

A Comparative Study of Midline Incision versus Paramedian Incision in Abdominal Surgeries – A Study of 100 Cases

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Abstract

Introduction: The incision must not only give direct access to the pathology but also provide sufficient room for operation to be performed, therefore we organized a clinical trial to compare the paramedian incision with midline incision.

Objectives: To find better Incision among Midline and Paramedian Incision with respect to Incidence of wound complications like wound infection, dehiscence, burst abdomen, and incisional hernia. Time taken for opening and closure, and accessibility.

Methods: Surgical procedures necessitating abdominal incision irrespective to age were included in this study. This was an observational prospective analytical Hospital based study conducted at Department of General surgery of Guru Nanak Dev Hospital, Amritsar during the period of 2015 – 2017. A total number of 100 patients were taken for study. Randomly divided into two groups A (midline) and B (paramedian) to evaluate the time taken, post-operative complications and other para-meters in these two groups. Each group was divided into 50 Cases. Midline incision and Para median incisions were performed as per standard technique. The details of operations, post-operative complications and follow up to be recorded and analysed.

Results: Most of the paramedian incisions 64% among group B provided easy access to deal with pathology while midline approach was easier in 54% cases. Complications were also statistically (Statistics software used to calculate was SPSS Ver. 17) more in midline. Mean time taken to open and close in midline was lesser than paramedian incision.

Conclusion: As most of pathologies are in right half of abdomen paramedian incision provided more easy access and for exploratory laparotomy it should be recommended for reduced wound infection, wound dehiscence and ventral incisional hernias. Midline incision due to less time consuming can be preferred in emergency cases but has got the disadvantage of forming more complications than paramedian incision

Keywords: Midline incision; paramedian incision; wound infection; wound dehiscence; incisional hernia; burst abdomen.

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I. Introduction

Exploratory Laparotomy is the commonest major operation performed by the general surgeon in emergency settings worldwide. The incision should be big enough that the surgeon is comfortable with the exposure and access to the pathology.

Traditionally, vertical incisions are used for exploratory laparotomy. Here the skin incision is made in the midline. The disadvantage of this incision is the greater risk for postoperative wound dehiscence and the development of postoperative hernia. The paramedian incision on other hand has the advantage of minimal risk of postoperative wound disruption.

The right paramedian incision is preferred as compare to left in majority of cases because pathologies causing acute abdomen which may be difficult to ascertain preoperatively are usually on the right side of the abdomen e.g. , perforated duodenal ulcer, liver abscess, biliary tract disease, ileal perforation, Meckel's diverticulitis, mesenteric lymphadenitis, and appendicitis. On the other hand pathologies of organs on the left side of the abdomen are not much difficult to diagnose preoperatively.

Risk factors which affect the outcome of abdominal surgeries are Wound infection and dehiscence, Anemia and hypoproteinemia, Gender, Body mass index, Cardiovascular disease, Chronic obstructive pulmonary disease (COPD).¹

In the present study, a prospective clinical trial was studied to compare the possible advantages of abdominal incision with two methods in common use:

- A. Midline Incision
- B. Paramedian Incision

Wound infections remain the most important early postoperative complication as within a month postoperatively it develop in 3–21% of patients undergoing a midline laparotomy.²In various studies, the incidence of postoperative hernia varies between 9% and 20% depending on various risk factors, techniques and material.^{3,4} The frequency of burst abdomen until the day of discharge has been within the range of 1–3% reported in the literature.²

II. Review Of Literature

There are many analysis and metaanalysis regarding the choice of incision with or without their closure technique. Ellis H. et al (1984)⁵showed that many factors influence the surgeon's choice when making an abdominal incision. Some will be overriding, such as inadequate access through alternative incisions, or previous surgery which makes it illogical to open the abdomen via an entirely separate incision. Almost all operations in the abdomen and retroperitoneum can be performed through the universally acceptable midline incision.¹⁵As It is almost bloodless, no muscle fibers are divided, no nerves are injured, and it affords goods access to the upper abdominal viscera. It is very quick to make as well as to close; it is unsurpassed when speed is essential⁷ a midline epigastric incision also can be extended the full length of the abdomen curving around the umbilical scar.⁸

