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ORIGINAL ARTICLE

Relaparotomy—the Surgeons Nightmare

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Abstract

The term relaparotomy (RL) refers to operations performed within 60 days of an initial laparotomy, for complications arising following the primary surgery. Our study aims to determine the incidence, indications, and outcome of RLs and identify factors affecting outcomes of RLs in Indian population. A prospective nonrandomized observational study was conducted at a tertiary care Medical College Hospital. Planned elective RL, those undergoing index laparotomy in other hospital were excluded. Demographic features, nutritional status, initial diagnoses, elective/emergency initial surgery, postoperative complications leading to RL, presence of diffuse peritonitis, average interval to RL, associated co morbidity, duration of hospital stay, outcome, and factors associated with outcome of RL were analyzed. Of 622 laparotomies in the study period, 30 underwent RL with incidence of 4.8%. The mean age was 52.2 years. RL was more common in emergency surgeries (80% vs 20%). The mean hospital stay among patients undergoing RL was 25.8 days. The mean interval between first laparotomy and RL was 12.3 days and the average gap between the time of detection of the complication and RL was 3.96 days. The mortality rate in the study was 20%. Five of the six mortality patients had underwent emergency primary surgery. The mean serum albumin level was 3.4 g/dL while that associated with mortality was 3.01 g/dL. All laparotomies have potential for RL. RL is associated with high morbidity and mortality. Careful surgical techniques and patient optimization help reduce RL rate. Intensive postoperative monitoring and early RL when indicated reduce mortality associated with RL.

Keywords Relaparotomy · Index laparotomy · Postoperative complications · Wound dehiscence · Post-operative hemorrhage · Re-exploration

Introduction

The term Relaparotomy (RL) refers to operations performed within 60 days of an initial laparotomy, for complications arising following the primary surgery [1–3]. RL rates have been reported to range from 1 to 4.4% [1]; RL may be early or late; planned or unplanned [4]; emergency or elective; and radical or palliative [3, 5, 6].

The objectives of RL are to manage complications of the primary surgery, restore intestinal continuity, prevent fecal contamination of the peritoneal cavity, obtain homeostasis, control hemorrhage, prevent intra-abdominal infection or sepsis, and plan delayed curative surgery [1, 2, 5].

Since most RLs are performed for life-threatening complications, morbidity and mortality rates are high [1, 2, 5, 7–9]. Our study aims to determine the incidence, indications, and outcome of RLs and identify factors that affect mortality and outcomes of RLs in Indian population.

Materials and Methods

A prospective nonrandomized observational study was conducted at a tertiary care Medical College Hospital from November 2012 to October 2014. All patients

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undergoing RL for various indications such as life-threatening hemorrhage, persistent or progressive peritonitis, persistent intra-abdominal abscess, anastomotic leak or wound dehiscence, and post-operative resistant ileus or intestinal gangrene were included.

Patients who underwent damage control surgery as primary surgery, minimally invasive surgery, planned elective RL such as for stomal closure, percutaneous drainage in primary surgery, and undergoing first laparotomy in other hospital were excluded. Complications of primary surgery needing RL were detected by serial clinical assessment by senior surgeons, assessment of drain output for quantity and content, laboratory investigations and imaging studies such as radiograph, ultrasonogram (USG), computerized tomography (CT), and magnetic resonance imaging (MRI).

All patients received single dose pre-operative antibiotic prophylaxis with second-generation cephalosporin, unless patient had gross contamination of peritoneal cavity, or septicemia, or patient developed post-operative wound infection when culture-based antibiotics were given. RL was performed by senior general surgeon along with the primary surgeon in order to standardize the outcome.

RL was done in cases where the treating surgeon decided for RL based on the following parameters.

