



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research
Vol. 13, Issue, 08, pp.18428-18438, August, 2021
DOI: <https://doi.org/10.24941/ijcr.41880.08.2021>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

RESEARCH ARTICLE

USE OF BARBED THREAD IN LAPAROSCOPIC GASTROINTESTINAL SINGLE LAYER SUTURE ANASTOMOSIS

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ARTICLE INFO

Article History:

Received 27th May, 2021

Received in revised form

10th June, 2021

Accepted 15th July, 2021

Published online 30th August, 2021

Key Words:

User Reaction.

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ABSTRACT

To observe the impact of barbed suture and study its safety and feasibility in laparoscopic gastrointestinal surgeries. The study was conducted in the Post Graduate Department of General and Minimal and Access Surgery from June 2018 to June 2021. Our study was conducted on 34 patients and following observation was made.: The mean age in our study was 59.76 ± 12.497 Yrs. (Range from 21 to 85 Yrs.). Maximum were present in the age range of 60 to 79 (52.9%) and out of 34 patients, 22 (64.7 %) were males and 12 (35.3 %) females. The peri-operative diagnosis were malignancy 28 (82.4 %) (Ca stomach 21 (61.8 %), Ca colorectum 7 (20.6%)) with 6 (17.6%) of the patients had a benign disease (Choledochal Cyst/Oriental Cholangiohepatitis 3 (8.8%), Benign Gastric Outlet Obstruction 3 (8.8%)). The various procedures done, Gastrojejunostomy in maximum number of patients i.e. 17 (50%) followed by esophagojejunostomy in 6 (17.6%) patients. Ileotransverse Anastomosis in 5 (14.7%), Jejunojejunostomy and Colorectal Anastomosis each in 3 (8.8%) patients was observed. The time taken for various gastro-intestinal anastomosis, Colorectal anastomosis (mean 35-50 minuts), Gastro- jejunostomy (mean 25-40 minuts), Esophago- jejunostomy (mean 40-45 miutes), Ileotransverse anastomosis (30-49 minute), Jejunojejunostomy (40 -49 minuts). The hospital stay in various Gastrointestinal Surgeries Colorectal anastomosis (7 to 10 days), Gastro- jejunostomy (3 to 8 days), Esophago- jejunostomy (7 to 10 mdays), Ileotransverse anastomosis (5 to 8 days), Jejunojejunostomy (5 to 7 days).We conclude that the barbed sutures make the intracorporeal suturing fascinating and technically easy, which otherwise is tedious event. It adds speed to the intracorporeal suturing and makes it more proficient and technically feasible there by decreasing anastomotic bloodloss and leaks.

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Citation: Dr. Mushtaq Chalkoo, Dr. Imtiyaz ahmad Ganie, Dr. Zahid Mohd Rather, Dr. Tajamul samad, Dr. Mehraj-ud-din Ganaie and Yasmeen Akhtar. 2021. "Use of barbed thread in laparoscopic gastrointestinal single layer suture anastomosis.", *International Journal of Current Research*, 13, (08), 18428-18438.

INTRODUCTION

A barbed surgical suture is an innovative type of wound closure device that has a plurality of barbs projecting out from the body of suture. Barbs can be fabricated on the surface of conventional monofilament sutures by means of mechanical cutting, laser cutting or by extrusion dies (1,2). The presence of directional barbs allows free movement of the barbed suture in one direction, while generating resistance in the reverse direction by engaging the barbs with the surrounding tissue.

Barbed sutures are also known as knotless sutures. Barbed sutures can be classified into two categories based on the barb direction, namely: unidirectional and bidirectional. Unidirectional barbed sutures have a needle attached at one end and a welded anchoring loop at the other end to facilitate fixation. Bidirectional barbed sutures have two needles attached, one on each end, with a non-barbed transition zone in the middle of the suture length. The deployment of a bidirectional barbed suture starts from the middle of the wound and continues in each direction, while the deployment of a

unidirectional barbed suture is the same as for conventional sutures, starting at one end and moving to the other end (3). The anchoring performance of barbed sutures is achieved by the engagement of numerous barbs with the surrounding tissue. Therefore, the level of anchoring depends on the frequency and geometry of the barbs, the characteristics of the surrounding tissue, and the interactions between them. The properties of barbed sutures may include, but are not limited to, the type of suture material, suture size, barb geometry, barb alignment and the type of needle (4). Laparoscopic intra-corporeal suturing and knot tying for anastomosis is one of the most tedious and time-consuming event. It requires a safe and reproducible technique because most of the morbidity and mortality after gastrointestinal anastomosis are caused by leaks and fistulas. A knot can be a potential source of anastomotic failure (5-9). The use of barbed sutures for laparoscopic surgery have the advantage of performing the anastomosis without the need of knotting the sutures, possibly leading to a shorter learning curve. Recently, knotless barbed absorbable sutures have been used in various surgical situations, including gastrointestinal surgery, (10-13) gynecologic surgery, (14-16) and hepatobiliary-pancreatic surgery.(17-19). The V-Loc 180 closure device is a unidirectional barbed variant of the absorbable copolymer polyglyconate (Maxon, Covidien). It has the same material and degradation properties as a Maxon (monofilament polyglyconate) suture, and its tissue closing strength is approximately 50% at 30 days, with complete absorption in 180 days. Although etching the barbs reduces the core diameter of these sutures, they have been sized according to their post etching diameter, and the 3-0 V-Loc suture has the same tensile strength as a 3-0 Maxon suture. A loop at the end of the suture can be used for knotless suturing, and the first 2 cm of the suture lacks barbs to allow throws to be readjusted before the barbs are engaged. (20). Since its introduction in 1990s, minimally invasive surgery has gained widespread acceptance in many surgical fields due to its safety and advantages that this kind of procedure can offer as compared to open surgery (21-28). Nevertheless, the possibility to perform intra-corporeal anastomosis in minimally invasive surgery has underlined the importance of being able to perform a laparoscopic knot, the most difficult skill in laparoscopic surgery. In fact, gastroentero-, enteroentero- and coloenterotomy closure in minimally invasive procedures have always been challenging and related with serious complications (anastomotic leakage, intraabdominal abscess and stenosis). With the introduction of barbed sutures, the challenge of laparoscopic suturing has been made easier. The principal advantage of barbed sutures is the presence of barbs to anchor the suture to tissues in a knotless fashion, avoiding the need to tie a knot in a confined space.

In the current literature, the safety and efficacy of barbed suture has been demonstrated in many surgical fields (29-34), but less is known in digestive surgery, where its efficacy and safety have been demonstrated mainly in bariatric surgery (35-37). Recently, several studies are focused on barbed sutures to close gastrointestinal anastomosis after gastrectomy for cancer (38-40).

Aims and objective

)] To observe impact of barbed suture and study its safety and feasibility in laparoscopic gastrointestinal surgeries.

)] To assess and observe safety of continuous single layer suture in gastrointestinal anastomosis.

