



## WARMING DEVICES REDUCE THE RISK OF SURGICAL SITE INFECTIONS

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## ABSTRACT

**BACKGROUND:** Surgical site infection is still a considerable cause of morbidity and mortality leading to a higher burden on the healthcare system and has become an increasingly important medico-legal issue in recent times. Hypothermia is common in the operating theatre and may increase susceptibility to postoperative complications. The purpose of this study was to correlate the use of warming devices to prevent hypothermia, with the risk of reduction in SSI, ultimately reducing the duration of hospital stay and post-operative complications associated with surgery.

**METHOD:** 100 patients above the age of 18 years and fulfilling the inclusion criteria admitted and operated on at Bharati Hospital and Research Centre, Pune during the period of August 2017 to August 2019 were included in this study. Out of the 100 patients, in 50 patients warmers were used and in 50 warmers were not used. A forced air warmer was used to maintain normothermia at 37 °C. Any surgical site infection developed was confirmed after culture sensitivity report of discharge from wound. Approval of the ethics committee was obtained before commencement of this study.

**RESULTS:** According to the study the total SSI incidence was 4% with the use of warmers and 10% without the use of warmers, hence having a reduction in 60% with the use of warming devices.

**CONCLUSION:** The use of warming devices reduces the overall risk of surgical site infections and is an easy, cost effective and convenient method to do so.

## KEYWORDS : SSI, Warming device

## INTRODUCTION

Surgical site infection is still a considerable cause of morbidity and mortality leading to a higher burden on the healthcare system and has become an increasingly important medico-legal issue in recent times. The maintenance of normothermia has a major benefit in reducing the risk of SSI when compared to standard care involving no warming. [1]

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. [1] The risk of adverse outcomes and overall hospital costs may decrease with the use of warming devices.<sup>[2]</sup>

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<sup>[3]</sup>

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. Typically, the periphery compartment may be 2-4°C cooler than the core compartment<sup>3</sup>. Exposure to a cold operating room environment and anaesthetic-induced impairment of thermoregulatory control are the most common events leading to hypothermia<sup>4,5</sup>.

Heat loss is increased due to exposure of skin during perioperative period. Furthermore, direct cooling of the patient occur by intravenous and irrigation fluids directly. Sedatives and anaesthetic agents inhibit the normal response to cold, resulting in improved blood flow to the periphery and increased heat loss<sup>4,5</sup>.

In India studies on surgical site incidence revealed that the rate of surgical site infections and the frequency of various

pathogens causing surgical site infection with their antibiotic resistance pattern in general surgery units were studied. In the period from May 2001 to July 2002, 190 patients admitted for surgery (clean elective cases) were assessed preoperatively, intraoperative and postoperatively.<sup>6</sup>

Surgical site infection rate was 3 percent in clean surgeries and 22.4 percent in clean-contaminated surgeries. The increase in the stay at hospital preoperatively was found to be positively associated with surgical site infection rate. Also a lengthy surgery was associated with a significant rise in the rate of surgical site infection.<sup>6</sup> The purpose of this study was to correlate the use of warming devices to prevent hypothermia, with the risk of reduction in SSI, ultimately reducing the duration of hospital stay and post-operative complications associated with surgery.

## METHOD

100 patients above the age of 20 years and fulfilling the inclusion criteria operated for elective inguinal hernia surgery at Bharati Hospital and Research Centre, Pune during the period of August 2017 to August 2019 were included in this study. Approval of the ethics committee was obtained before commencement of this study. A thorough general and physical examination of the patient was carried out. Out of the 100 patients, in 50 patients forced air warmers were used and in 50 warmers were not used postoperatively to maintain normothermia at 37 °C. Any Surgical site infection developed was confirmed after culture sensitivity report of discharge from wound. Complete record of the case was entered in the proforma of the study.

## Observation and Results

Note: All patients developed only superficial incision SSI.

3 out of 100 patients were females in this study. Warming devices were not used for all the 3 subjects and 2 females developed SSI with 1 purulent discharge. Out of the 97 males in this study, in 50 males warming devices were used and 2 had purulent discharge. While in 47 male patients without warming devices 4 had purulent discharge.