Many prospective trials have concluded that vertical midline incisions to have hernia rates of 5%–15%.⁹⁻¹¹On the other hand paramedian incisions have reported incisional hernia rates of less than 1%.¹²Cox et al, Guillou et al and Kendall et al conducted three separate randomized trials, which included a broad range of general surgical procedures, compared lateral paramedian and midline incisions and all three demonstrated the superiority of paramedian incisions with regard to hernia formation with equivalent rates of wound infection.¹³⁻¹⁵The paramedian incision has two theoretical advantages. The first is that it offsets the vertical incision to the right or left, providing access to the lateral structures such as the spleen or the kidney. The second advantage is that closure is theoretically more secure because the rectus muscle can act as a buttress between the reapproximated posterior and anterior fascial planes.¹³ On the other hand a midline incision divides the fascial fibers of the anterior abdominal wall, which are in transverse direction. The closure of these vertical wound causes laterally directed tension on the closure line because it places the suture between the fibers and contraction of the abdominal wall which may cause them to cut through by separation of the transversely orientated fascial fibers¹⁷.

In a study done by Suresh Karlatti et al 2014¹⁸, showed that chances of incisional hernia is more in midline incisions as compare to paramedian incisions which goes in line with previous study done by Cox et al¹³SSIs are among the most common hospital acquired infections comprising 14–16 percent of inpatient infections.⁶ SSI is a dangerous condition, a heavy burden on the patient and social health system.¹⁹ COPD is a biologically plausible risk factor and is known to be associated with VIH and VIH recurrence.²⁰Sinha *et al.* carried out a study in Oula University Hospital, 18 among 48 patients who developed burst abdomen and found that 65% patients with pre-operative hypoalbuminemia, other risk factors included anemia, malnutrition, chronic lung disease and emergency procedure.²¹ In another study, 43.8% of patients showed hemoglobin <10 g% as the chief risk factor. Other factors were poor nutritional status, obesity, diabetes mellitus, and hypoproteinemia.²² The maximum incidence of burst abdomen was seen within 7 days and these findings were in correlation to Parmaret *al.* study.²³

III. Aims And Objectives

In the present study there was an effort to compare the two different methods of skin incision in abdominal surgery, viz

- a) Midline Incision
- b) Paramedian Incision

As to their advantages and disadvantages over one another.

To find better Incision in various abdominal surgeries with respect to

- a) Incidence of wound complications (e.g. wound infection, dehiscence, burst abdomen, hematoma, formation ugly scar and incisional hernia)
- b) Time taken for opening and closure.
- c) Accessibility of anatomy of operating site

IV. Material And Methods

All the elective and emergency surgical procedures necessitating abdominal incision irrespective to age were included in this study. This was an observational prospective analytical Hospital based study conducted at Department of General surgery of Guru Nanak Dev Hospital, Amritsar. The study has been approved by Institutional ethics committee. The study population was composed of male and female patients who underwent vertical abdominal wall incisions and their closure during the period of 2015 – 2017. A total number of 100 patients were taken for study. They were randomly divided into two groups A (midline) and B (paramedian) to evaluate the time taken, post-operative complications and other para-meters in these two groups. Each group consisted of 50 Cases.

Inclusion and exclusion criteria

Diabetic, immunocompromised or patient suffering from any disease influencing wound healing viz skin diseases etc and patient with midline scar etc are not included so as to reduce the different variables affecting the outcome of this study.

Patients who will give informed consent will be included in this study. Uncooperative patients will be excluded. All patient have to undergo routine tests before surgery.

Participants

The inclusion and exclusion criteria as well as the surgical procedures have been described in the study protocol. The study included patients undergoing primary elective or emergency laparotomy with variable length of skin incision. All patient have to undergo routine tests before surgery. The study, furthermore, excluded patients not able to understand and to follow the instructions given by the investigator. To ensure optimal comparability, in the study group, only patients from Guru Nanak Dev Hospital Amritsar.

Group A

Standard midline incision will be taken and the abdomen will be opened by incising skin, linea alba and peritoneum. Closure will be done in two layers with No-1 vicryl round body needle for linea alba & 2-0 silk cutting needle for skin. Keeping in mind length of the suture is one half times the length of Incision.

Group B

Para median incisions will be performed as per technique described by Guillou and colleagues. The skin and the anterior layer of rectus sheath incised and rectus muscle retracted laterally and posterior layer of rectus sheath and peritoneum incised in same plane as that of anterior rectus sheath. Closure of both layers will be done using the same suture material and same technique.

Outcome

The details of operations, post-operative complications and follow up to be recorded and analysed statistically (Statistics software used to calculate was SPSS Ver. 17). The frequency of reoperation or secondary suturing due to burst abdomen, wound dehiscence or wound infection until the day of discharge was chosen as a primary combined endpoint for safety. The secondary endpoints, to study efficacy, were the frequency of abdominal hernias, the frequency of wound infections and complicated wound healing at 30 days after surgery, and the length of hospital stay.

