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Retrospective Study on Patients Undergoing Laparotomy to Assess the Risk Factors of Re-Laparotomy

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Abstract

Introduction: Abdominal surgery that has to be redone in association with initial surgery is referred to as re laparotomy. Re-laparotomy is associated with 22 to 513% morbidity and mortality, therefore it's the final choice of surgery. The main aim of this study was to find out the incidence of re- laparotomy and to identify the risk factors i.e. predictors of re laparotomy in patients undergoing general surgery operations.

Materials and Methodology: This was a retrospective study involving 100 patients, done from 1st Jan 2016 till 1st June 2017 Patients with age more than 18 years, those requiring laparotomy for both general and trauma surgery were included. Those with initial laparostomy, with only flank drain placement, any Laparotomies during colostomy or ileostomy closure, those with Initial laparoscopic procedure, minimal invasive procedure like ultrasound guided drainage etc. Were excluded. Data was analyzed using SPSS Software. The Results were expressed in percentage. Associations were analyzed using chi-square or '*t*' test depending on outcome variables.

Results: The incidence of revision laparotomy in this study was 7% and the incidence of second revision laparotomy was 1%. The indications for relaparotomy were anastamotic leak 2/7 (20%), burst abdomen 2/7 (20%), pancreatic injury 1/7 (10%), bladder injury 1/7 (10%), negative laparotomy 1/7 (10%). The variables with significant *p*-value are systemic hypertension, COPD, CAD, intra-op and post-op inotoropic support, wound infection, wound dehiscence and intra-abdominal abscess. These data can thus be used in future to formulate a prediction scoring system.

Keywords: Laparotomy; Re-lapaprotomy; Post-op peritonitis; Burst abdomen.

Introduction

Laparotomy is the surgical incision into the abdominal cavity, for diagnosis or in preparation for major surgery. From its origins in a private house in the backwoods of Kentucky in 1807, a large number of patients undergo various operative procedures every day, out of which laparotomy forms a major proportion.

Abdominal surgery that has to be re-done in association with initial surgery is referred to as re laparotomy. Laparotomy has to be re done due to complications like biliary peritonitis, faecal fistula, anastamotic leak, burst abdomen etc. Of these, post-operative peritonitis and intra abdominalsepsis[1] are the most common cause. Clinical and haematological parameters and radiological evidence form the basis of re laparotomy. Incidence of relaparotomy differs accordingto patient characteristics, initial surgery and post-op care. The surgeon factors include hesitation to decide on second surgery, focus more on conservative treatment. Need for supervision under a qualified surgeon.[2] Despite developments in preoperative and postoperative

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care, surgical materials, and techniques, vigilant and vigorous management could help reduce the rate of redo laparotomies. However when how and what depends upon the individual surgeons dilemma.

The basic steps of laparotomy is to give a peritoneal lavage to drain abscesses or fluid collections, debride necrotic tissues and address the primary issue and close the abdomen or leave it open as laparostomy or bring a diversion like stoma. Relaparotomy, if needed at the correct time, could be life saving. When not performed it could also lead to death in spite of correctable hidden cause. With the advent of additional methods of diagnosis of post-op complications the fatality after re-laparotomy can be reduced. CT scans have proved to be accurate in detecting postop inflammatory lesion and percutaneous drainage can be done ifneeded.

Depending upon time, its goal and nature of urgency, re-laparotomy can be classified into early or late, radical or palliative, planned or unplanned.[3,4] Recognition of patients at high risk of relaparotomy after initial surgery has significant patient outcome. Redo laparotomy are called On demand[4,5] if laparotomy has to be redone because of patient condition. It is called planned[4,5] if the second laparotomy is decided upon during the course of first surgery itself. In case of severe intra abdominal sepsis or post damage limitation surgery. The planned strategy may lead to early detection of persistent peritonitis or a new infectious focus but harbors the risk of potentially unnecessary re-explorations in critically ill patients. The causes for re-explorations following emergency or elective laparotomy are obstruction, wound dehiscence, fistula, anastomotic leak, hemorrhage, post-op peritonitis, perforation, circumscribed and diffuse peritonitis without perforation and suture line insufficiency due to necrosis of pancreas and biliary peritonitis.[6]

The pathophysiology after a redo surgery is to trigger inflammatory response such as the release of cytokines like IL 6 leading to hypotension and inotropic support, multiple redo surgery have a cumulative effect resulting in SIRS which will worsen the prognosis this is one reason to avoid redo. The other effects of redo surgery includes alteration of coagulation profile by destruction of coagulation factors by proteolytic enzymes, renal failure and also multiple organ dysfunction.[7]

Opening of abdomen has its own consequences like adhesions, injury to blood vessel and hollow organs, ileus, wound dehiscence and malnutrition. Thus re-laparotomy is associated with increased morbidity and mortality, as high as 22% to 51.3%.[8] Therefore it's the final choice of surgery. The surgical treatment is primarily aimed at eliminating the source. Prognosis and outcome of these patients depend upon early diagnosis and timely intervention.

