Original Article

Laparoscopic Versus Open Sigmoid Loop Colostomy: A Comparative Study from a Cohort of 62 Patients Requiring Temporary Faecal Diversion at a Tertiary Care Center in North India

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Abstract

Background: Over decades, colostomies have been done through open method, but laparoscopic creation of an intestinal stoma is safe, feasible and has distinct advantages over conventional techniques in specific procedures. The aim of this study compares operative and short-term outcomes of laparoscopic and open sigmoid loop colostomy formation for temporary fecal diversion. **Subjects and Methods:** A single institution, comparative study conducted in the department of surgery for patients who underwent either laparoscopic or open sigmoid loop colostomy. The 2 years' study was from December 1, 2013, to November 30, 2015. Subjects were prospectively enrolled in the study after informed consent, both genders of >12 years of age. Data analysis was done using Statistical Package for Social Sciences version 21.0. Variables were tested by Kolmogorov–Smirnov test, compared using unpaired *t*-test/Mann–Whitney Test, Chi-square test/Fisher's exact test. $P < 0.05$ was considered statistically significant. **Results:** Sixty-two patients were enrolled; laparoscopy group – 29 patients (46.77%) versus open group – 33 patients (53.22%). Laparoscopic group/open surgery group showed less blood loss (20.69 + 17.71 ml / 121.97 + 35.29ml, *P*-value 0.0005), lower requirement of analgesics (4.28 ± 1.76 days/6.88 ± 2.75 days), shorter hospital stay (8.79 ± 5.57 days and 11.73 ± 6.61 days, $P = 0.001$), early return of the bowel function and tolerance to diet. Complications and readmission requirement for any complication was lower in the laparoscopic group. **Conclusions:** Laparoscopic sigmoid loop colostomy is a simple alternative to open sigmoid loop colostomy with respect to postoperative pain, earlier return of bowel function, lower analgesic requirement, and lesser hospital stay.

Keywords: *Laparoscopic surgery, sigmoid loop colostomy, temporary faecal diversion*

Introduction

Fecal diversion refers to the surgical creation of an ileostomy or colostomy. The proven benefits of laparoscopic colorectal surgery with regards to postoperative outcomes include less postoperative pain, fast recovery, a shorter hospital stay, and improved cosmesis when compared with open procedures. Laparoscopically, created bowel stoma is technically feasible and safe.[1,2] Laparoscopic fecal diversion provides benefits in patients with complicated pelvic infections secondary to diverticulitis such as rectovaginal fistula, anorectal abscess, fecal incontinence, perianal sepsis, perianal Crohn's disease, radiation proctitis, advanced colorectal cancers presenting with obstruction, or J-pouch-related complications.[3] Laparoscopic techniques have been applied with increasing frequency

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to bowel surgery. Stoma creation and its reversal traditionally required laparotomy in the past, thus with evolution and experience with laparoscopy the advantage over the former was but evident considering the minimal dissection and bowel manipulation, and focus on one quadrant of the abdomen.[4] In this study, we aim to compare operative outcomes and short-term postoperative results of laparoscopic and open sigmoid loop colostomy for temporary fecal diversion.

Subjects and Methods [Figure 1]

This was a clinical, comparative study conducted in the department of surgery, involving 4 surgical units, which was initiated after obtaining institutional ethics research and review board approval. All patients requiring temporary fecal diversion were prospectively enrolled after informed consent; both genders of the age of 12 years and above were included in this study. No randomization process was followed for treatment allocation in view of the less number of patients expected to enroll and limited period, so every alternate patient was simply allocated to either laparoscopic or open sigmoid loop colostomy group as a treatment option for comparison. The study included recording of clinical observations from the recruited subjects fulfilling the inclusion criteria during 2 years; December 1, 2013, to December 30, 2015. Comparison of the open and laparoscopic groups was made initially to evaluate patients' demographics, indication for diversion, operative and specific short-term postoperative outcomes including the need for conversion to open procedure, hospital stay, reoperation, and repeated hospitalization for procedure-related stoma complications and mortality. The patients' demographics, the American Society of Anesthesiologists (ASA) score, operative time, estimated blood loss, need for conversion to open surgery, all short-term postoperative complications, readmission, reoperation, mortality, and length of hospital stay. Details regarding the postoperative period were noted on day 1, 3, 5, and follow-up after 1 month and 3 months. Complication once documented along with the time of occurrence was graded according to the Clavien-Dindo classification of surgical complications[5] and its course and treatment required was recorded. All the laparoscopic procedures and majority of the open procedures were conducted under general anesthesia (GA); spinal anesthesia being offered to the high risk and unfit candidate.

