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Antibacterial Medicated Suture Materials- Are They Really Effective in Preventing Surgical Site Infection?

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ABSTRACT

Background. Common general surgery procedures are associated with a 1–11% risk of infection as cited in contemporary general surgery literature. surgical site infection increase morbidity and mortality of post op patients and require prolonged antibiotic. Moreover, surgical site infections are commonly associated with prolonged hospital stays, and potential comorbidities associated with surgery like hernia recurrence. Aim. The prospective evaluation the incidence of surgical site infection following surgeries performed using either antimicrobial suture (AMS) or conventional suture.Methods. In a single-centre, prospective, randomized controlled trial, the authors enrolled 532 patients, among whom surgeries were performed over 20 months. Randomization to the study (AMS) or control (polyglactin suture) group was stratified to minimize the effect of known surgical site infection risk factors on the findings. The primary outcome measure was the incidence of shunt infection within 30 days of surgery.Results. The surgical site infection rate in the study group was 16 (5.59%) of 286 procedures and 18 (7.31%) of 246 procedures in the control group (EX2=0.02, p >0.05). No suture-related adverse events were reported in either group.Conclusions. These results support the suggestion that the use of AMS for general surgery procedures is only as effective as non medicated sutures but at increased cost, adding unnecessary financial burden to our patients.

KEYWORDS SSI, surgical site infection, antimicrobial sutures, medicated suture materials

Introduction

Infection has always been a feature of human life and sepsis in modern surgery continues to be a significant problem for healthcare practitioners across the globe. This paper describes the factors that influence surgical wound healing and effect of medicated suture material (triclosan coated vicryl) in reducing surgical site infection. Many factors influence surgical wound healing and determine the potential for, and the incidence of, infection [1] . The level of bacterial burden is the most significant risk factor [2,3,4], but modern surgical techniques and the use of prophylactic antibiotics have reduced this risk such as pre operative skin preparation by application of antiseptic solutions like chlorhexidine, povidine iodine[5,6,7]. Hair clipping[3,4], duration of surgery[8,9], technique of wound closure[10] and type of Suture material used for wound closure, as shown by some studies. In the present study, the authors have evaluated the efficacy of coated polyglactin 910 with tricosan (Vicryl Plus) in reducing the surgical site infection(SSI) in comparison with traditional polyglactin 910 (Vicryl) in vario surgeries.

Material and Methods

This was a prospective study conducted on 532 patients admitted for various surgeries in general surgery units of Dr. Sushila Tiwari Memorial Government Hospital, affiliated with Government medical College, Haldwani. The study was aimed to estimate the efficacy of triclosan-coated polyglactin 910 sutures (vicryl plus) over polyglactin 910 (vicryl) sutures for the reduction of surgical site infection .

Patients were included in the study based on following Inclusion criteria: (1) Type of surgery conducted (2) General nourishnal status of the patient (3) Associated comorbidities like obesity, diabetes mellitus and COPD (4) Open hernioplasty (5) Open cholecystectomy (6) Trans abdominal hysterectomy (7) Open appendicectomy (8) Patients undergoing elective surgery (9) Age limit 20-65 yrs.

Following patients were not included in the study group: (1) Immunocompromised state ie, patients suffering from AIDS, (2) Patients who have taken chemotherapy, radiotherapy (3) Patients on corticosteroid therapy (4) Extremes of age (5) Appendicular abcess/ ruptured/perforated appendix (6) Gangrenous gall bladder/perforated gall bladder (7) Obstructed hernia/strangulated hernia (8) Pyometra.

Surgical wounds were inspected at the time of first dressing on second postoperative day and regularly thereafter for 30 days.Wound infection was diagnosed if any of the following criteria was fulfilled: (a) Serous or non purulent discharge (b) Pus discharge (c) Serous/non purulent discharge from wound with signs of inflammation ie, edema, redness, warmth, raised local temperature, fever > 38 degree C, tenderness (d) Wound deliberately opened by surgeon due to localized collection.

Swabs obtained from infected wounds were collected by

standard methods and were sent to department of microbiology, Government medical college, Haldwani where processing was done by standard methods.

Data was evaluated by chi square statistical test. P< 0.05 was considered to be significant.

