 3.1%) respectively. Serum insulin levels showed a sharp and significant reduction at postoperative 1 day (13.5 ± 2.2 uU/mL) ($p < 0.001$) and at 3 months (4.4 ± 1.8 uU/mL) ($p < 0.001$), but a nonsignificant changes occurred at 6 months (5.3 ± 1.5 uU/mL) (p = 0.51), 9 months (5.2 ± 1.3 uU/mL) (p = 1), and 12 months (4.8 ± 1 uU/mL) (p = 0.85). The improvement in insulin sensitivity is primarily due to weight loss, reduction in inflammatory mediators, and decreased calorie intake, although the contribution of weight independent mechanisms seems very likely, rapid improvement of glucose hemostasis before substantial weight loss has occurred.[19] Our study showed that the PPBG levels had a significant declining at 1 day

postoperative (240.3 ± 30.9) mg/dL ($p < 0.001$) compared with the baseline (280.7 ± 45.4) mg/dL independent from the weight loss. At 3, 6, 9 months after surgery, a significant declining in PPBG, $p < 0.001$, occurred but it was associated with significant reduction of BMI. After 12 months, a significant reduction of BMI occurred ($p < 0.001$) with nonsignificant decline in the PPBG level. (By researching we did not find a published data about PPBG levels after SG for comparing with our results.)

CONCLUSION

Surgical procedure of LSG resulted in marked weight loss, BMI, improved glucose homeostasis, and remission of T2DM. Our study has found that LSG is an effective surgical treatment for most severely or morbidly obese patients with DM. Weight loss is an effective treatment for patients with these medical problems. Our results open the gate for MS in patients with normal BMI to control MS different components, such as cardiac events, polycystic ovary syndrome. The SG is associated with a high rate of resolution of T2DM at 12 months after surgery in severely obese patients with T2DM. The rate of T2DM resolution in patients undergoing SG in our study is similar to that reported in previous case series following this surgical technique.

SUMMARY

Bariatric surgery is known to be a highly effective and long-lasting treatment for morbid obesity and many related conditions, including T2DM and MS.

Laparoscopic sleeve gastrectomy is emerging as a new promising therapy for the treatment of morbid obesity. This procedure, originally conceived as a first stage for achieving weight loss in superobese patients before performing GBP or BPD, has revealed to be effective on its own and a potential competitor with these operations. Laparoscopic sleeve gastrectomy is a feasible and safe bariatric surgery procedure for morbid obesity, although evaluation of long-term outcome will be necessary to determine whether it yields durable results. Few studies have examined the effects of LSG on glucose control and comorbidities in obese T2DM patients, and limited information is available on the long-term efficacy of this procedure. Our study showed that the LSG is effective to achieve weight loss and resolve T2DM, and the resolution T2DM in this study was better in comparison with the results of other studies, so this study evaluated the short and long-term effects (1 day, 3, 6, 9, and 12 months) of LSG on body weight and glucose homeostasis in morbid obese T2DM subjects not adequately controlled with medical therapy.

REFERENCES

1. Singh RB, Pella D, Mechirova V, Kartikey K, Demeester F, Tomar RS, Beegom R, Mehta AS, Gupta SB, De Amit K, et al. Prevalence of obesity, physical inactivity and undernutrition, a triple burden of diseases during transition in a developing economy. The Five City Study Group. Acta Cardiol 2007 Apr;62(2):119-127.
2. Rosenthal R, Li X, Samuel S, Martinez P, Zheng C. Effect of sleeve gastrectomy on patients with diabetes mellitus. Surg Obes Relat Dis 2009 Jul-Aug;5(4):429-434.
3. Sugerman HJ, Starkey JV, Birkenhauer. A randomized prospective trial of gastric bypass versus vertical banded gastroplasty for morbid obesity and their effects on sweets versus non-sweets eaters. Ann Surg 1987 Jun;205(6):613-624.
4. Korkeila M, Kaprio J, Rissanen A, Koskenvuo M. Consistency and change of body mass index and weight. A study on 5967 adult Finnish twin pairs. Int J Obes Relat Metab Disord 1995 May;19(5):310-317.
5. Lagacé M, Marceau P, Marceau S, Hould FS, Potvin M, Bourque RA, Biron S. Biliopancreatic diversion with a new type of gastrectomy: some previous conclusions revisited. Obes Surg 1995 Nov;5(4):411-418.
6. Ren CJ, Patterson E, Gagner M. Early results of laparoscopic biliopancreatic diversion with duodenal switch: a case series of 40 consecutive patients. Obes Surg 2000 Dec;10(6):514-523.
7. Payne JH, DeWind L, Schwab CE, Kern WH. Surgical treatment of morbid obesity. Sixteen years of experience. Arch Surg 1973 Apr;106(4):432-437.
8. Türkoglu C, Duman BS, Günay D, Cagatay P, Ozcan R, Büyükdevrim AS. Effect of abdominal obesity on insulin resistance and the components of the metabolic syndrome: evidence supporting obesity as the central feature. Obes Surg 2003 Oct;13(5):699-705.
9. Steinbrook R. Surgery for severe obesity. N Engl J Med 2004 Mar;350(11):1075-1079.
10. Schauer PR, Burguera B, Ikramuddin S, Cottam D, Gourash W, Hamad G, Eid GM, Mattar S, Ramanathan R, Barinas-Mitchel E, et al. Effect of laparoscopic Roux-en Y gastric bypass on type 2 diabetes mellitus. Ann Surg 2003 Oct;238(4):467-484.
11. Pasquali R, Vicennati V, Scopinaro N, Marinari G, Simonelli A, Flamia R, Casimirri F, Gagliardi L. Achievement of near-normal body weight as the prerequisite to normalize sex hormone-binding globulin concentrations in massively obese men. Int J Obes Relat Metab Disord 1997 Jan;21(1):1-5.
12. Dixon JB, O'Brien PE, Playfair J, Chapman L, Schachter LM, Skinner S, Proietto J, Bailey M, Anderson M. Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomized controlled trial. JAMA 2008 Jan;299(3):316-323.
13. Gan SS, Talbot ML, Jorgensen JO. Efficacy of surgery in the management of obesity-related type 2 diabetes mellitus. ANZ J Surg 2007 Nov;77(11):958-962.
14. Vidal J, Ibarzabal A, Romero F, Delgado S, Momblán D, Flores L, Lacy A. Type 2 diabetes mellitus and the metabolic syndrome following sleeve gastrectomy in severely obese subjects. Obes Surg 2008 Sep;18(9):1077-1082.
15. Peterli R, Wölnerhanssen B, Peters T, Devaux N, Kern B, Christoffel-Courtin C, Drewe J, von Flüe M, Beglinger C. Improvement in glucose metabolism after bariatric surgery: comparison of laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy: a prospective randomized trial. Ann Surg 2009 Aug;250(2):234-241.

16. Koch TR, Finelli FC. Postoperative metabolic and nutritional complications of bariatric surgery. Gastroenterol Clin North Am 2010 Mar;39(1):109-124.
17. Nosso G, Angrisani L, Saldalamacchia G, Cutolo PP, Cotugno M, Lupoli R, Vitolo G, Capaldo B. Impact of sleeve gastrectomy on weight loss, Glucose homeostasis, and comorbidities in severely obese type 2 diabetic subjects. J Obes 2011;2011:340867.
18. Rizzello M, Abbatini F, Casella G, Alessandri G, Fantini A, Leonetti F, Basso N. Early postoperative insulin-resistance changes after sleeve gastrectomy. Obes Surg 2010 Jan;20(1): 50-55.
19. Beckman LM, Beckman TR, Earthman CP. Changes in gastrointestinal hormones and leptin after Roux-en-Y gastric bypass procedure: a review. J Am Diet Assoc 2010 Apr;110(4): 571-584.

10.5005/jp-journals-10033-1302

RESEARCH ARTICLE

Can Laparoscopic Chromopertubation with Methylene Blue Dye cause Anaphylactic Reactions like Pulmonary Edema?

[1]Rebecca Bagadia, [2]Vishwa Kanabar

ABSTRACT

Diagnostic laparoscopy has been performed ever since interests in infertility and fertility have developed. Methylene blue is administered to check tubal patency during the procedure. Extravasation of methylene blue is a recognized complication of diagnostic laparoscopy and chromopertubation. Anaphylaxis and anaphylactic reactions in the perioperative period are a significant concern for surgeons and anesthesiologists. The incidence is as high as 1 in 3,500 with a mortality rate of 3 to 6%.[16] There are no relevant literature or research article that provides sufficient data or guidelines for determining the nature of these reactions, mode of treatment algorithm, or the certain specifications we should consider before performing the procedure. This is a review literature for performing a safe practice evaluation and management.

Keywords: Allergy hypersensitivity, Anaphylaxis, Chromopertubation, Methylene blue, Perioperative, Pulmonary edema.

How to cite this article: Bagadia R, Kanabar V. Can Laparoscopic Chromopertubation with Methylene Blue Dye cause Anaphylactic Reactions like Pulmonary Edema? World J Lap Surg 2017;10(2):51-53.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Anaphy-laxis and anaphylactic reactions in the perioperative period are a significant concern for surgeons and anesthesiologists.

The incidence is as high as 1 in 3,500 with a mortality rate of 3 to 6%.[1]

Methylene blue is a new tool to evaluate *in vivo* tubal damage, and is a simple method of estimating salpingeal function.[2] Methylene blue is a common dye used in diagnostic procedures for checking the patency of the fallopian tubes.[3] This compound has a unique property of oxidation–reduction function and tissue staining. It has an opposite effect on hemoglobin depending upon its concentration. In higher levels, methylene blue converts the ferrous iron of reduced hemoglobin to the ferric form and produces methemoglobin. Lower levels help in converting methemoglobin to hemoglobin in drug-induced methemoglobinemia. Evaluation of tubal factor infertility is moving from mere anatomical assessment to morphological and functional enquiry of the patency of the tubes.[4] These days laparoscopy is being increasingly used in the evaluation of infertility, especially laparoscopic chromopertubation with methylene blue, which has become the gold standard for the functional assessment of the tubes.

Life-threatening anaphylactic or anaphylactoid reactions to methylene blue have been reported in the literature;[5,6] recently, methylene blue has been used for various conditions like sentinel node biopsy, but due to the rare reporting of its reactions, it was considered safest among dyes.

[1]Consultant, [2]Assistant Professor

[1]Department of Obstetrics and Gynecology, Divine Life Hospital Kutch, Gujarat, India

[2]Department of Obstetrics and Gynecology, Government Medical College, Bhavnagar, Gujarat, India

Corresponding Author: Rebecca Bagadia, Consultant Department of Obstetrics and Gynecology, Divine Life Hospital Kutch, Gujarat, India, Phone: +918147723187, e-mail: bagadiap@yahoo.com

AIMS AND OBJECTIVE

The aim of the study is to make the surgeons know the complications of methylene blue toxicity during the most common procedure of laproscopic chromopertubation, which most of us are unaware, and how to be careful and vigilant during the entire procedure.

MATERIALS AND METHODS

Literature review is performed using search terms that included methylene blue, chromopertubation pulmonary edema, anaphylaxis perioperative, and hypersensitivity.

Results were taken from recent case reports, basic science literature, and clinical studies.

Searches in the literature on methylene blue toxicity during laproscopy chromopertubation were conducted via pubmed, google scholer, medline and chochrene liberary database. No language restriction was applied to searches.

RESULTS

Although there have been slight variations in the incidences, management, evaluation, and their reporting, the authors do believe in the great saying "prevention is better than cure."

Preoperative patient analyses are ruling out glucose-6-phosphate dehydrogenase (G6PD) deficiency, history of allergy to drugs and dyes, and history of chronic pelvic infection. Drug analysis like the right amount of dilution; the right amount to be installed; identification of signs and symptoms on table or during perioperative period; the immediate treatment management protocol like epinephrine, steroids, histamine 1 and 2 blocking agents, and oxygen administration; postoperative cutaneous test; and systematic allergiological investigation of all the drugs and substances given during the perioperative period is important.

DISCUSSION

Normally, methemoglobin levels are <1% when measured by co-oximetry test.[7] Cyanosis is the classic symptom of methemoglobinemia; this occurs when methemoglobin >1%. Other signs and symptoms include mental status changes, shortness of breath, headache, fatigue, dizziness, and loss of consciousness. Severe methemoglobinemia is when methemoglobin >50% where patients have dysrhythmias, seizures, coma, and death.[3] In patients with conditions like anemia, heart and lung disease, G6PD deficiency, and sepsis, methylene blue can induce methemoglobinemia even at normal levels.[8]

Veerendrakumar et al[9] had injected 20 to 30 mL of 1% methylene blue, and 5 hours later, the patient developed tachypnea, hypotension, bilateral basal crepitations, and bluish-colored urine; patient was transferred to the intensive care unit and treated with oxygen, inotropes, and furosemide. According to the studies, one should always keep in mind the dangerous effect of methylene blue, alternatively diluted povidone iodine can be used. This patient had developed methemoglobinemia 26.4% (according to spectrometric analysis). In Trikha et al's[3] case, the patient weighed 53 kg; 20 mL of 1% methylene blue was injected. After 2 minutes, the oxygen saturation declined, and after 5 minutes patient developed crepitations and cyanosis; at 200 mL of fluid patient developed very rare features. The safe limit of the dye is 7 mg/kg. Anaphylactoid reaction occurred due to the dye causing intrapulmonary vascular vasospasm; a generalized vasoconstriction and some amount of anemic hypoxia could have caused this. According to Nolan[10] when the patient was injected with methylene blue dye intracervically, she developed inflammatory peritonitis after approximately 24 hours, where she complained of abdominal distention and pain; exploratory laparotomy was done revealing peritoneal ascites and sterile inflammatory exudates. This pt was treated with corticosteroids. According to Mhaskar and Mhaskar,[11] methylene blue is a treatment for methemoglobinemia, but his patient had tuberculosis, i.e., chronic pelvic inflammatory disease, which could be the cause of extravasation of dye causing methemoglobinemia. Bilgin et al[8] also presented a case of methemoglobinemia after methylene blue instillation, but his patient had G6PD deficiency. Herath et al[12] stated that bluish discoloration can occur without methemoglobinemia as their patient developed bluish discoloration and cyanosis immediately after injection of 20 mL of the dye intracervically for diagnostic laparoscopy; this could be an anaphylactic reaction to the dye or they might have used a concentrated version instead of 1%.

Ash-Bernal et al[7] did a retrospective study on 138 cases where they discussed about the acquired cause of methemoglobinemia. The most common drug causing it is dapsone.

Robert and Barbieri[13] recommend using 10 mg of methylene blue in 150 mL of NS to reduce the symptoms of anaphylaxis.

Dewachter et al[14] observed severe immunoglobulin E-mediated hypersensitivity reaction to 1% methylene blue; cutaneous test and biological assessment positivity confirmed anaphylactic reaction to methylene blue, so investigation is necessary. In Millo et al's[15] case after diagnostic laparoscopy for infertility, patient was shifted to the recovery room; about 15 minutes later, she developed restlessness, cyanosis, and was not maintaining oxygen saturation. Despite efforts of resuscitation, she died. On postmortem findings, the lungs were edematous, congested, blue stained, with features of pulmonary edema. Dhanpal and Joseph[16] injected 30 mL of 1% of methylene blue intracervically; 15 minutes later, patient turned blue with central and peripheral cyanosis. Oxygen saturation dropped spontaneously, and spectrophotometric analysis showed methemoglobinemia. Rzymski et al[5] discussed a case of anaphylactic reaction to methylene blue after chromopertubation.

CONCLUSION

It is important to publish clinical research article on the dangerous adverse outcome from techniques commonly used in clinical practice. All these cases highlighted the fact that methylene is highly potential in causing complications that are life-threatening even when not administered nonsystematically. This research article confirms that we need continuous and vigilant monitoring in the preoperative, intraoperative, and postoperative period; none of the complaints should be taken for granted even if it is as simple as a cough. Anesthetists and surgeons should know the immediate treatment protocol and should not be careless in using methylene blue dye in any amount or in any concentration.

ACKNOWLEDGMENT

Author would like to thank her husband Dr Pravin Bagadia for supporting her in doing this research article.