The main aim of this study wasto find out the incidence of re-laparotomy. To identify the risk factors/predictors of re laparotomy in patients undergoing general surgery operations. The primary objective of this study is to better define those patients who require further surgical management. It is often very difficult to decide which patient need operative intervention and which need careful observation on an already operated patient who has developed sepsis or SIRS eventually in intensive care for a prolonged period. To identify the risk group patients emphasis was placed on preoperative and intraoperative variables that would be available to the surgeon before abdominal closure of the initial laparotomy. A scoring system thus developed to assess patients at risk for re laparotomywill surely make it easier to decide whether to re-open or not. Thus Standardization in the approach to patients will help in making diagnosis, to take resuscitative measures and to rush to operating room.

Materials and Methods

This retrospective study done from 1st Jan 2016 till 1st July 2017 was based on data collected from the patients undergoing laparotomy in the department of general surgery at our institution. It is an observational study and the results are based on retrospective Analyzis. 100 patients from were recruited. The study participants were divided into two groups laparotomy and revision laparotomy group according to inclusion and exclusion criteria. Patients with Age more than 18 years, Patients requiring laparotomy, who underwent laparotomy for both general and trauma causes, were included. Patients with initial laparostomy, only flank drain placement, Laparotomies during colostomy/ ileostomy closure, Initial laparoscopic procedure, Minimal invasive procedure like ultrasound guided drainage etcwere excluded. The 100 consecutive laparotomies performed in between the year 2016 to 2017 were taken out of which the variables were entered in a datasheet and analyzed. The variables were selected in accordance with similar studies, the variables included were pre-op, intra-op and post-op characteristics. Pre-op characteristics: In pre-op

characteristics patient demographics, co morbids, personal habits, pre Anesthetic assessment in which ASA (American Society of Anesthesiologist-physical status classification) class were taken into consideration. Laboratory values like serum potassium and albumin were included Intra-op characteristics: Intra operative characteristics like intra-op findings, duration of surgery (<2 hours, 2 to 4 hours, >4 hours), intra-op blood loss (<500 ml, 500–1000 ml, >1000 ml), inotropic support, site of pathology (foregut, midgut, hindgut, multiple site), contamination of wound whether its clean, clean contaminated, contaminated or dirty. Post-op characteristics: Post-op variables include post-op inotropic support, ventilator support, number of days in intensive care, days spent in hospital, and complications relating to surgery like local and systemic complications. Factors like the type of incision, the ranking of operating surgeon and type of incision used were also included. All these variables were retrospectively collected from hospital information system and entered in data sheet, the data sheet was designed from similar studies in which new variables were included as per study requirements. The data was initially entered into a Microsoft excel data sheet. This was subsequently imported into SPSS 22. statistical software. Simple descriptive statistics were used for percentages. Univariate Analyzis were used to define the relationship between certain measured variables, Chi-square test was used to find significant *p*-value. The demographic details like age, sex were expressed in descriptive statistics. The incidence of laparotomy/relaprotomy is expressed as percentage. Relaprotomyis dependent variable. All the other variables are independent variable. The risk factors associated with re laparotomy was foundout by subjecting them to univariant Analyzis, each variable was tested using test of significance using chi-square test to look for significant *p*-value.

Results

This is an observational study conducted in department of general surgery, PSG hospitals Coimbatore. This is a retrospective Analyzis and the study period was 2016 to 2017. It was decided to take 100 laparotomies during the period of study. The following acute abdomen cases were included and the indications for re-laprotomy are shown in table. The 100 samples were selected according to inclusion criteria. The demographic details like age, sex were expressed in descriptive statistics. The incidence of laparotomy/relaprotomy is expressed as percentage. Relaprotomy is dependent variable. All the other variables are independent variable. The risk factors associated with re laparotomy was found out by subjecting them to univariant Analyzis, each variable was tested using test of significance using chi-square test to look for significant *p*-value. Of these 100 laprotomies totally 7 underwent relaparotomy. Thus the incidence of relaprotomy was 7% with 95% CI and one in those 7 patients under went a 2nd re-laparotomy. The incidence of 2nd relaprotomy was 1% with 95% CI. Only one second revision was done. The revision was done and the major cause of that is the anastomotic leak and burst abdomen.

