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ORIGINAL RESEARCH

Warming devices reduce the risk of surgical site infections

[1]Dr. Chandravarman Singh, [2]Dr. Sameer Marediya, [3]Dr. Akshay Rao, [4]Dr. Ravindra Kharat

[1-4]Department of General Surgery, Bharati Vidyapeeth Medical College, Pune, Maharashtra, India

Corresponding author
Dr. Ravindra Kharat
Professor, Department of General Surgery, Bharati Vidyapeeth Medical College, Pune, Maharashtra, India

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ABSTRACT

Background: Surgical site infection still causes considerable morbidity and high cost to the health care system and is becoming increasingly important medicolegally. The present study was conducted to assess the effectiveness and safety of using warming devices in patients undergoing elective inguinal hernia surgery. **Materials & Methods:** 100 patients were subjected through a general examination and local examination. Surgical site infection was confirmed after culture sensitivity report of discharge from wound. Complete record of the case was entered in the proforma of the study. **Results:** In aged >50 years, the rate of SSI with device was seen in 1 and without device in 1 patient and <50 years, it was 1 and 4 respectively. With hypertension, with device was seen in 1 and without hypertension with device in 1 and without device in 5 patients. With diabetes with device in 1, without diabetes with device in 1 and without device in 5 patients. With multiple co-morbidities, with device in 1 and without multiple co-morbidities with device in 1 and without device in 4 patients. In unilateral hernia repair with device was seen in 2 and without device in 4 patients. In bilateral hernia repair without device in 1 patient. In patients whose surgical time was within 1-2 hours, rate of SSI with device was 2 and without device seen 3. Surgical time>2 hours without device 2 patients. In patients, where previous abdominal surgery done with device in 2 and without device in 4 patients. The difference was significant (P< 0.05). **Conclusion:** Warming devices reduce the risk of SSI in patients more than 50 years of age. Warming devices in this study has no effect on presence of co-morbidities whoever absence of co- morbidities reduces the risk of SSI. Warming devices reduce the risk of SSI in patients undergoing surgery for more than 2 hours. Warming devices reduce the risk of SSI in patients undergoing bilateral inguinal hernia more than unilateral hernia possibly due to extended surgical time.

Keywords: Hernia **r**epair**,** Surgical site infection, Warming devices

INTRODUCTION

Surgical site infection still causes considerable morbidity and high cost to the health care system and is becoming increasingly important medicolegally. Infections increase the discomfort and disability experienced by patients following surgical procedures.[1] Moreover, the most severe form may endanger life.[2] The maintenance of normothermia has a major benefit in reducing the risk of SSI when compared to standard care involving no warming.[3] The Guidelines Development Group unanimously agreed that warming devices should be used to avoid patient hypothermia in the operating room and during the surgical procedure in order to reduce the risk of SSI and, more importantly, other complications associated with surgery.[4]

The risk of adverse outcomes and overall hospital costs may decrease with the use of warming devices.[5] Hypothermia (or low body temperature) is defined as a core temperature below 36° C and is common during and after major surgical procedures lasting more than two hours. The human body has a central compartment comprising the major organs where temperature is tightly regulated and a peripheral compartment where temperature varies widely.[6]

Heat loss is compensated by reducing blood flow through the skin and by increasing heat production, mainly by inducing muscular activity(shivering) and increasing the basal metabolic rate.[7] Typically, the periphery compartment may be 2-4° C cooler than the core compartment. Exposure to a cold operating room environment and anaesthetic-induced impairment of thermoregulatory control are the most common events leading to hypothermia.[8] The present study was conducted to assess the effectiveness and safety of using warming devices in patients undergoing elective inguinal hernia surgery.

MATERIALS & METHODS

The study was carried out on 100 patients admitted in male and female surgical wards of Bharati Hospital, Pune, who are posted to undergo elective inguinal hernia surgeries. All gave their written consent to participate in the study.

