A COMPARISON OF PRIMARY CLOSURE VERSUS DELAYED PRIMARY CLOSURE IN CONTAMINATED ABDOMINAL SURGERY IN TERMS OF SURGICAL SITE INFECTION

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ABSTRACT

Objective: *To compare the frequency of surgical site infection in patients undergoing delayed primary closure (DPC) with those undergoing primary closure (PC) of surgical wounds after abdominal surgery for perforated appendix, perforated duodenal ulcer and ileal perforation.*

Methodology: *This quasi-experimental study was carried out at Surgical Unit I at Benazir Bhutto Hospital from January 2011 to December 2011. Patients undergoing contaminated abdominal surgery including perforated appendix, duodenal perforation and ileal perforations were recruited through the emergency department. The study included 86 patients, 43 in the primary closure (PC) and 43 in delayed primary closure (DPC) groups. They were followed for evidence of surgical site infection (SSI) for 30 days.*

Results: *Out of 86 patients 43 (50%) had ileal perforation, 26 (30.2%) had duodenal perforation and 17 (19.8%) had appendicular perforation. The mean age was 28.9±8.7 years. 32 (37.2%) were males and 54 (62.8%) were females. Both groups were similar with respect to age, gender distribution and indication for surgery. SSI was diagnosed in 19.8% patients. 30.2% in the PC group and 9.3% in the DPC group developed SSI. Hence significantly greater proportion of PC group patients developed SSI as compared to DPC patients; p=0.015. The severity if infection (superficial, deep or organ space) was not significantly different between the PC and DPC groups; p= 0.378. Significantly greater wound dehiscence was encountered in PC group; p=0.011.*

Conclusion: *There frequency of SSI was significantly lower after delayed primary closure of contaminated wounds as compared to primary closure.*

Key Words: *Wound infection, Surgical site infection (SSI), Primary closure, Delayed primary closure, Contaminated abdominal wounds.*

This article may be cited as: Ahmed A, Hanif M, Iqbal Y. A Comparison of primary closure versus delayed primary closure in contaminated abdominal surgery on terms of surgical site infection. J Postgrad Med Inst 2013; 27(4):403-8.

INTRODUCTION

Patients with abdominal wounds following perforation of viscus have a higher incidence of wound infection in post operative period than clean wounds[1]. In case of abdominal surgery if peritoneal cavity is contaminated, wound sepsis is inevitable[2]. A surgical site infection (SSI) is seen in about 15% of all hospital acquired infections and occurs in 10%-30% of all patients having gastrointestinal surgery[3].

Postoperative wound infections have a significant impact on health resources and costs, and the sequelae of wound infections (wound dehiscence and resulting incisional hernias) can result in significant long-term problems. Of the many risk factors influencing postoperative wound infections, the method of skin closure has been implicated as an important factor. The optimal method of wound closure that results in lesser chances of infection remains controversial.

Delayed primary closure (DPC) and primary clo

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Date Received: February 06, 2013
Date Revised: August 22, 2013
Date Accepted: August 26, 2013

sure (PC) are two commonly used methods of skin closure after abdominal surgery, but there is no consensus as to the optimal method. Studies suggested that delayed primary closure should be utilized for dirty abdominal incisions since it significantly lowers the rate of SSI as well as fascial dehiscence and reduces the mean healing time and hospitalization[4]. The cosmetic appearance is also superior[5]. However, the situation with contaminated abdominal surgery is controversial.

We carried out this study to compare the frequency of surgical site infection in patients undergoing delayed primary closure (DPC) with those undergoing primary closure (PC) of surgical wounds after abdominal surgery for perforated appendix, perforated duodenal ulcer and ileal perforation. Our study will help to identify the preferred method of closure either DPC or PC that results in lesser frequency of SSI in contaminated abdominal surgeries. This will help in using that method of closure which lessens that frequency of SSI and thereby will help in reducing cost of surgery and will help in reducing long-term problems associated with wound infections.

METHODOLOGY

The study was carried out at Surgical Unit I at Benazir Bhutto Hospital from January 2011 to December 2011. After taking permission from the hospital ethical committee patients were recruited through the emergency department and inpatient of surgical unit I by non-probability convenient sampling. We enrolled 86 patients undergoing contaminated abdominal surgery after taking informed consent. This included perforated appendix, duodenal perforation and ileal perforations. Patients having risk factors influencing wound healing including tuberculosis, diabetes, obesity, malnutrition, malignancy and steroid use and patients with history of penetrating/blunt abdominal injuries were excluded from study. Patients with prolonged surgery > 2 hours were excluded. Critically ill patients with American Society of Anesthesiologists (ASA) score ≥ 3 were also excluded. Diagnosis was established on clinical grounds, erect abdominal X-ray and abdominopelvic ultrasound. Patients were assigned randomly by lottery method to either Group A or B. 43 patients were included in each group. Group A underwent primary closure and group B underwent delayed primary closure. All procedures were done under general anesthesia in both groups by researcher himself. Inj. Ceftriaxone 1gm and Inj. metronidazole 500 mg given to both groups just before anesthesia and repeated in post-op period, then same oral antibiotics were given to both groups for 10 days.