RESULTS

TABLE (1)

NAME OF SURGERY	Vicryl	No of infected wounds	Vicryl plus	No of infected wounds	Chi sq	p-value
OPEN HERNIO-PLASTY	112	6	136	4	0.407	0.523
OPEN CHOLE-CYSTEC-TOMY	32	4	38	2	0.516	0.421
TRANSAB-DOMINAL HYSTER-ECTOMY	48	4	54	4	0.030	0.862
APPENDI-CECTOMY	54	4	58	6	0.045	0.831
TOTAL	246	18 (7.31%)	286	16 (5.59%)		

OPEN HERNIOPLASTY

	Vic-ryl	No of infected wounds	Vicryl plus	No of infected wounds	Chi sq	P value
AGE (20-45)	44	4	40	2	0.091	0.761
(45-65)	68	2	96	2	0.123	0.725
MALE	108	6	132	4	0.421	0.516
FEMALE	4		4		-	-
DIABETIC	24		28	2	0.374	0.540
BMI (<18)	4		2		-	-
(18-30)	100	4	128	2	0.524	0.469
(30+)	8	2	6	2	0.116	0.732
COPD	8		12		-	-
TOTAL	112	6(5.4%)	136	4(2.9%)		

TABLE (2)

OPEN CHOLECYSTECTOMY

	Vic-ryl	No of infected wounds	Vicryl plus	No of infected wounds		
AGE (20-45)	20	2	18	1	0.257	0.611
(45-65)	12	2	20	1	0.220	0.638
MALE	4		2		-	-
FEMALE	28	4	36	2	0.572	0.449
DIABETIC	4	1	2		0.600	0.438
BMI (<18)			1		-	-
(18-30)	30	4	36	1	1.315	0.251
(30+)	2		1	1	0.187	0.665
COPD	4		4	1	1.143	0.285
TOTAL	32	4 (14.28%)	38	2 (5.55%)		

TABLE (3)

TRANS ABDOMINAL HYSTEREC-TOMY

	Vic-ryl	No of infected wounds	Vicryl plus	No of infected wounds		
AGE (20-45)	12		16	1	0.777	0.377
(45-65)	36	4	38	3	0.005	0.940
DIABETIC	6	2	8	2	0.116	0.732
BMI (<18)						
(18-30)	40	2	44		0.615	0.432
(30+)	8	2	10	4	0.028	0.866
COPD	6	1	4	1	0.104	0.746
TOTAL	48	4(8.33%)	54	4 (7.40%)		

TABLE (4)

OPEN APPENDICECTOMY

	Vic-ryl	No of infected wounds	Vicryl plus	No of infected wounds		
AGE (20-45)	16		22			
(45-65)	38	4	36	6	0.186	0.665
DIABETIC	8	1	12	1	0.092	0.769
BMI (<30)	46	3	50	4	0.077	0.780
(30+)	8	1	8	2	0.410	0.521
COPD	6	1	8	1	0.048	0.825
TOTAL	54	4(7.40%)	58	6 (10.34%)		

Out of total 532 patients, majority were operated for open inguinal hernia repair, followed by open appendicectomy, transabdominal hysterectomy and open cholecystectomy.Of the total 532 patients, 34 developed surgical site infection, with overall infection rate of 6.39%.

In hernioplasty group, out of 248 patients, 10 patients developed surgical site infection (4.03%). in this group, vicryl was used in 112 patients and 6 of them developed ssi (5.38%) (table2) whereas in 136 patients, we used vicryl plus sutures and ssi developed in 4 of these patients (2.94%) , ($p>0.05$, $EX^2=0.851$).Amongst diabetics, when vicryl was used, none out of 28 got affected whereas in vicryl plus group, 2 out of 24 developed ssi,(8.33%) Amongst obese patients(BMI>30), out of total 14 patients, 4 were affected. In vicryl group 2 out of 8 were affected, in vicryl plus group, 2 out of 6 were affected.

In open cholecystectomy group, out of 70 patients, 6 developed surgical site infection (8.57%) this group, vicryl was used in 32 patients and 4 of them developed ssi (14.28%) (table 3) whereas in 38 patients, we used vicryl plus sutures and ssi developed in 2 of these patients (5.55%), ($p>0.05$, $EX^2=1.16$). Amongst diabetics, one 1 out of total 6 diabetic patients were infected. We used vicryl in 4 patients, 1 patient got infected. When we used vicryl plus, none out of 2 were affected, ($p>0.05$, $EX^2=0.06$) Amongst obese patients(BMI>30), out of total 3 obese patients, 1 was affected. When we used vicyl, none out of 2 were affected, however in one obese patient that weused vicryl plus, 1 out of 1 was affected, ($p>0.05$, $EX^2=3.0$)

In transabdominal hysterectomy group, out of 102 patients, 8 developed surgical site infection (7.84%) In this group, vicryl was used in 48 patients and 4 of them developed ssi (8.33%) (table4) whereas in 54 patients, we used vicryl plus sutures and ssi developed in 4 of these patients (7.40%), ($p>0.05$, $EX^2=0.132$).Amongst diabetics, 4 out of total 14 diabetic patients were infected. We used vicryl in 6 patients, 2 patients got infected. When we used vicryl plus, 2 out of 8 were affected, ($p>0.05$, $EX^2=0.11$)Amongst obese patients(BMI>30), out of total 18 obese patients, 6 werw affected. When we used vicyl, 2 out of 8 were affected, however in obese patient that we used vicryl plus, 4 out of 10 were affected, ($p>0.05$, $EX^2=1.06$)

In appendicectomy group, out of 112 patients, 10 developed surgical site infection (8.92%); In this group, vicryl was used in 54 patients and 4 of them developed ssi (7.40%) (table 5) whereas in 58 patients, we used vicryl plus sutures and ssi developed in 6 of these patients (10.34%), ($p>0.05$, $EX^2=0.248$). Amongst diabetics, 2 out of total 20 diabetic patients were infected. We used vicryl in 8 patients, 1 patient got infected. When we used vicryl plus, 1 out of 12 were affected, ($p>0.05$, $EX^2=3.0$) Amongst obese patients(BMI>30), out of total 14 obese patients, 2 were affected. When we used vicyl, 1 out of 8 were affected.