MATERIAL AND METHODS

The study was conducted in the Post-Graduate Department of General and minimal access surgery, Government Medical College Srinagar from June 2018 to June 2021. A total of 34 patients were included in the study. It was a prospective, observational study. The approval from the ethical committee was obtained. All patients, above 20 years of age, irrespective of sex, and with any benign or malignant Gastro-intestinal conditions were included in the study. Patients with liver or lung metastasis, patients unfit for general anesthesia and laparoscopy, and patients who would have conversion to open procedure were excluded. The patients were taken for laparoscopic Gastro-intestinal surgery after proper clinical evaluation. Each patient and his attendants were fully explained about the nature of the procedure in the language which they understood and a written consent was taken from the patient before surgery. Patients were also informed about the possible complications of the procedure. The patient's age, sex, and other demographic features, anthropometry, underlying co-morbid conditions, and relevant family history was recorded. Clinical data and parameters like systolic/diastolic BP, heart rate, body temperature, and respiratory rate were noted. The presenting clinical features of any Gastro-intestinal conditions and any treatment received for it prior to hospitalization was recorded. All the patients were evaluated according to preformed proforma including an elaborate history, detailed clinical examination, routine investigations (Complete blood count, Coagulogram, Liver function test, Kidney function test, Blood sugars, Serum electrolytes (Na⁺/K⁺).Chest X-ray) and specific investigations such as USG, colonoscopy and tumour markers, e.g. CEA.Chest X-Ray and abdominal USG were considered important measures to investigate lung and liver metastasis respectively. Preoperative CT scan of abdomen was done in all patients as a preoperative staging. Study time of anastomosis, hemorrhage from anastomosis and technical use of barbed sutures intra-operatively were noted. All patients underwent intra corporeal anastomosis with barbed sutures. The postoperative course including all complications was documented.

All such patients having benign or malignant condition involving Gastro-intestinal tract underwent diagnostic laparoscopy and tumor assessment, localization, local spread and distant spread was assessed. The resection was done on the basis of findings of diagnostic laparoscopy. Resection was done and anastomosis was performed to restore the continuity of the bowel. The barbed sutures were used in a continuous single layer fashion.

Pre-operative Preparation: After complete evaluation, the patients were assessed for anesthetic fitness to undergo surgery. All the patients were kept fasting 12 hours before surgery and a proper preparation was done using Ryle's tube and stomach wash. Serum electrolytes were repeated before surgery and necessary corrections were made. Ceftriaxone 1 gm I.V as surgical prophylaxis was given to every patient before surgery and part preparation was done in morning on the day of surgery. Thromboembolic prophylaxis was only given to high risk patients.

Statistical analysis: Data obtained was entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Categorical variables were analysed using Chi-Square test and Continuous variables by 2-sample independent t-test & p value <0.05 was considered statistically significant

RESULTS

The study, "Use of barbed threads in laparoscopic gastrointestinal single layer sutures" was carried out at tertiary care hospital in the Post-Graduate Department of General and minimal access surgery, Government Medical College Srinagar from June 2018 to June 2021.

A total of 34 gastro-intestinal anastomosis were performed using V loc sutures in a continuous single layer meeting the criteria laid down for the study. Out of 34 patients, 22 (64.7 %) were males and 12 (35.3 %) females as shown in table 1.

Table 1. Gender distribution

| | | Frequency | Percent |
|--------|-------|-----------|---------|
| Gender | F | 12 | 35.3 |
| | M | 22 | 64.7 |
| | Total | 34 | 100.0 |

The mean age in our study was 59.76 SD 12.497 Yrs. (21-85 Yrs.). Most of the patients were falling in age group of 60-79 Yrs. (52.9 %) followed by 40-59 Yrs. (35.3%). Groups of 20-39 and 80 each had equal frequency of 2 (5.9%). Age distribution is shown in table 2.

Table 2. Age distribution

| Group (Yrs.) | Frequency | Percent |
|--------------|-----------|---------|
| 20-39 | 2 | 5.9 |
| 40-59 | 12 | 35.3 |
| 60-79 | 18 | 52.9 |
| 80 | 2 | 5.9 |

Our study included a variety of patients including all aspects of gastrointestinal tract. Maximum number of studied patients had a malignancy 28 (82.4 %) (Ca stomach 21 (61.8 %), Ca colorectum 7 (20.6%)) with 6 (17.6%) of the patients had a benign disease (Cholelithiasis 3 (8.8%), Benign Gastric Outlet Obstruction 3 (8.8%)) as depicted in table 3.

Table 3. Peri-operative diagnosis

| | | Frequency | Percent |
|-------|-----------------------------------|-----------|---------|
| Valid | Benign Gastric Outlet Obstruction | 3 | 8.8 |
| | Ca Colorectum | 7 | 20.6 |
| | Ca Stomach | 21 | 61.8 |
| | Cholelithiasis | 3 | 8.8 |
| | Cholangiohepatitis | | |
| | Total | 34 | 100.0 |

Out of 34 patients we observed Gastrojejunostomy in maximum number of patients i.e. 17 (50%) followed by esophagojejunostomy in 6 (17.6%) patients. Ileotransverse Anastomosis in 5 (14.7%), Jejunojunctionostomy and Colorectal Anastomosis each in 3 (8.8%) patients was observed as shown in table 4.

Table 4. Procedure under observation

| | | Frequency | Percent |
|-------|----------------------------|-----------|---------|
| Valid | Colorectal Anastomosis | 3 | 8.8 |
| | Esophagojejunostomy | 6 | 17.6 |
| | Gastrojejunostomy | 17 | 50.0 |
| | Ileotransverse Anastomosis | 5 | 14.7 |
| | Jejunojunctionostomy | 3 | 8.8 |
| | Total | 34 | 100.0 |

Table 5 is showing the preoperative statistics of various laboratory parameters. The mean haemoglobin in the study was 10.920 SD 1.283 (8.200-13.700) and mean albumin level was 3.879 SD 0.468 (3.080-4.900). Out of 34 patients a single patient developed duodenal blow out 2.9%. No stenosis or any other complication was noted at end of the follow up. Perioperative period of all other patients was uneventful. All the patients had an uneventful follow up with satisfactory results.