Wound infection was diagnosed as discharge and redness, wound dehiscence with secretion (putrid or caliginous fluid) and/or microbiological evidence of bacterial contamination along with gaping of wound, with abdominal fascia intact. A burst abdomen was defined if postoperatively the continuity of the abdominal fascia was interrupted in combination with wound dehiscence and a consecutive relapse operation.

Study objectives

The primary hypothesis of the study was that the time taken to open and close these two types of intra-abdominal approach, their accessibility and combined frequency of wound infection and of re-operation due to burst abdomen until day of discharge was equal or variable and suitable approach as per pathology.

V. Observation And Result

Table 2: Mean Age (range), patients below and above 50 years of age.

	Midline	Paramedian
Mean Age (Range)	38.6(12-70)	37.68(11-75)
>50years	12	11
<50years	38	39

There is no significant difference of mean age between the midline and paramedian group [t(98)=0.304, p=0.761]

Table 6 Population characteristics as per Incision

		Midline	Paramedian	Total
Total Number		50	50	100
Average Age (years)		38.6	37.68	38.14
Sex (M:F)		22:3	21:4	43:7
Smoking		25	17	42
Alcohol		33	31	64
Tobacco		5	8	13
BMI ^a	Normal Weight	27	31	58
	Under Weight	16	11	27
	Over Weight	2	5	7
	Obese	5	3	8
Deranged RFTs		26	21	47
Deranged S. Electrolyte		33	27	60
COPD		11	8	19
Drugs		21	22	43

a- $\chi^2 = 2.988$, $p = 0.394$;

Table 9: Analysis of Risk factor for wound dehiscence, Burst Abdomen and Incisional Hernia

	Wound dehiscence ^a		Burst abdomen ^b		Incisional Hernia ^c		
	ML	PM	ML	PM	ML	PM	
Total Number	14	8	2	3	3	2	
Age>50	2	2	1	1	2	1	
Sex (M:F)	13:1	7:1	2:0	2:1	3:0	2:0	
Smoking	10	7	1	2	3	2	
Alcohol	12	4	1	2	3	2	
Tobacco	1	4	1	2	1	1	
BMI ^d	Normal Weight	6	4	1	1	2	1
	Under Weight	4	3	1	2	1	1
	Over Weight	1	1	0	0	0	0
	Obese	3	0	0	0	0	0
Deranged RFTs		7	6	2	2	3	0
Deranged S. Electrolyte		11	7	2	3	3	2
Anemia Hypoproteinemia		12	6	2	3	2	2
COPD		4	4	1	2	1	2
Drugs ^e		5	4	1	2	3	2
Wound infection		12	8	1	3	3	2

a- $\chi^2 = 2.098$, $p = 0.114$;

b- $\chi^2 = 1.243$, $p = 0.537$;

c- $\chi^2 = 2.621$, $p = 0.270$;

d- $\chi^2 = 2.988$, $p = 0.394$;

e- $\chi^2 = 0.41$, $p = 0.5$

Table 10. Time for incisions. Mean (range) in minutes

Time taken	Midline	Paramedian
Opening	3.76 (2-8.58) mins	9.09 (5-13.17)mins
Closing	7.14 (4.50-14) mins	12.77 (6.67-17) mins
Opening time		
Less than 5 mins	40	2
5 to 9 mins	10	26
More than 10 mins	0	22

There is significant difference in the opening time [$t(97)=-12.208$, $p=0.000$] and closing time [$t(98)=-12.366$, $p=0.000$] between the midline and paramedian groups.

Figure 15. Comparison of accessibility of two study groups.