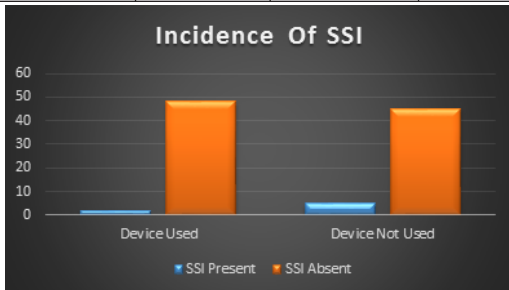
55 out of 100 patients were 50 years and above. In 45 patients warming devices were used and 1 had purulent discharge. While in 10 patients without warming devices 1 had purulent discharge. Out of 45 patients who were less than 50 years old, in 5 patients warming devices were used and 1 patient developed purulent discharge. While in 40 patients without warming device 4 had purulent discharge.

8 out of 100 patients had multiple comorbidities like HTN, DM, Asthma, BPH. In 7 patients warming devices were used and 1 patient developed SSI with purulent discharge. While in 1 patient without a warming device no SSI developed. 56 out of 100 patients had no comorbidities, among which in 22 patients warming devices were used and 1 had purulent discharge. In 34 patients warming devices were not used and 4 had purulent discharge.

87 out of 100 patients underwent unilateral hernia repair. In 40 patients warming device was used and 2 had purulent discharge. While in 47 patients without warming device 4 had purulent discharge 13 out of 100 patients underwent bilateral hernia repair, in 10 patients warming device was used and no patients had discharge. While in 3 patients without warming device 1 had purulent discharge.

90 out of 100 patients had a total surgical time between 1-2 hours. In 46 patients warming device was used and 2 had purulent discharge. While in 44 patients without warming device 3 had purulent discharge. Out of 10 patients with more than 2 hours of surgical time, in 4 patients warming device was used and no SSI developed. While in 6 patients without warming device 2 had purulent discharge.

|                 | SSI Present | SSI Absent | Total |
|-----------------|-------------|------------|-------|
| Device Used     | 2           | 48         | 50    |
| Device Not Used | 5           | 45         | 50    |
| Total           | 7           | 93         | 100   |



**RISK RATIO – 0.4**

Rate of SSI without device – 10%

Rate of SSI with device – 4%.

**The use of Warming Devices reduces the risk of SSI by (1-RR) x 100 = 60%**

**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.<sup>1</sup>

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”<sup>67</sup> 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. Normothermia was maintained at 37 °C, above the level of hypothermia i.e. 33 °C - 36.4 °C<sup>74</sup>The warmer used in our institution costs Rest. 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.<sup>7</sup>

Also in order to have a valid assessment of effectiveness of the warmers all patients in the study had a similar exposure to the strong recommendations in the guidelines such as-

- Antibiotic prophylaxis
- Preoperative clipping/ shaving of hair
- Surgical site preparation

According to the study the total SSI incidence was 4% with the use of warmers and 10% without the use of warmers, hence having a reduction in 60% with the use of warming devices.

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**DECLARATIONS**

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**Conflict of interest:** none declared

**Ethical approval:** approval attained

**REFERENCES**

1. World Health Organization, 2018. Global guidelines for the prevention of surgical site infection.
2. Fleisher LA, Metzger SE, Lam J, Harris A. Perioperative cost-finding analysis of the routine use of intraoperative forced-air warming during general anaesthesia. *Anaesthesiology: The Journal of the American Society of Anaesthesiologists*. 1998 May 1; 88(5):1357-64.
3. Hall JE. Guyton and Hall textbook of medical physiology. Philadelphia, PA: Saunders Elsevier. 2011; 107:1146.
4. Sessler DI. Mild perioperative hypothermia. *New England Journal of Medicine*. 1997 Jun 12;336(24):1730-7.
5. Diaz M, Becker DE. Thermoregulation: physiological and clinical considerations during sedation and general anesthesia. *Anesthesia progress*. 2010 Mar;57(1):25-33.
6. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. *Indian journal of medical microbiology*. 2005 Oct 1;23(4):249.
7. Ng SF, Oo CS, Loh KH, Lim PY, Chan YH, Ong BC. A comparative study of three warming interventions to determine the most effective in maintaining perioperative normothermia. *Anesthesia & Analgesia*. 2003 Jan 1;96(1):171-6.