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Data such as name, age, gender etc. was recorded. 100 patients were subjected through a general examination and local examination. Surgical site infection was confirmed after culture sensitivity report of discharge from wound. Complete record of the case was entered in the proforma of the study. Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of SSI patients

Parameters	Used	Not used
Age >50 years	1	1
Age <50 years	1	4
With hypertension	1	0
Without hypertension	1	5
With diabetes mellitus	1	0
Without diabetes mellitus	1	5
With multiple co-morbidities	1	0
Without multiple co-morbidities	1	4
In unilateral hernia repair	2	4
In bilateral hernia repair	0	1
Surgical time 1-2 hours	2	3
Surgical time >2 hours	0	2
No previous abdominal surgery done	2	4

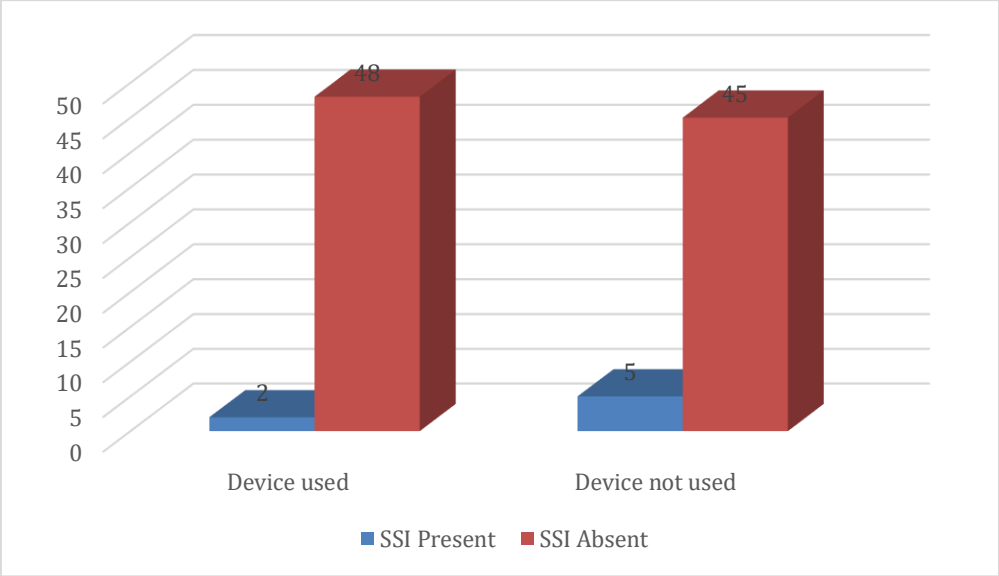
Table I shows that in aged >50 years, the rate of SSI with device was seen in 1 and without device in 1 patient and <50 years, it was 1 and 4 respectively. With hypertension, with device was seen in 1 and without hypertension with device in 1 and without device in 5 patients. With diabetes with device in 1, without diabetes with device in 1 and without device in 5 patients. With multiple co-morbidities, with device in 1 and without multiple co-morbidities with device in 1 and without device in 4 patients. In unilateral hernia repair with device was seen in 2 and without device in 4 patients. In bilateral hernia repair without device in 1 patient. In patients whose surgical time was within 1-2 hours, rate of SSI with device was 2 and without device seen 3. Surgical time>2 hours without device 2 patients. In patients, where previous abdominal surgery done with device in 2 and without device in 4 patients. The difference was significant (P< 0.05).

Table II Final result

Device	SSI Present	SSI Absent	Total
Device used	2	48	50
Device not used	5	45	50

Table II, graph I shows that with device SSI was seen in 2 and without device SSI was seen in 5 patients.

Graph I Final result



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DISCUSSION

This prospective study was carried out during the period of August 2017 to August 2019 at Bharati Hospital and Research Centre to study the effectiveness of warming devices in curbing the risk of surgical site infections. According to CDC and WHO guidelines the use of warming devices to reduce the risk of SSI is a category IA recommendation with moderate quality of evidence.[9,10] This study was based on 100 patients suffering from uncomplicated inguinal hernia who were randomly chosen to form a study population. The exclusion criteria included patients who did not fit in the age range, on chronic steroid use or those who had complicated hernia. This study was done to find out whether the warming devices, specifically forced air warmers reduce the incidence of surgical site infections, one of the major source of postoperative complications and morbidity.