DISCUSSION

A barbed surgical suture is an innovative type of wound closure device that has a plurality of barbs projecting out from the suture main body. Barbs can be fabricated on the surface of conventional monofilament sutures by means of mechanical cutting, laser cutting or by extrusion dies (2). First patented in 1964 by John Alcamo, though not approved for use in the United States until 2007 for approximation of soft tissue (1), barbed sutures are specially engineered sutures that slide through tissue in only one direction. Laparoscopic intra-corporeal suturing and knot tying for anastomoses is one of the most tedious and time-consuming. It requires a safe and reproducible technique because most of the morbidity and mortality after gastrointestinal anastomosis are caused by leaks and fistulas. A knot can be a potential source of anastomotic failure (5-9). The use of barbed sutures for laparoscopic surgery have the advantage of performing the anastomosis without the need of knotting the sutures, possibly leading to a shorter learning curve. Recently, knotless barbed absorbable sutures have been used in various surgical situations, including gastrointestinal surgery (10-13), gynecologic surgery (14-16) and hepatobiliary-pancreatic surgery (17-19). This prospective study was aimed to estimate the safety and feasibility of intestinal anastomosis using continuous single layer barbed sutures. Barbed sutures could potentially improve the efficiency of the intracorporeal reconstruction of the digestive tract after laparoscopic bowel resection, with less time needed to suture as they resist slippage and preclude the requirement for constant traction. In addition, they could reduce costs by closing the entry hole of the stapler instead of stapling. We performed 34 gastrointestinal anastomosis using V loc sutures in a continuous single layer out of whom 22 (64.7 %) were males and 12 (35.3 %) females. The mean age in our study was 59.76 ± 12.497 Yrs. (21-85 Yrs.). Various authors have evaluated barbed sutures in gastrointestinal tract surgeries viz. Lee SW, Kawai [HYPERLINK "https://www.ncbi.nlm.nih.gov/pubmed/?term=Kawai%20M%5BAuthor%5D&cauthor=true&cauthor_uid=26819279"](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kawai%20M%5BAuthor%5D&cauthor=true&cauthor_uid=26819279) Tashiro [HYPERLINK "https://www.ncbi.nlm.nih.gov/pubmed/?term=Tashiro%20K%5BAuthor%5D&cauthor=true&cauthor_uid=26819279"](https://www.ncbi.nlm.nih.gov/pubmed/?term=Tashiro%20K%5BAuthor%5D&cauthor=true&cauthor_uid=26819279) K et al (2016)⁽¹¹⁾, Silvia Palmisano et al (2014)⁽²¹⁾, Pacifico F et al (2015)⁽²⁴⁾.

Table 5. Laboratory parameters

| | Hb | HCT | TLC | PLT (in lacs) | Sr. Bilirubin | Sr. Protein | Sr. Albumin | Sr. Creatinine | Sr. Bun |
|-------------------|-------|-------|-------|------------------|------------------|----------------|----------------|-------------------|---------|
| Mean | 10.92 | 38.23 | 6.96 | 213.26 | .90 | 7.38 | 3.87 | 1.04 | 27.97 |
| Std. Deviation | 1.28 | 4.45 | 2.38 | 97.37 | .58 | .82 | .46 | .60 | 8.512 |
| Minimum | 8.20 | 30.0 | 3.00 | 1.98 | .20 | 5.80 | 3.08 | .10 | 16 |
| Maximum | 13.70 | 48.0 | 13.00 | 443.00 | 3.80 | 8.90 | 4.90 | 3.00 | 48 |

Table 6. Distribution of time taken for various gastrointestinal procedures and various anastomosis

| Report | | Duration of Surgery (Minutes) | | | Anastomotic Time (Minutes) | | Hospital Stay(Days) | |
|-------------------------------|----------------|-------------------------------|--|--|----------------------------|--|---------------------|--|
| Procedure | | | | | | | | |
| Colorectal Anastomosis | Mean | 170.00 | | | 40.00 | | 8.33 | |
| | N | 3 | | | 3 | | 3 | |
| | Std. Deviation | 45.826 | | | 8.660 | | 1.528 | |
| | Minimum | 130 | | | 35 | | 7 | |
| | Maximum | 220 | | | 50 | | 10 | |
| % of Total N | | 8.8% | | | 8.8% | | 8.8% | |
| Esophago- jejunostomy | Mean | 223.33 | | | 45.83 | | 9.50 | |
| | N | 6 | | | 6 | | 6 | |
| | Std. Deviation | 10.328 | | | 3.764 | | .837 | |
| | Minimum | 210 | | | 40 | | 8 | |
| | Maximum | 240 | | | 50 | | 10 | |
| % of Total N | | 17.6% | | | 17.6% | | 17.6% | |
| Gastro- jejunostomy | Mean | 146.76 | | | 33.71 | | 7.00 | |
| | N | 17 | | | 17 | | 17 | |
| | Std. Deviation | 42.608 | | | 5.034 | | 1.904 | |
| | Minimum | 90 | | | 25 | | 4 | |
| | Maximum | 190 | | | 40 | | 12 | |
| % of Total N | | 50.0% | | | 50.0% | | 50.0% | |
| Ileotransverse Anastomosis | Mean | 136.00 | | | 32.00 | | 5.60 | |
| | N | 5 | | | 5 | | 5 | |
| | Std. Deviation | 30.496 | | | 4.472 | | .894 | |
| | Minimum | 120 | | | 30 | | 5 | |
| | Maximum | 190 | | | 40 | | 7 | |
| % of Total N | | 14.7% | | | 14.7% | | 14.7% | |
| Jejuno- jejunostomy | Mean | 236.67 | | | 43.33 | | 7.33 | |
| | N | 3 | | | 3 | | 3 | |
| | Std. Deviation | 5.774 | | | 2.887 | | .577 | |
| | Minimum | 230 | | | 40 | | 7 | |
| | Maximum | 240 | | | 45 | | 8 | |
| % of Total N | | 8.8% | | | 8.8% | | 8.8% | |
| Total | Mean | 168.68 | | | 37.00 | | 7.38 | |
| | N | 34 | | | 34 | | 34 | |
| | Std. Deviation | 50.111 | | | 7.067 | | 1.891 | |
| | Minimum | 90 | | | 25 | | 4 | |
| | Maximum | 240 | | | 50 | | 12 | |
| % of Total N | | 100.0% | | | 100.0% | | 100.0% | |

Table 7. Distribution of time taken for various Gastrointestinal procedures

| Duration of surgery | | | | | |
|---------------------|---------------------------|---------------------|-----------------------|-------------------------------|---------------------|
| Time(Min) | Colorectal anastomosis | Gastro- jejunostomy | Esophago- jejunostomy | Ileotransverse anastomosis | Jejuno- jejunostomy |
| 75-99 | 0 | 5 | 0 | 0 | 0 |
| 100-124 | 0 | 1 | 0 | 3 | 0 |
| 125-149 | 1 | 0 | 0 | 1 | 0 |
| 150-174 | 1 | 4 | 0 | 0 | 0 |
| 175-199 | 0 | 7 | 0 | 1 | 0 |
| 200-224 | 1 | 0 | 4 | 0 | 0 |
| 225-250 | 0 | 0 | 2 | 0 | 3 |

Table 8. Distribution of time taken for various gastro-intestinal anastomosis

| Anastomotic Time | | | | | |
|------------------|----------------------|---------------------|-----------------------|---------------------------|---------------------|
| Time(Min) | Colorectalanstomosis | Gastro- jejunostomy | Esophago- jejunostomy | Ileotransverseanastomosis | Jejuno- jejunostomy |
| 20-29 | 0 | 2 | 0 | 0 | 0 |
| 30-39 | 2 | 11 | 0 | 4 | 0 |
| 40-49 | 0 | 4 | 4 | 1 | 3 |
| 50-59 | 1 | 0 | 2 | 0 | 0 |