REFERENCES

1. Giladi AM, Kasten SJ. Anaphylactic like reaction to methylene blue: case report and review of perioperative hypersensitivity reaction. Plast Reconstr Surg 2012 Jul;130(1):98e-105e.
2. Marconi G, Quintana R. Methylene blue dyeing of cellular nuclei during salpingoscopy, a new in-vivo method to evaluate vitality of tubal epithelium. Hum Reprod 1998 Dec;13(2):3414-3417.
3. Trikha A, Mohan V, Kashyap L, Saxena A. Pulmonary oedema following intrauterine methylene blue injection. Acta Anaesthesiol Scand 1996 Mar;40(3):382-384.
4. Papaioannou S, Afnan M, Jafettas J. Tubal assessment tests: still have not found what we are looking for. Reprod Biomed Online 2007 Oct;15(4):376-382.
5. Rzymski P, Wozniak J, Opala T, Wilczak M, Sajdak S. Anaphylactic reaction to methylene blue dye after laparoscopic chromopertubation. Int J Gynaecol Obstet 2003 Apr;81(1): 71-72.
6. Asha R, Tamkin R, Sabahat R, Omar ZAS. Dyed but not dead: methemoglobinemia following chromopertubation with methylene blue. South Asian Feder Obstet Gynecol 2010;2(1):69-70.
7. Ash-Bernal R, Wise R, Wright SM. Acquired methemoglobinemia: a retrospective series of 138 cases at 2 teaching hospitals. Medicine (Baltimore) 2004 Sep;83(5):265-273.
8. Bilgin H, Ozcan B, Bilgin T. Methemoglobinemia induced by methylene blue pertubation during laparoscopy. Acta Anaesthesiol Scand 1998 May;42(5):594-595.
9. Veerendrakumar CM, Joshi Suyajna D, Madhu YR. A rare case of delayed pulmonary oedema due to methemoglobinemia following laparoscopic chromopertubation with methylene blue. J Clin Diagn Res 2014 Jun;8(6):5-6.
10. Nolan DG. Inflammatory peritonitis with ascites after methylene blue dye chromopertubation during diagnostic laparoscopy. J Am Assoc Gynecol Laparosc 1995 Aug;2(4):483-485.
11. Mhaskar R, Mhaskar AM. Methemoglobinemia following chromopertubation in treated pelvic tuberculosis. Int J Gynaecol Obstet 2002;77(1):41-42.
12. Herath RP, Warnakulasuriya T, Silva AD, Wijesinghe PS. Methylene blue induced bluish discolouration mimicking cyanosis at diagnostic laparoscopy. J Womens Health, Issues Care 2014;3(5):2.
13. Robert L, Barbieri MD. Farewell to indigo carmine. OBG Manag 2014 Sep;26(9):8-9.
14. Dewachter P, Mouton-Faivre C, Trechot P, Lieu JC, Mertes PM. Severe anaphylactic shock with methylene blue instillation. Anesth Analg 2005 Jul;101(1):149-150.
15. Millo T, Mishra R, Giridhar S, Rajutji R, Lalwani S, Dogra TD. Fatal pulmonary oedema following laparoscopic chromopertubation. Natl J India 2006 Mar-Apr;19(2):78-79.
16. Dhanpal R, Joseph D. The blue lady – a case report. J Anaesth 2006;50(6):481-482.

10.5005/jp-journals-10033-1303

REVIEW ARTICLE

LINX Magnetic Esophageal Sphincter Augmentation *vs* Laparoscopic Nissen Fundoplication for Gastroesophageal Reflux Disease

Bipin T Prasad

ABSTRACT

The LINX magnetic sphincter augmentation system is a surgical technique with short-term evidence demonstrating the efficacy in the treatment of medically refractory or chronic gastroesophageal reflux disease (GERD). Currently, the Nissen fundoplication is the gold standard surgical treatment for GERD.

Keywords: Gastroesophageal reflux disease, Magnetic sphincter augmentation, Nissen fundoplication.

How to cite this article: Prasad BT. LINX Magnetic Esophageal Sphincter Augmentation *vs* Laparoscopic Nissen Fundoplication for Gastroesophageal Reflux Disease. World J Lap Surg 2017;10(2):54-56.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Gastroesophageal reflux disease (GERD) affects approximately 25% of the population and its prevalence is increasing.[1] First-line treatment of GERD consists of lifestyle modification and medical therapy with proton pump inhibitors (PPIs). Although PPIs are efficacious in the majority of GERD patients, nearly 30% of the individuals on optimized PPI therapy have persistence of symptoms.[2-4] The main reason for PPI resistance is due to nonacid reflux of gastric contents through an incompetent lower esophageal sphincter (LES).[5] Other causes for PPI resistance or failure can be due to esophageal dysmotility disorder, paraesophageal hernia, and erosive esophagitis.[6,7]

Laparoscopic Nissen fundoplication (LNF) is the gold standard treatment for medically refractory GERD. Although the LNF provides excellent resolution of GERD, the extensive operative procedural manipulation may result in significant postoperative morbidities, which are dysphagia and bloating mainly.[8]

The LINX magnetic sphincter augmentation (MSA) is a device in the form of a ring of magnetic beads, laparoscopically placed at the distal esophagus to increase the LES tone.

This document reviews the advanced treatment of GERD, applicable to laparoscopic surgery and also a comparison study between MSA and LNF.

AIM

The aim of this study was to compare the effectiveness of the two surgical modalities, namely MSA and LNF, on a larger scale.

MATERIALS AND METHODS

The inclusion criteria are: (1) Studies that included one or more primary outcome of interest, (2) a direct comparison study between MSA and LNF.

Outcomes of Interest

- Ability to belch
- Ability to emesis
- Operative time
- Discontinuation of PPI
- Endoscopic dilation
- Dysphagia and bloating features.

Morbidities associated with both the surgical modalities are also taken into account.

Statistical Analysis

With regard to the above-mentioned outcomes of interest, MSA and LNF were compared.

DISCUSSION

It was found that MSA has similar efficacy to LNF, which is the gold standard treatment. In preserving the ability to emesis and belch and also less features of dysphagia and bloating (clinical basis), MSA holds a significant advantage over LNF.

Magnetic sphincter augmentation functions as a purely mechanical treatment for GERD, as it prevents

Assistant Professor

Department of General Surgery, Dr. Somervell Memorial CSI Medical College & Hospital, Thiruvananthapuram, Kerala, India

Corresponding Author: Bipin T Prasad, Assistant Professor Department of General Surgery, Dr. Somervell Memorial CSI Medical College & Hospital, Thiruvananthapuram, Kerala, India Phone: +919895901732, e-mail: bipin.thomas@rocketmail.com

the reflux of gastric contents into the esophagus while maintaining a physiological LES tone, allowing the passage of the food bolus.[9] Magnetic sphincter augmentation serves the surgeon and the patient with a faster, simpler, and less invasive tool to effectively treat GERD. On comparison, the LNF is a difficult procedure with the outcomes based on the skill and experience of the surgeon.[9] It eliminates the need for extensive dissection of esophagus and mobilization of gastric fundus, which is the hallmark of the LNF procedure. The long-term complications of MSA reversibility are still unclear, as in cases where the device may be removed using the minimally invasive technique.[10] The device is currently compatible with 1.5 Tesla magnetic resonance imaging.

Magnetic sphincter augmentation is not indicated in patients with large paraesophageal hernias, esophageal dysmotility, and hence considered less versatile than LNF. The notable drawback associated with MSA is dysphagia reported as more severe and lasts longer than LNF-associated dysphagia. However, a graduated modified diet and endoscopic balloon dilation have alleviated the dysphagia features in patients.

LIMITATION

This study was basically done with case series and there were no randomized controlled trials. Moreover, there were only a few studies comparing MSA and LNF with regard to the outcome on long-term basis.

RESULTS

There were two retrospective case–control studies[11,12] and a prospective control study[13] taken into consideration for the review. A total of 688 patients were identified, and 273 patients had undergone LNF; 415 patients went for LINX MSA. The mean duration of follow-up was almost the same term ranging from 8 to 18 months for both MSA and LNF groups.

Males accounted for 46% of LNF and 57% of MSA. Mean age was 50 and 58 years for LNF and MSA respectively. Both groups had similar duration of reflux disease. Hiatal hernia was present in 70% of the LNF group of patients and in 68% of MSA group.

Magnetic sphincter augmentation was superior to LNF in preserving the patient's ability to belch and to emesis, but there was no significant difference between MSA and LNF with regard to the postoperative problems, such as bloating, dysphagia, and also in discontinuing PPI drug therapy.

Six patients of the MSA group were in need of endoscopic balloon dilation, whereas LNF group required none. Major morbidity of LNF included intraoperative pleural injury,[13] formation of retropharyngeal abscesses,[12] and four cases were subjected to a revision surgery due to hiatal hernia recurrence.[12,13] The MSA group morbidity included one pleural injury, two incidences of intraoperative bleeding, one pneumothorax,[13] and one gastroesophageal obstruction.[12] Two patients had their device removed, one had treatment failure, and the other patient had dysphagia secondary to device erosion 18 months after the surgery. No mortalities were reported.

CONCLUSION

Magnetic sphincter augmentation appears to be an effective treatment for GERD, with short-term outcomes comparable to the more technically challenging and time-consuming LNF. It has a favorable side-effect profile for the majority of the morbidities associated with GERD surgery. In order to further understand the efficacy of MSA, a long-term comparative outcome data past 1 year are needed.

REFERENCES

1. El-Serag HB, Sweet S, Winchester CC, Dent J. Update on the epidemiology of gastro-oesophageal reflux disease: a systematic review. Gut 2014 Jun;63(6):871-880.
2. Toghanian S, Johnson DA, Stålhammar NO, Zerbib F. Burden of gastro-oesophageal reflux disease in patients with persistent and intense symptoms despite proton pump inhibitor therapy. Clin Drug Investig 2011 Oct;31(10):703-715.
3. Castell DO, Kahrilas PJ, Richter JE, Vakil NB, Johnson DA, Zuckerman S, Skammer W, Levine JG. Esomeprazole (40 mg) compared with lansoprazole (30 mg) in the treatment of erosive esophagitis. Am J Gastroenterol 2002 Mar;97(3): 575-583.
4. Labenz J, Malfertheiner P. Treatment of uncomplicated reflux disease. World J Gastroenterol 2005 Jul;11(28):4291-4299.
5. Kinoshita Y, Ishihara S. Causes of, and therapeutic approaches for, proton pump inhibitor-resistant gastroesophageal reflux disease in Asia. Ther Adv Gastroenterol 2008 Nov;1(3): 191-199.
6. Kawamura O, Hosaka H, Shimoyama Y, Kawada A, Kuribayashi S, Kusano M, Yamada M. Evaluation of proton pump inhibitor-resistant nonerosive reflux disease by esophageal manometry and 24-hour esophageal impedance and pH monitoring. Digestion 2015 Jan;91(1):19-25.
7. Patti MG. An evidence-based approach to the treatment of gastroesophageal reflux disease. JAMA Surg 2016 Jan;151(1):73-78.
8. Yates RB, Oelschlager BK. Surgical treatment of gastroesophageal reflux disease. Surg Clin N Am 2015 Jun;95(3): 527-553.
9. Bonavina L, DeMeester TR, Ganz RA. LINX™ reflux management system: magnetic sphincter augmentation in the treatment of gastroesophageal reflux disease. Expert Rev Gastroenterol Hepatol 2012;6:667-674.
10. Bonavina L, Saino G, Lipham JC, DeMeester TR. LINX® reflux management system in chronic gastroesophageal reflux: a novel effective technology for restoring the natural barrier to reflux. Ther Adv Gastroenterol 2013 Jul;6(4):261-268.

11. Sheu EG, Nau P, Nath B, Kuo B, Rattner DW. A comparative trial of laparoscopic magnetic sphincter augmentation and Nissen fundoplication. Surg Endosc 2015 Mar;29(3):505-509.
12. Warren HF, Reynolds JL, Lipham JC, Zehetner J, Bildzukewicz NA, Taiganides PA, Mickley J, Aye RW, Farivar AS, Louie BE. Multi-institutional outcomes using magnetic sphincter augmentation versus Nissen fundoplication for chronic gastroesophageal reflux disease. Surg Endosc 2016 Aug;30(8):3289-3296.
13. Riegler M, Schoppman SF, Bonavina L, Ashton D, Horbach T, Kemen M. Magnetic sphincter augmentation and fundoplication for GERD in clinical practice: one-year results of a multicenter, prospective observational study. Surg Endosc 2015 May;29(5):1123-1129.

10.5005/jp-journals-10033-1304

REVIEW ARTICLE

Telerobotic Surgery: Transcending Barriers

J Rohan Krishna

ABSTRACT

Telerobotic surgery has the potential to revolutionize the field of medicine and health care delivery in the near future. Rapid technological advancements have been made in the field of robotic surgery, and telerobotic surgery in particular. Through telerobotic surgery, it is possible to provide advanced surgical care to patients even in the remotest of places and for experienced surgeons to guide young surgeons to perform complex surgeries. The aim of this study is to trace the origin, implementation, and developments in the field of telerobotic surgery.

Keywords: Minimally invasive surgery, Robotic surgery, Telerobotic surgery, Telesurgery.

How to cite this article: Krishna JR. Telerobotic Surgery: Transcending Barriers. World J Lap Surg 2017;10(2):57-60.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Technological advancements continue to occur at a rapid pace in all walks of life, and the field of surgery is no exception to it. Minimally invasive surgery that has revolutionized the field of surgery offering distinct advantages over open surgery also has limitations like loss of dexterity and two-dimensional vision of the operative field. Robotic surgery and telepresence surgery have addressed the limitations of laparoscopic procedures and have revolutionized the field of minimal access surgery. In the early 1970s, NASA commissioned a project to perform surgeries on astronauts using remotely controlled robots.[1] Kwoh et al[2] used a Robot-Puma 200 and performed neurosurgical biopsies with greater precision. In 1988, ultrasound-guided prostatic resection[3] was done using PROBOT, a robotic system. Real breakthrough in telerobotic surgery came in 2001 when Professor Marescaux performed the first transatlantic telesurgical procedure (Operation Lindbergh) on a patient in France. Professor Marescaux et al[4] performed laparoscopic cholecystectomy on a 68-year-old lady in Strasbourg, France, using a Zeus robotic system located in New York. Following this landmark event, telerobotic surgery has been performed in various places around the world with successful results.

Senior Resident

Department of General Surgery, Karpagam Faculty of Medical Sciences & Research, Coimbatore, Tamil Nadu, India

Corresponding Author: J Rohan Krishna, Senior Resident Department of General Surgery, Karpagam Faculty of Medical Sciences & Research, Coimbatore, Tamil Nadu, India, e-mail: jrohankrishna@gmail.com

AIM

The aim of this article is to study the origin, implementation, and latest advancements in the field of telerobotic surgery.

MATERIALS AND METHODS

A literature search was performed using PubMed and search engine Google. The following keywords were used "telerobotic surgery," "robotic surgery," and "telesurgery." Selected papers were screened for further references with respect to the origin, implementation, and latest advancements in the field of telerobotic surgery.

RESULTS AND DISCUSSION

A telerobotic system primarily consists of surgeon's "master" console from where the surgeon operates and a patient-side "slave" unit that performs surgery on the patient using robotic arms. In telerobotic surgery, the surgeon operates from the surgeon's console, which is thousands of miles away from the slave robotic arm mounted on the patient; the surgeon's commands are relayed to the slave manipulator via fiberoptic cables. Two major factors impacting the outcome of telerobotic surgery are data transmission speed[1] and communication latency. Round-trip latency[5] represents the time interval between the initiation of movement by the surgeon and the appearance of image on the monitor.

