



Surgical Wound Infection and Suture Material --A Study of 60 Cases

KEYWORDS

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ABSTRACT *This study will evaluate the role of suture material in development of surgical wound infection-like type of suture material like absorbable/non absorbable suture material ,technique of closure like continuous/interrupted.they are evaluated for various type of wound infection like wound site infection,sinus formation,wound dehiscence and incisional hernia.*

OBJECTIVE OF STUDY

The objective of this study is to compare the incidence of infection and development of incisional hernia in the wound for abdominal wall closure with using absorbable/nonabsorbable suture material .

The Technique—i.e. continuous versus interrupted method of abdominal wall closure using both absorbable and non-absorbable suture in patients of underwent laprotomy in emergency and elective setting.

There are different ways of suturing for closure of abdomen fascia ,and because of this there are chances of development wound infection and incisional hernia in immediate post operative period and after long interval period ,in this study we are planning to evaluate the , type of suturing material, technique of suturing—continuous/interrupted which is essential for prevention of development of wound infection and incisional hernia by comparing the incidence of the same by using the different suturing material.

we will evaluate this in emergency and elective surgery setting as it is also one of the factor in development of surgical site infection ,so it will help us to evaluate the causes of development of wound infection and incisional hernia.

REVIEW OF LITERATURE FACTORS:-

Will contribute for development of wound infection and incisional hernia--

1.CHOICE OF INCISION:

2.Type OF SUTURING MATERIAL –absorbable/nonabsorbable

3.Type of closure CONTINUOUS VS INTERRUPTED CLOSURE

AIMS AND OBJECTIVES

A)compare continuous versus interrupted technique of abdominal fascia closure for incidence of wound infection and incisional hernia by various absorbable and non absorbable suture material and

B) study of related complication of wound infection like wound dehiscence , sinus formation and incisional hernia development.

METHODS AND MATERIALS

1. Study design:

This study is a hospital based prospective study undertaken to evaluate continuous and interrupted methods of abdominal fascia closure in patients with laprotomy so that an ideal suture material and technique of abdominal closure can be identified and also study of wound infection and related complication incisional hernia with various suture material.

2. Study population:

Total of 60 patients with admitted in who underwent in elective or emergency setting laparotomy through a midline vertical incision at KEM General Hospital, PUNE City were enrolled in the study. These 60 patients were divided into six groups:

Group A: 10 patients who underwent continuous closure of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Group B: 10 patients who underwent continuous closure of abdominal wall using slowly absorbable monofilament (polydioxanone) suture.

Group C: 10 patients who underwent continuous closure of abdominal wall using slowly absorbable polyfilament (polyglycolic acid) suture.

Group D: 10 patients who underwent interrupted suturing of abdominal wall using non-absorbable monofilament (polypropylene) suture.

Group E: 10 patients who underwent interrupted suturing of abdominal wall using slowly absorbable monofilament (polydioxanone) suture.

Group F: 10 patients who underwent interrupted suturing of abdominal wall using slowly absorbable polyfilament (polyglycolic acid) suture.

3. Inclusion criteria.

For inclusion in this study patients must underwent laprotomy with midline incision, age greater than or equal to 18 and less than 70 years and an informed consent must be taken.

Cases of laprotomy and patients with severe co-morbidities such as hepatic disease, renal disease, hemoglobin less

than 8 mg%, uncontrolled diabetes, malignancy patients on chemotherapy and patients who have had laparotomy previously were excluded.

4. Preoperative Workup:

All patients underwent the following investigations:

Complete blood hemogram, blood urea, serum creatinine, serum electrolytes, blood sugar, liver function test including total protein and serum albumin, chest X-ray, electrocardiogram, grouping and cross-matching.

5. Procedure:

Laprotomy done through midline incision, after dealing the cause the peritoneal wash given and wound closed in layers by employing different techniques as divided in in 6 group.

6. Methods of Closure:

Written informed consent was taken from all patients. Patients were subsequently divided into the following 6 groups for closure:

Group A (Continuous non-absorbable monofilament suture): Non-absorbable No.1 polypropylene was used in a simple running technique in a non-interlocking manner starting just proximal to the incision. The bites were taken 1-2 cm from the divided edge with a distance of 1 cm between two bites.

Group B (Continuous slowly absorbable monofilament suture): Slowly-absorbable No.1 polydioxanone was used in a simple running technique in a non-interlocking manner starting just proximal to the incision..

Group C (Continuous slowly absorbable polyfilament suture): Slowly-absorbable No.1 polyglycolic acid was used in a simple running technique in a non-interlocking manner starting just proximal to the incision. .