Operative technique

All patients preoperatively were counseled and stoma was sited (left iliac fossa), by the stoma nurse, except for those who underwent emergency fecal diversion. All patients were catheterized on the table, if not done earlier, prior to the surgery and discontinued by 48 h postprocedure, if not required.

Open technique

After cleaning and draping, a midline laparotomy incision was given. On accessing the peritoneal cavity the sigmoid loop was isolated, mobilized if required and taken out through stoma site and stoma was matured over a bridge (stiff red rubber catheter) with 3'0 vicryl suture or 3'0 silk suture. The sheath was closed with no. 1 nylon and skin was closed with 3'0 nylon.

Trephine technique[6]

After cleaning and draping, a transverse incision was given over the proposed site of stoma formation. On accessing the peritoneal cavity, sigmoid loop was isolated, mobilized if required and taken out through stoma site and stoma was matured over a bridge (red rubber catheter).

Laparoscopic technique

After cleaning and draping, three ports were created, the primary trocar was placed in the infraumbilical region (10 mm port) to initiate and maintain pneumoperitoneum as well, second port was placed in the left iliac fossa over the selected stoma site (10-mm port), and a third port (5 mm) was placed in suprapubic region for bowel manipulation and mobilization if required. In the area of the planned stoma site, prior to the insertion of the trocar, the skin, fascia was divided, and rectus muscle separated, but the peritoneum was spared, before placement of a trocar through the site. The intact peritoneum allowed pneumoperitoneum to be maintained while the bowel was mobilized. A 10-mm trocar was inserted through this site and mobilized sigmoid loop was grasped using a Babcock clamp under vision, and the pneumoperitoneum was reduced to allow further approximation between the bowel segment and the abdominal wall. The segment of sigmoid loop was exteriorized by increasing the peritoneal opening at the trocar entry point from outside, easily allowing the stoma to be created, and matured quickly, with no loss of the pneumoperitoneum (the bowel loop with mesentery acting as a temporary pinch cork). A tension-free sigmoid loop stoma was matured over a bridge (stiff red rubber catheter) with 3'0 absorbable or nonabsorbable suture as mentioned earlier.

Sample size calculation

From the outcome of the previous study 1, the minimum sample size was calculated to be $n = 26$ in each group using the formula $n = (Z1-\alpha/2 + Z1-\beta)\ 2\ 2 \times \sigma 2/(\mu 1-$

μ2) 2 where Z1−α/2 = 1.96, is standard normal deviate at type 1 error α = 0.05 with 95% confidence interval, Z1−β = 0.84 is standard normal deviate at type 2 error β = 0.20 with power of the study to be 80%, σ is pooled standard deviation (SD) and μ1 and μ2 are the blood loss mean for both the groups, respectively. Data were entered into Microsoft Excel spreadsheet, and analysis was done using SPSS (Statistical Package for the Social Sciences, version 21.0, armonk, NY: IBM Crop). All categorical variables were presented in number and percentage (%), and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov–Smirnov test. Quantitative variables were compared using unpaired *t*-test/Mann–Whitney test (when the data sets were not normally distributed) between the two groups. Qualitative variables were compared using Chi-square test/Fisher's exact test. $P < 0.05$ was considered statistically significant.