In Group A wound was washed with normal saline and closure of rectus muscle was done with prolene 1 and skin closed with silk 2/0 vertical mattress sutures in primary closure (PC). While in Group B rectus muscles closed with prolene1 and skin and subcutaneous tissue left open with saline-soaked gauze dressings for delayed primary closure (DPC) on the 3rd postoperative day or later if the incision conditions were inappropriate for closure.

The wounds would be routinely inspected in both groups from the 3rd postoperative day onward till 30 days. They were examined for purulent discharge, pain or tenderness, localized swelling, redness, or heat in the wound (these were measured clinically). In such cases culture was taken from wound to confirm SSI. In such instances some sutures were removed to allow free egress of the purulent discharge, followed by daily wound dressing with EUSOL (Edinburgh University solution of lime). Surgical site infection (SSI) was defined as;

Infection occurs within 30 days after the operation infection involves skin or subcutaneous tissue or deep soft tissues (e.g., fascial and muscle layers) of the incision or organs or spaces other than the incision, which was opened or manipulated during an operation AND at least ONE of these: 1) Purulent drainage, with or without laboratory confirmation from the incision. 2) Organisms isolated from an aseptically obtained culture of fluid or tissue from the incision. 3) At least one of the following signs or symptoms of infection: fever (>38ºC), pain or tenderness, localized swelling, redness, or heat *AND incision is deliberately opened by surgeon.* Plz. clarify the meaning of the sentece.

All this data was recorded on a proforma and patients were followed on day 3, 7, and then in 2nd 3rd and 4th week till 30 days postoperatively. Data was stored and analyzed using SPSS 12. We compared the frequency of surgical site infection in patients undergoing delayed primary closure (DPC) with those undergoing primary closure (PC) of surgical wounds after abdominal surgery for perforated appendix, perforated duodenal ulcer and ileal perforation using the chi square test. A p value < 0.05 was considered statistically significant.

RESULTS

Out of 86 patients 43 (50%) had ileal perforation, 26 (30.2%) had duodenal perforation and 17 (19.8%) had appendicular perforation. Both groups had similar indication for surgery (p=0.534); in the PC group 19 (44.2%) had ileal perforation, 15 (34.9%) had duodenal perforation and 9 (20.9%) had appendicular perforation and in the DPC group 24 (55.8%) had ileal perforation, 11 (25.6%) had duodenal perforation and 8 (18.6%) had appendicular perforation.

The age of the patients ranged from 18 to 55 years with a mean age of 28.9±8.7 years. The mean age of the two groups was not significantly different

(28.3± 9.2 vs 29.6± 8.3 years in PC and DPC groups respectively; p= 0.464). 32 (37.2%) were males and 54 (62.8%) were females. The gender distribution was also similar in the two groups (p= 0.372) [Table 1].

SSI was diagnosed in 17 (19.8%) patients. 13 (30.2%) in the PC group and 4 (9.3%) in the DPC group developed SSI. Hence significantly greater proportion of PC group patients developed SSI as compared to DPC patients; p=0.015.

Out of 17 patients with SSI, 8 has superficial incisional SSI (5 had PC and 3 had DPC), 6 had deep incisional SSI (5 had PC and 1 had DPC) and 3 (all 3 had PC) had intra-abdominal sepsis. The severity of infection (superficial, deep or organ space) was not significantly different between the PC and DPC groups; p= 0.378.

Out of 17 patients with SSI, 2 had appendicular perforation (both had PC), 3 had duodenal perforation (all 3 had PC) and 12 had ileal perforation (8 had PC and 4 had DPC).

Six (6.9%) patients with SSI in the PC group who had laparotomy for ileal perforation also developed wound dehiscence, this was not encountered in any patient in the DPC group; p=0.011 (Figure 1).