Group D (Interrupted non-absorbable monofilament suture): Non-absorbable No.1 polypropylene was used taking interrupted sutures starting at a distance of 1-2 cm proximal to the divided edge with a distance of 1 cm between two consecutive sutures taking 5-6 knots in a single suture tie.

Group E (Interrupted slowly absorbable monofilament suture): Slowly-absorbable No.1 polydioxanone was used taking interrupted sutures starting at a distance of 1-2 cm proximal to the divided edge .

Group F (Interrupted non-absorbable polyfilament suture): Slowly-absorbable No.1 polyglycolic acid was used taking interrupted sutures starting at a distance of 1-2 cm proximal to the divided edge .

7. Evaluation Parameters:.

1) **Wound dehiscence:** defined as postoperative missing continuity of the abdominal fascia with bursting open or splitting along suture lines.

2) **Wound infection:** defined as redness, wound dehiscence with secretion either of putrid caliginous smelly fluid or requiring antibiotic or surgical intervention.

3) **suture sinus**

8. Follow Up:

Patients were followed up and re-evaluated at 2, 4, 6 and 12 weeks after surgery in out patient department and examined for following complications:

1) Wound infection

2) Suture sinus: defined as abnormal protrusion of underlying suture threads through intact skin, may or may not require removal.

3) Burst abdomen/incisional hernia: defined as postoperative evidence of a fascial dehiscence after completed superficial wound healing with or without prolapse of abdominal organs.

9. Statistical Analysis:

For qualitative data, significant difference between means was computed by using t-test. To see significant difference for proportions of qualitative data; chi-square and fisher's exact test was applied. Data will be expressed as mean, median.

RESULTS

This study was conducted in Surgical Department of KEM General Hospital, pune City, over a period of one years ,a total of 60 patients were included in the study and were divide into 6 groups as describe above--

1. AGE:

Patients between age group 18-70 years were included in this study. The mean age in the six groups were 38.4 yrs, 40.4 yrs, 35.5 yrs, 38.7 yrs, 42.1 yrs, 44.3 yrs.

Age (yrs)	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
MEAN	38.40	40.4	35.5	38.7	42.1	44.3
MEDIAN	40.30	38.6	30.1	39.2	29	48
STD. DEVIATION	18.4	18.67	15.79	20.64	18.50	10.7
MINIMUM	19	20	18	18	19	28
MAXIMUM	60	66	69	58	64	58

TABLE 1: MEAN, MEDIAN AND STANDARD DEVIATION OF AGES (YEARS) IN THE SIX GROUPS

2. **SEX:** Around 43 patients (71.6%) out of 60 included in this study were males.

Sex	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
MALES	6 (60%)	7 (70%)	9 (90%)	8 (80%)	6 (60%)	7 (70%)
FE-MALES	4 (40%)	3 (30%)	1 (10%)	2 (10%)	4 (40%)	3 (30%)

TABLE 2: SEX DISTRIBUTION IN THE SIX GROUPS

3. DIAGNOSIS: in emergency-- Duodenal ulcer perforation peritonitis was the most common diagnosis 12 followed by enteric perforation peritonitis at 4 cases, intestinal obstruction -10 cases others-4

Non emergency cases—open cholecystectomy (6),colectomy—10 others--14

4. WOUND INFECTION:

a) INDIVIDUAL GROUPS:

The rate of wound infection in the six groups are 20%, 10%, 30%, 30%, 10% and 20 % respectively. Wound infection was present in 20% of patients. (Table 3)

Wound Infection	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
Present	1 (20%)	2 (10%)	3 (20%)	3 (30%)	1 (10%)	2 (20%)
Absent	9 (80%)	8 (90%)	7 (80%)	7 (70%)	9 (90%)	8 (80%)

TABLE 3: WOUND INFECTION RATES IN THE SIX GROUPS

b) CONTINUOUS AND INTERRUPTED GROUPS:

Wound infection rates in the continuous and interrupted groups irrespective of the suture material used was 13.3% and 13.3% respectively. (Table 4)

Wound infection	Continuous (n=30)	Interrupted (n=30)	Total
Absent	24 (86.67%)	24 (86.67%)	48
Present	6 (13.33%)	6 (13.33%)	12

TABLE 4: WOUND INFECTION RATES IN CONTINUOUS AND INTERRUPTED GROUPS.

c) POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID:

Wound infection rates in the polypropylene group, was found to be 20% as compared to 15% in polydioxanone group and 25 % in polyglycolic acid group. (Table 5)

Wound infection	Polypropylene	Polydioxanone	Polyglycolic acid	Total
Absent	16 (80%)	17 (85%)	15 (75%)	48
Present	4 (20%)	3 (15%)	5 (25%)	12

TABLE 5: WOUND INFECTION RATES IN POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID GROUPS.

