

Full Length Research Paper

Surgical site infection prevention by local warming up before operation

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Surgical site infection (SSI) accounts for 37% of US hospital infection and increase in morbidity and cost. The Preoperative planning and intra-operative techniques become important in preventing surgical site infection. The present work has been undertaken with an aim to assess the role and extent of warming up of surgical site just before clean operation to prevent surgical site infection. 400 patients referring to Imam Reza hospital- Tehran-Iran from 2009 to 2010 with indication of clean surgery for treatment of hernia, varicocele, varicose, thyroidectomy and mastectomy were the study cases. Patients were divided randomly into two groups of 200 each. The surgical site of patients belonging to group I was warmed up just 30 minutes before operation. For patients belonging to group II no pre-operation interference was performed. The findings indicate a significant difference ($P<0.05$) in the rate of infection between the two groups. As a whole, 7.5% of patients belonging to group II showed SSI while 2% of patients of group I suffered surgical site infection. Warming up of surgical site just before operation may acts as a safe and inexpensive antimicrobial prophylaxis to prevent infection.

Keywords: Infection, bacterial infection, surgery, surgical site infection, prevention.

INTRODUCTION

Surgical site infections (SSIs) are wound infections that occur after invasive (surgical) procedures (Webster and Osborne, 2007). Surgical site infections include superficial incision infections, infections of the deep incision space and organ space infections (Mangram et al., 2001).

Surgical site infections are common complications occurring in 4-5% of patients after clean extra-abdominal surgeries and in up to 20% of patients undergoing intra-abdominal procedures (Auerbach, 2001). Surgical site infections can have significant effect on quality of life for the patient. They are associated with considerable morbidity and extended hospital stay. In addition, increased numbers of infections are now being seen in primary care because patients are allowed home earlier

following day care and fast-track surgery (Costing, 2008).

The number of variables that can influence SSI rate is large. The incidence of surgical site infection has been significantly reduced clinically by preparation of the skin pre-operation (Kao et al., 2009). Preoperative planning and intra-operative techniques become important in prevention of SSI. Finally, new strategies that appear to enhance host responsiveness must be considered (CME/CE Information, 2003).

Many surgeons instruct their patients to shower and scrub the surgical site with antiseptic soap on the evening prior to the procedure. This easy and low-cost strategy reduces surface contamination and involves the patient in the process of infection control.

Prevention in the operation room begins with the skin preparation of the operative site. The site is cleansed with chlorhexidine or povidone iodine (CME/CE Information; 2003).

Perhaps the greatest area of interest in the prevention of SSI has been the use of systemic antibiotics

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Table I. Patients' distribution in different groups

illness	Group I (%)	Group II (%)	Total (%)	Age range	Mean Age	Sex	
						M	F
Hernia	132 (66)	140 (70)	272 (68)	18 - 40	23	2	0
Varicocele	31 (15.5)	33 (16.5)			23	7	
Varicose	20 (10)	17 (8.5)	64 (16)	18 - 40	24	2	0
Mastectomy	10 (5)	6 (3)			52		
Thyroidectomy	7 (3.5)	4 (2)	37 (9.25)	18 - 40	38	6	0
			16 (4)	40 - 56		3	15
			11 (2.75)	25 - 50		7	5
						1	
						6	
Total	200 (100)	200 (100)	400 (100)				

(CME/CE Information; 2003). Approximately 80-90% of surgical patients receive some kind of antibiotic prophylaxis (Auerbach, 2001).

Attention to patient temperature is standard of care in intra-operative anesthesia management. The body temperature of patients may fall by 1 to 1.5° C during the first hour of general anesthesia (Mangram et al., 2001). Regional anesthesia typically causes core hypothermia. Intra operative hypothermia impairs immune function (especially oxidative killing by neutrophils) and results in dermal vasoconstriction and reduced blood flow to surgical sites, which further increases the risk of surgical site infection by lowering tissue oxygen tension (Auerbach, 2001). However, there are no data on the extent to which active warming measures are currently used pre operatively.

The present work has been undertaken with an aim to assess the role and extent of warming up of surgical site just before clean operation to prevent surgical site infection.