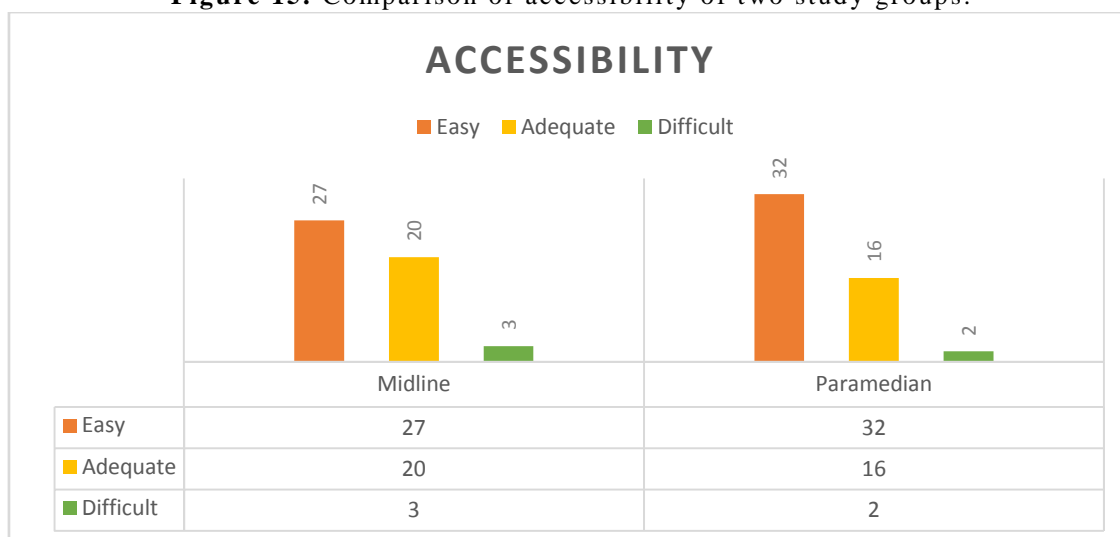


Table 12: Comparison of complication between midline and paramedian incisions

Number of cases	Midline	Paramedian	Total
No. of patients	50	50	100
Burst abdomen	2	3	5
Incisional hernia	3	2	5
Lost to follow up	4	1	5
Death	7	3	10
Reopen surgery	3	4	7

VI. Discussion

Operative techniques used for exploratory laparotomy varies and these techniques have been evaluated through various studies. Associated with high morbidity and mortality, it continues to be a matter of concern to the surgeons, particularly in a tropical country like India.

Out of 100 cases studied 50 cases were randomized in group A (midline) and 50 cases in group B (paramedian). Among these most common were gastric perforations total 48% in whole study, intestinal perforation (16 %), intestinal obstruction (9%), appendicular perforation (4%), rest were duodenal, jejunal, sigmoidal, caecal and rectal perforation, liver abscess, liver abscess, splenic injury and a case of carcinoma colon. The most common etiology noted in study group was alcohol (64 cases), smoking (42 cases), blunt trauma (7 cases), tuberculosis (5 cases) and typhoid (8 cases). Other were carcinoma, NSAIDs, increased intake of junk, raised stress, blunt trauma, tobacco chewing, stab and corrosive ingestion.

Mean age among group A (midline) was 38.6 years. And in Group B (paramedian) mean age was 37.68. Cases more than 50 years of age were 12 among Group A and 11 among Group B. There was no significant difference of mean age between the midline and paramedian group [t (98) =0.304, p=0.761]. Majority of cases (51%) were between 20-39 years of age (51 cases). Youngest of whole study was 11 year old female child with rectal perforation and oldest of all was 75 year old male with descending colon perforation.

It was also noted that males presented relatively more than females attributing to their consumption of alcohol, smoking and tobacco. Chronic Obstructive pulmonary disease, one of the major disruptive force causing wound dehiscence and burst abdomen postoperatively.

Midline incision is fast and easy to perform as compared to paramedian incision, which is more tedious to learn and takes longer to perform. And precision is required while opening to avoid injury to inferior epigastric vessels which are present in the rectus box. And also because of layered closure, anterior rectus and posterior rectus becomes time consuming.¹³In our study in group A (midline) mean time taken to open was 3.76 minutes, range was from 2 minutes to 8.58 minutes and mean time taken to close was 7.14 minutes range was from 4.5 minutes to 14 minutes. In group B (paramedian) mean time taken to open was 9.09 minutes, range was from 5 minutes to 13.17 minutes and mean time taken to close was 12.77 minutes, range was from 6.67 minutes to 17 minutes. There was significant difference in the opening time [t (97) =-12.208, p=0.000] and closing time [t (98) =-12.366, p=0.000] between the midline and paramedian groups].

As shown in study done by karlatti et al 2014, Paramedian incision does not prevent incisional hernia even though our study noted two case (2%), in comparison to midline where 3 cases of incisional hernia (3%) were noted.¹⁸Many prospective trials have concluded that vertical midline incisions to have hernia rates of 5%–

15%.⁹⁻¹¹ on the other hand Lateral paramedian incisions have reported incisional hernia rates of less than 1%.¹² Chances of incisional hernia development persists even after one year so more period of follow up is required.⁵ Other studies have found age, gender, body mass index, COPD and wound infection to be risk factors for Ventral incisional hernia formation.