5. WOUND DEHISCENCE:

a) INDIVIDUAL GROUPS:

Percentage of wound dehiscence in the six groups were 0%, 10%, 20%, 10%, 0% and 10% respectively. Wound dehiscence occurred in 8.3% of the patients. (Table 6)

Wound dehiscence	Group A	Group B	Group C	Group D	Group E	Group F	Total
Absent	10 (100%)	9 (90%)	8 (80%)	9 (90%)	10 (100%)	9 (90%)	55
Present	0 (00%)	1 (10%)	2 (20%)	1 (10%)	0 (00%)	1 (10%)	5

TABLE 6: WOUND DEHISCENCE RATES IN SIX GROUPS

b) CONTINUOUS AND INTERRUPTED GROUP:

Wound dehiscence rate was found to be 10 % in the continuous and interrupted 6.6%. (Table 7)

Wound dehiscence	Continuous (n=30)	Interrupted (n=30)	Total
Absent	27 (90%)	28 (93.4%)	55(91.7%)
Present	3 (10%)	2 (6.6%)	5(8.3%)

TABLE 7: WOUND DEHISCENCE RATES IN CONTINUOUS AND INTERRUPTED GROUPS.

c) POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID:

Wound dehiscence rates in the polypropylene group was 5% as same in polydioxanone group and 15 % in the poly-

glycolic acid group. (Table 8)

Wound dehiscence	Polypropylene	Polydioxanone	Polyglycolic acid	Total
Absent	19 (80%)	19 (90%)	17 (90%)	55
Present	1 (5%)	1 (5%)	3 (15%)	5

TABLE 8: WOUND DEHISCENCE RATES IN POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID GROUPS.

FOLLOW-UP EVALUATION

1) WOUND INFECTION:

a) INDIVIDUAL GROUPS:

wound infection rates in the individual groups during follow-up. (Table 9)

Wound infection	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
2 weeks	2 (20%)	1 (10%)	2 (10%)	2 (20%)	1 (10%)	2 (20%)
4 weeks	0	0	0	0 (00%)	0	2 (20%)
6 weeks	1(10%)	0	0	0 (00%)	0	1(10%)
12 weeks	0	0	0	0	0	0

TABLE 9: WOUND INFECTION IN THE SIX GROUPS DURING FOLLOW-UP

b) CONTINUOUS AND INTERRUPTED GROUPS:

The wound infection was more in interrupted group(8/30) as compared to continuous group(6/30)-- (Table 10)

Wound infection	Continuous (n=30)	Interrupted (n=30)
2 weeks	5 (16.66%)	5 (16.66%)
4 weeks	0	2 (6.6%)
6 weeks	1(3.3%)	1 (3.3%)
12 weeks	0	0

TABLE 10: WOUND INFECTION IN CONTINUOUS AND INTERRUPTED GROUPS DURING FOLLOW-UP

c) POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID:

Maximum wound infections were seen in the polypropylene(5/20) and polyglycolic acid groups(7/20)-- (Table 11)

Wound infection	Polypropylene (n=20)	Polydioxanone (n=20)	Polyglycolic acid (n=20)
2 weeks	4 (20%)	2 (10%)	4 (20%)
4 weeks	0 (0%)	0	2 (10%)
6 weeks	1 (5%)	0	1 (5%)
12 weeks	0	0	0

TABLE 11: WOUND INFECTION IN POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID GROUPS DURING FOLLOW-UP.

2. SUTURE SINUS:

a) INDIVIDUAL GROUPS: Maximum number of suture sinuses was seen in interrupted polypropylene group. (Table 12)

Suture sinus (n=60)	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
2 weeks	0	0	0	0	0	0
4 weeks	0	0	0	0	0	0
6 weeks	0	0	0	2	0	1
12 weeks	1	0	0	1	0	0

TABLE 12: OCCURENCE OF SUTURE SINUS FOLLOW-UP.

b) CONTINUOUS AND INTERRUPTED GROUPS:

suture sinus was seen in the continuous groups were less as compared to interrupted group during the period of follow. Polypropylene interrupted had the maximum number of suture sinuses followed by interrupted polyglycolic acid.

