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Incidence of Surgical Site Infections in Abdominal Wound Closure with Triclosan Coated Sutures

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Abstract: *The aim of the present study is to comprehensively study and evaluate the difference in the incidence of superficial surgical site infections developing in laparotomy wounds approximated with bioactive suture material (coated polyglactin 910 with triclosan) versus a normal suture. Patients and methods: This hospital based observational comparative study included 90 consecutive patients who underwent a laparotomy, regardless of the indication, at Siddhartha Medical College, Vijayawada between January 2016 and December 2017 (2 years). Results:19.10% developed a superficial SSI – 10% from Normal Suture Group, 24.1% from the Bioactive Suture Group and 23.3% from the No Suture Group. Escherichia coli were cultured from 57.89% of the infected wounds. No significant difference in the number of postoperative days when a superficial SSI was diagnosed across the three groups. Conclusion: Use of Bioactive suture in the approximation of the subcutaneous layer of a laparotomy wound is associated with a higher incidence of superficial SSI. Obliterating the subcutaneous dead space with suture material in closure of laparotomy wounds is associated with a higher risk of superficial SSI. Escherichia coli was the most frequent organism cultured from infected wounds. There is no significant difference in the number days when a superficial SSI develops postoperatively based on which method is used for approximating the subcutaneous layer.*

Keywords: *Surgical site infections; antibacterial sutures; bioactive sutures; Triclosan, Polyglactin 910*

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I. Introduction

Surgical site infections (SSI) are the second most frequent nosocomial infection, after urinary tract infection[1]. Global incidence rates of SSIs vary from 4.5% to 20%, depending on the region and facilities available[2]. Indian studies reveal an incidence of 4% -30% of surgical patients develop an SSI[3]. Within the subset of surgical patients, SSI are the most common nosocomial infection1, contributing substantially to the morbidity and financial burdens of those affected. A host of factors are known to increase a person's susceptibility to developing a SSI, including patient related factors and surgeon related factors.

Since suture materials have been proven to be a contributor to SSI[4], they have been the focus of research and development centered on making them less conducive to bacterial overgrowth. By fixing drugs onto suture material, biologically active suture materials have been created. The only commercially available bioactive suture is coated polyglactin910 with Triclosan, which is a broad spectrum antibacterial agent effective against bacteria and fungi[5]. Preliminary studies using Triclosan coated suture materials have shown a decrease in the incidence of SSI[6]. The present study aimed to assess the difference in the SSI incidence rates in laparotomy wounds, where the subcutaneous layer has been approximated with the bioactive suture versus the normal suture. This study also included patients in whom the subcutaneous later was not approximated and compared the SSI rates of the latter with the former.

II. Objectives Of The Study

1. To study the difference in the incidence of superficial surgical site infections developing in laparotomy wounds approximated with bioactive suture material (coated polyglactin 910 with triclosan) versus a normal suture (coated polyglactin 910).
2. To compare the incidence of superficial SSI developing in laparotomy wounds which have had suture approximation of the subcutaneous layer versus those in which the subcutaneous layer has not been approximated.
3. To study the most common organism cultured from the wounds.

III. Materials And Methodology

This observational comparative study included 90consecutive patients who underwent a laparotomy, regardless of the indication, at Siddhartha Medical College, Vijayawada between January 2016 and December 2017(2 years) satisfying all the inclusion and exclusion criteria mentioned below.1 patient was lost to follow up.

The inclusion criteria were:

- Age 18 years and above
- Midline, subcostal, transverse or loin incisions to approach the peritoneal cavity
- Skin approximated at the end of the surgery

The exclusion criteria were:

- Age less than 18 years.
- Skin not approximated at the end of the surgery.
- Patient requiring re-exploration.
- Patients who developed a deep incisional or organ/space infection
- Patients lost to follow up
- Demise of the patient
- Laparoscopic surgeries

The patients were divided into 3 groups of 30 patients each, based on the method usedto approximate the subcutaneous layer of the abdomen, at the end of the surgery.