Table 9. Distribution of hospital stay in various Gastrointestinal Surgeries

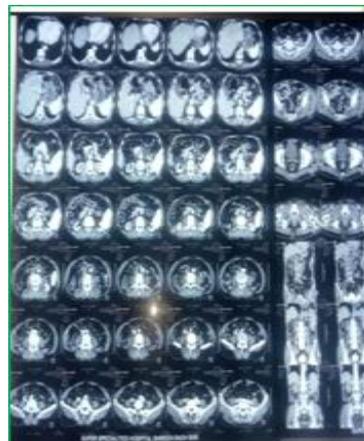
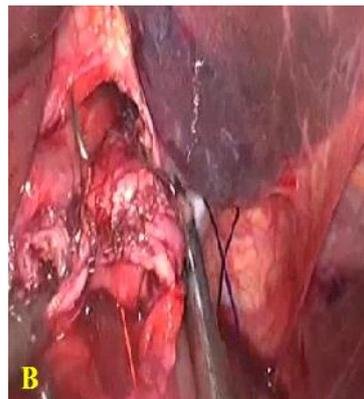
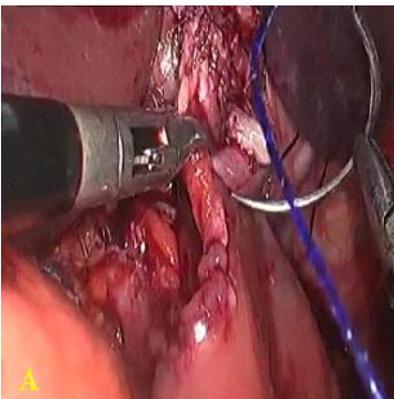
| Hospital Stay | | | | | |
|---------------|----------------------|---------------------|-----------------------|----------------------------|---------------------|
| Days | Colorectalanstomosis | Gastro- jejunostomy | Esophago- jejunostomy | Ileotransverse anastomosis | Jejuno- jejunostomy |
| 3-4 | 0 | 2 | 0 | 0 | 0 |
| 5-6 | 0 | 3 | 0 | 4 | 0 |
| 7-8 | 2 | 11 | 1 | 1 | 3 |
| 9-10 | 1 | 0 | 5 | 0 | 0 |
| 11-12 | 0 | 1 | 0 | 0 | 0 |

Table 10. Distribution of post procedural complication in particular procedure

| Procedure | Frequency | Complication |
|----------------------------|-----------|--------------|
| Colorectal Anastomosis | 3 | 0 |
| Esophagojejunostomy | 6 | 0 |
| Gastrojejunostomy | 17 | 1 |
| Ileotransverse anastomosis | 5 | 0 |
| Jejunojejunostomy | 3 | 0 |

Table 11. Distribution of post-surgical complication

| Diagnosis | Frequency | Complication |
|--|-----------|--------------|
| Benign Gastric outlet Obstruction | 3 | 1 |
| Ca Colorectum | 7 | 0 |
| Ca Stomach | 21 | 0 |
| Choledchal cyst/ Oriental cholangiohepatitis | 3 | 0 |

**Instruments used in laparoscopic gastro-intestinal Surgery****CT scan Showing Growth at Body of Stomach****Port position of laparoscopic total Gastrectomy**

Continue

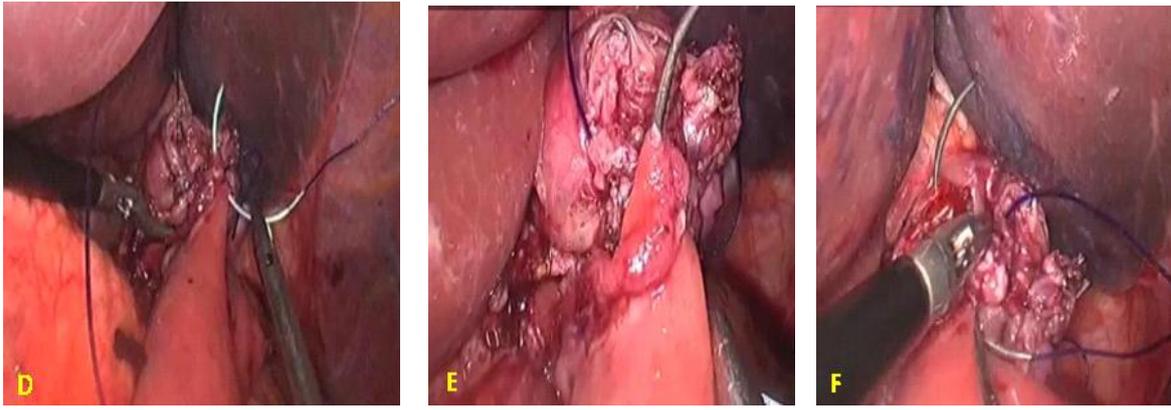
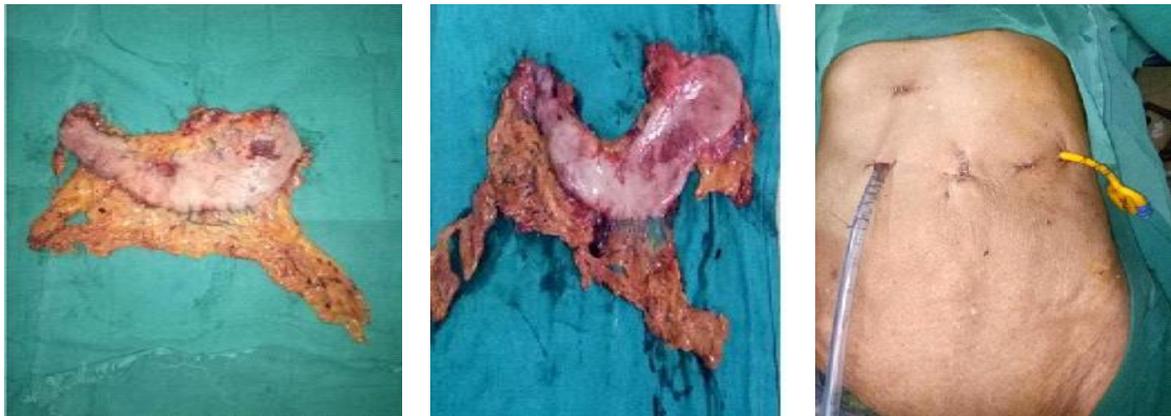


Figure A, B, C, D, E, F: Shows Laparoscopic Esophago-jejunal anastomosis in total gastrectomy using V-loc suture