(Table 13)

Suture sinus	Continuous (n=30)	Interrupted (n=30)
6 weeks	0	3
12 weeks	1	1

TABLE 13: SUTURE SINUS IN CONTINUOUS AND INTERRUPTED GROUPS DURING FOLLOW-UP

c) POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID:

There was statistically significant difference between the occurrence of suture sinuses in the non-absorbable and

absorbable groups . There was no statistically significant difference between polydioxanone and polyglycolic acid groups. (Table 14)

Suture sinus	Polypropylene (n=20)	Polydioxanone (n=20)	Polyglycolic acid (n=20)
6 weeks	2	0	1
12 weeks	2	0	0

TABLE 14: OCCURRENCE OF SUTURE SINUS IN THE THREE SUTURE GROUPS DURING FOLLOW-UP

3. BURST ABDOMEN/INCISIONAL HERNIA:

a) INDIVIDUAL GROUPS:

Burst abdomen rate was evaluated till six weeks. Incisional hernia rates in the six groups at the end of 12 weeks was 20%,10%,20%,10%, 0% and 20% respectively. (Table 15)

Burst abdomen/incisional hernia	Group A (n=10)	Group B (n=10)	Group C (n=10)	Group D (n=10)	Group E (n=10)	Group F (n=10)
2 weeks	0	1 (10%)	1 (10%)	1 (10%)	0	1 (10%)
4 weeks	1	0	0	0	0	0
6 weeks	1 (10%)	0	0	0	0	0
12 weeks	0	0	1 (10%)	0	0	1 (10%)

TABLE 15: BURST ABDOMEN/INCISIONAL HERNIA RATES IN SIX GROUPS DURING FOLLOW-UP

b) CONTINUOUS AND INTERRUPTED GROUPS:

significant difference in the rates of burst abdomen/incisional hernia was seen in the continuous and interrupted arms more in continuous group as compare to interrupted group. (Table 16)

Burst abdomen/incisional hernia	Continuous (n=30)	Interrupted (n=30)
2 weeks	2 (6.6%)	2 (6.6%)
4 weeks	1(3.3%)	0
6 weeks	1 (3.3%)	0
12 weeks	1 (3.3%)	1 (3.3%)

TABLE 16 BURST ABDOMEN/INCISIONAL HERNIA RATES IN CONTINUOUS AND INTERRUPTED GROUPS IN FOLLOW-UP.

c) POLYPROPYLENE, POLYDIOXANONE AND POLYGLYCOLIC ACID GROUPS:

Polyglycolic acid group have very high incidence of burst abdomen and incisional hernia rates as compared to two other group (Table 17)

Burst abdomen/incisional hernia	Polypropylene (n=20)	Polydioxanone (n=20)	Polyglycolic acid (n=20)
2 weeks	1 (5%)	2(10%)	2(10%)
4 weeks	1(5%)	0	0
6 weeks	1(5%)	0	0
12 weeks	0	0	2(10%)

TABLE 17: OCCURRENCE OF BURST ABDOMEN/INCISIONAL HERNIA IN THE THREE SUTURE GROUPS DURING FOLLOW-UP.

DISCUSSION

The results have been discussed under two subheadings, between continuous and interrupted method of abdominal closure and between polypropylene, polydioxanone and polyglycolic acid sutures. For the study, the patients were divided into 6 groups namely continuous non-absorbable, interrupted non-absorbable, continuous monofilament slowly absorbable, interrupted monofilament slowly absorbable, continuous multifilament slowly absorbable and interrupted multifilament slowly absorbable.

1.AGE

The mean age of patients was 41.30±18.52, 46.30±19.77, 34.5±14.79, 43.7±21.64, 32±16.53 and 47.3±9.86 years respectively. More than 50% of total patients were in 18-40 yrs age group. The average age in all the six groups was 49 years. All the six groups were comparable in terms of age as there was no statistical difference between the mean ages of the six groups. Also the age profile did not show any significant difference when compared to other studies.

Cameron et al ⁽⁴¹⁾ in their randomized trial had a mean age of 60.2±17 years.

2.SEX

Around 70% of the patients included in the study were males. However, the sex distribution was comparable in the six groups. Richards et al ⁽⁵⁷⁾ in their study found a similar sex distribution with around 76% of their patients being males.