Group 1: Subcutaneous layer approximated with coated polyglactin 910 – "Normal suture group"
Group 2: Subcutaneous layer approximated with coated polyglactin 910 with triclosan – "Bioactive suture group"
Group 3: No suture approximation of the subcutaneous layer (dead space not obliterated) – "None group"

All patients received similar standards of care in the operating room, with regards to pre-operative shaving, pre-operative skin preparation, intra-operative antimicrobial prophylaxis, use of sterile drapes, masks, gowns and gloves. All the wounds were inspected everyday from the second post-operative day onwards till the day of discharge and from then, on weekly out-patient visits till 30 days after the date of surgery.

IV. Observations And Results

Table 1: Distribution of Age among Patients in Present Study

AGE IN YEARS	NORMAL SUTURE	BIOACTIVE SUTURE	NONE
18-20	3	0	3
21-30	4	5	8
31-40	8	7	7
41-50	7	6	3
51-60	6	6	5
61-70	2	2	2
71-80	0	3	2
TOTAL	30	29	30
MEAN ± SD	41.57±13.70	46.96±16.18	40.23±17.42

Table 2: Distribution of Gender among Patients in Present Study

GENDER	NORMAL SUTURE	BIOACTIVE SUTURE	NONE
Male	6	16	16
Female	24	13	14
Total	30	29	30

Table 3: Distribution of comorbid conditions among Patients in Present Study

COMORBID CONDITIONS	NORMAL SUTURE	BIOACTIVE SUTURE	NONE	P VALUE
Diabetes	3	3	7	0.320
Hypertension	5	4	6	0.937
Anemia	4	7	7	0.545
Hypoproteinuria	6	7	8	0.863
Steroid Usage	1	0	2	0.770
Nicotine Usage	2	5	2	0.415
AIDS	0	1	0	1.000

The NNIS risk index criteria includes the ASA class of the patient, the class of wound and the duration of the surgery in hours. NNI risk is statistically similar in the three groups of patients studied with p=0.459.

Table 4: NNI Risk among Patients in Present Study

NNI RISK	NORMAL SUTURE	BIOACTIVE SUTURE	NONE
0	4	4	6
1	14	17	17
2	11	6	7
3	1	2	0
TOTAL	30	29	30

Incidence of clean /Contaminated is significantly less in study groups (groups I+II) compared to Group III with P=0.001

Table 5: Classification of wound among Patients in Present Study

CLASS OF WOUND	NORMAL SUTURE	BIOACTIVE SUTURE	NONE
Clean	11	15	4
Clean – contaminated	12	4	19
Contaminated	7	10	7
Total	30	29	30

Incidence of SSSI is statistically similar in three groups with P=0.327.

Table 6: Incidence of SSI among Patients in Present Study

SSSI	NORMAL SUTURE	BIOACTIVE SUTURE	NO SUTURE
No	27	22	23
Yes	3	7	7
Total	30	29	30

Incidence of SSI according to organism is statistically similar in three groups studiedwith p=0.424

Table 7: Organism cultured in SSI among Patients in Present Study

ORGANISM	NORMAL SUTURE	BIOACTIVE SUTURE	NO SUTURE
Nil	27	23	23
Present	3	6	7
E coli	2	5	4
E coli + S. aureus	0	0	1
Klebsiella	1	0	1
Proteus	0	1	0
Citrobacter	0	0	1

V. **Discussion**

19.10% of patients developed a superficial surgical site infection after laparotomy, 10% in the Normal Suture group; 24.1% in the Bioactive Suture group; 23.3% in the No Suture group. The results of this study initially indicate no significant difference in the incidence of superficial SSI among the three groups i.e – normal suture (coated polyglactin 910); bioactive suture (coated polyglactin 910 with triclosan); none (subcutaneous dead space not obliterated). However, on performing a multivariate logistic regression analysis to predict the incidence of superficial SSI among the three groups, the following was observed:

• Patients in whom the subcutaneous layer was approximated with normal suture material had a lower incidence of superficial SSI compared to those in whom the bioactive suture material was used and this was statistically significant.
• Patients in whom the dead space was not obliterated had a lower incidence of superficial SSI compared to the patients in whom the subcutaneous layer was suture approximated with either of the two suture materials.