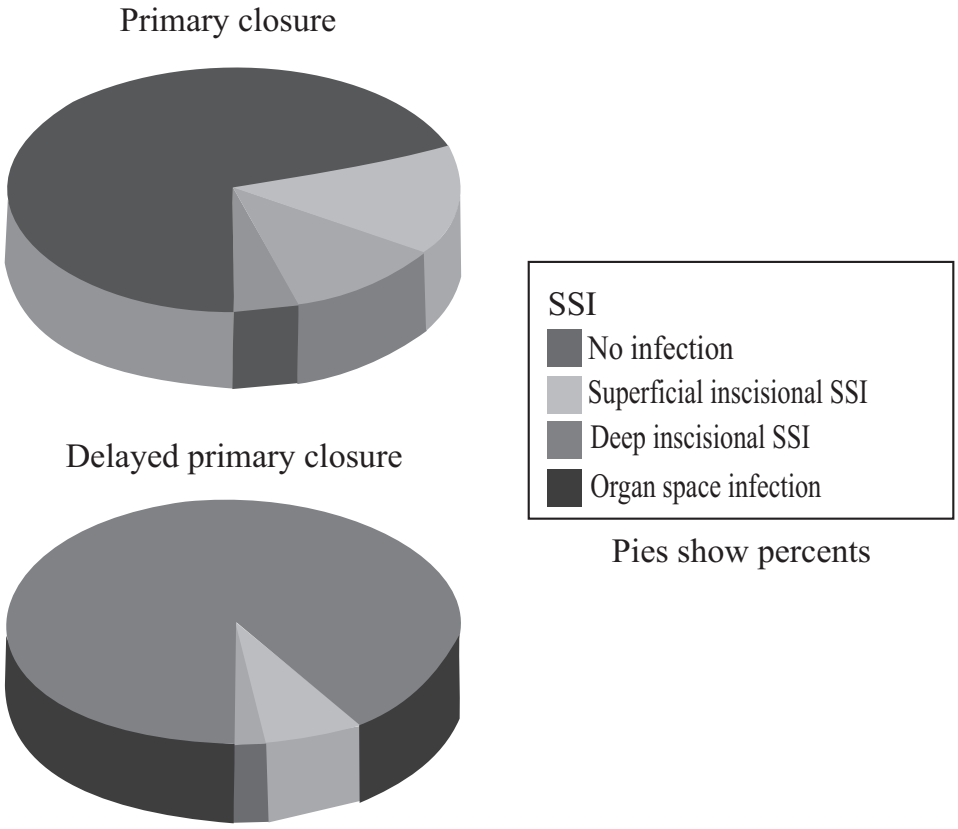
Cultures were sent in all patients. 11 had a positive culture. 2 showed a polymicobial pattern, 5 had Ecoli, 1 had enterococcus sp, I had pseudomonas sp and 2 had staphylococcal sp.

Table 1: Comparison of Primary closure (PC) and Delayed primary closure (DPC) groups

Variable	Primary closure group (PC) n= 43	Delayed primary closure group (DPC) n= 43	p value
Age (years)	28.3± 9.2	29.6± 8.3	0.464*
Gender			
Male	18 (41.9%)	14 (32.6%)	0.372ψ
Female	25 (58.1%)	29 (67.4%)	
Indication of surgery			
Ileal perforation	19 (44.2%)	24 (55.8%)	
Duodenal perforation	15 (34.9%)	11 (25.6%)	0.534ψ
Appendicular perforation	9 (20.9%)	8 (18.6%)	
SSI	13 (30.2%)	4 (9.3%)	0.015ψ
Severity of SSI			
Superficial incisional SSI	5 (11.6%)	3 (6.9%)	
Deep incisional SSI	5 (11.6%)	1 (2.3%)	0.378ψ
Organ space SSI	3 (6.9%)	0	
Wound dehiscence	6 (13.9%)	0	0.011ψ
Pus culture, Positive (%)	9 (20.9%)	2 (4.6%)	NA
Organism			
E coli	5	0	
Polymicrobial	2	0	NA
Enterococcus	1	0	
Pseudomonas	1	0	
Staphylococcus sp	0	2	

* Calculated using independent samples t test ψ Calculated using chi square test

Figure 1: SSI in the study groups



DISCUSSION

Whether a SSI occurs is dependent upon a complex interaction between numerous factors including: the nature and number of organisms contaminating the surgical site, the health of the patient and the skill and technique of the surgeon. To control for bias caused by these factors we used a uniform protocol of preoperative shaving of the area and similar antibiotic regimen. All patients had ASA score ≤ 2 and all were operated by the researcher himself. Several other patient-related characteristics have consistently been identified as risk factors for SSI in well-designed studies[6]. These risk factors include: the extremes of age[7], diabetes, obesity, steroids or immunosuppressive drugs and malnutrition. These factors were controlled by including patients from 18-65 years and excluding diabetics, obese or underweight (BMI >30 or < 15) and immune-compromised patients. Other factors of note also include an operation lasting over 2 hours and were excluded if operative time exceeded this. The type of wound is one of the most important predictor of SSI and to control for this we included only contaminated wound. By these we made an effort to minimize the bias caused by patient and operative factors so that the impact of type of closure on SSI rate can be studied more accurately.