MATERIALS AND METHODS

Four hundred patients referring to Imam Reza hospital-Tehran- Iran, for elective surgery for last 2 years i.e. from 2009 to 2010 constituted the study cases.

Inclusion Criteria- All the patients with indication of clean surgery, not suffering from any other disease that affects the rate of SSI were included in this study. Patients were informed about the procedure prior to the operation and a consent form was signed by all the patients.

Exclusion Criteria- Patients were excluded from the study on the basis of their unwillingness to continue.

Those suffering from illnesses that affect SSI in any way like suffering from anemia and malnutrition, cancer or chronic dermal diseases, immune compromised patients, using immunosuppressive drugs and antibiotics and smokers were excluded from the study.

Various studies demonstrated a reduction of wound infection rate in diabetic patients when glucose control is maintained at levels below 200 mg/dl (Kao et al. 2009). For this reason, patients suffering from diabetes mellitus were also excluded from our study.

Study Case- patients were candidates for elective surgery for treatment of hernia, varicocele, varicose, thyroidectomy and mastectomy. They were divided randomly into two groups of 200 each. Out of two hundred cases who were placed in group I (Study Group), 132 patients were operated for treating hernia (66%), 31 (15.5%) patients were operated for treating varicocele, 20 (10%) underwent operation for varicose, 10 (5%) were mastectomized and 7 (3.5%) were thyroidectomized. In second group (Control Group, N=200) 140 (70%) patients were operated for treating hernia, 33 (16.5%) patients were operated for treating varicocele, 17 (8.5%) underwent operation for varicose, 6 (3%) were operated for mastectomy and 4 (2%) were thyroidectomized.

Methodology- The surgical site of patients belonging to group I was warmed up just before operation. For this purpose, 30 minutes before operation a hot water bag with water temperature of about 55°c was placed on the surgical site for 30 minutes in the operation room. As water bag temperature decreases after 10 minutes, every 10 minutes a fresh hot water bag with water temperature of 55°c replaced the previous one. In this way a third replacement maintains the temperature constant at 55°c for 30 minutes. As a result, body temperature of patients

Table 2. Frequency of SSI in two groups

Kind of operation	No. of infections in Group I	No. of infections in Group II
Hernia	3	10
Varicocele	0	2
Varicose	1	2
Mastectomy	0	1
Thyroidectomy	0	0
Total	4	15

rises up to 1 °C and soon after, operation was carried out. For patients belonging to group II no pre-operation interference was performed.

No antibiotic was administered before and after operation for patients belonging to group I, as is routine for clean operations. Local hair was shaved prior to operation. Betadin was used for skin sterilization.

As infection of surgical site happens within 3-5 days post operation, patients of both groups were checked for any sign of infection regularly for one week. Erythema, edema, abnormal pain and local heat are signs of infection. Data were analyzed using spss- 17 software.

RESULTS

Out of four hundred cases, 272 patients were operated for hernia, 64 patients were operated for varicocele, 37 for varicose, mastectomy 16 patients and 11 cases operated for thyroidectomy. Grouping and demography of patients is shown in Table I.

Statistical analysis performed between group I and group II shows a real association between group and illness in the population as a whole. As this significance level is less than 0.001 we can be 99.9 per cent certain that there is an association between group of patients and illness in the population.

As is clear from Table 2, surgical site infection is significantly lower in first group compared to group II ($P=0.034$). As a whole, 7.5% of patients belonging to group II showed SSI while only 2% of patients of group-I suffered SSI.

Among patients operated for thyroidectomy no infection was recorded in either group. Among patients mastectomized only 1 patient suffered post operation infection in group II and no patient of group I showed surgical site infection (Table 2). Highest number of infections occurred among patients operated for hernia i.e. 3 cases were infected in group I while 10 cases belonged to group II. Among patients operated for varicose 1 out of 31 patients were infected in group I and 2 out of 33 patients were infected in group II. Patients operated for varicocele had no infection in group I while 2

cases were infected among patients belonging to group II.

While our Chi-square result confirmed the existence of a significant association between group of patients and illness we are also interested in finding out the strength of that association. Statistical analysis performed confirms that there is a significant association between group of patients and illness, the Phi value of 0.313 indicates that this association is not weak.