In addition, there was no significant difference in the incidence of surgical site infection amongst patients who had COPD in comparison to those who did not have COPD. Similarly, there was no significant difference in incidence amongst male and female. Though not a part of our study,

we also tried to find out the different types of bacterial strains responsible for surgical site infection in our set up.

Amongst 34 cases of surgical site infection, staphylococcus aureus was found in 16 samples, pseudomonas was elicited in 8 samples.

2 samples were positive for E.coli, 6 samples of the infected samples were found to be sterile. S.aureus+E.coli were found in 1 samples and 1 was found to contain S.aureus+Acinetobacter.

DISCUSSION

post operative (post op) surgical site infection continue to be a matter of concern for any surgery. Post op infection increases patient morbidity and mortality. In addition, post op surgical site infection is a well known risk factor for hernia recurrence [10]. Previous reports have identified numerous factors associated with surgical site infection, including patient age, skin shaving , longer operating times, intraoperative glove breach, and participation of trainee surgeons.[11],[12] Taken together, these risk factors support the conclusion that patient factors and surgical technique both directly influence surgical site infection risk. Patient population characteristics did not differ significantly with regard to any factors known or suspected to influence infection risk. No changes in surgery technique were instituted by either surgeon during the study period. Open method of surgery rather than laproscopic method was chosen to eliminate additional risk factors associated with improper sterelization of laproscopic instruments, in addition, the suture material used would be comparatively insufficient to carry the same bacterial load, as would be expected in open surgeries. Most surgical site infections are believed to arise from Intra operative contamination in the operating room, either by skin flora from the host[4]or from surgical personnel .Meticulous surgical technique appears to reduce surgical site

infection risk.[11],[4], The use of prophylactic perioperative intravenous antibiotics has been reported to reduce subsequent surgical site infection risk.[13] The medicated suture is another recently developed technology that may be beneficial in the prevention of surgical site infections. Polyglactin 910 suture coated with triclosan was approved for clinical use by the Food and Drug Administration in 2002. The antimicrobial-agent, triclosan, is bacteriostatic for a wide range of microbial (including MSSA, MRSA, and Staphylococcus epidermidis) at concentrations found in the suture.[14] The presence of conventional suture in a surgical wound is known to lower the size of bacterial inoculi necessary to produce a wound infection[15] and to increase the overall risk of surgical site infections.[16] Triclosan-coated polyglactin 910 suture has been shown in some studies to prevent colonization of the suture by both gram-positive and –negative bacteria.[17] Another in vitro study demonstrated a zone of staphylococcal growth inhibition surrounding the medicated suturematerial .[18]. however, in our study we did not find similar efficacy in terms of reducing surgical site infection. This study shows that there is no evidence for any effectiveness of triclosan coating. Triclosan is an antiseptic drug that has been used since the1970s mainly in disinfecting soaps and dentistry. Safety studies have been performed in the past, mainly focusing on systemic toxicity and local adverse reactions. Overall, these studies concluded that triclosan has no carcinogenic, genotoxic, pyrogenic, or teratogenic effects. In addition, systemic levels of triclosan are extremely low due to the use of these products.[19] Recently, however, concern ensued after reports of the formation of toxic byproducts of triclosan containing soaps in household conditions.[20] Laboratory and modelling studies indicate that the formation of chloroform and other chlorinated daughter products can occur when triclosan-containing antimicrobial products react with free chlorine and that these reactions can potentially lead to enhanced chloroform exposures[20]. The use in suture material has been tested in animal and in vitro experiments. Handling and tension force of the sutures was found to be comparable to standard suture material. No effect on wound healing was observed[21]. Thus, although triclosan is relatively nontoxic in classical toxicological terms, negative effects such as dermatitis, skin irritation, and allergic reactions have been described[22]. Potential formation of toxic products due to chemical reactions has to be elucidated[23]. Although few studies have validated efficacy of antimicrobial suture in cerebrospinal shunt surgery [24] and in sternal wound closure, but their study population was small and larger trials conclusively proved it to be ineffective[25]

Conclusion

In conclusion, in our observation, there is lack of clinical and laboratory evidence to support the efficacy of triclosan-containing suture material, suggesting that more clinical research is needed to prove its efficacy .

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