Professor Marescaux et al[4] performed the first successful telerobotic surgery on September 7, 2001, which was famously known as Operation Lindbergh. This surgery was completed using a commercially available robotic surgery system, called Zeus T, which featured a robotic endoscope positioning system called AESOP (Automated Endoscope System for Optimal Positioning). Professor Marescaux et al[4] were able to minimize latency using a dedicated multiservice transmission network provided by France Telecom. First trial simulations of telesurgery took place in 2000 with a transmission delay of 200 ms. Subsequent work reduced the time delay to 150 ms even though the round-trip distance was 14,000 km. Flawless network quality with guaranteed bandwidth of 10 megabits per second and transmission delays of less than 200 ms

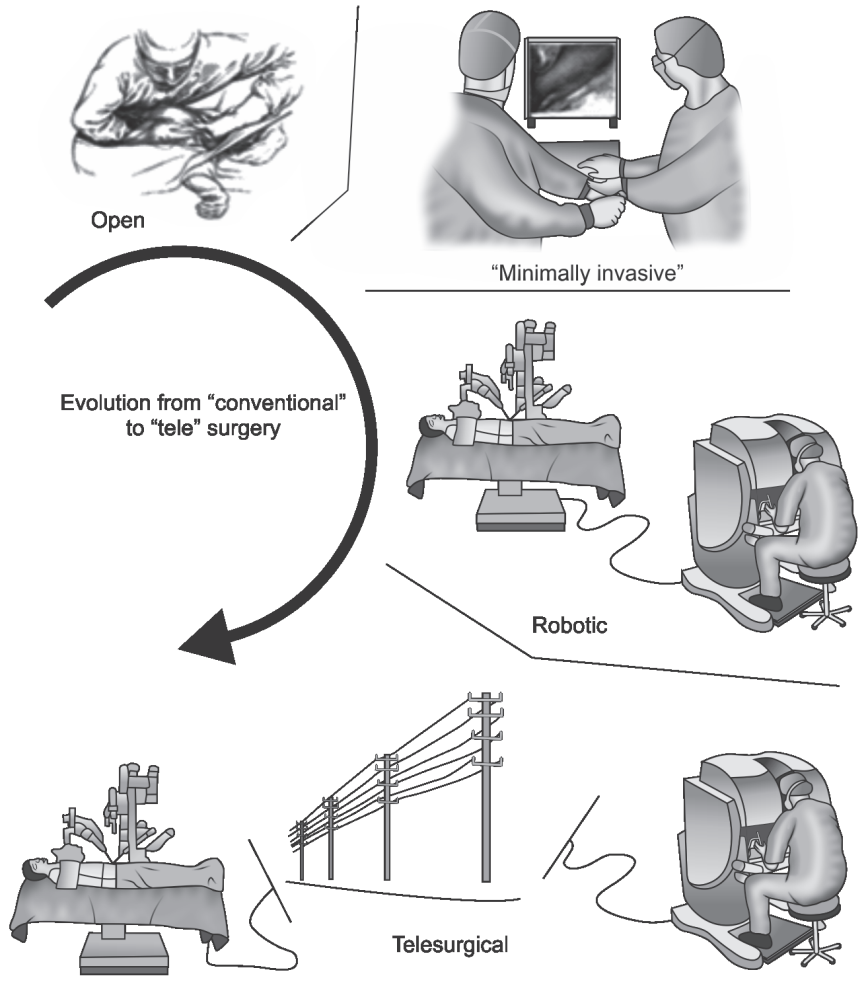


Fig. 1: Evolution from "conventional" to "Tele" surgery

made this achievement possible. Asynchronous transfer mode (ATM) technology was used with a dedicated fiberoptic network. But dedicated ATM lines were expensive, ranging from $100,000 to $200,000 (Fig. 1).[6]

In addition to the high cost of ATM lines, the availability is poor in remote and rural areas. Most commonly available networks are satellite connections (with latency of about 500 ms) and virtual private networks (VPN) with variable latency.

Anvari et al[7] established the first dedicated telerobotic remote surgical setup between St. Joseph's Hospital in Hamilton and North Bay General Hospital 400 km north of Hamilton on February 28, 2003. A Zeus TS microjoint system was used and a total of 21 surgeries[6] were performed with no major complications. Unlike "Operation Lindbergh" which used a dedicated fiberoptic network with ATM technology, Anvari et al[6] used a commercially available Internet protocol (IP)/VPN fiberoptic network. It had an active line and a fully redundant (backup) line. The overall latency experienced by the telerobotic surgeon was 135 to 140 ms. Of this, 14 ms was due to network and the rest was due to compression and decompression of the video signals by the MPEG CODECs. During each surgery, the telerobotic surgeon in Hamilton and the laparoscopic surgeon in North Bay collaborated to perform the surgeries.

In 2007, NASA[8] commissioned a series of NEEMO (NASA Extreme Environment Mission Operations) projects to conduct research related to remote health care of astronauts on space missions with special emphasis on telerobotic surgery. The experiment was conducted in the Aquarius Underwater Habitat, a 20 m underwater facility about 16 km from Key Largo, Florida. Two surgical robots were deployed into the Aquarius habitat: The RAVEN and the SRI, international M7 robot. Surgeons and researchers were able to operate the robotic arms using the controllers linked across several thousand miles (Fig. 2).[6]

Challacombe et al[9] performed the first randomized controlled trial on human *vs* telerobotic access to the kidney during percutaneous nephrolithotomy and concluded that robotic access was more accurate though slower compared with human access.

Telerobotic surgeries in space is another exciting new frontier where lot of research and experiments are

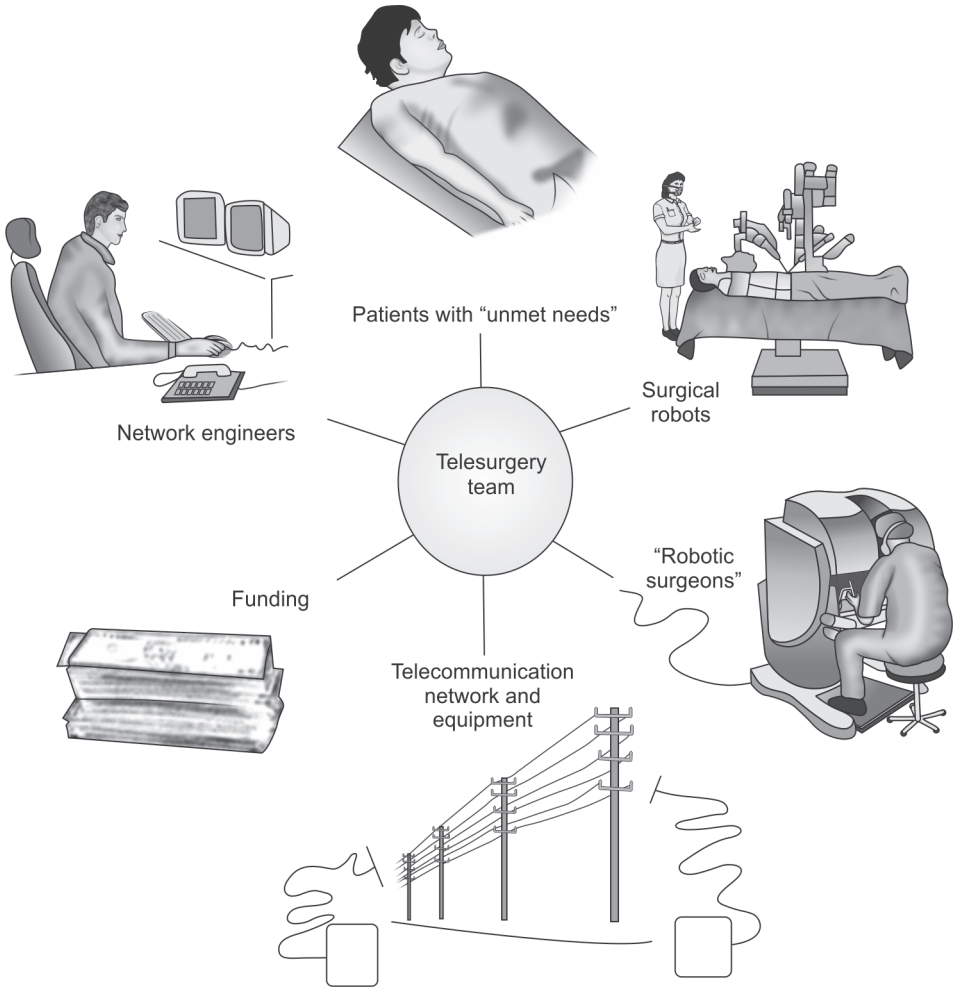


Fig. 2: Necessary elements of a telerobotic surgery team

being carried on. The world's first human operation[10] was a cyst removed from a patient's arm, on board the European Space Agency's Airbus A-300 Zero-G aircraft. The plane performed 25 parabolic curves, providing 20 to 25 s of weightlessness every time. NASA carried out its first zero-gravity robotic surgery experiment in September 2007. On a DC-9 aircraft, suturing tasks were performed using the M7 robot and results were analyzed. The experiments showed that humans can better adapt to extreme environments; however, advanced robotic solutions performed comparably.

CONCLUSION

Telerobotic surgery has the potential to change the landscape of health care delivery in the future. Providing advanced surgical care to patients even in farthest of locations with decreased cost and improved outcomes becomes possible with telerobotic surgery. Through telementoring experienced surgeons can mentor and guide new surgeons to perform even complex surgeries with confidence. Major limitations of telerobotic surgery at present are its high cost and time latency, which can be improved in the foreseeable future. Although robot-assisted remote telesurgery is feasible, more prospective randomized trials evaluating efficacy and safety must be undertaken to revolutionize and change health care delivery and the field of surgery.

REFERENCES

1. Marescaux J. State of the art of surgery: robotic surgery and telesurgery. Cir Cir 2013 Jul-Aug;81(4):265-268.
2. Kwoh YS, Hou J, Jonckheere EA, Hayati S. A robot with improved absolute positioning accuracy for CT guided stereotactic brain surgery. IEEE Trans Biomed Eng 1988 Feb;35(2):153-160.
3. Harris SJ, Arambula-Cosio F, Mei Q, Hibberd RD, Davies BL, Wickham JE, Nathan MS, Kundu B. The PROBOT – an active robot for prostate resection. Proc Inst Mech Eng H 1997 Feb;211(4):317-325.
4. Marescaux J, Leroy J, Rubino F, Smith M, Vix M, Simone M, Mutter D. Transcontinental robot-assisted remote telesurgery: feasibility and potential applications. Ann Surg 2002 Apr;235(4):487-492.
5. Xu S, Perez M, Yang K, Perrenot C, Felblinger J, Hubert J. Determination of the latency effects on surgical performance and the acceptable latency levels in telesurgery using the dV-Trainer simulator. Surg Endosc 2014 Sep;28(9):2569-2576.

6 Hanly E, Broderick T. "Telerobotic Surgery," Oper Tech in Gen Surg, 2005;7(4):170-181.
7. Anvari M, McKinley C, Stein H. Establishment of the world's first telerobotic remote surgical service for provision of advanced laparoscopic surgery in a rural community. Ann Surg 2005 Mar;241(3):460-464.
8. Haidegger T, Sándor J, Benyó Z. Surgery in space: the future of robotic telesurgery. Surg Endosc 2011 Mar;25(3): 681-690.
9. Challacombe B, Patriciu A, Glass J, Aron M, Jarrett T, Kim F, Pinto P, Stoianovici D, Smeeton N, Tiptaft R, et al. A randomized controlled trial of human versus robotic and telerobotic access to the kidney as the first step in percutaneous nephrolithotomy. Comput Aided Surg 2005 May;10(3):165-171.
10. Doctors remove tumor in first zero-g surgery. New Scientist. September 2006. Available from: http://www.newscientist.com/article/dn10169-doctors-remove-tumour-in-first-zerog-surgery.html.

10.5005/jp-journals-10033-1305

REVIEW ARTICLE

Reviewing the Comparison of Robotic Colectomy with the Laparoscopic Ones of All the Procedures based on Determined Parameters

[1]Michail A Kirmanidis, [2]Christodoulos Keskinis

ABSTRACT

Aim: The purpose of our systematic review is to clarify the current data in the domain of colorectal surgery regarding minimally invasive surgery (MIS).

Introduction: Two new methods have been recently introduced in the MIS arena. Most of the studies are in favor of robotic surgery (RS), whereas the literature lacks statistically significant results.

Results: Totally, only 19 articles fulfilled the prerequisites and our research was mainly based on meta-analyses. Some parameters were established, in order to investigate the oncologic and clinical outcomes. Heterogeneity is the existing condition, which means that robotics is more beneficial than laparoscopic surgery in some parameters in a specific procedure and the opposite.

Conclusion: There is no clear conclusion in the literature whether RS is indeed more advantageous than laparoscopic ones, so it is recommended that long-term meta-analyses and reviews be conducted, in order to specify the effectiveness of each method in every surgical procedure.

Clinical significance: It would be really beneficial for the patients to be informed in detail of the clinical and oncologic outcomes for each method.

Keywords: Colorectal malignancies, Comparison, Laparoscopic, Robotic, Surgery, Systematic review.

How to cite this article: Kirmanidis MA, Keskinis C. Reviewing the Comparison of Robotic Colectomy with the Laparoscopic Ones of All the Procedures based on Determined Parameters. World J Lap Surg 2017;10(2):61-65.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Two different main surgical methods are emerging in the field of minimally invasive surgery (MIS) over the past 20 years and they are being applied in colorectal domain.[1-8] Laparoscopic surgery (LS) for colon cancer has a wide use due to its beneficial properties and has prevailed compared with open surgery.[9-15] However, robotic surgery (RS) has been recently introduced as a new contemporary alternative because of its obvious advantages, including the three-dimensional view, the ability to use multidegree-of-freedom forceps, the elimination of physiological tremors, and the stable camera control, in order to broaden the horizons of MIS.[3-5,16-19] Initially, it was expected that RS would dominate the field of MIS related to colorectal surgery because of its obvious structural advantages and due to the limited space in the pelvis for the laparoscopic instruments and the restricted potential of movements even for an experienced surgeon to perform rectal dissection.[3] However, it seems that there is no clear-cut answer in the literature determining the beneficial use of RS over LS in the field of colorectal cancer.[20,21] In our review, we present the data regarding the use of both methods in the domain of colorectal surgery regarding all the surgical techniques. According to the New York Statewide Planning and Research Cooperative System administrative data, colectomy is one of the five most common laparoscopic procedures between 2008 and 2012, so a comparison between the laparoscopic and robotic colectomy is a matter of big significance and has to be clearly underscored.[22] The first robotic colectomy was reported in 2002, and the use of robotic procedures has been increasing since then, while it has a more extensive use in the field of urology.[3,17,23,24] This is a retrospective comprehensive review of various publications comparing these two methods of surgical procedures separately and taking into consideration plenty of parameters, such as the clinical and the oncologic outcomes and how they can be affected, the body mass index (BMI), the total mean hospital costs for each procedure, and postoperative complications. Only studies that had classified their patients with similar criteria were taken into consideration (gender, BMI, American Society of Anesthesiologists [ASA] score, tumor location, previous abdominal surgery).

RESULTS

The review was built-up by downloading various articles regarding laparoscopic and robotic colectomy from

[1]Surgeon, [2]Intern

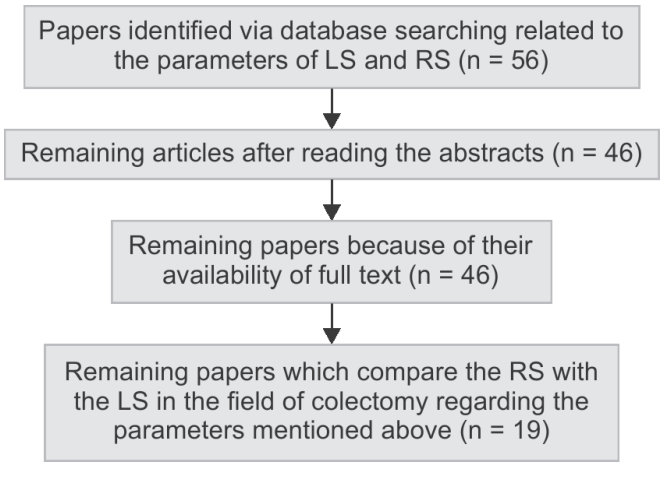
[1,2]Department of General Surgery, General Hospital of Drama Drama, Greece

Corresponding Author: Michail A Kirmanidis, Surgeon Department of General Surgery, General Hospital of Drama, Drama, Greece, Phone: +00302521350412, e-mail: mihaliskirmanidis@yahoo.gr

search engines like PubMed, MEDLINE, and so forth. "Laparoscopic *vs* robotic colectomy" and "comparing laparoscopic with robotic colectomy" were the search keywords that were used to find the publications that would conduct our research, and publications until March of 2016 were included. Our review contains retrospective studies, comparative studies, and meta-analyses. Only papers relevant to the laparoscopic and robotic colectomy have been taken into consideration in this review, focusing on the parameters mentioned above and also on the learning curve of young novice surgeons. Articles which compared the two methods with a separate specific surgical procedure, such as right colectomy are included, and reviewed and articles which do not classify the procedures separately are reviewed as well. Totally, 19 studies were reviewed.