1. Refractory post-operative hemorrhage
2. Persistent progressive peritonitis
3. Persistent intra-abdominal abscess refractory to medical treatment and percutaneous drainage
4. Evidence of anastomotic failure
5. Wound dehiscence
6. Refractory post-operative ileus
7. Deterioration of patients' clinical condition despite appropriate therapy

We examined for demographic features, initial diagnoses, indication for their initial surgery, nutritional status of the patients, type of initial surgery (elective/emergency), their postoperative complications leading to RL, presence of diffuse peritonitis, the average interval between the first laparotomy and RL, associated co-morbidity and its influence on outcome of RL, duration of hospital stay, and outcome and factors associated with outcome of RL. Pre-operative serum albumin levels (reference value 3.5–5.5 g/dL) was used as an indicator of the nutritional status of the patients. Significant hypoalbuminemia was defined as albumin levels less than 3.0 g/dL.

Results were tabulated and statistical analysis was done using Chi-square test and a p value < 0.05 was considered statistically significant.

Results

A total of 622 laparotomies were performed during the study period of which 30 patients underwent RL for various indications (Fig. 1), bringing the incidence of RL in our tertiary care Hospital to 4.8%. The average patient's age was 52.2 years and the male to female ratio was 5:1. Twenty-two (44%) patients were above 50 years of age. Twenty-four of 30 RL (80%) had underwent emergency primary surgery and 6 RL (20%) elective surgery. The average interval between first laparotomy and RL was 12.3 days and the average gap between the time of detection of the complication and RL was 3.96 days. Six patients had diabetes mellitus and 5 patients had malignancies. Out of 30 patients who underwent RL, 22 patients had signs of florid intra peritoneal infection and 8 patients had no or minimal infection. Sixteen of 30 patients had hypoalbuminemia. The mean serum albumin levels in the study was 3.4 g/dL (range 2.2 to 4.3 g/dL). However, the mean albumin levels associated with mortality was 3.01.

Surgical intervention for hollow viscus perforation was the most common index surgery needing RL followed by surgery for Intestinal obstruction. Mortality was also found to be higher among this group. Other index surgeries were bowel gangrene and abdominal sepsis (Table 1).

Common indications for RL were anastomotic leak ($n = 7$, 23.33%), post-operative intra-abdominal infection ($n = 7$, 23.33%), burst abdomen ($n = 6$, 20%), enterocutaneous fistula ($n = 3$, 10%), persisting intra-abdominal abscess ($n = 2$, 6.67%), stomal complication ($n = 2$, 6.67%), post-operative hemorrhage ($n = 2$, 6.67%), and persisting intestinal gangrene ($n = 1$, 3.33%).

The average hospital stay among RL patients was 25.8 days. The mortality rate in the study was 20% (6 out of 30). All six patients were aged more than 50 years. Three patients had anastomotic failure and one intestinal gangrene. The cause of death among these patients was multi-organ dysfunction secondary to septicemia and diffuse peritonitis. Among the other two patients, RL was done for significant post-operative hemorrhage. One patient died of intractable hemorrhagic shock. Another died secondary to metabolic complications. Five of the six mortality patients had underwent emergency primary surgery. Three of the six mortality cases had uncontrolled diabetes mellitus.

Discussion

Laparotomy is an important cause of postoperative morbidity. RL further increases the morbidity as well as increases the risk of mortality [1, 2, 4, 5, 8, 10]. Incidence of RL in our study is