Specimen of total Gastrectomy

D2 Lymphadenectomy

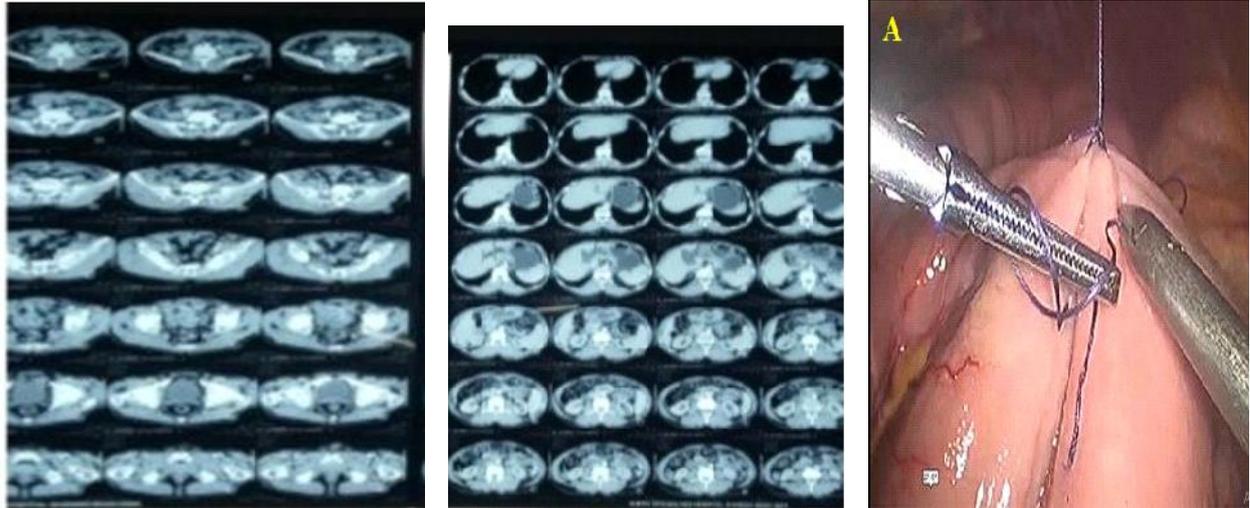
Post-operative picture of laparoscopic total gastrectomy with D2 lymphadenectomy with Feeding Jujunostomy

The intestines of humans and canines are similar in size and histology. Various canine models have been used to study the barbed sutures. Omotosho et al. ⁽⁰⁶⁾ used the barbed suture in 24 dogs to close enterotomies in the stomach, jejunum and colon. Three enterotomies were made and each closed with monofilament, absorbable barbed suture and nonabsorbable suture respectively in a single-layer simple running fashion. The closures were then tested at day 3, 10 and 21 to evaluate for leak and burst pressure. No significant difference was found between the control and barbed suture groups for leak rates, overall 0%, but the enterotomies were able to be sutured closed 35% to 42% faster ⁽⁰⁶⁾. Tyner et al. ⁽⁴⁴⁾ and Lee et al. ⁽¹¹⁾ have evaluated barbed suture anastomosis in human models. Tyner studied 84 morbidly obese patients who underwent laparoscopic gastric bypass surgery with a hand-sewn gastrojejunostomy anastomosis and hand-sewn closure of the common enterotomy of the jejunojejunostomy. 84 cases were studied, 46 of which were closed with 3-0 V- Loc 180 barbed suture and 38 with traditional 3-0 PDS. There was no significant difference in overall complication rate (no incidences of anastomotic leak or stenosis for each group). In addition the cases with barbed suture were completed on average 23 minutes faster ⁽⁴¹⁾.

Lee et al. ⁽¹¹⁾ studied the use of barbed sutures in laparoscopic gastrectomy for tumor resection in which staple anastomosis entry holes were closed using knotless unidirectional barbed suture in a continuous two-layer fashion. Two hundred forty-two patients underwent a total of 256 intracorporeal anastomoses all with the use of the 3-0 V-Loc suture.

The researchers determined that though this was a novel technique for most of the surgeons in the study, all mastered the suture by 6 cases. At the conclusion of this study, there were no deaths and no incidence of anastomotic leak, bleeding or stricture. In conclusion, the researchers determined that intracorporeal suturing is a safe practice in gastric surgery though further research still needs to be conducted ⁽¹¹⁾. Our study included a variety of patients including all aspects of gastrointestinal tract. Maximum number of studied patients had malignancy 28 (82.4 %) (Ca stomach 21 (61.8 %), Ca colorectum 7 (20.6%)) and 6 (17.6%) of the patients had a benign disease (Cholechal Cyst(Oriental Cholangiohepatitis 3 (8.8%), Benign Gastric Outlet Obstruction 3 (8.8%)). Out of 34 gastrointestinal anastomosis, gastro-jejunostomy was done in maximum number of patients 17 (50%) with a mean duration of anastomosis 33.71 ± 5.034 minutes with range of 25-40 minutes.

This was followed by esophago-jejunostomy in 6 patients (17.6%) in whom mean duration of anastomosis was 45.83 ± 3.764 minutes with a range of 40-45 minutes. Ileo-transverse anastomosis was done in 5 patients (14.7%) with mean duration of 32 ± 4.472 minutes with range of 30-40 minutes. Colorectal anastomosis was 3 patients (8.8 %) with mean anastomosis time of 40 ± 8.660 minutes with range of 35-50 minutes. And jujeno-jejunosomy was done in 3 patients (8.8 %) with mean anastomosis time of 43.33 ± 2.887 minutes with range of 40-45 minutes. Out of 34 patients, a single patient of distal gastrectomy with gastrojujunostomy developed duodenal blow out and was converted to open.