At first, there were 56 articles related to our scientific interest identified after a long database search, but 10 of them were excluded after reading the abstract. Twenty-one of the remaining 46 records were excluded due to lack of full texts. Six more papers were excluded because they mentioned the comparison between hybrid robotic-assisted laparoscopy colectomy and conventional colectomy. The rest 19 papers were assessed for eligibility, screened in detail, and included in our review. Retrospective comparative studies and meta-analyses are the majority of the articles in our review. More importance is given to the findings of the meta-analyses due to their reliability. Heterogeneity can be found in the literature whether or not RS is indeed superior to LS in the colorectal field.[21] Total operative time, estimated blood loss (EBL), conversion to open procedure, length of hospital stay (LOS), readmission rate, number of lymph nodes harvested, time to return of bowel function, time of initiation of soft diet, and perioperative complications are the main clinicopathologic and oncologic parameters that have been extensively assessed in our review (Flow Chart 1).

Flow Chart 1: Literature research



Ferrara et al[2] mention that there are no differences between right, left, and rectal robotic colectomy and respective laparoscopic procedures in terms of mentioned parameters. In fact, RS shows larger number of harvested lymph nodes, while LS seems to have lower conversion rate (7.1% for robotics and 3.4% for laparoscopy) and operative time, but the results are not statistically significant.[2]

Comparison between RS and LS in the Field of Left Colon and/or Rectal Resections

A matched case–control study indicates that there are no different short-term outcomes between the two methods regarding left-sided and rectal resections.[3] The EBL, the need for open conversion, complications (anastomotic leakage, ileus, and wound infections), flatus passage, LOS, and the number of retrieved lymph nodes presented no significant difference, except for the operative time which was significantly longer in the RS colectomy.[3] On the contrary, a recent meta-analysis conducted by Sun et al[25] shows that robotic low anterior resection (R-LAR) for rectal cancer is proven to be more beneficial for LOS, the conversion to open surgery, the circumferential margin involvement, and the overall complications than the laparoscopic low anterior resection (L-LAR), whereas there was no difference regarding the operative time, the number of lymph nodes removed, and the return of bowel function.[25]

Comparison of RS with the LS in the Field of Right Colon Resections

Because robotic right colectomy (RRC) and laparoscopic right colectomy (LRC) are less complicated as a surgical procedure than rectal resection due to the anatomy of the human body, there are fewer studies comparing these two methods with right colectomy.[17] We included three meta-analyses in our research.[4,7,17] Cumulatively, these three studies include 30 comparative studies, in which 1,322 patients underwent RRC and 4,185 were treated with LRC. The first one was recently conducted from the Surgery Department of Sapienza University and compared the indications, surgical and oncologic outcomes, and costs of RRC with the LRC ones.[17] The EBL, the conversion to open procedure, the number of retrieved lymph nodes were similar in both of them.[17] Unimportant statistical differences were presented regarding LOS and the overall complications.[17] The RRC entails more expenses than LRC, although the difference is still not statistically important.[17] On the contrary, the second meta-analysis which had the larger statistical sample was conducted by Trinh et al[4] and yielded the following outcomes. No significant difference was spotted regarding the harvested lymph nodes, the bowl function, the

days to soft diet, the LOS, the hospital readmission, and the postoperative complications.[4] Based on this meta-analysis, the robotic approach showed longer operating times, less EBL, and a higher rate of conversion to an open procedure compared with that of LS.[4] Xu et al[7] considered in their meta-analysis which showed that RRC involves longer operative times, lower EBL, shorter LOS, lower overall complications, and, importantly, faster bowel function recovery. The rest clinical and oncological results seem to not have any statistical difference.[7]

A newly comparative study by Cardinali et al[26] indicates that RRC appears to have some advantages over the LRC like the lower time of first flatus, but it does not offer any benefit in obese patients due to the fact that both methods perform no significant difference in the conversion rate. Another comparative study points out that the RS could also shorten the learning curve, in case the respective strict protocols are applied.[1]

Table 1: Presentation of each one of the three meta-analyses for every parameter

Parameters	*1st Meta-analysis*	*2nd Meta-analysis*	*3rd Meta-analysis*
Operative time	Yes	Yes	Yes
EBL	No	Yes	Yes
Conversion to open procedure	No	Yes	No
Number of retrieved lymph nodes	No	No	NA
LOS	No	No	Yes
Overall complications	No	No	Yes
Financial expenses	No	NA	NA
Bowel function	NA	No	Yes
Days of soft diet	NA	No	NA
Hospital readmission	NA	No	NA
Circumferential margin involvement	NA	NA	NA

The meta-analyses are numbered according to their order in the text; NA: Not applicable

DISCUSSION

In the field of colorectal cancer, LS and RS are both considered almost equally safe and effective methods, proving that radical prostatectomy was only the beginning of consolidation of RS and the use of RS can be more widespread.[3,7,17,24,26] Our research focuses on the conventional laparoscopy and the RS as separate surgical methods and does not include their hybrid use. The confirmation of the existing heterogeneity between these two new surgical methods involves our reviewed parameters along with the clinicopathological, oncological, and financial ones. The accurate choice of these criteria was accomplished after a careful, long research via recent meta-analyses, control and statistically reliable comparative studies.[1,3,7,16,17,20,25] Mainly, meta-analyses were reviewed due to their credibility compared with other studies, which are reviewed and included in our manuscript. More specifically, the criteria are presented in Table 1, but the research contains the rectal and left-sided colon resections as well.

Pelvis is the anatomical section of the human body where RS can be applied with its maximum benefits according to its adopters, but controversial studies' results came up through our research. Studies which did not end up with this conclusion were reviewed, but the most statistically reliable meta-analysis, the one by Sun et al,[25] clarifies the advantages of R-LAR over L-LAR for the LOS as mentioned earlier. Another randomized controlled study is in favor of the adoption of RS in rectal surgery, but tempers the encouraging conclusion from the former meta-analysis.[3] The main reason why RS seems to be a more promising tool in the pelvis is because of the absence of the tremor, which implies less EBL and makes it easier to avoid the trauma to the nerves related to the sexual and urinary functions.[27] Fabrizio Luca presented a paper in the 5th Congress of the Clinical Robotic Surgery Association (CRSA) and mentioned that RS can enhance the nerve-sparing results of total mesorectal excision related to LS method regardless of the gender.[28] However, during the paper's discussion some doubts were posed about the preoperative reliability of the evaluation of these specific functions (urinary and sexual), so that they become more standardized in the future.

Undoubtedly, right colectomy is a less complicated procedure than rectal resection, but the use of both RS and LS has also been reviewed thoroughly. Two of the three recent meta-analyses concluded that there are some statistical differences between the RRC and the LRC in some of our parameters. Both studies agree that RRC is a longer procedure than LRC and that the EBL is less in the RRC. Huirong Xu et al[7] deem that LOS, the overall complications, and the bowel function differ between the two methods in an important way, whereas the other respective meta-analysis' results are considered controversial. The results of these three meta-analyses are summarized in Table 1 and the "YES" and "NO" are used as the answers to the question: "Is there a statistically significant result between the RRC and LRC regarding to a specific parameter each time?" while the choice "not available (NA)" is used for whether or not in this particular meta-analysis the mentioned appearing parameter is included.

In the CRSA Fifth Worldwide Congress in Washington DC from 3 to 5 October 2013, a controlled randomized trial ended up with the conclusion that RRC has no significant difference with the LRC and due to its expenses it should not be frequently used.[28]

The intro of a learner in the MIS can be easier for the RRC than LRC in a specific center with rigorous protocols,

which can be explained once more due to some of the structural advantages of the RS like the three-dimensional view, for instance.[29] But, acceptable outcomes can be fulfilled with simultaneously practical exercise.[29]

CONCLUSION

It is common even for meta-analyses reviewing the same parameters to present contradictory results in the literature. As a result, we conclude that the benefits from the RS in all the procedures related to colorectal cancer are currently under scientific investigation. Hopefully, the benefits will be more clearly defined in the near future. We suggest for more standardized controlled studies and meta-analyses to be performed in the future, as to evaluate the current data and the long-term outcomes of our parameters. The heterogeneity was more obvious in the right colectomy procedure than in the others, but all the results should be better stabilized.

CLINICAL SIGNIFICANCE

In fact, it is very crucial to establish whether the RS is more beneficial than the LS or the opposite. Patients with morbidity factors would have to be aware of the positive aspect of each method for every procedure.

REFERENCES

1. Formisano G, Misitano P, Giuliani G, Calamati G, Salvischiani L, Bianchi PP. Laparoscopic versus robotic right colectomy: technique and outcomes. Updates Surg 2016 Mar;68(1):63-69.
2. Ferrara F, Piagnerelli R, Scheiterle M, Di Mare G, Gnoni P, Marrelli D, Roviello F. Laparoscopy versus robotic surgery for colorectal cancer: a single-center initial experience. Surg Innov 2016 Aug;23(4):374-380.
3. Sawada H, Egi H, Hattori M, Suzuki T, Shimomura M, Tanabe K, Okajima M, Ohdan H. Initial experiences of robotic versus conventional laparoscopic surgery for colorectal cancer, focusing on short-term outcomes: a matched case-control study. World J Surg Oncol 2015 Mar;13:103.
4. Trinh BB, Jackson NR, Hauch AT, Hu T, Kandil E. Robotic versus laparoscopic colorectal surgery. JSLS 2014 Oct;18(4): e2014.00187.
5. Trinh BB, Hauch AT, Buell JF, Kandil E. Robot-assisted versus standard laparoscopic colorectal surgery. JSLS 2014 Oct-Dec;18(4):e2014.00154.
6. Zeng WG, Zhou ZX. Mini-invasive surgery for colorectal cancer. Chin J Cancer 2014 Jun;33(6):277-284.
7. Xu H, Li J, Sun Y, Li Z, Zhen Y, Wang B, Xu Z. Robotic versus laparoscopic right colectomy: a meta-analysis. World J Surg Oncol 2014 Aug;12:274.
8. Baek SJ, Kim SH, Cho JS, Shin JW, Kim J. Robotic versus conventional laparoscopic surgery for rectal cancer: a cost analysis from a single institute in Korea. World J Surg 2012 Nov;36(11):2722-2729.
9. Clinical Outcomes of Surgical Therapy Study Group. A comparison of laparoscopically assisted and open colectomy for colon cancer. N Engl J Med 2004 May;350(20):2050-2059.
10. Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, Heath RM, Brown JM; MRC CLASICC trial group. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. Lancet 2005 May;365(9472):1718-1726.
11. Veldkamp R, Kuhry E, Hop WC, Jeekel J, Kazemier G, Bonjer HJ, Haglind E, Påhlman L, Cuesta MA, Msika S, et al. Laparoscopic surgery versus open surgery for colon cancer: short-term outcomes of a randomised trial. Lancet Oncol 2005 Jul;6(7):477-484.
12. Kang SB, Park JW, Jeong SY, Nam BH, Choi HS, Kim DW, Lim SB, Lee TG, Kim DY, Kim JS, et al. Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): short-term outcomes of an open-label randomised controlled trial. Lancet Oncol 2010 Jul;11(7):637-645.
13. Leung KL, Kwok SP, Lam SC, Lee JF, Yiu RY, Ng SS, Lai PB, Lau WY. Laparoscopic resection of rectosigmoid carcinoma: prospective randomised trial. Lancet 2004 Apr;363(9416): 1187-1192.
14. Lezoche E, Feliciotti F, Paganini AM, Guerrieri M, De Sanctis A, Minervini S, Campagnacci R. Laparoscopic vs open hemicolectomy for colon cancer. Surg Endosc 2002 Apr;16(4): 596-602.
15. Fleshman J, Sargent DJ, Green E, Anvari M, Stryker SJ, Beart RW Jr, Hellinger M, Flanagan R Jr, Peters W, Nelson H, et al. Laparoscopic colectomy for cancer is not inferior to open surgery based on 5-year data from the COST Study Group trial. Ann Surg 2007 Oct;246(4):655-662.
16. Pai A, Marecik SJ, Park JJ, Melich G, Sulo S, Prasad LM. Oncologic and clinicopathologic outcomes of robot-assisted total mesorectal excision for rectal cancer. Dis Colon Rectum 2015 Jul;58(7):659-667.
17. Petrucciani N, Sirimarco D, Nigri GR, Magistri P, La Torre M, Aurello P, D'Angelo F, Ramacciato G. Robotic right colectomy: a worthwhile procedure? Results of a meta-analysis of trials comparing robotic versus laparoscopic right colectomy. J Minim Access Surg 2015 Jan-Mar;11(1):22-28.
18. Yu HY, Friedlander DF, Patel S, Hu JC. The current status of robotic oncologic surgery. CA Cancer J Clin 2013 Jan;63(1):45-56.
19. Wedmid A, Llukani E, Lee DI. Future perspectives in robotic surgery. BJU Int 2011 Sep;108(6 Pt 2):1028-1036.
20. Trastulli S, Farinella E, Cirocchi R, Cavaliere D, Avenia N, Sciannameo F, Gullà N, Noya G, Boselli C. Robotic resection compared with laparoscopic rectal resection for cancer: systematic review and meta-analysis of short-term outcome. Colorectal Dis 2012 Apr;14(4):e134-e156.
21. Baek SK, Carmichael JC, Pigazzi A. Robotic surgery: colon and rectum. Cancer J 2013 Mar-Apr;19(2):140-146.
22. Altieri MS, Yang J, Telem DA, Zhu J, Halbert C, Talamini M, Pryor AD. Robotic approaches may offer benefit in colorectal procedures, more controversial in other areas: a review of 168,248 cases. Surg Endosc 2016 Mar;30(3):925-933.
23. Weber PA, Merola S, Wasielewski A, Ballantyne GH. Telerobotic-assisted laparoscopic right and sigmoid colectomies for benign disease. Dis Colon Rectum 2002 Dec;45(12): 1689-1694.
24. Sandoval Salinas C, González Rangel AL, Cataño Cataño JG, Fuentes Pachón JC, Castillo Londoño JS. Efficacy of robotic-assisted prostatectomy in localized prostate cancer: a systematic review of clinical trials. Adv Urol 2013;2013:105651.

25. Sun Y, Xu H, Li Z, Han J, Song W, Wang J, Xu Z. Robotic versus laparoscopic low anterior resection for rectal cancer: a meta-analysis. World J Surg Oncol 2016 Mar;14:61.
26. Cardinali L, Belfiori G, Ghiselli R, Ortenzi M, Guerrieri M. Robotic versus laparoscopic right colectomy for cancer: short-term outcomes and influence of body mass index on conversion rate. Minerva Chir 2016 Aug;71(4):217-222.
27. Scarpinata R, Aly EH. Does robotic rectal cancer surgery offer improved early postoperative outcomes? Dis Colon Rectum 2013 Feb;56(2):253-262.
28. Bianchi PP, Pigazzi A, Choi GS. Clinical Robotic Surgery Association fifth worldwide congress, Washington DC, 3 to 5 October 2013: robotic colorectal surgery. Ecancermedicalscience 2014 Jan;8:385.
29. Melich G, Hong YK, Kim J, Hur H, Baik SH, Kim NK, Sender Liberman A, Min BS. Simultaneous development of laparoscopy and robotics provides acceptable perioperative outcomes and shows robotics to have a faster learning curve and to be overall faster in rectal cancer surgery: analysis of novice MIS surgeon learning curves. Surg Endosc 2015 Mar;29(3):558-568.

10.5005/jp-journals-10033-1306

REVIEW ARTICLE

Laparoscopy in Blunt Abdominal Trauma

Michael Ikechukwu Nnamonu

ABSTRACT

Introduction: This review describes the role of laparoscopy in patients with blunt abdominal trauma.

Materials and methods: Keywords, such as laparoscopy, blunt, abdominal, trauma were entered into PubMed search engine and filtered for peer-reviewed articles written in the last 5 years.

Results and discussion: The findings from these articles are collated and discussed.