The age range was between 18 to 85 and the mean age was 49.6. The male to female ratio was 7:3 showing male predominance. Male participants were more in both group when compared to women. Among the 68 males who underwent laparotomy, only 5 needed relaprotomy. Among the 25 females who underwent laparotomy, only 2 needed relaprotomy. 34 cases were ASA 1 (onecrevision laparotomy), 42 cases were ASA 2 (no revisions), 23 cases were ASA 3 (5 revision laparotomies), one patient was class 4, who underwent revision laparotomy. patient in laparotomy group belonged to ASA class 2 (42/93) and patients in relaparotomy group actively belong to ASA Class 3. Assesing the comorbid status, among the 100 patients, 26% of participants were hypertensives, 21 were diabetics, 12 had CAD, 11 had COPD, 1 had PVD, 16 had malignancy (1 ca breast, 1 ca cervix, 4 ca colon, 2 ca rectum, 1 ca stomach, 1 ca endometrium, 2 renal cell carcinoma with brain mets. 1 with recurrence), 2 underwent radiotheraphy. Among all of them, as per chi-square Analyzis for association with relaparotomy, SHT, CAD and COPD showed significant *p*-value (0.012, 0.036, 0.028) respectively. When the duration of surgery was categorised and taken into criteria it showed that 34/93 and 5/7 underwent surgery for 2 to 4 hrs, 51/93 and 1/7 underwent surgery for <2 hours and 8/93, 1/7 underwent surgery for > 4hrs. The *p*-values were 0.053, 0.106 and 0.494 respectively. The site of pathology contributing for laparotomy was also studied though it did not show any significant *p*-value, table shows that 30/93, 4/7 had pathology in forgut, 52/93, 3/7 had pathology in mid gut, 14/93, 1/7 had pathology in hindgut and 17/93, 2/7 patients had pathology in multiple sites. 30/93, 4/7 had pathology in forgut with a *p*-value of 0.224. Though a significant *p*-value was not obtained 4/7 patients in re laparotomy group predominantly had pathology in forgut. Classification of wounds were also taken as a variable but it also did not show any

significance, only 5/93 (5%0, 0/7 (0%) were clean wounds, 20/93 (20%), 1/7(1%) clean contaminated, 36/93 (36%), 2/7 (2%) were contaminated wounds, 34/93 (34%) & 4/7 (4%) were dirty wounds. The timing of surgery was also considered whether it was planned or elective to know the percentage of laparotomy being done as elective or emergency. It was found that 68/93 & 5/7 were the number of cases underwent emergency laparotomies 25/93 & 2/7 underwent elective surgery. Blood loss during surgery did not show any significance, 73/93 & 3/7 had blood loss <500 ml, 16/93, 3/7 had blood loss 500 to 1000 ml, 3/93 & 1/7 had blood loss between 1000–1500 ml and 1/93 & 0/7 had blood loss >2000 ml. The patients in the relaparotomy group predominantly has extended midline incision 5/7. Wound infection showed significant *p*-value in which 20/93 and 5/7 had wound infection, whereas 73/93 & 2/7 did not have infection. Wound dehiscence had a significant *p*-value where 10/93 and 3/7 had wound dehiscence, 83/93 & 4/7 did not have wound dehiscence. Intra-abdominal abscess showed a significant *p*-value of 0.04. 3/93 & 3/7 had abscess, whereas 90/93 & 4/7 had negative findings. The intra-op and post-op inotropic support had a significant *p*-value of 0.002 & 0.003 respectively, pre-op inotopic support were started in 7/93 & 4/7 patients, 86/93 & 3/7 did not require inotropic support. Post-op inotropic support were required in 15/93 & 5/7 and 78/93 & 2/7 did not require inotropic support. When studying the variables using pre-op, intra-op and post-op characters variables with significant *p*-value has been identified, in this retrospective study the factors with significant *p*-value are SHT, CAD, COPD, pre-op and post-op inotropic support, wound infection, abscess and wound dehiscence. (Table 1).