CT scan showing growth at Antro-pyloric region of stomach

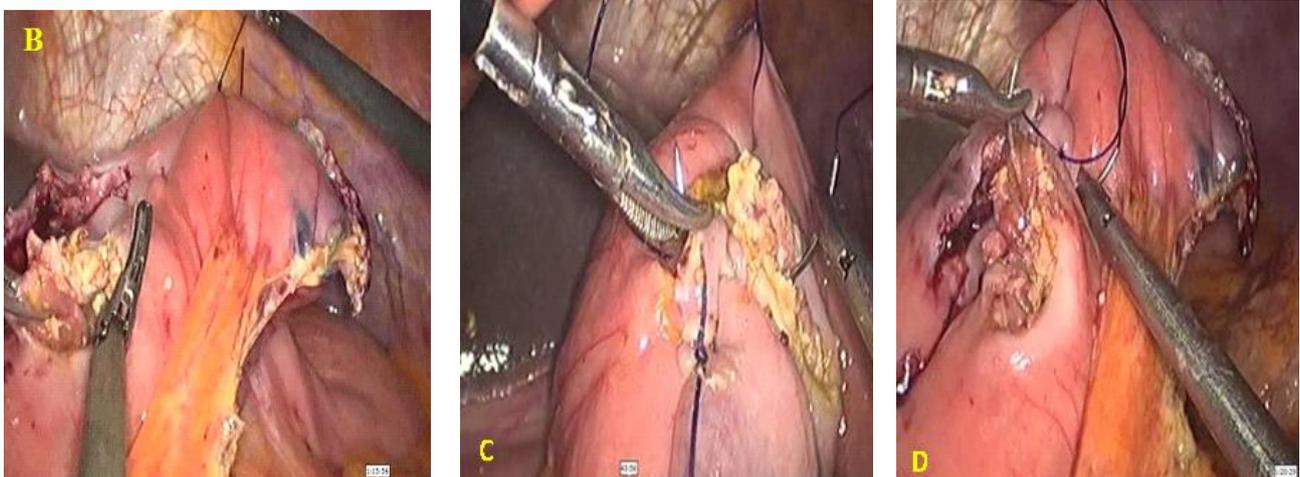
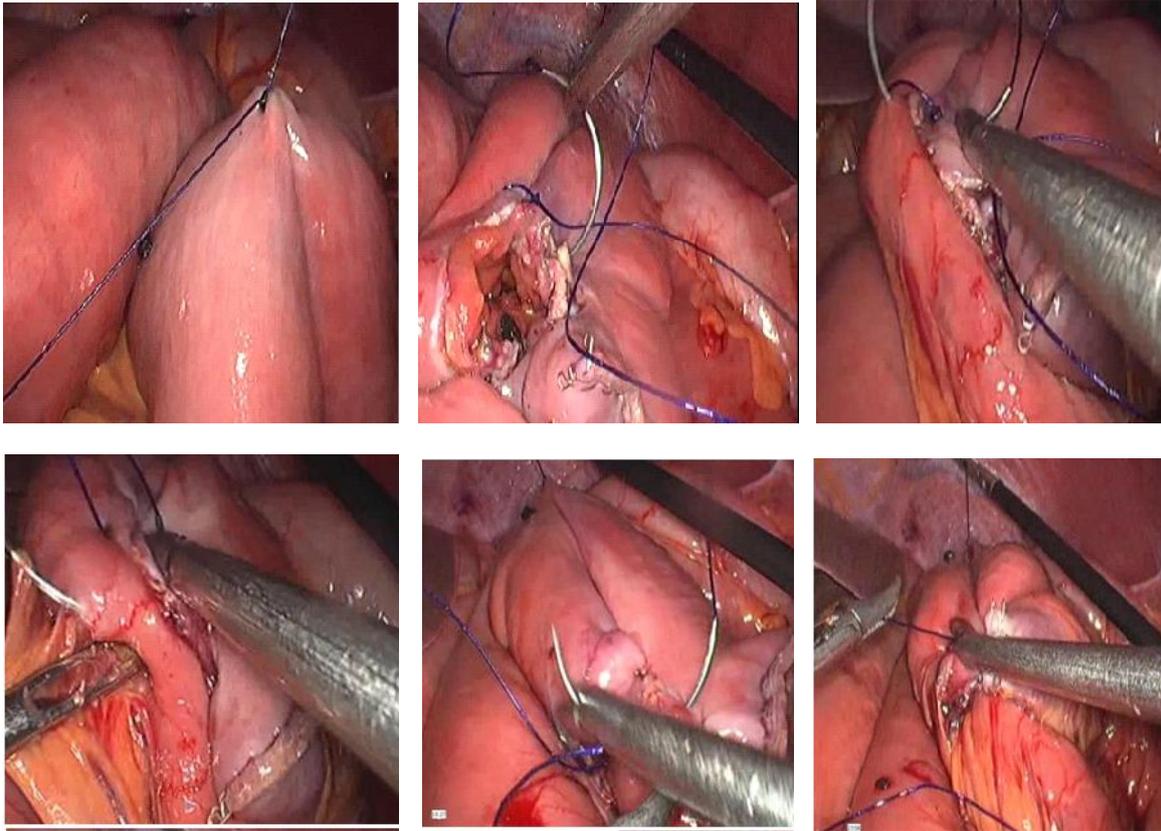


Figure A,B ,C ,D: Shows Laparoscopic Gastro-jejunal anastomosis in partial gastrectomy using V-loc suture

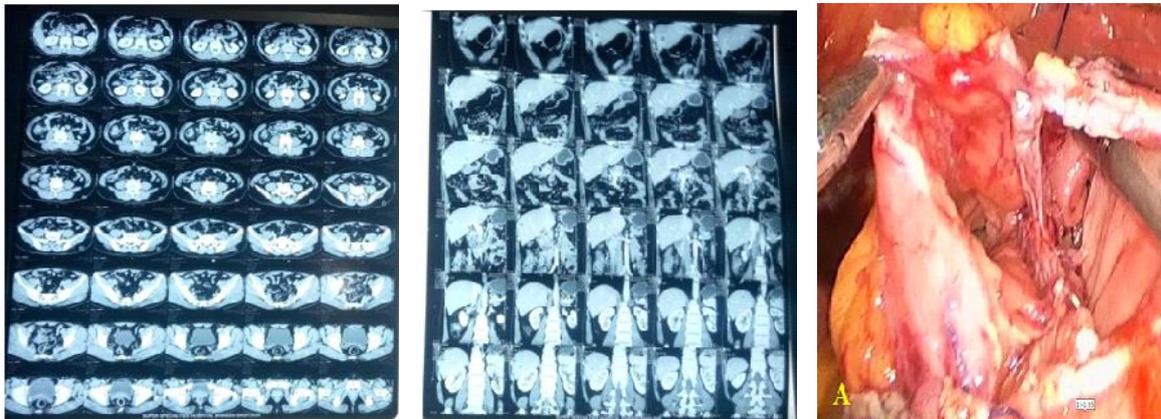


Specimen of partialgastrectomy with D2 Lymphadenectomy

Post-operative picture of Laparoscopic Partial Gastrectomy with D2 Lymphadenectomy



Figures. Showing laparoscopic jejunum-jejunum anastomosis using V-loc suture



CT scan of patient showing growth at caecum and ascending colon

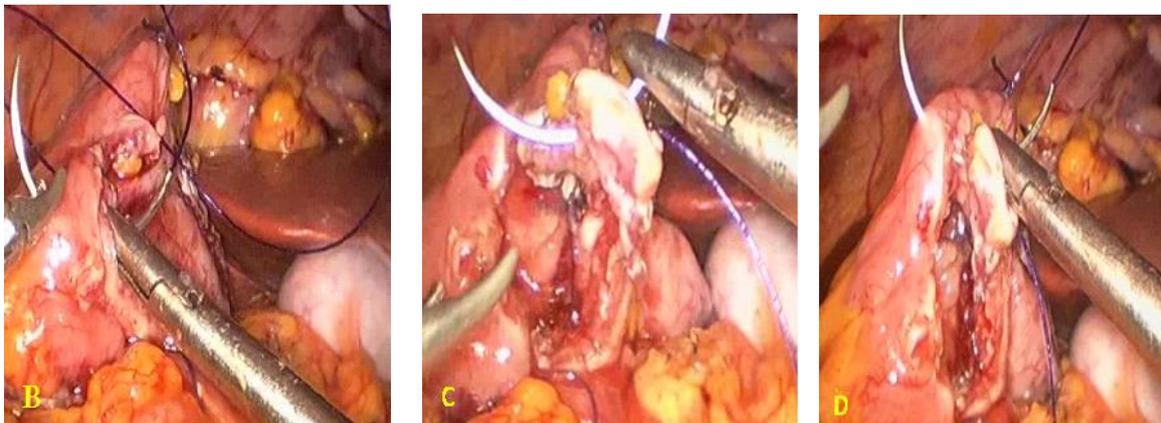


Figure 13 A, b, C, D. Shows Laparoscopic ileo-transverse anastomosis using V-loc Suture



Figure; ileo-transverse Anastomosis



Specimen of ceecal and ascending colon growth after laparoscopic right hemicolectomy



Post operative picture of laparoscopic right hemicolectomy

Duodenal blowout was due to accidental removal of Ryle's tube by patient and patient had taken orals on 1st post-operative day without our consent. No stenosis or any other complication was noted at end of the follow up. Perioperative period of all other patients was uneventful. All the patients had an uneventful follow up with satisfactory results. Our study had similar results as seen in previous studies done by Lee SW et al⁽²⁰⁾, Silvia Palmisano et al⁽⁴²⁾, Yifei Lin et al⁽⁴³⁾, Erin Kloos et al⁽⁴⁴⁾. These studies observed minimal postoperative complications, shorter hospital stay and faster recovery.