Conclusion: Laparoscopy is a safe approach both for diagnosis and treatment of patients with blunt abdominal trauma and is associated with the benefits of laparoscopic approach.

Keywords: Blunt abdominal trauma, Diagnostic laparoscopy, Missed visceral injuries, Therapeutic laparoscopy.

How to cite this article: Nnamonu MI. Laparoscopy in Blunt Abdominal Trauma. World J Lap Surg 2017;10(2):66-68.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

The use of laparoscopy in trauma has lagged behind in the otherwise rapid progression of this groundbreaking surgical tool. Although reports exist of the use of laparoscopy for the diagnosis of hemoperitoneum as far back as the 1920s, there is still a paucity of literature on this subject to this day.[1,2]

There is no doubt that this is related to the nature of trauma. There is often anxiety and concern to optimize the patient with the quickest possible intervention. It should be stated early in this discourse that there is no role for laparoscopy in the management of the patient with abdominal trauma who is hemodynamically unstable. The priority in this situation follows the standard life-saving principles of resuscitation, with quick access for hemostasis, which must in those situations be open surgery. Associated extraabdominal injuries like head injuries may also be worsened by the hemodynamic effects of carbon dioxide pneumoperitoneum and may preclude laparoscopy. The gasless laparoscopy technique has been described to attenuate this as well as to prevent air embolism and also pneumothorax in patients with occult diaphragmatic injuries.[3]

Laparoscopy can be safely used when an intraabdominal injury is suspected in a patient, i.e., hemodynamically stable. These are patients with a systolic blood pressure of >100 mm Hg, diastolic blood pressure of >60 mm Hg, a heart rate of <110 beats per minute, and crystalloid resuscitation requirements of <2 L.[4]

The objective of this review is to determine the scope of the diagnostic and therapeutic uses of laparoscopy in blunt abdominal trauma, and also to delineate the benefits, complications, as well as prospects of laparoscopy in patients with blunt abdominal trauma.

MATERIALS AND METHODS

The PubMed search engine was used to search for peer-reviewed articles. The keywords entered were laparoscopy, blunt, abdominal, and trauma. The search was filtered to include only articles written in the last 5 years. All 55 articles obtained from the database were then reviewed for relevance and sample size. Case reports were excluded.

RESULTS

Several articles discussed the uses of laparoscopy in blunt abdominal trauma. The role of laparoscopy as the most sensitive detector of a breach of the peritoneum in penetrating abdominal trauma is immediately apparent.[5] It is instructive that the authors reviewed equally acknowledged the role of laparoscopy in diagnosis in blunt abdominal trauma. Johnson et al[5] started their study on the established premise that diagnostic laparoscopy (DL) had decreased the rate of nontherapeutic laparotomies in patients with penetrating abdominal injuries. They sort to determine whether DL similarly lowered nontherapeutic laparotomy in blunt abdominal injury. They found that coupled with diagnostic computed tomography (CT) scan, DL yielded a nontherapeutic laparotomy rate of 0% in patients with blunt abdominal trauma. They concluded that when combined with CT scan, DL is a useful tool in the initial evaluation of patients with blunt abdominal trauma. Lee et al[6] had similar findings demonstrating that the use of laparoscopy in patients with abdominal trauma safely decreased the laparotomy rate.

Surgeon

Department of Surgery, NLNG Industrial Hospital, Bonny, Rivers State, Nigeria

Corresponding Author: Michael Ikechukwu Nnamonu, Surgeon Department of Surgery, NLNG Industrial Hospital, Bonny, Rivers State, Nigeria, e-mail: miknnamonu@yahoo.com

Furthermore, Talutis et al[7] and Borgialli et al[8] demonstrated the value of DL in the diagnostic workup for blunt abdominal trauma in the pediatric age group. This would be of value in this age group where clinical symptoms and signs of peritonism may be equivocal. Tharakan et al[9] also found that laparoscopy reliably resolves uncertainty in hemodynamically stable pediatric patients with blunt abdominal trauma with a concerning clinical examination and inconclusive imaging. They further reported that laparoscopy provided sensitive diagnostic capability and opportunity for definitive repair with decreased surgical morbidity. Wisner et al[10] equally included laparoscopy in the evaluation protocol in their large study involving 12,044 children.

In other articles, additional benefits accruing from the use of DL in patients with blunt abdominal trauma are conclusively demonstrated. Trejo-Avila et al[11] compared outcomes following laparoscopic *vs* open surgery in patients with abdominal trauma. They came to the conclusion that laparoscopic surgery for abdominal trauma is safe and feasible in hemodynamically stable patients. Furthermore, they found that laparoscopic surgery was associated with shorter operative time, lower estimated blood loss, faster return to normal diet, and shorter hospital length of stay. Lim et al[12] had similar findings. In their series of 111 patients with abdominal trauma, 41 were explored laparoscopically and 70 by open surgery. The patients who had laparoscopic surgery had less wound infection, passed gas earlier, and had a shorter hospital stay. Operative times were similar and neither approach was complicated by missed injury or postoperative intraabdominal abscesses. Khubutiya et al[13] in a larger study involving 628 patients equally found that compared with patients who had open surgery, patients who had laparoscopic surgery had quicker recovery time, less pain, shorter hospital stay, and a lower complication rate. There were no missed abdominal organ injuries at laparoscopy.

Laparoscopy for abdominal trauma is useful in the diagnosis of diaphragmatic rupture, an often missed injury.[14,15] Lin et al[16] have described a new approach for management of high-grade splenic injury laparoscopically. They, however, emphasize the need for adequate training on laparoscopy in trauma.

DISCUSSION

Evaluation of diagnostic tools in blunt abdominal trauma remains a contemporary issue to clarify the need for appropriate surgical intervention.[17] This study clearly describes the safety of DL as an approach in blunt abdominal trauma. With the increasing trend for limited intervention in appropriately selected hemodynamically stable patients with blunt abdominal trauma, the role of DL is brought to the fore.[18-20]

As minimal access surgery becomes more prominent, laparoscopic surgeons should equally remain aware of the potential complications that could arise when this approach is adopted in the management of patients with blunt abdominal trauma.[21]

CONCLUSION

Laparoscopy can be safely used both diagnostically and therapeutically in hemodynamically stable patients with blunt abdominal trauma.

ACKNOWLEDGMENT

The author would like to acknowlege Prof RK Mishra, Dr Chowhan, The Society of Laparoscopic Surgeons, Laparoscopy for Trauma, Ransom KJ, Smith RS, Staff of World Laparoscopy Hospital, Gurgaon, India, March 2017 batch of FMAS and DMAS, World Laparoscopy Hospital, Gurgaon.

REFERENCES

1. Short AR. The uses of coelioscopy. Br Med J 1925 Aug 8;2(3371):254-255.
2. Stone WE. Intra-abdominal examination by the aid of the peritoneoscope. J Kansas Med Soc 1924;24:63-65.
3. Liao CH, Kuo IM, Fu CY, Chen CC, Yang SJ, Ouyang CH, Wang SY, Chen SW, Hsu YP, Kang SC. Gasless laparoscopic-assisted surgery for abdominal trauma. Injury 2014 May;45(5):850-854.
4. Choi YB, Lim KS. Therapeutic laparoscopy for abdominal trauma. Surg Endosc 2003 Mar;17(3):421-427.
5. Johnson JJ, Garwe T, Raines AR, Thurman JB, Carter S, Bender JS, Albrecht RM. The use of laparoscopy in the diagnosis and treatment of blunt and penetrating abdominal injuries: 10-year experience at a level 1 trauma center. Am J Surg 2013 Mar;205(3):317-320.
6. Lee PC, Lo C, Wu JM, Lin KL, Lin HF, Ko WJ. Laparoscopy decreases the laparotomy rate in hemodynamically stable patients with blunt abdominal trauma. Surg Innov 2014 Apr;21(2):155-165.
7. Talutis SD, Muensterer OJ, Pandya S, McBride W, Stringel G. Laparoscopic-assisted management of traumatic abdominal wall hernias in children: case series and a review of the literature. J Pediatric Surg 2015 Dec;50(3):456-461.
8. Borgialli DA, Ellison AM, Ehrlich P, Bonsu B, Menaker J, Wisner DH, Atabaki S, Olsen CS, Sokolova PE, Lillis K et al. Association between the seat belt sign and intra-abdominal injuries in children with blunt torso trauma in motor vehicle collisions. Acad Emerg Med 2014 Nov;21(11):1240-1248.
9. Tharakan SJ, Kim AG, Collins JL, Nance ML, Blinman TA. Laparoscopy in pediatric abdominal trauma: A 13-Year Experience. Eur J Pediatr Surg 2016 Oct;26(5):443-448.
10. Wisner DH, Kuppermann N, Cooper A, Menaker J, Ehrlich P, Kooistra J, Mahajan P, Lee L, Cook LJ, Yen K et al. Management of children with solid organ injuries after blunt torso trauma. J Trauma Acute Care Surg 2015 Aug;79(2):206-214.
11. Trejo-Avila ME, Valenzuela-Salazar C, Betancourt-Ferreyra J, Fernandez-Enriquez E, Romero-Loera S, Moreno-Portillo M.

Laparoscopic versus open surgery for abdominal trauma: a case-matched study. J Laparoendosc Adv Surg Tech A 2017 Mar;27(4):383-387.
12. Lim KH, Chung BS, Kim JY, Kim SS. Laparoscopic surgery in abdominal trauma: a single center review of a 7-year experience. World J Emerg Surg 2015 Mar;10:16.
13. Khubutiya MSh, Yartsev PA, Guliaev AA, Levitsky VD, Tlibekova MA. Laparoscopy in blunt and penetrating abdominal trauma. Surg Laparosc Endosc Percutan Tech 2013 Dec;23(6):507-512.
14. Jahromi AH, Pennywell D, Owings JT. Does a negative emergency celiotomy exclude the possibility of significant diaphragmatic injury? A case report and review of the literature. Trauma Mon 2016 Sep;21(4):e25053.
15. Leung VA, Patlas MN, Reid S, Coates A, Nicolaou S. Imaging of traumatic diaphragmatic rupture: evaluation of diagnostic accuracy at a level 1 trauma centre. Can Assoc Radiol J 2015 Jun;66(4): 310-317.
16. Lin HF, Lin KL, Wu JM, Chen SC. Preliminary experience of sandwich repair technique: a new method of laparoscopic splenorraphy for high-grade splenic injuries. Surg Innov 2014 Aug; 21(4): 355-364.
17. Nnamonu MI, Ihezue CH, Sule AZ, Ramyil VM, Pam SD. Diagnostic value of abdominal ultrasonography in patients with blunt abdominal trauma. Niger J Surg 2013 Jul;19(2):73-78.
18. Oyo-Ita A, Chinnock P, Ikpeme IA. Surgical versus non-surgical management of abdominal injury. Cochrane Database Syst Rev 2015 Nov;13(11):CD007383.
19. Stassen NA, Bhullar I, Chen JD, Crandall M, Friese R, Guillamondegui O, Jawa R, Maung A, Rohs TJ Jr, Sangosanya A et al. Non-operative management of blunt hepatic injury: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg 2012 Nov;73(5):288-293.
20. Swift C, Garner JP. Non-operative management of liver trauma. J.R. Army Med Corps 2012;158(2):85-95.
21. Kindel T, Latchana N, Swaroop M, Chaudhry UF, Noria SF, Choron RL, Seamon MJ, Lin MJ, Mao M, Cipolla J et al. Laparoscopy in trauma: an overview of complications and related topics. Int J Crit Illn Inj Sci 2015 Jul-Sep;5(3): 196-205.

10.5005/jp-journals-10033-1307

CASE REPORT

Osseous Metaplasia of Endometrium: A Very Rare Entity

[1]Garima Gupta, [2]Divya Mahindru, [3]Aparajita D'Souza, [4]Sunita Goyal

ABSTRACT

Introduction: Osseous metaplasia of endometrium is a rare disorder characterized by the presence of mature or immature bone in the endometrium. The rarity of the case and high probability of missing out, which may lead to delay in appropriate treatment, makes this case of interest.

Case report: A 37-year-old lady, married for 10 years P2L2 with previous two lower-segment cesarean section, presented to the gynecology outpatient department with complaints of secondary infertility for past 7 years, irregular menstrual cycles, dysmenorrhea, and dyspareunia. Her general examination and bimanual exploration were normal. On ultrasonography, an echogenic foci was seen casting posterior acoustic shadow. On diagnostic laparohysteroscopy, multiple small coral-like white plaques–bony spicules were seen. They were removed using hysteroscopic forceps and submitted for histopathological study. A histological diagnosis of osseous metaplasia of endometrium was made. She is on follow-up for infertility treatment.

Conclusion: Endometrial ossification is a rare finding, which can be misdiagnosed and requires higher degree of suspicion to diagnose the condition properly. Hysteroscopy has been shown to be effective in the diagnosis and treatment of cases of osseous metaplasia of the endometrium associated with infertility.

Keywords: Hysteroscopy, Infertility, Osseous metaplasia.

How to cite this article: Gupta G, Mahindru D, D'Souza A, Goyal S. Osseous Metaplasia of Endometrium: A Very Rare Entity. World J Lap Surg 2017;10(2):69-72.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Osseous metaplasia of endometrium is a rare[1] disorder characterized by the presence of mature or immature bone in the endometrium. It is a rarely encountered condition, with an estimated incidence of 3/10,000.[2] Nearly 80 cases have been reported in the world literature, including around 9 cases from India.[3]

[1]Assistant Professor, [2]Resident, [3,4]Professor

[1-4]Department of Obstetrics and Gynecology, Christian Medical College & Hospital, Ludhiana, Punjab, India

Corresponding Author: Garima Gupta, Assistant Professor Department of Obstetrics and Gynecology, Christian Medical College & Hospital, Ludhiana, Punjab, India, e-mail: amity garima@gmail.com

It appears in women of reproductive age, though it has been reported in menopausal women as well. A history of previous pregnancy is reported in more than 80% of the cases.[4] A history of abortion, either spontaneous or therapeutic, is the hallmark of this condition.[5] It can also be related to transformation of mesenchymal tissue to bone in response to inflammation and the reparative process induced by abortion.

Most cases present with secondary infertility following an abortion or chronic endometritis. Some patients are asymptomatic, while others have menstrual irregularities or menorrhagia. Ultrasound examination showing characteristic hyperechogenic pattern of osseous tissue within the uterus helps suspect the diagnosis. The final diagnosis is confirmed by hysteroscopy and removal of the bony tissue by curettage. Complete removal of the bony spicules from the endometrial cavity by hysteroscopy usually cures the patient.