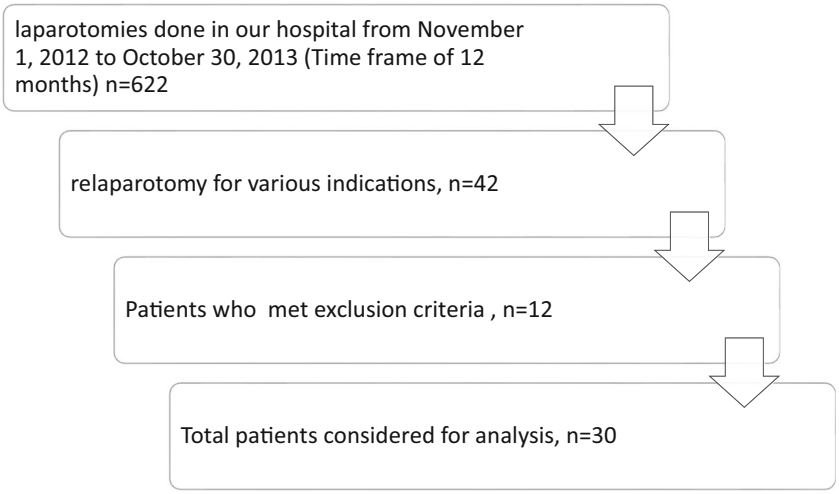

Fig. 1 Flow chart depicting selection of patient for study

4.8% while average incidence in literature varies between 1 and 4.4% [1, 5, 11, 12]. The mean age group of our study was 52.2 years. Twenty-two RL patients (73.33%) were above 50 years of age. Out of 30 RL, 80% of patients underwent emergency primary surgery and 20% elective. Unalp HR [1] and Koirala [11] have also found similar results [1, 11]. This is also reflected in most literature where RL rates are significantly higher in patients after 5th decade of life [1–3, 5, 11, 13].

In our study, the most common indication for RL (Table 1) was anastomotic dehiscence (23.33%), peritonitis not amenable to conservative management (23.33%) and burst abdomen (20%). Persistent localized intra-abdominal abscess (6.67%), stomal complication (6.67%), post-operative hemorrhage (6.67%), and persistent intestinal gangrene (3.33%) were relatively uncommon indications for RL in our study. Unalp et al. also has reported anastomotic leak as the most common cause of RL at 41.97% [1]. However, Rabin Koirala et al. have reported post-operative hemorrhage as the most common cause (34.2%) of RL [11], showing that the causes of RL may be different at different centers.

Certain complications of laparotomy are probably preventable and hence at least some RLs are avoidable. In our study, complications such as anastomotic leak, burst abdomen, and post-operative bleeding have also been observed in young adults who were otherwise healthy. Though various factors affect healing of the anastomotic site and abdominal wound, its occurrence even in otherwise healthy patients suggests that improper surgical techniques do play an important role in preventing the disastrous complications. Desiaterik et al. reported that 62.7% of RL are performed for improper surgical techniques and incorrect decision-making during primary surgery [6]. It has been reported that in 32.6–42.5% of patients who suffered postoperative peritonitis or abscess, RLs were ultimately performed for intestinal suture failure or technical mistakes during the first operation [2, 6]. This suggests that most of the RLs are essentially preventable through extra precaution and care during the primary surgery.

Table 1 RL and type of primary surgery

Primary surgery	$N = 30$	Mortality $n = 6$
Obstruction	8	2
Perforation	16	3
Infection	2	0
Gangrene	2	1
Misc	2	0

The average interval between 1st operation and RL was 11.26 days (range 0 to 55 days). This is comparable to the interval reported by Unalp et al. (6.93 days) and Koirala et al. (9.36 days) [1, 11]. The average hospital stay in our study was 27.41 days (range 11 to 66 days). Unalp et al. also reported an average hospital stay of 27.1 days [1] while Koirala et al. reported 24 days [11].

Our study showed a mortality of 20%. The mortality rate in different studies vary between 15.5 and 61.5% [1, 11–13]. The differences in mortality rates among these reports are due to non-standardized demographics in different hospitals, and indications for RL and also, differences in treatment approaches. However, most important factors affecting mortality in RL are age, cause of RL, elective/emergency primary procedure, inflammatory complications, and presence of comorbidities [1, 2, 5, 6, 8, 9, 11, 12]. Our study found that of six cases of mortality, three were for anastomotic leak, two for post-operative hemorrhage, and one for persistent gangrene (Table 1). Unalp et al. and Koirala et al. have shown that wound failure, obstruction, and fistulae had lower mortality rates for RL in comparison to hemorrhage, infection, and anastomosis failure [2, 11].