Results

Of the 62 patients, who were enrolled into the study fulfilling the inclusion criteria, 29 underwent laparoscopic procedure (46.77%) while 33 underwent open procedure (53.22%, open – 28, trephine – 5; the trephine group was clubbed with the open group collectively) as illustrated in Table 1 and Figure 2a and b. The mean age of subjects in the laparoscopic group was 55.86 ± 11.94 years, and open group was 52.52 ± 16.430 years. There was female preponderance in both groups, in the laparoscopic group, it was 6 male and 23 female individuals, and in open group, it was 11 male and 22 female individuals. Most of the surgeries were conducted under GA-laparoscopic 29 and open surgery 25 patients as elective procedure in 93.54% of the patients with majority of the patients belonging to ASA 1–2 Grade (laparoscopic group – 26 and open group – 22) followed by the ASA Grade 3 (laparoscopic group – 1 and open group – 9 patients), 4 cases being conducted as an emergency procedure; spinal anesthesia was given only for those unfit for general anaesthesia (GA) in 8 patients overall representing 12.9%. The distribution of compared variables was normal in both the groups. Mean body weight in both the groups (lap vs. open) was similar (68.38 ± 12.19 kg vs. 63.06 ± 12.54 kg) and mean duration of surgery in the laparoscopic sigmoid stoma and open group was 124.48 ± 39.85 min versus 121.97 ± 35.29 min.

Majority of the patients underwent surgery for trauma involving the perianal region with or without sphincter involvement (*n* = 18, 29.03% - rectal tears/perineal injuries/burns), infections (*n* = 15,

Table 1: Comparative analysis of patient demographics and procedure specific outcomes

Factors	Laparoscopic sigmoid colostomy (*n*=29)	Open sigmoid colostomy (*n*=33)	Test of significance *P* (<0.005)
Age (years)			
Mean	56.52±16.43	55.86±11.94	0.855
Median	59	56	
Gender			
Male (17)	6	11	0.393
Female (45)	23	22	
Type of anesthesia			
GA	29	25	0.005
Spinal anesthesia	Nil	8	
ASA grade			
1-2	26	22	0.029
3	1	9	
Emergency	2	2	
Body weight (kg)			
Mean	68.38±12.19	63.06±12.54	0.097
Range	43-102	40-92	
Duration of surgery (min)			
Mean	124.48±39.85	121.97±35.29	0.365
Range	50-280	80-120	
Diet initiation (days)			
Liquid diet	2.35±1.49	3.12±1.32	0.003
Solid diet	3.79±1.68	5.15±3.58	0.006
Stoma movement (days)	2.76±1.15	3.15±1	0.119
Hospital stay (days)	8.79±5.57	11.73±6.61	0.001