CASE REPORT

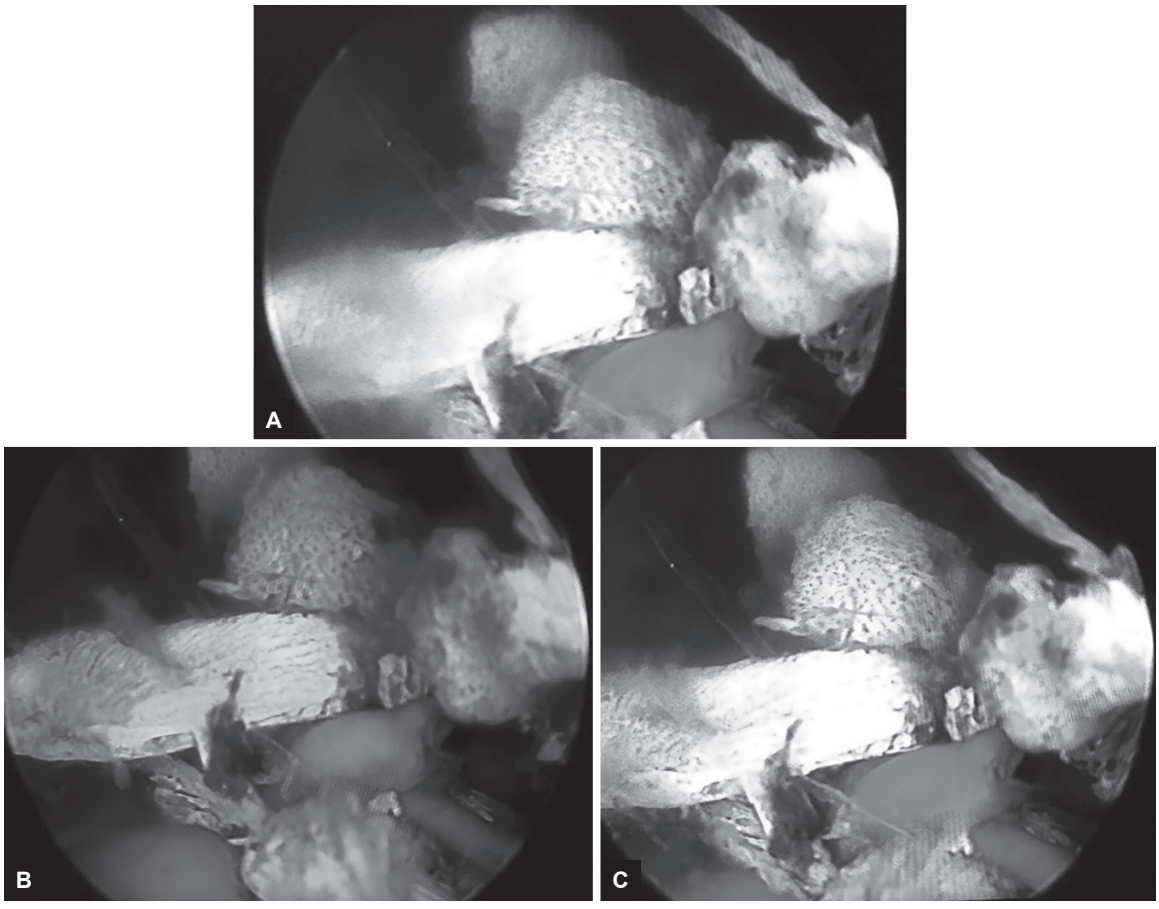
A 37-year-old lady married for 10 years P2L2 with previous two lower-segment cesarean section presented to the obstetrics and gynecology outpatient with complaints of secondary infertility for past 7 years, irregular menstrual cycles with intermenstrual bleeding. She presented with history of dysmenorrhea and dyspareunia.

Her general examination and bimanual exploration were normal. Her routine hematological parameters were normal. Both couples were subjected for infertility workup and nothing abnormal was noted.

Ultrasound pelvis showed the uterus to be of 5.2 × 4.3 cm size with normal shape, and echotexture. Endometrial stripe was 7.5 mm. An echogenic foci was seen casting posterior acoustic shadow. Cervix was normal with closed internal os. Bilateral ovaries were normal. No adnexal mass or free fluid was noted in pouch of douglas.

She was taken up for diagnostic laparoscopy and chromohysteroscopy. On laparoscopy, uterus was found to be bulky with normal bilateral tubes and ovaries. Chromopertubation test showed bilateral free spill, suggestive of patency of both fallopian tubes.

Hysteroscopy was done using rigid hysteroscope with saline as distending media and multiple small coral-like white plaques – bony spicules were seen. They were removed using hysteroscopic forceps and submitted for histopathological study (Fig. 1).



Figs 1A to C: Hysteroscopic appearance of endometrial osseous metaplasia showing multiple coral like white plaques

Histopathological examination revealed the following:

- Stroma with interspersed fragmented endometrial glands (secretory phase)
- Cells with vacuolations along with spicules of lamellar bone
- No inflammatory cell infiltrates
- No granulomas
- No chorionic villi or fetal remnants

A histological diagnosis of osseous metaplasia of endometrium was made. She made an uneventful recovery (Fig. 2).

DISCUSSION

Osseous metaplasia of the endometrium is a rare clinical entity characterized by the presence of mature or immature bone in the endometrium. It is described as an endogenous nonneoplastic pathological condition as no tissue reaction is found in the endometrial tissue studied and the endometrium showed normal regular cyclical changes. Its estimated incidence is 3/10,000,[2] there being about 80 cases described in the literature.[3]

It has been referred to by various names like ectopic intrauterine bone, heterotopic intrauterine bone, endometrial ossification, etc.[1]

Majority of the patients belong to the reproductive age group with history of first trimester abortion, either therapeutic or spontaneous, and have normal menstrual cycle in the postabortive period. The interval between the antecedent pregnancy and detection of endometrial ossification varies from 8 weeks to 14 years.[6]

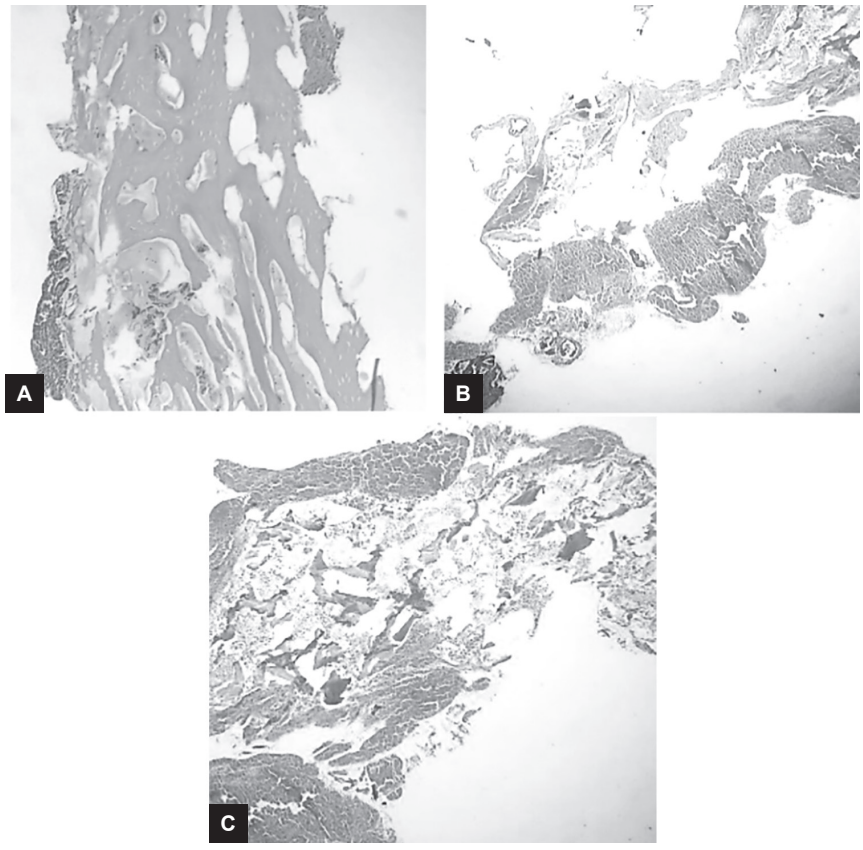
Pathogenic mechanisms related to the histogenesis of heterotopic bone into the endometrium are controversial. As early as 1884, Virchow attributed the formation of bone in the endometrium to spontaneous differentiation of fibroblasts into osteoblasts.[7] Various theories have been described in the pathogenesis of endometrial osseous metaplasia.

The most common theories proposed are heterotopia, dystrophic calcifications, ossification of postabortive endometritis, metastatic calcification, metaplasia in healing tissue, prolonged estrogenic therapy after abortion, and retained fetal bone.

Genital tuberculosis, unspecific chronic endometritis, or pyometra are other sources of chronic inflammation occurring from retained embryonic tissue after first trimester abortion. This inflammation acts as a promoter of secondary osteogenesis from nonosseous embryonic tissue.[8]

In India, endometrial tuberculosis should be ruled out as it can cause infertility as well as calcification and subsequent ossification.[1]

Chronic endometritis stimulates the proliferation of mesenchymal cells that have inherent property of



Figs 2A to C: Histopathological appearance of endometrial osseous metaplasia showing secretory phase stroma with interspersed endometrial glands and vacuolated cells with spicules of lamellar bone

metaplasia and can differentiate into chondroblasts or osteoblasts.[1]

Adamson linked endometrial ossification to hypervitaminosis in one of his two patients reported to have ossification after therapeutic abortions.[2]

It is also probable that the concept of a superoxide radical superoxide dismutase system, which plays an important role in endometrial differentiation, may be functional in osseous metaplasia. Chronic postabortal inflammation due to retained gestational tissues may promote superoxide radical or tumor necrosis factor release from thermonuclear phagocytes. Endometrium deficient in protective superoxide dismutase activity may perhaps present a long-lasting insult to the multipotential stromal cells, and this insult may therefore transform these cells into osteoblasts.[9]

Roth and Taylor[10] demonstrated the presence of acid mucopolysaccharides, thereby supporting the capability of mature endometrial stromal cells to undergo cartilaginous metaplasia in response to chronic inflammation or trauma.

Use of estrogen is controversial as it can promote osteogenesis and can be one of the causes of endometrial ossification.

The most common presentation of osseous metaplasia of endometrium is usually secondary infertility. The patients can also present with menstrual irregularities, pelvic pain, dyspareunia, and vaginal discharge. Osseous metaplasia causes subfertility and menstrual irregularities by changing the *milieu* of uterine cavity through the increased production of prostaglandins. Marcus et al[11] proposed increased prostaglandin production as a cause of subfertility in the presence of bony fragments.

Ultrasound examination plays a primary role in the diagnosis of patients with osseous metaplasia.[7] The characteristic hyperechogenic pattern is strongly suggestive of osseous tissue within the uterus and should be confirmed by hysteroscopic examination. The gold standard for its diagnosis and treatment is hysteroscopy.[12] Hysteroscopy is an effective means of extracting the heterotopic tissue from the uterus and reestablishing fertility, even after a long period of infertility.

Complete removal of the bony spicules from the endometrial cavity by hysteroscopy regains fertility and cures menstrual symptoms.

CONCLUSION

Endometrial ossification is a rare entity, which can be misdiagnosed and requires higher degree of suspicion to diagnose the condition properly. Sonography plays an important role in detecting this condition. Osseous metaplasia can be deeply embedded in the uterine

mucosa and may present the same contraceptive effect as an intrauterine contraceptive device, thereby causing secondary infertility. Hysteroscopy has been shown to be effective in the diagnosis and treatment of cases of osseous metaplasia of the endometrium associated with infertility.

REFERENCES

1. Umashankar T, Patted S, Handigund R. Endometrial osseous metaplasia: clinicopathological study of a case and literature review. J Hum Reprod Sci 2010 May-Aug;3(2):102-104.
2. Adamson NE Jr, Sommers SC. Endometrial ossification: report of two cases. Am J Obstet Gynecol 1954 Jan;67(1):187-190.
3. Singh P, Kapur K, Singla S, Naz N. Endometrial osseous metaplasia and mature bone formation with extramedullary hematopoiesis. J Hum Reprod Sci 2011 Jan-Apr;4(1):56-57.
4. Melius F, Julian T, Nagel T. Prolonged retention of intrauterine bones. Obstet Gynecol 1991 Nov;78(5 Pt 2):919-921.
5. Bhatia NN, Hoshiko MG. Uterine osseous metaplasia. Obstet Gynecol 1982 Aug;60(2):256-259.
6. Ramya T, Chitra TV, Poornima C, Anjana B. Endometrial osseous metaplasia: clinicopathological study of a case and literature review. Int J Reprod Contracept Obstet Gynecol 2013 Dec;2(4):719-721.
7. Rose-e-Silva JC, Barcelos ID, Navarro PA, Rosa-e-Silva ACJ, Nogueira AA, Ferriana RA. Osseous metaplasia of the endometrium associated with infertility: a case report and review of the literature. J Med Case Rep 2009 Sep;3:7427.
8. Cayuela E, Perez-Medina T, Vilanova J, Alejo M, Canadas P. True osseous metaplasia of the endometrium: the bone is not from a fetus. Fertil Steril 2009 Apr;91(4):1293.e1-1293.e4.
9. Bahceci M, Demirel LC. Osseous metaplasia of the endometrium: a rare cause of infertility and its hysteroscopic management. Hum Reprod 1996 Nov;11(11):2537-2539.
10. Roth E, Taylor HB. Heterotopic cartilage in the uterus. Obstet Gynecol 1966 Jun;27(6):838-844.
11. Marcus SF, Bhattacharya J, Williams G, Brinsden P, Hamou J. Endometrial ossification: a cause of secondary infertility. Am J Obstet Gynecol 1994 May;170(5 Pt 1):1381-1383.
12. Lainas T, Zorzovilis I, Petsas G, Alexopoulou E, Lainas G, Ioakimidis T. Osseous metaplasia: case report and review. Fertil Steril 2004 Nov;82(5):1433-1435.

10.5005/jp-journals-10033-1308

CASE REPORT

Management of Acute Appendicitis and Left Paraovarian Cyst in a Case of Situs Inversus Totalis by Laparoscopy

[1]Samir S Deolekar, [2]Dnyaneshwar Mohare, [3]Anuj Sharma

ABSTRACT

Introduction: Situs inversus totalis (SIT) is an entity in which there is transposition of both the abdominal and thoracic organs. Presentation of acute abdomen in a case of SIT poses a challenge to the treating surgeon. We present a rare case report in which we identify the role of laparoscopy in confirming acute appendicitis with a simultaneous left paraovarian hemorrhagic cyst as a cause of left iliac fossa pain.

Case report: A 17-year-old female presented with pain in the left lower abdominal quadrant. Ultrasonography and computed tomography confirmed a left-sided inflamed appendix and a left paraovarian hemorrhagic cyst along with transposition of other organs. A diagnostic laparoscopy was done to confirm the diagnosis with subsequent appendectomy and cyst enucleation as a definitive treatment for left iliac fossa pain.

Discussion: Management of acute abdomen in a case of SIT can be challenging, keeping in mind the transposed organs and also that the nervous supply may still be normal in up to 50% of the cases. The role of diagnostic laparoscopy is pertinent in arriving at diagnosing and treatment of the underlying pathology or pathologies as in our case.

Keywords: Abdominal pain, Appendicitis, Paraovarian cyst, Situs inversus totalis.

How to cite this article: Deolekar SS, Mohare D, Sharma A. Management of Acute Appendicitis and Left Paraovarian Cyst in a Case of Situs Inversus Totalis by Laparoscopy. World J Lap Surg 2017;10(2):73-76.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Situs inversus (SI) is a rare congenital developmental anomaly occurring with an incidence of 1:5,000 to 1:10,000 live births in which abdominal organs are placed as mirror image of each other.[1] There is no racial predilection, and sex incidence is 1:1. Situs inversus totalis (SIT) is a condition in which both thoracic and abdominal organs are transposed. The incidence of SIT is approximately 1/1,400 to 1/35,000 in the general population. Acute abdomen in SIT possesses a big diagnostic dilemma as though the viscus is transposed, but their nervous innervation may follow the normal original distribution as in 50% of the individuals. The incidence of acute appendicitis associated with SIT is reported to be between 0.016 and 0.024%.[2,3] Laparoscopy is a valuable tool in surgeon's hand in case of SIT with acute abdomen, which provides confirmatory and definitive surgery of involved pathology.[4]

To the best of our knowledge, there are no reported cases of acute abdomen due to acute appendicitis associated with left paraovarian hemorrhagic cyst in patients with SIT.