Table 1: Factors leading to re- laparotomy which were statistically significant

S. No	Patient characteristics	*p*-value
	Pre-op Characteristics	
1	Systemic hypertension	0.012
2	Coronary artery disease	0.036
3	COPD	0.028
	Intra-op Characteristics	
4	Ionotropic support	0.002
	Post-op Characteristics	
5	Ionotrophic support	0.003
6	Wound infection	0.010
7	Wound dehiscence	0.045
8	Intra abdominal abscess	0.004

The mean number of days spent in icu for laparotomy group was 2 days and the mean number of days spent in icu for revision laparotomy group was 11 days. The mean days spent in ventilator for laparotomy group and revision laparotomy group are 0.5 and 5 days respectively, the mean number of days spent in hospital for laparotomy group is 12 days and the mean number of days spent in hospital for revision group is 32 days. The expected post-op day in which the patient has undergone re do surgery is between 4th to 15th day. The lab values like serum k and albumin did not have any significant outcome. The other complications were non specific causes like alcohol withdrawal, ARDS, basal atelectasis, bed sores, burst abdomen, CHD stricture with pleural effusion, focal seizure, Hypokalemia, sepsis, shock, metabolic acidosis, paralytic ileus, pleural effusion, Pneumonia, Seizure and Type 2 respiratory failure. To know the laparotomy outcome the patient discharge status was considered and analyzed. 3/7 pts went home, 3/7 pts went Against medical advice, 1/7 needed LTAC (long-term assistance care). In total irrespective of the number of laparotomies 72/100 went home, 15/100 went against medical advice, 2/100 needed LTAC, 3/100 died. The rank of operating surgeon was considered in which 16/93 & 1/7 were performed by Senior residents, 43/93 & 3/7 by Assistant professor and 14/93, 3/7 by Professors, for 20 surgeries the details of surgeon were not available.

Discussion

PSG hospital is a tertiary care centre where it serves lakhs of people in and around Coimbatore district. Patient admission, operation details and discharge summary are recorded in computarized system. Incidence of relaparotomy in this study was 7%,

various studies have found different incidence rates in various scenarios which is as low as 1.9% (5) to as high as 24% (4), Incidence varies from study to study due to different variables and study design. 1/7 patient underwent initial surgery else where, 1/7 patient underwent 2 revision laparotomy. The indications for relaparotomy were anastamotic leak 2/7 (20%), burst abdomen 2/7 (20%), pancreatic injury 1/7 (10%), bladder injury 1/7 (10%), negative laparotomy 1/7 (10%), anastamotic leak and burst abdomen seems to be the leading cause of revision laparotomy in similar studies too[2]. The re exploration rate for anastamotic leak and burst abdomen were high while the re exploration rate for peritonitis, wound dehiscence or fistula was either low or not done[5]. This study has a good number of therapeutic relaparotomy indicating that all these patients abdomen were opened only for good. The incidence of negative revision laparotomy was only 10% (1/7), which coincides with a study conducted Matthias et al.[4] where in the incidence of negative revision laparotomy was 9%. The incidence of multiple revision laparotomy is 10% (1/7), the indications of revision laparotomy are more or less the same, the only difference is the incidence of each indication. The number of relaparotomy does not increase the significance it's the time of intervention which matters. The total number of relaparotomy was 7 in which 5/7 were performed in emergency set up. Many of the patients requiring repeat laparotomy in which the index surgery were done as emergency basis. Another study also shows that the maximum re laparotomies are taken as emergency surgery only. The number of planned relaparotomy were 2/7, emergency re laparotomy were 5/7. The percentage of emergency re laparotomy is consistent with a study conducted by Matthias et al. which is 85%.[7] The mean duration between laparotomies depends upon the index surgery, surgical technique and post-op factors and it varies according to ICU and hospital set up. In this study the mean duration between laparotomies were 8.85 days and it ranges from 4 to 15 day. The mean duration between first and second relaparotomy is 5 th day. This study was designed in such a way that the cause of relaparotomy and the factors leading to re exploration were analyzed by selecting variables, each variable starting from pre-op to intra-op and post-op were chosen and studied using univariant Analyzis, the significant variable with p-value < 0.05 was obtained which was consistent with other study. The pre-op factors included patient demographics and co morbids, the intra-op characters included were the site of pathology, duration of surgery, blood loss and inotropic support, where as the post-op characteristics included surgery related complications. Gender wise distribution of relaparotomy was higher in male patients which is comparable to similar study, the male:female ratio is 7:3, the male participants were more in both laparotomy and revision laparotomy group. The mean age of the participants was 49.6 (10) The mean age of participants were 50 with male dominance in a study conducted by Unalp HR et al. The pre-op factors with significant p-value are SHT, CAD, COPD. Systemic hypertension was present in 26%, diabetes mellitus was present in 21%, coronary artery disease was present in 12%, COPD was present in 11% and peripheral vascular disease was present in 1%. The percentage of CAD and COPD was found to be 21% and 14% respectively in a study conducted by Oddeke van et al. which is very well similar to this study. CAD with significant p-value was also found in a study conducted by Jerry J. Kim et al.[3] Intraopertive characteristics like site of pathology, classification of wound, duration of surgery, type of incision, blood loss and need for inotropic support were studied. When site of pathology was considered nothing was significant but majority in the group had forgut 30/93, 4/7. and 52/93, 3/7 midgut pathology and minority of the group had pathology in hindgut 14/93, 1/7-hindgut and multiple site 17/93, 2/7. Blood loss also was studied but it failed to show any significance but patients on intra-op inotropic support had significant p-value. The patient in laparotomy group had all types of midline incision whereas 5/7 had extended mid line incision. Among the 100 patients studied, 3 were clean cases, 19 were clean contaminated, 40 were contaminated and 38 were dirty.