ASA: American Society of Anesthesiologist, GA: General anaesthesia

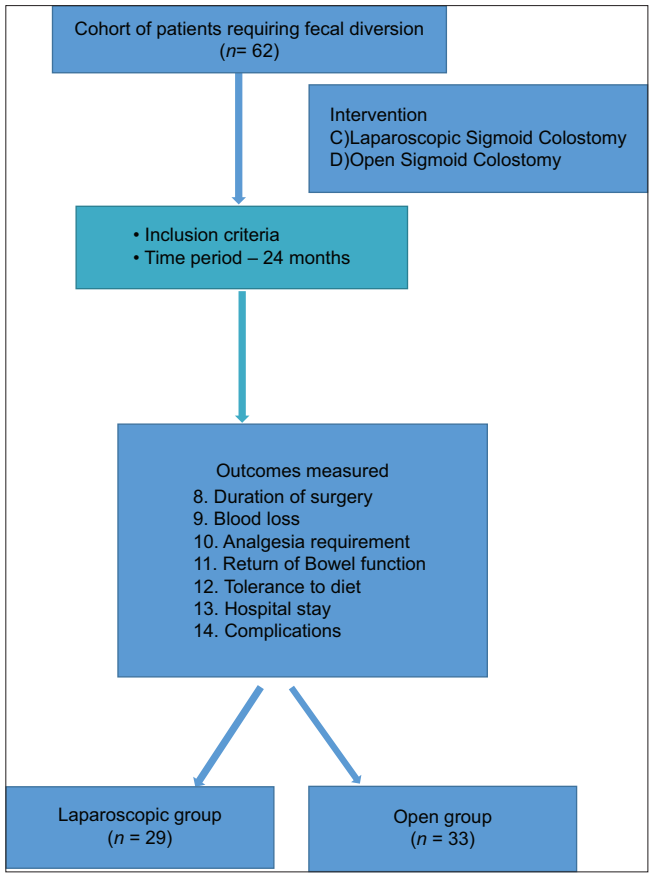

Figure 1: Study algorithm

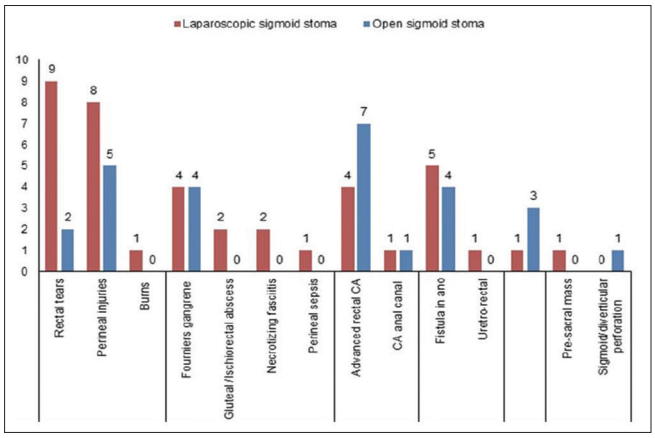

Figure 3: Indications for the fecal diversion in both the group

24.19% - Fournier's gangrene/gluteal-ischiorectal abscess/necrotizing fasciitis-perineal sepsis), lower gastrointestinal malignancy with obstruction (*n* = 13, 20.97% - advanced rectal cancer and cancer anal canal), complex perianal fistula (*n* = 10, 16.13% - fistula in ano/uretero-rectal) bed sores (*n* = 4,6.45%), miscellaneous (*n* = 2,3.23% - presacral mas/ sigmoid – diverticular perforation) as depicted in Table 2 and Figure 3.

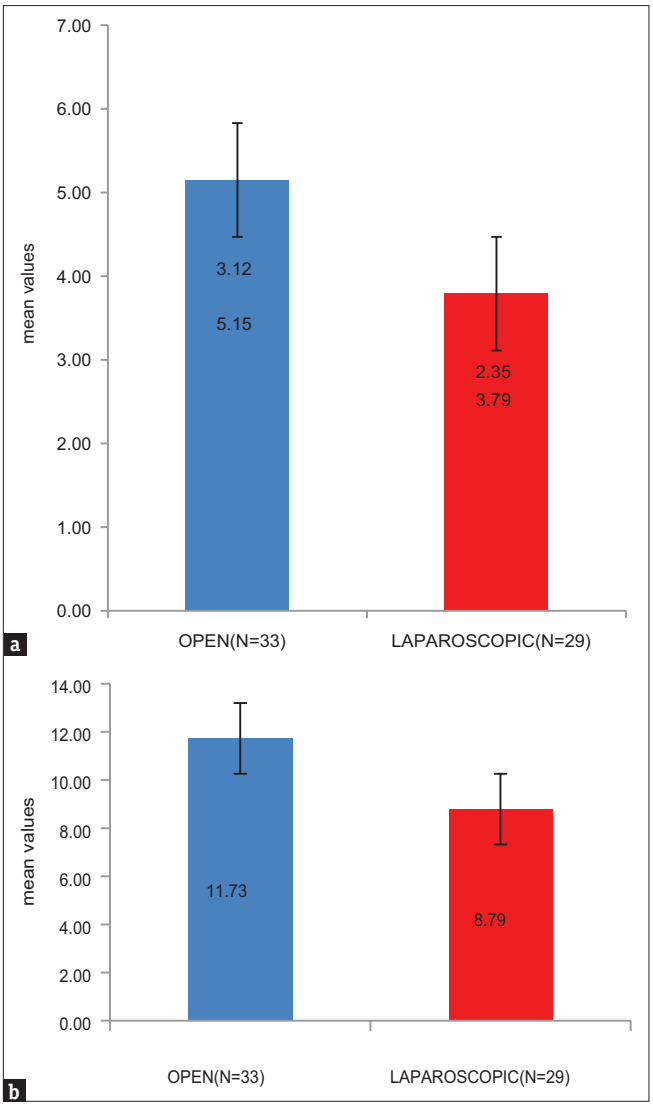

Figure 2: (a) Tolerance to liquid→ solid residue diet in days, $P = 0.005$. (b) Hospital stay in days, $P < 0.05$