CASE REPORT

A 17-year-old female presented in the casualty ward with complaints of left lower quadrant nonradiating pain for 1 day. The patient had history of nausea, but no fever, vomiting, or diarrhea. There was no history of associated abdominal or any previous similar attack of pain in abdomen. The patient had a normal menstrual history with no comorbid conditions like tuberculosis, diabetes, etc. She was hemodynamically stable and on physical examination revealed tenderness in the left iliac fossa with localized guarding. Laboratory investigations revealed a raised total leukocyte count of 13,500 cells/mL, with a differential neutrophil count of 85% of the total cells. The liver function tests and renal function tests were within the normal limits. A plain chest radiograph showed the presence of dextrocardia with a gastric bubble on the right side. Ultrasonography (USG) revealed a tubular, aperistaltic structure in the left iliac fossa with a diameter of 9 mm along with a paraovarian cyst of size 8 × 12 mm and transposition of the abdominal organs. The abdominal computed tomography (CT) revealed the presence of a contrast-enhanced appendix with the maximum diameter of 9.5 mm and adjacent fat stranding along with a left paraovarian cyst of diameter 9 × 12 mm (Fig. 1) in size with transposed intraabdominal organs (Fig. 2). A diagnostic laparoscopy was planned in view of localized guarding and raised white blood cell count. A 10 mm umbilical port was placed with open technique. The second 10 mm working port was placed

[1]Associate Professor, [2]Assistant Professor, [3]Registrar

[1-3]Department of General Surgery, King Edward Memorial Hospital and Seth Gordhandas Sunderdas Medical College Mumbai, Maharashtra, India

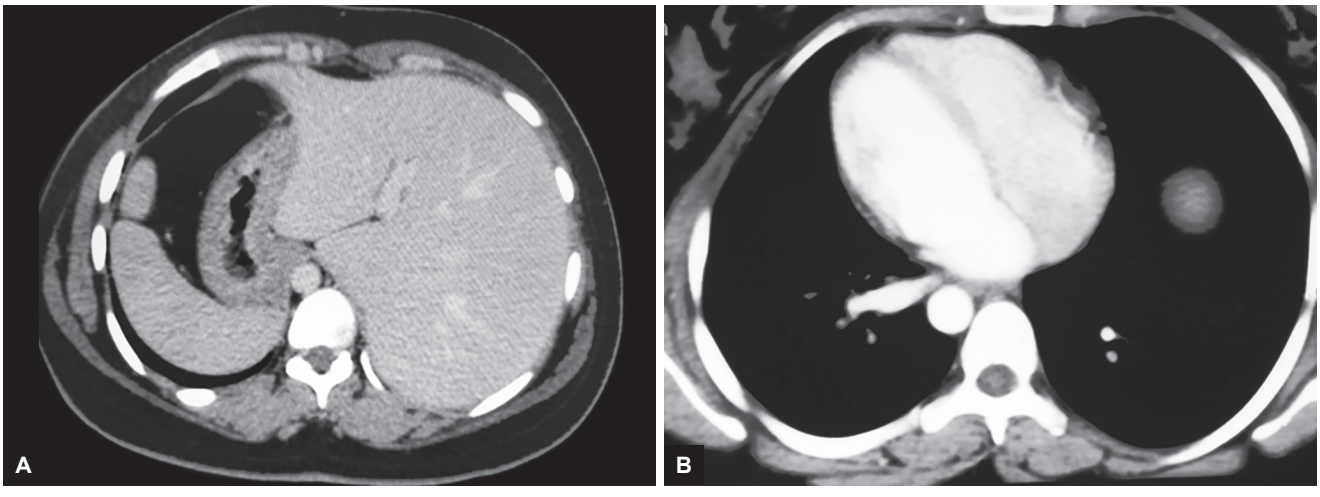
Corresponding Author: Anuj Sharma, Registrar, Department of General Surgery, King Edward Memorial Hospital and Seth Gordhandas Sunderdas Medical College, Mumbai, Maharashtra India, Phone: +917303907379, e-mail: anuj9863@gmail.com

Fig. 1: Computed tomography scan with a left-sided inflamed appendix

in right iliac fossa on the midclavicular line and the third 5 mm trocar with the working port was placed in the suprapubic region. The operative findings showed an inflamed turgid appendix with a normal base (Fig. 3). There was also a paraovarian cyst present along the left ovary with minimal free fluid collection in the pouch of Douglas (Fig. 4). Transposition of the various abdominal organs was also confirmed (Fig. 5). A laparoscopic appendectomy with enucleation of paraovarian cyst was done. An inflamed appendix with inflammatory infiltrates was confirmed in the histopathology report. Postoperative recovery was uneventful with patient discharged on full diet on 4th postoperative day without any complications.

DISCUSSION

Matthew Baillie[5] first demonstrated the complete mirror image, reversal of thoracic and abdominal organs in SI in the 18th century. It is a rare congenital anomaly where abdominal organs are placed as a mirror image of each other. In SIT, both abdominal and thoracic organs are transposed. The SI results due to incomplete penetration



Figs 2A and B: Computed tomography scan with transposition of the visceral abdominal organs: (A) A dextrocardia and (B) confirming SIT

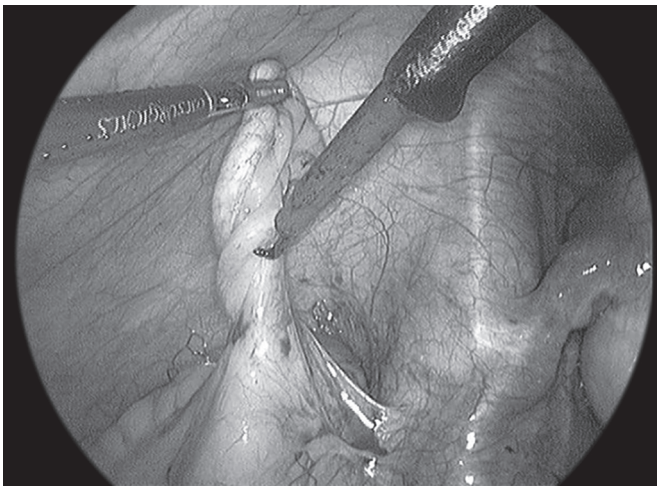


Fig. 3: Diagnostic laparoscopy showing an inflamed left-sided appendix with a normal base

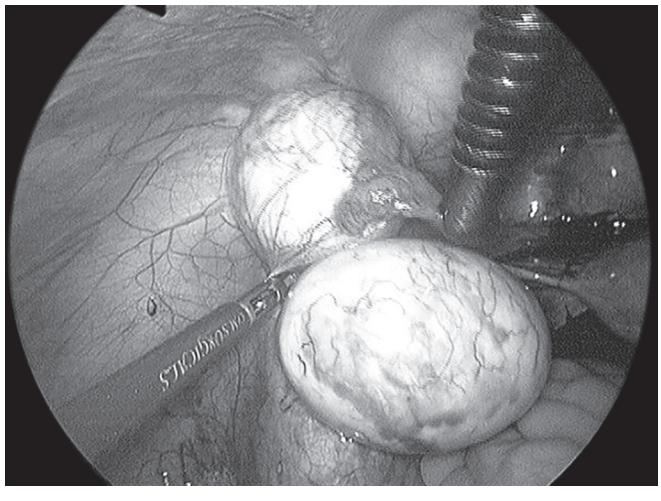
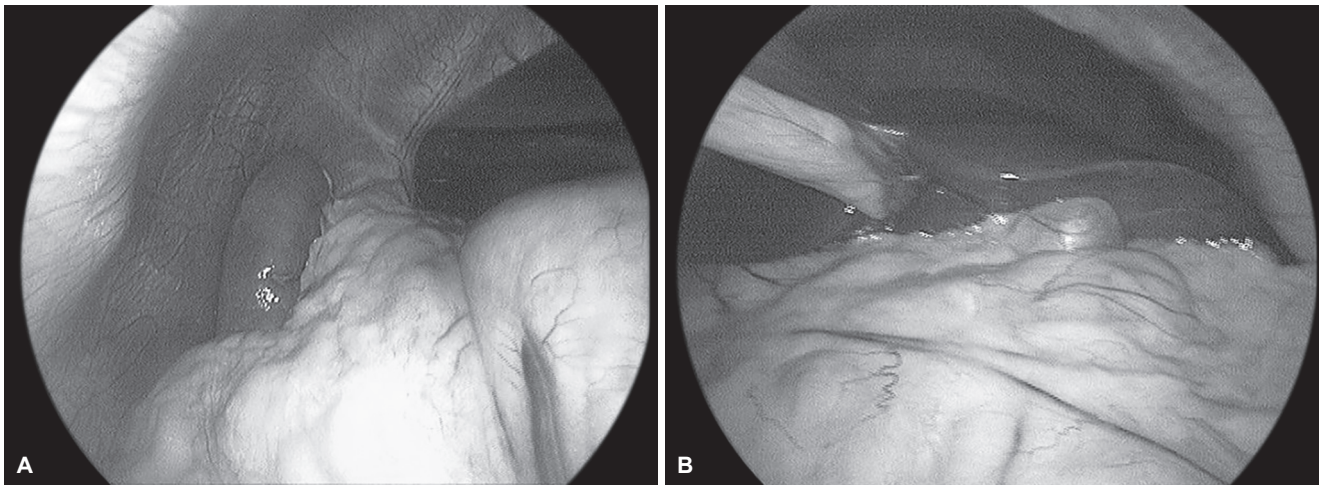


Fig. 4: Left-sided paraovarian cyst during diagnostic laparoscopy



Figs 5A and B: Transposed abdominal organs with spleen in the right hypochondrium: (A) Liver along the left hypochondrium; and (B) during diagnostic laparoscopy

of single autosomal recessive gene located on the long arm of chromosome 14.[6] Acute abdomen in SI is a major clinical challenge for surgeons for diagnosing and treating the pathology. In fact, this is the reason why in 40% of cases, the incision for surgical pathology is planned inappropriately.[7,8]

The differential diagnosis of left lower quadrant pain in SIT patients includes diverticulitis, epididymitis, incarcerated or strangulated hernia, bowel obstruction, regional enteritis, psoas abscess, mesenteric ischemia, right- and left-sided acute appendicitis (LSAA), pelvic inflammatory disease, endometriosis (in females), and others.[9,10]

The diagnosis of acute appendicitis in patients with SIT can be based on clinical examination, blood investigations, X-rays, USG, electrocardiogram, barium studies, CT scan, and diagnostic laparoscopy. However, in SIT with multiple pathologies, cause of symptoms is difficult to correlate and in these circumstances, the laparoscopy offers a big role in diagnosis as well as definite treatment of pathology. Even if the surgery is not possible to be completed laparoscopically due to any reason, it allows the incision to be properly placed at the site of pathology, as in about 18.4 to 31% of patients with SIT, the pain caused by LSAA has been replaced in right lower quadrant. Incision has been reported as inappropriate sites in greater than 40% of cases.[7,8]

Regarding the pain location of LSAA, Akbulut et al[11] reported that 62% of patients presented with left lower quadrant pain, 14% with right lower quadrant pain, and 7% with bilateral pain. Because the nervous system may not show corresponding transposition, pain location may be confusing, so preoperative diagnosis has been made only in 51% of patients.

The authors believe that any SIT patients who present with lower abdominal pain, especially female, should undergo diagnostic laparoscopy as many gynecological pathologies may also mimic appendicitis. Removing the appendix even if appearing normal may eliminate any possibility of misdiagnosis in future. It will also exclude the risk of complications that come with delayed diagnosis, such as appendiceal rupture, which can be fatal in young female patients.[12]

There is no standard port position for laparoscopic appendectomy in SIT patients, and it is placed according to basic principles of laparoscopy and ergonomics.[13]

CONCLUSION

With the case report, the authors wish to suggest that in patients of SI with acute abdomen, the laparoscopy is an important tool in surgeons' hand in diagnosing as well as in doing definitive management of patient. Even in the circumstances of normal looking appendix, it is better to do appendectomy to avoid future misdiagnosis and decrease morbidity associated with the same.

REFERENCES

1. Zilberstein B, Dio LJ, Eshkenazy R, Sallet JA, Ramos AC. The treatment of portal hypertension by videolaparoscopy in situs inversus totalis. Hepatogastroenterology 2000 May-Jun;47(33):678-680.
2. van Steensel CJ, Wereldsma JC. Acute appendicitis in complete situs inversus. Neth J Surg 1985 Aug;37(4):117-118.
3. Huang SM, Yao CC, Tsai TP, Hsu GW. Acute appendicitis in situs inversus totalis. J Am Coll Surg 2008 Dec;207(6):954.
4. Contini S, Dalla Valle R, Zinicola R. Suspected appendicitis in situs inversus totalis: an indication for a laparoscopic approach. Surg Laparosc Endosc [Internet]. 1998 Oct [cited 2017 Jan 11];8(5):393-394.
5. Baillie M. An account of a remarkable transposition of the viscera. Trans R Soc Lond 1788 Jan;78:350-363.
6. Ishibashi H, Oshio T, Sogami T, Nii A, Mori H, Shimada M. Torsion of an accessory spleen with situs inversus in a child. J Med Invest [Internet]. 2012 [cited 2017 Jan 11];59(1-2):220-223.
7. Blegen HM. Surgery in situs inversus. Ann Surg [Internet]. 1949 Feb [cited 2017 Jan 11];129(2):244-259.

8. Garg P, Singh M, Marya SK. Intestinal malrotation in adults. Indian J Gastroenterol 1991 Jul;10(3):103-104.
9. Nelson MJ, Pesola GR. Left lower quadrant pain of unusual cause. J Emerg Med [Internet]. 2001 Apr [cited 2017 Jan 11];20(3):241-245.
10. Cartwright SL, Knudson MP. Evaluation of acute abdominal pain in adults. Am Fam Physician 2008 Apr;77(7):971-978.
11. Akbulut S, Caliskan A, Ekin A, Yagmur Y. Left-sided acute appendicitis with situs inversus totalis: review of 63 published cases and report of two cases. J Gastrointest Surg 2010 Sep;14(9):1422-1428.
12. Song JY, Rana N, Rotman CA. Laparoscopic appendectomy in a female patient with situs inversus: case report and literature review. JSLS 2004 Apr-Jun;8(2):175-177.
13. Palanivelu C, Rangarajan M, John SJ, Senthilkumar R, Madhankumar MV. Laparoscopic appendectomy for appendicitis in uncommon situations: the advantages of a tailored approach. Singapore Med J 2007 Aug;48(8):737-740.

10.5005/jp-journals-10033-1309

CASE REPORT

Xanthogranulomatous Cholecystitis

[1]Hana Alhomoud, [2]Mohamed Abdelmohsen

ABSTRACT

Xanthogranulomatous cholecystitis is a rare, benign, chronic inflammatory disease of the gallbladder (GB). Its importance lies in the fact that imaging studies and intraoperative appearance may mimic tumor of the GB. Xanthogranulomatous cholecystitis is difficult to diagnose pre- or intraoperatively and remains a challenge in medical practice. The definitive diagnosis depends on the histopathologic examination.

Keywords: Gallbladder cancer, Surgery, Xanthogranulomatous cholecystitis.

How to cite this article: Alhomoud H, Abdelmohsen M. Xanthogranulomatous Cholecystitis. World J Lap Surg 2017;10(2):77-79.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Xanthogranulomatous cholecystitis (XGC) is an uncommon variant of chronic cholecystitis characterized by the presence of grayish yellow nodules or streaks in the gallbladder (GB) wall, mainly caused by lipid-laden macrophages.[1] Although well-defined pathologically, XGC still remains difficult for the radiologist to recognize because some of the sonographic and computed tomography (CT)[2-4] features of the disease are nonspecific, such as GB wall thickening and calculi. This case report describes the clinical, sonographic, and CT findings in one patient with histologically diagnosed XGC.

CASE REPORT

A 59-year-old male with a history of chronic calcular cholecystitis, type II diabetes mellitus was admitted to Al-Sabah Hospital, Kuwait, with a 2-day history of abdominal pain and jaundice.

Abdominal ultrasound (US) and CT abdomen were done, which revealed distended GB with concentric lobulated wall thickness (1.1 cm) with mud seen within it, dilated common bile duct (CBD), dilated intrahepatic biliary radicles, possibility of cholangiocarcinoma as described by sonarist and suggestion of cholecystitis with fluid collection in CT conclusion. The patient had endoscopic retrograde cholangiopancreatography with papillotomy and sweeping to the CBD with balloon catheter, with small amount of pus coming from the GB as described by the interventional radiologist.

Laparoscopic cholecystectomy was started, which was converted to open cholecystectomy. The GB wall was thickened and the serosa was surrounded by dense fibrous adhesions, which were attached to adjacent hepatic parenchyma and transverse colon. There was a small-sized abscess in the GB wall. Dissection between the GB serosa and hepatic parenchyma was difficult leading to subtotal cholecystectomy. Cross-section through the wall revealed multiple yellow-colored, nodule-like lesions, and there were also multiple black-pigmented gallstones.

The pathologic findings showed the collections of foamy histiocytes containing abundant lipid in the cytoplasm and admixed lymphoid cells. Histologically, it was confirmed as XGC.

The picture of XGC is shown in Figures 1 and 2.

The patient was discharged on postoperative day 10 without complications.