Table 2 RL and mortality

	n (%)	Mortality (%)	*p* value
Age			$p = 0.001$
< 50	17	0	
> 50	13	6	
Sex			$p = 0.17$
Male	24	6	
Female	6	0	
Primary surgery			$p = 0.81$
Emergency	24	5	
Elective	6	1	
Diabetes mellitus			$p = 0.03$
Present	6	3	
Absent	24	3	
Timing of RL in anastomotic leak			$p = 0.04$
< 72 h	3	0	
> 72 h	4	3	

In our study, patients aged more than 50 years had higher mortality rates (Table 2) compared to below 50 years ($p = 0.001$). Unalp et al. also reports that the average age of patients who died of early RL was 52.16 years [1]. Most mortality was observed in those undergoing emergency primary surgery as preparedness for surgery, intraoperative clearance of septic foci determined rate of recovery. Studies show that mortality rate increases further in patients undergoing second and third RL [1]. This may be due to reduction in patient reserves or development of newer complications after the RL.

Timing of RL is another factor affecting mortality (Tables 2 and 3) in patients undergoing RL [1, 11]. The average time interval between the date of detection of complication and performance of RL in our study was 3.96 days which is less than that reported in literature at 5.5 ± 3.5 days [1, 2]. This difference may probably be explained by the low threshold for RL among senior surgeons in our setup. This may also account for relatively lower mortality in our study. In our study, among patients of anastomotic dehiscence, requiring RL, performing RL within 72 h of detection of the leak was associated with a lower mortality than delayed surgery ($p = 0.04$). Desiaterik et al. [6] and Zavernyi [14] et al. have shown a similar reduction in mortality rate from 46 to 20.5% and 21.4 to 15.3% by performing timely RL [2, 6, 13]. A delay in the timing of RL might accentuate sepsis and hence multi-organ dysfunction as also stated by Hutchins et al. [14]. However, the need for RL and the timing of RL does vary among patients and the experience of the deciding surgeon plays an important role to help reduce mortality rates.

With regard to timing of RL for intra-abdominal sepsis, Thomas Koperna has reported that clinical deterioration was higher (92%) in patients undergoing RL after 48 h as against 75% for those who underwent RL within 48 h of detection of a complication [7]. There is a low accuracy of physical tests and clinical examination in detecting post-operative peritonitis and intra-abdominal sepsis especially so in case of patients on ventilator or on good analgesia [10]. Bader et al. also states that CT scan probable has the highest diagnostic accuracy to help in decision-making for RL [10]. This shows that clear-cut indications for RL for sepsis are less frequently detected within 48 h [7, 13, 15, 16] and early intervention with RL prior to the onset of sepsis and multi-organ failure can help reduce associated morbidity and mortality [10].

In our study, the most common cause of mortality was found to be sepsis (66%). Koirala et al. have also reported similar statistics where sepsis was the cause of mortality in 64% of mortality cases in their study [11]. Unalp et al. also reported sepsis to the most common cause of mortality (55.55%) [1]. This emphasizes the fact that infections control by both conservative techniques and early surgical intervention is paramount for better results. Determining the focus of sepsis, however, may not be possible in all cases and in some cases peritoneal lavage is all that can be done. The ratio of septic focal determination was reported as 17% by Hutchins et al [15]. Mulier et al. showed the persistence of high rate of residual peritonitis in cases who underwent urgent RL for controlling the source of infection, which possibly explains the higher morbidity and mortality following RL for infective complications [9].

Mortality in our study was highest among patients undergoing RL for anastomotic dehiscence. Though the RL was done

Table 3 Cause for RL and mortality

Reason for RL	*n* (%)	Mortality (*n*)	Time of RL	Cause of mortality
Anastomotic leak	7 (23%)	3	2.42 days	Sepsis with MOF*
Intra-abdominal infection	7 (23%)	0	2.16 days	–
Burst abdomen	6 (20%)	0	0	–
Fecal fistula	3 (10%)	0	26 days	–
Intra-abdominal abscess	2 (7%)	0	3.5 days	–
Stomal complications	2 (7%)	0	0	–
Post op hemorrhage	2 (7%)	2	0	Shock, metabolic complications
Persisting gangrene	1 (3%)	1	4 days	Sepsis and metabolic complication

within 2 days of detecting the anastomotic leak, the risk of mortality was high due to the higher incidence of sepsis (Table 2).