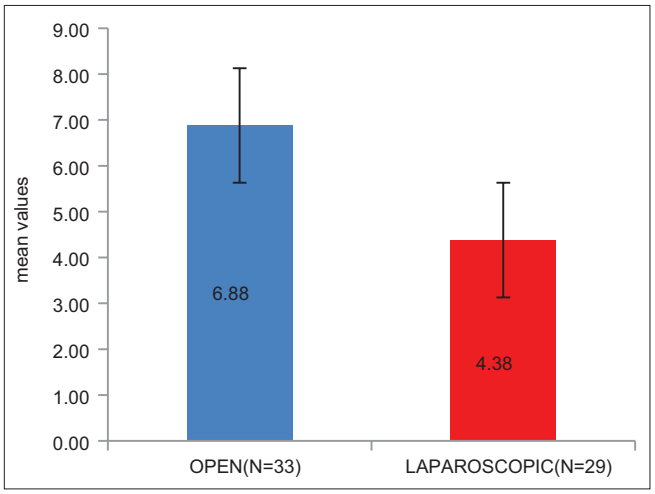

Figure 4: Analgesic requirement in days, $P < 0.05$

Table 2: Indications for the fecal diversion in both the groups

Indications for fecal diversion	Laparoscopic sigmoid stoma (29)	Open sigmoid stoma (33)	Test of significance
Trauma (*n*=18; 29.03%)			
Rectal tears	9	2	0.558
Perineal injuries	8	5	
Burns	1	Nil	
Infections (*n*=15; 24.19%)			
Fournier's gangrene	4	4	0.441
Gluteal/ischiorectal abscess	2	Nil	
Necrotizing fasciitis	2	Nil	
Perineal sepsis	1	2	
Malignancy (*n*=13; 20.97%)			
Advanced rectal CA	4	7	1.00
CA anal canal	1	1	
Complex fistula (*n*=10; 16.13%)			
Fistula in ano	5	4	1.00
Uretro-rectal	1	Nil	
Bed sores (*n*=4, 6.45%)	1	3	
Miscellaneous (*n*=2; 3.23%)			
Presacral mass	1	Nil	1.00
Sigmoid/diverticular perforation	Nil	1	

CA: Carcinoma

Table 3: Laparoscopic versus open sigmoid colostomy, comparative outcomes

Factors	Laparoscopic sigmoid stoma (*n*=29)	Open sigmoid stoma (*n*=33)	Test of significance (*P*)
Blood loss (ml)			
Mean	20.69±17.71	121.97±35.29	0.0005
Range	10-100	20-300	
Analgesic requirement (days)			
Mean	4.28±1.76	6.88±2.75	0.0005
Range	2-10	3-16	

Table 4: Comparison of complications in both the groups

Complications	Laparoscopic group	Open group	*P*
Clavien-Dindo Grade	2/29	3/33	
Early	1 patient	3 patients	0.211
	Nonfunctioning	2-SSI (Graded I*)	
	Stoma/ileus (temporary)	1-dehiscence (Grade IIIB**)	
Late	Nil	1; Hernioplasty** Later	
Requiring revision surgery (3 weeks)	1 patient required revision of stoma; nondefunctioning	Nil	

SSI: Surgical site infection, *: No surgery required, **: Surgery required

The blood loss intraoperatively was significantly less in the laparoscopic and open group (20.69 ± 17.71 ml and 121.97 ± 35.29 ml, $P = 0.0005$). The time interval for the movement of colostomy in the laparoscopic and open group was 2.76 ± 1.15 days versus 3.15 ± 1 day, with initiation of liquid diet on 2.35 ± 1.49 and 3.12 ± 1.32 postoperative days ($P = 0.003$), followed by solid residue diet on 3.79 ± 1.68 and 5.15 ± 3.58 postoperative day ($P = 0.006$). The days of analgesic requirement (injectable morphine) in the laparoscopic group were significantly less as compared to the open group, 4.28 ± 1.76 days and 6.88 ± 2.75 days [$P = 0.0005$, Table 3] with a shorter duration of hospital stay observed in the laparoscopic group as compared to the open group; 8.79 ± 5.57 days and 11.73 ± 6.61 days, respectively ($P = 0.001$) [Table 3 and Figure 4].

Complication rate was 8% in the entire cohort (laparoscopic group – 2 and open group – 3) [Table 4]. Wound infection and hernia development was nil in the laparoscopic group, however procedure-related morbidity was documented in two patients (one patient with Ileus, one patient with nondefunctioning of stoma

requiring revision by open surgery at follow-up) as compared to the open group (2 patients with Grade I - surgical site infection (SSI) and one patient with Grade IIIB SSI – wound dehiscence, later manifested with hernia requiring surgical repair).