DISCUSSION

Xanthogranulomatous cholecystitis was first reported and named by McCoy et al, with a low incidence, merely 0.7 to 13.2% of all inflammatory diseases of the GB, and

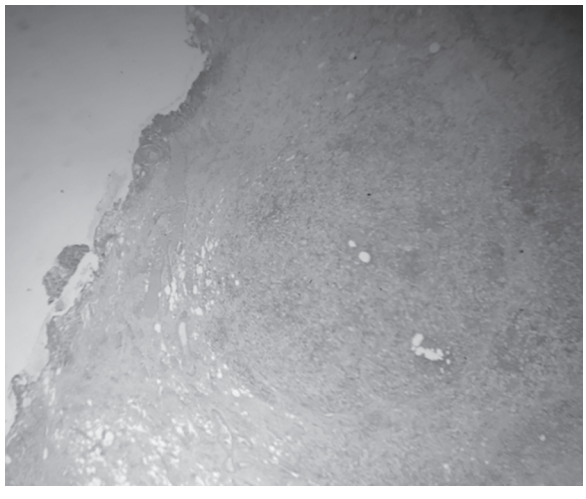


Fig. 1: Low-power microscopic view of ulceration of epithelium with underline lobulated lesion

[1]Consultant, [2]Registrar

[1,2]Department of Surgery, Al-Sabah Hospital, Kuwait City, Kuwait Kingdom of Saudi Arabia

Corresponding Author: Hana Alhomoud, Consultant Department of Surgery, Al-Sabah Hospital, Kuwait City, Kuwait Kingdom of Saudi Arabia, Phone: +966551440610, e-mail: hana_alhomoud@hotmail.com

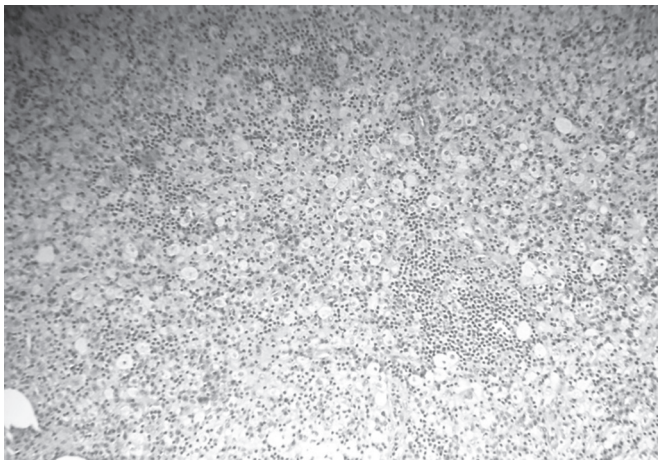


Fig. 2: High-power microscopic picture. Collections of foamy histiocytes mixed with lymphocytes

it occurs mostly in middle-aged and old persons.[5-8] The low incidence of XGC sometimes leads to misdiagnosis by clinicians.

No symptoms and signs are specific for XGC; they are similar to those of acute or chronic cholecystitis.[9] In this case report, the patient had the symptoms in the right hypochondrial region and suffered from radiating pain in the shoulder and back, nausea, vomiting, and fever. Yet, some features on US[4] and CT[10] were highly suggestive of XGC, including thickening of the GB wall, GB stone shadow, and adhesion to neighboring tissues and organs. Despite all these distinctions, it is difficult to differentiate XGC from carcinoma of the GB clinically.[11,12] In this study, US misdiagnosed this case of XGC as carcinoma of the GB, while CT is not, indicating a fairly high misdiagnosis rate, which may be related to the low incidence of XGC as well as insufficient experience of clinicians. Chronic inflammation in XGC causes persistent thickening of the GB wall, adhesions to adjacent tissues and organs, and in some cases, Mirizzi syndrome was found.[2] In other cases, an internal fistula forms between the GB and a neighboring viscous.[13] In this case report, the major intraoperative findings included thickening of the GB wall and adhesions of the GB to adjacent tissues and organs. In addition, cholecystolithiasis was found in our case, in accordance with the incidence rate in most reports (85[13] to 100%). Cholecystectomy is the first choice for XGC, either complete or partial. Dissection should not proceed by force and the excision range should not be blindly extended in order to avoid injuries to the extrahepatic bile duct and neighboring organs. Special attention should be paid to cases where internal fistula or Mirizzi syndrome is found and biliary injuries should be avoided. Analysis of data from outside of China[7] shows that in 65% of XGC cases, complete cholecystectomy was difficult and 35% of them underwent partial cholecystectomy. In our study, the mean duration of operation was longer than that of common open cholecystectomy, illustrating that XGC creates difficulty in operation.

Although XGC is a benign change of the GB with a low mortality rate,[13] patients with XGC usually have a longer hospital stay than those with cholecystitis who undergo cholecystectomy and more postoperative complications, including leakage of bile, bile peritonitis, GB bleeding, hepatic abscess, infection of the incisional wound, and cholangitis stenosis. This is largely related to difficulty in stripping the GB, the mode of operation, and the physical condition of the patient.[7]

In spite of difficulty in surgical treatment of XGC, the operation can be carried out successfully as long as clinicians have a sound knowledge of the anatomical structures of the GB, make an accurate intraoperative diagnosis, and choose the proper mode of operation.

CONCLUSION

Differentiating XGC from GB cancer is a diagnostic dilemma. Making this distinction preoperatively or intraoperatively is difficult. The presence of firm adhesions of the GB to neighboring organs and tissues, thickened GB wall together with gallstones in a patient with chronic disease is highly suggestive of XGC. A definitive diagnosis still necessitates a histopathological examination.

REFERENCES

1. Houston JP, Collins MC, Cameron I, Reed MW, Parsons MA, Roberts KM. Xanthogranulomatous cholecystitis. Br J Surg 1994 Jul;81(7):1030-1032.
2. Lichtman JB, Varma VA. Ultrasound demonstration of xanthogranulomatous cholecystitis. J Clin Ultrasound 1987 Jun;15(5):342-345.
3. Casas D, Pérez-Andrés R, Jiménez JA, Mariscal A, Cuadras P, Salas M, Gómez-Plaza MC. Xanthogranulomatous cholecystitis: a radiological study of 12 cases and review of the literature. Abdom Imaging 1996 Sep-Oct;21(5):456-460.
4. Kim PN, Ha HK, Kim YH, Lee MG, Kim MH, Auh YH. US findings of xanthogranulomatous cholecystitis. Clin Radiol 1998 Apr;53(4):290-292.
5. Eriguchi N, Aoyagi S, Tamae T, Kanazawa N, Nagashima J, Nishimura K, Hamada S, Kawabata M, Kodama T. Xanthogranulomatous cholecystitis. Kurume Med J 2001;48(3): 219-221.
6. McCoy JJ Jr, Vila R, Petrossian G, McCall RA, Reddy KS. Xanthogranulomatous cholecystitis. Report of two cases. J S C Med Assoc 1976 Mar;72(3):78-79.
7. Guzman-Valdivia G. Xanthogranulomatous cholecystitis in laparoscopic surgery. J Gastrointest Surg 2005 Apr;9(4): 494-497.
8. Cardenas-Lailson LE, Torres-Gomez B, Medina-Sanchez S, Mijares-Garcia JM, Hernandez-Calleros J. Epidemiology of xanthogranulomatous cholecystitis. Cir Cir 2005 Jan-Feb;73(1):19-23.

9. Reaño G, Sanchez J, Ruiz E, Celis J, Payet E, Berrospi F, Chavez I, Young F, Doimi F. Xanthogranulomatous cholecystitis: retrospective analysis of 6 cases. Rev Gastroenterol Peru 2005 Jan-Mar;25(1):93-100.
10. Chun KA, Ha HK, Yu ES, Shinn KS, Kim KW, Lee DH, Kang SW, Auh YH. Xanthogranulomatous cholecystitis: CT features with emphasis on differentiation from gallbladder carcinoma. Radiology 1997 Apr;203(1):93-97.
11. Baykara M, Karahan OI. Xanthogranulomatous cholecystitis mimicking carcinoma of gallbladder. Tani Girisim Radyol 2004 Mar;10(1):56-58.
12. Rao RV, Kumar A, Sikora SS, Saxena R, Kapoor VK. Xanthogranulomatous cholecystitis: differentiation from associated gall bladder carcinoma. Trop Gastroenterol 2005 Jan-Mar;26(1):31-33.
13. Guzman-Valdivia G. Xanthogranulomatous cholecystitis: 15 years' experience. World J Surg 2004 Mar;28(3):254-257.

10.5005/jp-journals-10033-1310

CASE REPORT

Gastric Fistula as a Complication of Splenectomy: Case Report and Literature Review

[1]Hana Alhomoud, [2]Mohamed Abdelmohsen

ABSTRACT

Gastric fistula following splenectomy is a rare but serious occurrence, which may result in morbidity or death. Several factors, acting singly or in combination, may predispose to the development of postsplenectomy gastric fistula and perforation. These include direct surgical trauma to the gastric wall, generalized arteriosclerotic disease, hematoma in the gastrosplenic bed, and reflection of gastric muscle fibers into the gastrosplenic ligament. The usual site of rupture of the stomach is along the greater curvature in the fundic portion. In circumstances in which splenectomy is associated with known or suspected compromise of the blood supply to this portion of the stomach, a method of enfolding the greater curvature is done to prevent the development of a gastric perforation or fistula formation. The objective of this study was to report a case of a patient who had splenectomy because of closed abdominal trauma. 3 weeks postsurgery, the patient presented with hematemesis, and the results of investigations showed gastric fistula. During the second operation, perforation was identified at gastroesophageal junction resulting from a huge hematoma at postsplenectomy bed. The lesion was sutured after revival of its borders, and the patient had good recovery.

Awareness of the possibility of this uncommon but serious complication will aid in its early recognition and treatment.

Keywords: Gastric fistula, Splenectomy, Stomach rupture.

How to cite this article: Alhomoud H, Abdelmohsen M. Gastric Fistula as a Complication of Splenectomy: Case Report and Literature Review. World J Lap Surg 2017;10(2):80-81.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Delayed perforation of the stomach following splenectomy is uncommon. Reports of this complication have appeared sporadically. The perforation is usually situated high on the greater curvature of the stomach where short gastric vessels in the gastrosplenic omentum have been transected, and the cause has been assumed to be direct injury to the gastric wall. However, it appears that interference with the vascular supply to the greater curvature may be a factor in fistula formation.

The objective of this study was to report a case of gastric perforation after splenectomy due to trauma that evolved with necrosis and gastric perforation, which was successfully dealt with.

CASE REPORT

A 37-year-old male was admitted to the emergency unit after fall from height. Physical examination revealed tachypnea, heart rate of 100/minute, and arterial pressure of 100/50 mm Hg. He had severe pain in pelvic due to pelvic fracture. Computed tomography (CT) chest, abdomen, and pelvis showed grade I splenic injury (in accordance with the organ lesion scale of the American Association of Trauma Surgery).

Patient was shifted to operating theater where pelvic fixation was done. Postsurgery, patient developed massive deep venous thrombosis (DVT) and kept on anticoagulant. Five days postsurgery, hemoglobin dropped and blood pressure too dropped, so resuscitation was done. Urgent abdominal CT showed presence of free abdominal fluid with splenic tear.

Laparotomy showed the presence of 500 mL of hemorrhagic fluid free in peritoneal cavity and a splenic tear involving the hilum. In the course of splenectomy, the short vessels were carefully individualized and sectioned. The body and fundic regions of the stomach were inspected without any inadvertent ligatures of the gastric wall being detected. A drain was fixed at left subphrenic space exteriorized through an opening on the left flank. At the end of the intracavity surgical procedure, the coloration of the stomach was normal.

Bowel sounds returned on the second operative day, and oral feeding was started. The drain was removed after 5 days. Patient was kept on anticoagulants due to massive DVT. Ten days post-op patient developed postsplenectomy hematoma at splenic bed in relation to stomach fundus and that was treated conservatively by adjusting the anticoagulant dose.

Three weeks postsurgery, the patient developed hematemesis. Upper endoscopy was done which showed perforated necrotic ulcer with bleeding at fundus stomach around 2 cm from gastroesophageal junction.

Patient was submitted to a new surgical intervention. Laparotomy showed a huge well-developed organized

[1]Consultant, [2]Registrar

[1,2]Department of Surgery, Al-Sabah Hospital, Kuwait City, Kuwait Kingdom of Saudi Arabia

Corresponding Author: Hana Alhomoud, Consultant, Department of Surgery, Al-Sabah Hospital, Kuwait City, Kuwait, Kingdom of Saudi Arabia, Phone: +966551440610, e-mail: hana_alhomoud@hotmail.com

hematoma at splenic bed with fistula tract connecting the perforated fundus ulcer to the hematoma.

The hematoma was evacuated completely with excision of the fistula tract and the lesion at stomach fundus was around 2 × 2 cm and was sutured after revival of its borders with simple stiches on two planes.

The patient was discharged 2 weeks postoperatively in a good general condition.

DISCUSSION

The stomach has exuberant arterial blood irrigation, which makes the organ resistant toward postoperative ischemic changes.[1] Several studies have demonstrated the rich intramural and extramural anastomotic network by experiments.[1,2] Nevertheless, there are some surgical procedures that interfere to a greater or lesser extent with the blood supply, such that reports of gastric necrosis and gastric perforation are becoming more frequent.[3,4]

Classically, this complication has been thought to be secondary to direct trauma to gastric wall by surgical instrumentation.[5] An area of necrosis presumably appears high on the posterior gastric wall and is followed by ulceration and perforation. At the apex of the triangular-shaped gastrosplenic omentum, the superior pole of the spleen is in its closest proximity to the stomach. In the course of ligation of the short gastric arteries in the apex of this triangle, direct injury to the stomach wall may occur. In describing the technique of splenectomy, various authors[6-9] have cautioned against inadvertent instrumentation of this area of the stomach. In spite of this precaution and careful surgical technique, gastric fistulas still do occur following splenectomy.

One of the rarest conditions which may predispose to a gastric fistula following splenectomy is the presence of organizing hematoma with inflammatory reaction in the gastrosplenic omentum adjacent to the gastric wall secondary to rupture of the spleen, which was published by Harrison et al.[10]

In this case study, we believe that the organized huge hematoma was the leading cause for the stomach perforation as it led to compression necrosis on the fundus wall.

There are other several conditions which may predispose to gastric fistula following splenectomy, such as abrasions or denudement of serosal covering of the greater curvature of the stomach resulting from a technically difficult splenectomy, interruption of a reflection of gastric muscle fibers into the gastrosplenic ligament at the attachment to the stomach wall. This condition was demonstrated by Whitesell.[11]

Decreased vascularity, especially in elderly patients with arteroscleroticdisease of the gastric vasculature, may also predispose to gastric fistula postsplenectomy. And severe trauma with multiple injuries or any condition predisposes to stress ulceration.

CONCLUSION

Gastric perforation and fistula formation should be suspected when a patient who has had splenectomy presents unfavorable postoperative evolution. Awareness of the possibility of this uncommon but serious complication will aid in its early recognition and treatment.

REFERENCES

1. Barlow TE, Bentley FH, Walder DN. Arteries, veins and arteriovenous anastomosis in human stomach. Surg Gynecol Obstel 1951 Dec;93(6):657-671.
2. Souza LA. Micro-hemocirculation do stomach: aspectos morfologicos e functionaris [tese]. Lisboa: Faculadade de Medicina de Lisboa; 1974.
3. Lambert R, Bugnon B, Partensky C, Saubier E. Ulcer gastric procedure après vagotomy hyperselective and drainage. Arch Fr Mal App Dig 1976 Jan-Feb;65(1):41-46.
4. Schein M, Saadia R. Postoperative gastric ischaemia. Br J Surg 1989 Aug;76(8):844-848.
5. Bryk D, Petigrow N. Postsplenectomy gastric perforation. Surgery 1967 Feb;61(2):239-241.
6. Balfour DC. Surgery of the spleen. Collect Papers Mayo Clinic 1917;9:375.
7. Ballinger WF, Erslev AJ. Splenectomy. Curr Probl Surg 1965 Feb:35.
8. Mayo WJ. Surgery of the spleen. Surg Gynecol Obstet 1913;16:233.
9. Poole EH, Stillman RG. Surgery of the spleen. New York: Appleton and Co; 1923. p. 318.
10. Harrison BJ, Glanges E, Sparkman RS. Gastric fistula following splenectomy: its cause and prevention. Ann Surg 1977 Feb;185(2):210-213.
11. Whitesell FB. A Clinical and surgical anatomic study of the spleen. Surg Gynecol Obstet 1960;110:750.