CONCLUSION

The experience with the barbed sutures seems to be effective to the intracorporeal suturing which is the most difficult part in the laparoscopic procedures. These sutures are self-maintaining with a terminal loop that allows one end of the suture to be tethered without a knot. These characteristics allow skills and proficiency in laparoscopic surgery to be improved, especially for the in-training surgeons. In our opinion the use of the barbed suture had an excellent short-term safety profile with minimal complications. It was time saving procedure due to the initial knot and continuous self-anchored suturing.

REFERENCES

- Ruff GL. The history of barbed sutures. *Aesthet Surg J*. 2013; 33: 12S-16S
- Ingle, N.P., Cong, H. & King, M.W., 2013. Barbed suture technology. In *Biotextiles as medical implants*. pp. 366–407.
- Paul, M.D. & Avelar, R., 2010. QuillSRS Techniques and Procedures: A novel approach to soft tissue approximation. Angiotech Pharmaceuticals, Inc. Available at: <http://medical-bg.info/resources/2010-Quill-Manual---4th-HYPERLINK> "http://medical-bg.info/resources/2010-Quill-Manual---4th-%20Edition.pdf" HYPERLINK "http://medical-bg.info/resources/2010-Quill-Manual---4th-%20Edition.pdf" Edition.pdf.
- Ruff, G., 2006 b. Technique and uses for absorbable barbed sutures. *Aesthetic surgery journal*, 26(5), pp.620–8.
- De Blasi V, Facy O, Goergen M, Poulain V, De Magistris L, Azagra JS. Barbed versus usual suture for closure of the gastrojejunal anastomosis in laparoscopic gastric bypass: a comparative trial. *Obes Surg*. 2013;23(1):60-3.
- Omotosho P, Yurcisin B, Ceppa E, Miller J, Kirsch D, Portenier DD. In vivo assessment of an absorbable and nonabsorbable knotless barbed suture for laparoscopic single-layer enterotomy closure: a clinical and biomechanical comparison against nonbarbed suture. *J Laparoendosc Adv Surg Tech A*. 2011;21(10):893-7.
- Ritter EM, McClusky DA 3rd, Gallagher AG, Smith CD. Real-time objective assessment of knot quality with a portable tensiometer is superior to execution time for assessment of laparoscopic knot-tying performance. *Surg Innov*. 2005;12(3):233-7
- Facy O, De Blasi V, Goergen M, Arru L, De Magistris L, Azagra JS. Laparoscopic gastrointestinal anastomoses using knotless barbed sutures are safe and reproducible: a single-center experience with 201 patients. *Surg Endosc*. 2013;27(10):3841-5.
- McKenzie AR. An experimental multiple barbed suture for the long flexor tendons of the palm and fingers. *J Bone Joint Surg Br* 1967;49(3):440-7)
- Demyttenaere SV, Nau P, Henn M, et al. Barbed suture for gastrointestinal closure: a randomized control trial. *Surg Innov* 2009;16:237-242.
- Lee SW, Kawai M, Tashiro K, et al. Laparoscopic gastrointestinal anastomoses using knotless barbed absorbable sutures are safe and reproducible: a single-center experience with 242 patients. *Jpn J Clin Oncol* 2016;46:329-335.
- Yang SM, Hsiao WL, Lin JH, Huang PM, Lee JM. Laparoscopic percutaneous jejunostomy with intracorporeal V-Loc jejunopexy in esophageal cancer. *Surg Endosc* 2017;31:2678-2686.
- Son SY, Cui LH, Shin HJ, et al. Modified overlap method using knotless barbed sutures (MOBS) for intracorporeal esophagojejunostomy after totally laparoscopic gastrectomy. *Surg Endosc* 2017;31:2697-2704.
- Cong L, Li C, Wei B, Zhan L, Wang W, Xu Y. V-Loc 180 suture in total laparoscopic hysterectomy: a retrospective study comparing Polysorb to barbed suture used for vaginal cuff closure. *Eur J Obstet Gynecol Reprod Biol* 2016;207:18-22.
- Song T, Lee SH. Barbed suture vs traditional suture in singleport total laparoscopic hysterectomy. *J Minim Invasive Gynecol* 2014;21:825-829.