Most of the above mentioned factors were studied by Jerry J Kim. et al. and the results were more or less the same. As per expectations complications related to revision laparotomy are high and our results were no different when post-op complications were analaysed it was found that wound infection, wound dehiscence[9] and intra -abdominal abscess had significant p-value which is consistent in a study conducted by Koirola et al.[5] The other post-op complications taken into account were pulmonary complications, septicaemia, dyselectremia, cardiovascular complications, stroke, tracheostomy, enterocutaneous fistula, laparostomy and others. 1/7 had tracheostomy and 2/7 had laparostomy in this study. The need for multiple laparotomies is associated with worse outcomes in terms of ICU care, ventilator dependency and increased hospital stay. The mean

number of days spent in ICU for laparotomy group was 2 days and the mean number of days spent in icu for revision laparotomy group was 11 days, The mean days spent in ventilator for laparotomy group and revision laparotomy group are 0.5 and 5 days respectively, the mean number of days spent in hospital for laparotomy group is 12 days and the mean number of days spent in hospital for revision group is 32 days. The expected post-op day in which the patient has undergone re do surgery is between 4th to 15th day and the mean post-op day was 8.7. The rank of operating surgeon was considered in which 16/93 & 1/7 were performed by Senior residents, 43/93 & 3/7 by Assistant professor and 14/93, 3/7 by Professors, for 20 surgeries the details of surgeon were not available. Junior two ranks performed majority of the index surgeries this is attributed to the staffing ratio of the hospital, whereas it was not possible. to bring out the leak rate or complications related to surgery. This has no impact on the study. What is shown here is emergency theatres which were performed by junior two consultants. Similar findings are shown in a study conducted by professor BFK Odimba et al. This forms a deficit in co-relation between experience of Surgeon and impact on surgical outcome, which can be focused upon in the next study. Thus 8 variables with significant *p*-value have be obtained and shown in the (Table 2).

Among the variables a minimum of 2 to a maximum of 6 variables were present in relaparotomy group.

Table 2: Significant variables noted in re-laparotomy

Sl. No	SHT	CAD	COPD	Inotropes pre-op	Inotropes post op	Infection	Dehiscence	Abscess	Total
1	1	0	0	0	0	1	0	0	2
2	1	1	1	0	1	0	0	0	4
3	1	1	1	0	0	0	1	1	5
4	0	0	0	1	1	1	1	1	5
5	1	1	1	1	1	1	0	0	6
6	1	0	0	1	1	1	1	1	6
7	0	0	0	1	1	1	0	0	3

Conclusion

Although repeat laparotomies create a huge stress for the patient in the post-operative period, due to lack of adequate pre-operative nutritional preparation, further worsened by the pathology from the disease/previous surgery, the need for re-laparotomy supersedes these risks in view of worsening clinical status of the patient. The decision for re-laparotomy has to be made by an experienced surgeon and with all relevant investigations needed without any time delay. The major result of our study was the incidence of revision laparotomy 7% and the incidence of second revision laparotomy was 1%. This was an observation study and the results were based on retrospective data available with which some significant predictors were obtained and the findings were observed in the other studies. The major limitation of this study can be overcome by randomized control trial which will have ethical consideration. Anyhow this study incidence was concordance with major studies and the scoring system should be developed with the important predictors listed.

Limitations

Among the patient demographics BMI and personal habits could not be studied as there were many missing data in patient records. Though alcohol usage and smoking have shown to be significant in a other studies since this study is retrospective correct information regarding personal details were not available. Burst abdomen was a major indication in our study. The suture material used for abdomen closure could have also been considered. The mortality rate could not be calculated as significant number of patients went AMA which could be due to increased financial constraints considering patient affordability they could not have been able to continue ICU treatment.

Recommendations

To develop a scoring system with the important predictors listed. All the necessary investigations and pre-op preparation has to be made once the decision for revision laparotomy has taken the patient has to be shifted to operating room without any time delay. Utmost post-op care has to be

given to prevent revision laparotomy associated morbidity and mortality.

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