3.DIAGNOSIS:

in emergency-- Duodenal ulcer perforation peritonitis was the most common diagnosis 12 followed by enteric perforation peritonitis at 4 cases, intestinal obstruction -10 cases others-4

Non emergency cases—open cholecystectomy (6),colecotomy—10 others--14

4. WOUND INFECTION:-

*total wound infection is 20 %

Rate of wound infection in individual group is as follows— (A,B,C,D,E,F)

20%,10%,30%,30%,10%,20% each

*wound infection rates in continuous suture group is 13.3% and interrupted suture group is 13.3%.

*wound infection rates in each suture type

PP-20% ,PD-15% ,PG-25%

Higher in polyglycolic acid group and lowest in polydioxanone group.

comparison with other trials---

*a study by Gisslason et al included 32 patient in emergency setting wound infection rates were 14%.

Which is comparable with ours 20%.

*Sahlin et al wound infection rates in continuous group 10% and interrupted group was 11% which is comparable to our study 10% each.

*Weiland et al—there is no substantial difference of wound infection rates between slowly absorbing and non absorbing group.

DURING FOLLOW UP PERIOD:-***In Individual group:-**

---At end of 2 nd week—the incidence of wound infection in individual group—

20%,10%,20%,20%,10%,10%.

---at end of 4 th week,polyglycolic acid group—20%.

---at end of 6 th week—polypropylene group—10% and polyglycolic acid -10%.

*wound infection rates in interrupted group /continuous group—

--at end of 2 nd week—interrupted group-16.6% and continuous group—16.6%

--at end of 4 th week ,interrupted group is has 6.6 % incidence of infection

---at end of 6 th week—3.3% on each continuous and interrupted group.

*wound infection rates in PP/PD/PG group—

At end of 2 nd week—PP has 20%,PD has 10% and PG has 20%

At end of 4 th week –PG has 10% incidence of wound infection

At end of 6 th week-5% incidence of wound infection in PP/PG group.

5. WOUND DEHIENCE:-***In individual group—**

The incidence of wound dehience is 0%,10%,20%,10%,0%,10%

Overall it is –8.3% present and absend in 91.6%.

*wound dehience rate is 10% in continuous group and 6.6% in interrupted group

*wound dehience incidence PP-5%,PD-5%,PG-15%

Polyglycolic acid group have high incidence of wound dehience of 15% as compared to two other group of Polypropylene and Polydioxanone group which 5%.

Comparison with other Trial---

*wound dehience rates is 2% in Gisslason et al

* in Cleveland clinic study –PD and PP group comparison no significance difference was found dehience rates.

*in study Sahlin et al no difference in continuous and interrupted group inPP/PG group.

6. SUTURE SINUS:-**Individual group---**

*Maximum no of sinus in PP group at 6 th week and at 12 week is 20%.

*at end of 6 th week sinus incidence is continuous group and interrupte group is 10 %.

*at end of 12 th week 3.3% of each in continuous and interrupted group

*at PP has 10% incidence at end of 6/12 th week

PD has 0% incidence at end of 6/12 th week

PG has 5% at end of 6 th week

Comparison with other trials:-

*Wissing at el study PD/PP --suture sinus has 3.9% and 7.7%

* Cameron et al PP has 1.1% incidence of sinus and no sinus in PD group.

7. INCISIONAL HERNIA /BURST ABDOMEN---

*At end of 2 nd week—incidence of incisional hernia –

In PP-10%,PD -10%,PG –20% group

*at end of 2 nd week—incidence of incisional hernia in interrupted amd continuous group—6.6% each

*at end of 4th and 6 th week—3.3% in continuous group

At end of 12 th wek 3.3% in each continuous and interrupted group.

*PP group—15% ,PD has 10% and PG has 20 % at end of 12 th week is incidence of incisional hernia.

Comparison with other trial—

• Richard et al—continuous and interrupted group irrespective of type of suture material the incidence of incisional hernia is 1.3% and in our series is 6.6%

- Cameron et al -- no significant difference in incidence of incisional hernia between PP (11/90) and PD (10/90) in our study PP(3/20) PD(2/20),PG(4/20).

Higher in PG group.

SUMMARY

This study is a prospective randomized trial comparing the interrupted and continuous method of closure of abdominal wall fascia using both absorbable and non-absorbable suture materials .

*wound infection rates is same for continuous and interrupted group at 13.3%.

But wound dehiscence rates are 10% for continuous and 6.6% for interrupted group.

*wound infection rates are in PP-20% & PG is 25% while in PD group is 15%.

Wound dehiscence rates are same for PP/PD at 5% and in PG is high of 15%.

*suture sinus rates are high in PP group -10% and PG is 5 % and PD is 0%.

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