16. Kim JH, Byun SW, Song JY, et al. Barbed versus conventional 2-layer continuous running sutures for laparoscopic vaginal cuff closure. *Medicine (Baltimore)* 2016;95:4981.
17. Kim EY, Hong TH. Laparoscopic Longitudinal Pancreaticojejunostomy Using Barbed Sutures: an Efficient and Secure Solution for Pancreatic Duct Obstructions in Patients with Chronic Pancreatitis. *J Gastrointest Surg* 2016;20:861-866.
18. Fernandez LC, Toriz A, Hernandez J, et al. Knotless choledochorrhaphy with barbed suture, safe and feasible. *Surg Endosc* 2016;30:3630-3635.
19. Lee JS, Yoon YC. Laparoscopic common bile duct exploration using V-Loc suture with insertion of endobiliary stent. *Surg Endosc* 2016;30:2530-2534.
20. Sang-Woong Lee, et al. Laparoscopic gastrointestinal anastomoses using knotless barbed absorbable sutures are safe and reproducible: a single-center experience with 242 patient. *Japanese Journal of Clinical Oncology*, 2016, 46(4) 329–335 doi: 10.1093/jco/hyv212
21. Oxley SG, Mallick R, Odejinmi F. Laparoscopic myomectomy: an alternative approach to tackling submucous fibroids? *J Minim Invasive Gynecol.*, 2019, pii: S1553-4650(19)30139-6. DOI:10.1016/j.jmig.2019.03.015
22. Milone M, Vignali A, Milone F, Pignata G, Elmore U, Musella M, De Placido G, Mollo A, Fernandez LM, Coretti G, Bracale U, Rosati R. Colorectal resection in deep pelvic endometriosis: Surgical technique and post-operative complications. *World J Gastroenterol.*, 2015, 21, 13345-51. DOI: 10.3748/wjg.v21.i47.13345
23. Milone M, Fernandez LM, Musella M, Milone F. Safety and Efficacy of Minimally Invasive Video-Assisted Ablation of Pilonidal Sinus: A Randomized Clinical Trial. *JAMA Surg.*, 2016, 151(6), 547-53. DOI: 10.1001/jamasurg.2015.5233
24. 2017 and 2015 European Society of Coloproctology (ESCP) collaborating groups. The impact of conversion on the risk of major complication following laparoscopic colonic surgery: an international, multicentre prospective audit. *Colorectal Dis.* 2018, 20 Suppl 6, 69-89. DOI: 10.1111/codi.14371
25. Milone M, Elmore U, Vignali A, Mellano A, Gennarelli N, Manigrasso M, Milone F, De Palma GD, Muratore A, Rosati R. Pulmonary Complications after Surgery for Rectal Cancer in Elderly Patients: Evaluation of Laparoscopic versus Open Approach from a Multicenter Study on 477 Consecutive Cases. *Gastroenterol Res Pract.* 2017:5893890
26. Milone M, Elmore U, Musella M, Parise P, Zotti MC, Bracale U, Di Lauro K, Manigrasso M, Milone F, Rosati R. Safety and efficacy of laparoscopic wedge gastrectomy for large gastrointestinal stromal tumors. *Eur J Surg Oncol.*, 2017, 43(4), 796-800. DOI: 10.1016/j.ejso.2017.01.005
27. Conzo G, Musella M, Corcione F, De Palma M, Ferraro F, Palazzo A, Napolitano S, Milone M, Pasquali D, Sinisi AA, Colantuoni V, Santini L. Laparoscopic adrenalectomy, a safe procedure for pheochromocytoma. A retrospective review of clinical series. *Int J Surg.*, 2013, 11(2), 152-6. DOI: 10.1016/j.ijsu.2012.12.007.
28. Martínez-Pérez A, Carra MC, Brunetti F, de'Angelis N. Short-term clinical outcomes of laparoscopic vs open rectal excision for rectal cancer: A systematic review and meta-analysis. *World J Gastroenterol.* 2017, 23(44), 7906-7916. Review. DOI: 10.3748/wjg.v23.i44.7906
29. Greenberg JA. The use of barbed sutures in obstetrics and gynecology. *Rev Obstet Gynecol*, 2010, 10, 82–91.
30. Einarsson JI, Chavan NR, Suzuki Y. Use of bidirectional barbed suture in laparoscopic myomectomy: evaluation of perioperative outcomes, safety, and efficacy. *J Minim Invasive Gynecol*, 2011, 18, 92–95. DOI: 10.1016/j.jmig.2010.10.003
31. Mansour A, Ballard R, Garg S, Baulesh D, Erickson M. The use of barbed sutures during scoliosis fusion wound closure: a quality improvement analysis. *J Pediatr Orthop*, 2013, 33, 786–790. DOI: 10.1097/BPO.0b013-3182 -11.
32. Shah HN, Nayyar R, Rajamahanty S, Hemal A. Prospective evaluation of unidirectional barbed suture for various indications in surgeon-controlled robotic reconstructive urologic surgery: Wake Forest university experience. *Int Urol Nephrol*, 2012, 44, 775–785. DOI: 10.1007/s11255-011-0075.
33. De Blacam C, Colakoglu S, Momoh A, Lin S, Tobias A, Lee B. Early experience with barbed sutures for abdominal closure in deep inferior epigastric perforator flap breast reconstruction. *ePlasty*, 2012, 5, 231–236.
34. Warner JP, Gutowski KA. Abdominoplasty with progressive tension closure using a barbed suture technique. *Aesthet Surg J*, 2009, 29, 221–225. DOI: 10.1016/j.asj.2009.01.009
35. Lin Y, Long Y, Lai S, Zhang Y, Guo Q, Huang J, Du L. The Effectiveness and Safety of Barbed Sutures in the Bariatric Surgery: a Systematic Review and Meta-analysis. *Obes Surg.*, 2019. DOI: 10.1007/s11695-019-03744-4.
36. Pennestri F, Gallucci P, Prioli F, Giustacchini P, Ciccoritti L, Sessa L, Bellantone R, Raffaelli M. Barbed vs conventional sutures in bariatric surgery: a propensity score analysis from 508 Michele Manigrasso *et al.* a high-volume center. *Updates Surg.*, 2019, 71(1), 113-120. DOI: 10.1007/s13304-018-0589-2.
37. Milone M, Di Minno MN, Galloro G, Maietta P, Bianco P, Milone F, Musella M. Safety and efficacy of barbed suture for gastrointestinal suture: a prospective and randomized study on obese patients undergoing gastric bypass. *J Laparoendosc Adv Surg Tech A.* 2013, 23(9), 756-9. DOI: 10.1089/lap.2013.0030.
38. Bautista T, Shabbir A, Rao J, So J, Kono K, Durai P. Enterotomy closure using knotless and barbed suture in laparoscopic upper gastrointestinal surgeries. *Surg Endosc.*, 2016, 30(4), 1699-703. DOI: 10.1007/s00464-015-4395-3.
39. Lee SW, Kawai M, Tashiro K, Nomura E, Tokuhara T, Kawashima S, Tanaka R, Uchiyama K. Laparoscopic gastrointestinal anastomoses using knotless barbed absorbable sutures are safe and reproducible: a single-center experience with 242 patients. *Jpn J Clin Oncol.* 2016, 46(4), 329-35. DOI: 10.1093/jjco/hyv212
40. Lee SW, Kawai M, Tashiro K, Kawashima S, Tanaka R, Tanaka K, Nomura E, Uchiyama K. The crossover technique for intracorporeal esophagojejunostomy following laparoscopic total gastrectomy: a simple and safe technique using a linear stapler and two barbed sutures. *Surg Endosc.*, 2018, 33(5), 1386-1393. DOI: 10.1007/s00464-018-6413-8.
41. Silvia Palmisano, Michela Giuricin, Petra Makovac, Biagio Casagranda, Giuseppe Piccinni, Nicolò de Manzini. Totally hand-sewn anastomosis using barbed suture device during laparoscopic gastric bypass in obese. A feasibility study and preliminary results. *International*

- Journal of Surgery 12 (2014) 1385-1389
<http://dx.doi.org/10.1016/j.ijsu.2014.10.030>
42. Takahashi Y, Yokoyama N, Matsuzawa N, Sato D, Otani T. Effectiveness of a barbed suture in the repair of bile duct injury during laparoscopic cholecystectomy: Report of two cases. *International Journal of Surgery Case Reports*. 2016; 26: 183-186.
43. Erin Kloos, Ravindra Vegunta and Kristina Morgan. Unidirectional Barbed Sutures can be used Safely in Pediatric Gastro-Intestinal Surgery. *Remedy Publications LLC.*, | <http://clinicsinsurgery.com/> 2017 | Volume 2 | Article 1469
44. Tyner, RP, Clifton GT, Fenton SJ. Hand-sewn gastrojejunostomy using knotless unidirectional barbed absorbable suture during laparoscopic gastric bypass. *Surg Endosc*. 2013; 27: 1360-1366.