The most worrying feature about this trial were the 5 burst abdomens, which is well comparable to study done by Soni P et al (2015)¹⁶ who reported overall rate of burst abdomen was 4.8%-6.6%. Admittedly a small number but a disaster for the patients when they occur. A clue to the etiology of this is seen in the table showing the analysis of risk factors (Table 9). There were three cases of burst abdomen seen in paramedian incision group and two in midline group. Our present study shows chances of incisional hernia is more in midline incisions as compared to paramedian incisions which goes in line with previous study done by Cox et.al.¹³

As most of the abdominal pathologies lies in right half of abdomen therefore right paramedian gave easy access during surgery inspite of that the rectus has to be retracted out of the way. The paramedian incision has two theoretical advantages. The first is that it offsets the vertical incision to the right or left, providing access to the lateral structures such as the spleen or the kidney. The second advantage is that closure is theoretically more secure because the rectus muscle can act as a buttress between the reapproximated posterior and anterior fascial planes.¹³

Here it is significant to mention that in our study 59% cases had good exposure and easy accessibility in which paramedian incision provided easy approach to 64% in its group (32 cases) as compare to midline (27 cases) where it was 54%. In the present study 4 cases of group A and 1 case of group B lost to follow-up. The overall mortality was 10%. The cause of mortality was very poor general condition of patient at the time of admission, anaemia, septicemia, dehydration, delayed presentation to appropriate healthcare system, underweight and deranged renal function tests.

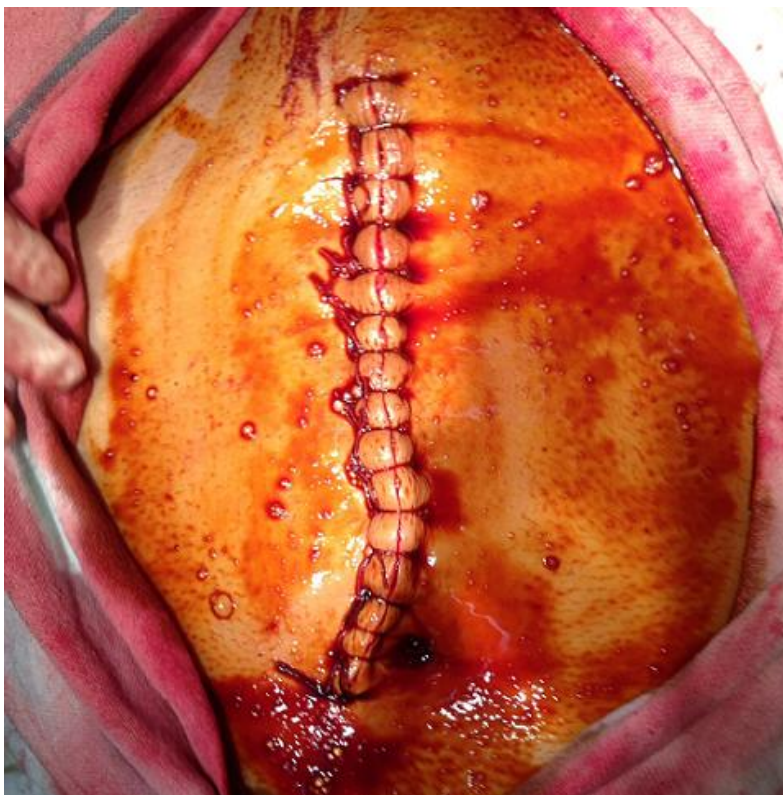


Figure 17: Midline Incision



Figure 18: Paramedian Incision

VII. Summary And Conclusion

The paramedian incision requires precision, is tedious to learn and takes longer to perform but as most of pathologies are in right half of abdomen it provided more easy access and exposure. Males presented relatively more than females attributing to their consumption of alcohol, smoking and tobacco. Mean time taken to open and close in midline was very less than paramedian incision. For left lateral pathologies like spleen injury, sigmoid descending colon perforations left paramedian incision proved easier. The paramedian incision for exploratory laparotomy is not associated with increased morbidity and should be recommended for reduced wound infection, wound dehiscence and ventral incisional hernias. Midline incision due to less time consuming can be preferred in emergency cases but has got the disadvantage of forming more incisional hernias as compare to paramedian incision. The accessibility in two comparative in this study group, it was noted that most of the paramedian incisions 64% among group B provided easy access to deal with pathology while midline approach was easier in 54% cases. There were no complications of burst abdomen and incisional hernia among overweight and obese in our study. It can be attributed to the advantage of adipose tissue reserve in post-operative days when patient is kept nil per oral.

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