97 patients were males and 3 were female which is in accordance to the article "Nationwide Prevalence of Inguinal Hernia"[11] in which 90.2% were male and 9.8% were female. That study was conducted in the United States, hence a higher male prevalence can be expected in India. Out of the 100 patients, in 50 patients warmers were used and in 50 warmers were not used. A study done on which type of warmer is the best in maintain normothermia it was found that forced air warmer was more effective in maintaining normothermia and is also cost effective.[12] Normothermia was maintained at 37^{o} C, above the level of hypothermia i.e. 33^{o} C - 36.4^{o} C.[12] The warmer used in our institution costs Rs. 1.5 lakh/- approximately which has a usability period of about 4-5 years. Even if used twice everyday it costs 50/- per patient The disposable blanket cost 1500/- per piece. This overall cost is compensated with lower postoperative recovery time (cut by half) and reduced management of postoperative complications of hypothermia.[12]

The incidence of SSI was calculated with and without the use of warmers and the risk ratio calculate was 0.47. The risk of SSI was reduced by 53% in males with the use of warmers. In females the study did not reveal significant outcome The incidence of SSI was calculated in patients above the age of 50 years with and without the use of warmers and the risk ratio calculate was 0.22. The risk of SSI was reduced by 78% in patients > 50 years with the use of warmers The risk of SSI was not significant in patients < 50 years with the use of warmers.

The presence of singular or multiple comorbidities did not reveal a significant outcome for reduction in SSI risk however in the absence of comorbidities, the risk of SSI fell by 62% with a risk ratio of 0.38. The incidence of SSI was calculated in patients with unilateral or bilateral hernia with and without the use of warmers and the risk ratio calculate was 0.58 and 0 respectively. The risk of SSI was reduced by 42% in patients with unilateral hernia repair with the use of warmers The risk of SSI was reduced by 100% in patients with bilateral hernia repair with the use of warmers. The incidence of SSI was calculated in patients with a surgical time of >2 hours or within 1-2 hours, with and without the use of warmers and the risk ratio calculate was 0.63 and 0 respectively.

The risk of SSI was reduced by 37% in patients whose surgical time was within 1-2 hours with the use of warmers The risk of SSI was reduced by 100% in patients whose surgical time was over 2 hours with the use of warmers. The incidence of SSI was calculated in patients with and without history of previous abdominal surgeries and with and without the use of warmers and the risk ratio calculate was 0 and 0.46 respectively.

The risk of SSI was reduced by 100% in patients with previous surgeries with the use of warmers The risk of SSI was reduced by 54% in patients with no previous abdominal surgeries with the use of warmers. Finally, the incidence of SSI with the use of warming devices was 4% as compared to 10% without warmers hence suggesting a reduction in risk of 60%, with the environmental factors similar and other WHO guidelines for prevention of SSI followed for each patient hence not creating any discrepancy in the study. This study does shed light over the fact that warming devices reduce the risk of SSI in certain conditions more, however further studies over large scale populations need to be carried out to consider the use of these devices over a widescale nationally and globally.

CONCLUSION

Forced air warmers are better suited for normothermia as compared to intravenous or reflective blankets. - Warming devices reduce the overall risk of surgical site infections subject to the fact that the essential recommendations according to WHO remain static in all cases. Warming devices reduce the risk of SSI in patients more than 50 years of age. Warming devices in this study has no effect on presence of co-morbidities whoever absence of co- morbidities reduces the risk of SSI. Warming devices reduce the risk of SSI in patients undergoing surgery for more than 2 hours. Warming devices reduce the risk of SSI in patients undergoing bilateral inguinal hernia more than unilateral hernia possibly due to extended surgical time.

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