Discussion

Temporary fecal diversion remains an area of concern among practicing surgeons for patient-specific scenarios.[7] The laparoscopic technique applied to the creation of a sigmoid loop colostomy has not been compared with its open counterpart for temporary fecal diversion. As advocates of this technique in this study, feasibility and simplicity of the procedure have been demonstrated over the years through scientific reporting of various case reports.[8] Loop stomas have technical advantages of reduced blood loss, avoidance of unnecessary dissection, and bowel resection. The technical difficulties associated with exteriorizing a loop stoma in a patient with obesity, disseminated malignancy, severe diverticulitis, and patients with short and thick mesentery. Debating the merits and demerits of constructing a loop stoma in relation to the present study, the stoma itself may fail to divert fecal matter completely, has a larger stoma aperture compared to an end stoma. While an end stoma easily fits to external appliances, its takedown requires a larger and separate abdominal incision.[9]

Majority of the patients underwent stoma for perineal trauma followed by infections, malignant obstruction. A study by Gorgun *et al*. compared laparoscopic colostomy in 63 patients and open surgery in 133 patients; major indication for fecal diversion was hidradenitis suppurativa (12 patients/28%) followed by advanced anal carcinoma (9 patients/21%); none of the patients underwent sigmoid colostomy for traumatic rectal tears or complex fistula-in-ano.[9] A similar study by Young *et al*. found rectovaginal fistula as a major indication for fecal diversion (16 patients/38.1%), followed by advanced rectal cancer (3 patients/7.1%), 2 patients (4.76%) with penetrating rectal or anal trauma.[10]

The outcomes of our study reaffirm that laparoscopic technique in creating a sigmoid loop colostomy group benefits the patients in terms of significantly less blood loss than open group ($P = 0.0005$). Gorgun *et al*. in their study documented that laparoscopic procedure was associated with reduced blood loss as compared to open surgery. A similar study by Ravi P. Kiran *et al*. demonstrated that in patients undergoing open colorectal surgery required significantly more units of blood than laparoscopic group. Operative time was similar in both the compared groups in this study ($P = 0.365$) similar to the findings in the study by Gorgun *et al*. Young *et al*. observed significant longer operating time in laparoscopy group when compared with the open surgery group ($P < 0.0001$), which was attributed to the learning curve with laparoscopic procedures. Significant reduction in the requirement of analgesics postoperatively was documented in our study which is similar to the findings noted by Liu *et al*.; lower requirement of intravenous morphine in the laparoscopic group (4.8 days) as compared to the open surgery group (6.2 days).[11] Similarly, Young *et al*. calculated total dose of intravenous morphine requirements for the first 48 h postoperatively and found the mean requirement being significantly less ($P < 0.01$) in the laparoscopic group.

Early return of bowel function and tolerance to diet was noted in the laparoscopic group as compared to the open group in this study. Observations from the study by Hollyoak *et al*. noted similar findings in laparoscopic surgery group as compared to the open group.[1] Another study by Iroatulam *et al*. found earlier movement of the colostomy in the laparoscopic group than in the open group.[12] Young *et al*. in their study observed early tolerance to diet in the laparoscopic group as compared to open group ($P = 0.001$). Liu *et al*. showed early tolerance to both liquid and the solid diet in the laparoscopic group as compared to the open surgery group thus reaffirming the findings in this study.

A shorter hospital stay ($P = 0.001$) was observed in the laparoscopy group as compared to the open group which was similar to the observations by Gorgun *et al*. and Iroatulam *et al*.

Complications in terms of wound infection and hernia development was higher in the open group as compared to the laparoscopic group which is similar to the findings published by Young *et al.* in his study.

This study was limited by its time-bound nature and a small cohort of patients, but it clearly demonstrates the technical simplicity and benefits of using laparoscopic approach for temporary fecal diversion using a sigmoid loop.

Conclusions

Laparoscopic sigmoid loop colostomy is a simple alternative to open sigmoid loop colostomy with less postoperative pain, earlier return of bowel function, lower analgesic requirement, lower complication rates, and lesser hospital stay.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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