Table 8: Comparison of Results with other Researchers

AUTHOR	STUDY DESIGN	NO.OF PATIENTS	OPERATIVE PROCEDURE	RESULTS	CONCLUSION
Flek et al[7]	Retrospective	479	Cardiac Sx	0% SSI in bioactive suture group	Favoured Triclosan suture

Rozelle et al[8]	RCT	84	CSF Shunt Procedure	4% SSI in Bioactive gp, 21% in control gp.	Favoured Triclosan suture
Mingmal airak et al[9]	RCT	100	Appendicectomy	10% SSI in bioactive gp, 5% in polyglactin 910 gp	No difference
Deliaret et al[10]	RCT	26	Breast Reduction	61% SSI in bioactive gp, 21% in polyglactin 910 gp	Cautioned against Triclosan sutures
Justinger et al[11]	Retrospective	2088	Midline Laparotomy	5% SSI in triclosan, 11% in PDS	Favoured Triclosan suture
Justinger et al[12]	Retrospective	839	Transverse Abdominal Incision	4% SSI in Triclosan, 9% in PDS II	Favoured Triclosan suture
Chen et al[13]	RCT	241	Wide excision of Head & Neck oncology	14.9% SSI in triclosan, 14.7% in coated polyglactin 910	No difference

As demonstrated by the above table, there have been mixed results in the trials comparing SSI occurring in wounds approximated with triclosan bioactive sutures against sutures without bioactivity. The study with most similarities with this dissertation is the one conducted by Justinger et al in 2009 which compared the incidence of SSI in patients in whom mass closure of the abdomen was done using either triclosan coated polyglactin 910 or Loop PDS without triclosan[11]. This study found a significantly lower incidence of SSI in the triclosan suture group.

The present study shows no statistical difference in the incidence of superficial SSI occurring between the 2 suture groups. However, on performing a multivariate logistic regression analysis to predict the incidence of superficial SSI among the three groups, patients in whom the subcutaneous layer was approximated with normal suture material had a lower incidence of superficial SSI compared to those in whom the bioactive suture material was used and this was statistically significant. Most studies comparing the incidence of SSI occurring in patients in whom the subcutaneous dead space is not obliterated with the incidence in patients where the subcutaneous layer is sutured demonstrate a lower incidence rate of SSI in the sutured patients or no difference at all.

However, the present study demonstrates a significantly lower incidence rate in superficial SSI in patients in whom the subcutaneous layer is not approximated compared with either of the two suture materials used for subcutaneous layer approximation. The present study found that the causative organism in most superficial SSI was Escherichia coli – a total of 57.89% of the time. However, most studies demonstrate skin commensals like staphylococcus aureus as the common causative culprit in SSI[14]. This study also showed no significant difference in the number of post-operative days when a superficial SSI occurs in any of the three groups.

VI. Summary

- Higher incidence of superficial surgical site infections after suture approximation of subcutaneous layer of anterior abdominal wall after a laparotomy procedure when compared to not obliterating the subcutaneous dead space.
- Higher incidence of superficial surgical site infections if sutures with triclosan (Bioactive sutures) are used in approximating the subcutaneous layer of the anterior abdominal wall after a laparotomy procedure than when sutures without triclosan is used to approximate the same layer.
- The most common organism cultured from the superficial surgical site infections is Escherichia coli.
- There is no significant difference in the number days when a superficial surgical site infection develops post operatively based on which method is used for approximating the subcutaneous layer.

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