Nutritional adequacy is an important predictor of outcome in any illness and serum albumin is a marker of nutritional status. Hypoalbuminemia is an independent risk factor associated with occurrence of RL. In the study, the mean albumin was 3.4 and 54% of patients had hypoalbuminemia. Five of seven patients (71%) who underwent RL for anastomotic dehiscence had hypoalbuminemia and four out of six patients (66%) undergoing RL for burst abdomen had hypoalbuminemia. Out of the six mortalities in the study, four had hypoalbuminemia ($p = 0.042$). These suggest that hypoalbuminemia is an important indicator to predict RL and its outcomes including mortality. Hence, whenever possible it is better to correct the nutritional status of the patient before major surgery. The same has also been reiterated by Martinez-casas [17] who found in their study of 254 patients of RL that patients with albumin > 3 mg/dL had a 5.8% mortality; it increased to 14.1% with levels between 2.1 and 3 mg/dL and peaked at 43% in patients with albumin levels < 2 mg/dL ($p < 0.001$).

Diabetes mellitus acts as an important comorbidity which is associated with higher mortality rate. In our study, 20% (6 of 30) of cases undergoing RL had poorly controlled diabetes mellitus (DM). Uncontrolled DM was seen in three of six mortality cases ($p = 0.03$). This shows that it is essential to achieve adequate control of blood sugars in the perioperative stages in order to reduce the associated mortality.

Another important cause of RL was post-operative hemorrhage with an incidence of 6.67% in our study. Though incidence of post-operative hemorrhage following abdominal surgeries is reported to be 0.1% as shown by Kononov et al. [8], other studies report incidence as high as 18% [1]. The relatively higher incidence of hemorrhage needing RL in our study may be explained by a smaller number of cases. It is commonly due to a slipped ligature or incision site bleed or inadvertent injury during the primary surgery. In our study, both the cases of RL done for post-operative hemorrhage died, one due to metabolic consequences of massive transfusion and the other due to intractable hypovolemic shock. Studies point that up to 72.22% of the hemorrhages were due to technical errors at the primary surgery [8]. Up to 22.22% of hence post-operative hemorrhage is an important preventable cause of RL and meticulous hemostasis during the primary surgery helps reduce both the associated morbidity and mortality [1, 8]. Better post-operative monitoring to detect hemorrhage early before severe shock sets in and early RL is very important to bring down the mortality rates.

Wound dehiscence is a largely preventable cause of RL and was found in 20% of the cases of RL in our study. Many of the wound failure in literature are reported to be due to faulty technique of closure with either inappropriate suture material or suturing technique [5, 15, 16]. This significantly affects the morbidity and mortality of the patients. Hence, appropriate technique must be adhered to while closing the abdomen.

Conclusion

Almost all laparotomy surgeries have potential for RL though the risk varies based on the indication for primary surgery, age of the patient, elective of emergency primary surgery. RL is associated with a high Morbidity and mortality rate and necessary steps have to be taken to prevent its occurrence wherever possible. A serious attempt to eliminate modifiable risk factors must be made at all steps in patient care. Following precautions at surgery help reduce incidence of RL:

1. Avoid general contamination of the peritoneal cavity
2. Safeguard doubtful anastomosis by a diversion stoma
3. Avoid inadvertent injury to other structures
4. Follow proper aseptic principles
5. Satisfactory hemostasis must be achieved at all costs
6. Adhere to standard surgical techniques at all steps including wound closure
7. Careful post-operative monitoring to detect complications at the earliest
8. Low threshold for an early RL where deemed required

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

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