In our study SSI was diagnosed in 19.8% patients. 30.2% in the PC group and 9.3% in the DPC group developed SSI. Hence significantly greater proportion of PC group patients developed SSI as compared to DPC patients. These results were similar to many locally and internationally published data. The internationally reported SSI rate for contaminated abdominal wounds is 6.4 to 15.2%[8,9]. In our study the SSI rate was higher than this i.e., 19.8%. In our study wound dehiscence occurred in 6.9% patients. Local literature reveals a similar incidence in the range of 3% to 8%[10].

At Islamia Trust Hospital Chiniot, 81 patients were operated having localized or generalized bacterial peritonitis during a period of 3 years[11]. All patients with primary closure had wound infection and only in 15.38% patients with delayed primary closure requiring secondary closure. In another local study by Shabbir et al[12] sixty patients underwent exploratory laparotomy through vertical abdominal incision. Skin wound of the first thirty patients (DPC) were left open and closed on 4th day while that of next thirty patients (PC) closed primarily. Out of

sixty patients ten patients developed major wound infection leading to wound dehiscence (16.66 %). Four belonged to DPC group (13.33%) and six belonged to PC (20 %); $p<0.05$. Regarding hospital stay of patients of two groups the difference was statistically significant; DPC (7.77±2.029 days) and PC (10.30±4.82 days); p= 0.00. In another local study by Ashraf et al[13] 66 patients (33 in PC and 33 in DPC groups), undergoing surgery for perforated appendix and duodenal or ileal perforation were included. Frequency of SSI was 60% and 33% in PC and DPC groups respectively; p= 0.02. However, a study performed on appendectomy wounds showed no advantage to DPC in terms of decreased wound infection compared with PC[14].

A controlled randomized study was conducted in India[15] involving 77 patients (DPC = 37, PC = 40) patients with dirty abdominal incisions. The main outcome measure was the incidence of postoperative SSI. In the entire series, SSI developed after incision closure in 23% of the patients. Infections were significantly more common in the PC group (42.5% for PC vs. 2.7% for DPC; p = 0.00). There also were significantly more cases of abdominal dehiscence in the PC group (DPC 2.7% vs. PC 25%; p = 0.005). The mean complete incision healing (CIH) time and length of hospital stay (LOS) were longer after PC (18.52 days) than DPC (13.86 days). Short-term cosmetic results for PC incisions were significantly inferior to those for DPC (p = 0.03).

Infections were polymicrobial or by E coli in the PC group and by staphylococci in DPC group. In most cases of perforation of a hollow viscus, mixed bacteria are isolated; the most common agents include Gram-negative bacilli (e.g., *Escherichia coli*) and anaerobic bacteria (e.g., *Bacteroides fragilis*). SSIs reflect the endogenous flora of the viscus or nearby mucosal surface. On the other hand the Staphylococcal species are encountered in DPC perhaps because of infection from the skin pathogens.

Our study had certain limitations. The Flora of all the three mentioned areas is usually different. So, to eliminate bias the share of the 3 surgeries should have been equally divided among both the groups. Moreover as braided sutures have in itself tendency to harbor bacteria therefore instead of silk PDS/Prolene 2-0 should have been used.

The use of DPC on 3rd postoperative day is important in our setup since most of the patients come to this tertiary care facility from far off areas and doing a secondary closure for contaminated wounds in 2nd postoperative week as is the usual protocol in many centers is bound to increase the duration of hospital stay. On the other hand most patients after doing a DPC on 3rd day can be discharged.

Although the incidence of abdominal wound infection and dehiscence has markedly reduced over the years but the condition has not been eliminated from the list of complications of abdominal surgery. Prevention is the best way of managing the condition. One such preventive strategy could be the use of delayed primary closure for contaminated abdominal surgeries.

CONCLUSION

There was significant reduction in wound infection after delayed primary closure of contaminated wounds and hence this strategy seems to be better than primary closure in decreasing the rate of SSI without increasing the length of hospital stay.

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CONTRIBUTORS

AA conceived the idea, planned and wrote the manuscript of the study. MH and YI helped in data acquisition and write up of the manuscript. All the authors contributed significantly to the research that resulted in the submitted manuscript.