Pearson's Chi-Square value for number of infections by Kind of operation is 1.104 which indicates that there isn't a significance relation between these two variables ($P > 0.05$).

Infection occurred on days 3 to 7 post-operation. Suture withdrawal and drainage along with antibiotic therapy were advised in case of infection.

DISCUSSION

Any surgical procedure has the potential risk of infection (Cunningham et al. 2006). It is conventional to use any technique to reduce the risk of bacterial contamination of the surgical site (CME/CE Information; 2003).

The risk of wound infection is generally determined by pre-operative and intra-operative events. Postoperative period will least change this. For this reason, we also warmed up the surgical site just before operation.

Wide areas of skin preparation around the proposed surgical site will reduce the risk of microbial breakthrough into the wound area (CME/CE Information; 2003). The procedure we employed also covered the area to be cut and its surroundings.

According to the published data surgical site infections have been shown to compose up to 20% of all of healthcare-associated infections. At least 5% of patients undergoing a surgical procedure develop surgical site infection (Costing, 2008). Cunningham et al (2006) in their study reported infection rate for surgical treatment of breast cancer between 3 and 15%, higher than average for a clean surgical procedure (Cunningham et al. 2006).

In this study SSI was noticed in 7.5% of the cases while among patients who were warmed up before

operation SSI was calculated to be 2%. Melling et al (2001) stated the overall rate of wound infection as 8% in non-treated group and Dolynchuk (2005) reported the overall incidence of SSI as 3.2 per cent in treated group.

Most surgical site infections are caused by contamination of an incision with microorganisms from the patient's own body during surgery. Infection caused by microorganisms from an outside source following surgery is less common. The majority of surgical site infections are preventable (Costing, 2008).

In the present work, we employed a technique which not only by warming up the patients' skin where to be cut may cause deactivation of microorganism of the skin but also by warming the site and increasing the body temperature by 1°C increases blood flow into the area thereby increases the phagocytosis of the microorganisms present in the suture site. As is concluded in a study performed earlier that patients maintained at the higher core temperature had an SSI rate of 6%, while the lower core temperature group had an SSI rate of 19% ($P < 0.009$). The normalization of core body temperature appears to enhance host responsiveness (CME/CE Information; 2003).

Sigg et al (1999) suggested: "it is likely that warming up of the surgical site prior to operation leads to reduced surgical site infections and associated decreases in length of hospital stay".

Melling et al. (2001) proposed that mild pre-operative warming of the patient reduces the risk of infection significantly.

According to Dolynchuk (2005) tissue ischemia must be prevented as much as possible in order to prevent surgical site infection. He believes patient's temperature has profound effects on tissue perfusion and even mild hypothermia can increase the likelihood of infection.

Miles (1980) demonstrated that a critical period of three hours post injury is the most important in terms of being able to mount an effective inflammatory response.

de novo invasion does not occur after an hour of the wound being closed. The need for proper pre-operative patient assessment is vital in the fight against SSIs (Dolynchuk, 2005).

The incidence of surgical site infection has been significantly reduced clinically by preparation of the skin pre-operation (Tanner et al., 2007).

Surgical site infection accounts for 37% of the US hospital infections and increase morbidity and cost (Clinical Trials.gov.2009). With the introduction of antibiotics into clinical practice after World War II, it was the hope of surgeons that the era of infection-free surgery had arrived. Numerous studies confirmed the shortcomings of the clinical use of preventive postoperative antibiotics. Systemic antibiotics given after

the contaminating event had no appreciable effect on the natural history of infection (CME/CE Information; 2003).

Better intra-operative and postoperative temperature control of the patient may reduce the risk of SSI. In a study, a warming pack (chemical activation) was applied to the dressing over the surgical incision, warming to 38°C, for a period of 90 minute 6 times treatments (Clinical Trials.gov.2009). While in our study warming up of operation site was used prior to operation as an effective way of preventing suture site infection with only 3 times treatments for a period of 30 minute yet the infection rate of the both the treatments employed is significantly lower.

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