



Warming with an underbody warming system reduces intraoperative hypothermia in patients undergoing laparoscopic gastrointestinal surgery: A randomized controlled study



Ying Pu^a, Gang Cen^{b,1}, Jing Sun^c, Jin Gong^a, Ying Zhang^a, Min Zhang^a, Xia Wu^a, Junjie Zhang^d, Zhengjun Qiu^{b,**}, Fang Fang^{a,*}

^a Department of Nursing, Affiliated First People's Hospital, Shanghai Jiao Tong University, Shanghai 200080, PR China

^b Department of General Surgery, Affiliated First People's Hospital, Shanghai Jiao Tong University, Shanghai 200080, PR China

^c Department of General Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai 200025, PR China

^d Department of Anesthesiology, Affiliated First People's Hospital, Shanghai Jiao Tong University, Shanghai 200080, PR China

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ABSTRACT

Background: Intraoperative hypothermia is a common event during laparoscopic abdominal surgery. On one hand, intraoperative hypothermia can delay the metabolism and prevent tissue damage. On the other hand, long-term and severe intraoperative hypothermia may also lead to perioperative complications, such as increasing of peripheral resistance, coagulation dysfunction, intraoperative hemorrhage and post-operative shivering. Maintenance of normothermia during surgical procedures may improve the quality of patient care.

Objectives: This study investigated the feasibility and efficacy of intraoperative cutaneous warming with an underbody warming system during laparoscopic gastrointestinal surgery.

Methods: 110 patients undergoing laparoscopic surgery for gastrointestinal cancer between January and December 2011 were randomized into the laparoscopic control (Control) group and laparoscopic intervention (Intervention) group. Nasopharyngeal temperature, prothrombin time, activated partial thromboplastin time, and thrombin time were measured before and during surgery, intraoperative and postoperative complications, as well as shivering after anesthesia and visual analog scale score for pain evaluation after surgery were also recorded. Clinical risk factors that may cause intraoperative hypothermia during laparoscopic surgery were also analyzed by correlation analysis.

Results: The two groups were comparable at the baseline. Intraoperative hypothermia was observed in 29 patients (52.7%) in Control group and 3 (5.5%) in Intervention group. Nasopharyngeal temperature in Control group was significantly decreased since 30 min after the start of operation until the end of surgery comparing to that at the start of anesthesia, but there was no difference in the Intervention group. In Intervention group, the nasopharyngeal temperature was remaining at ~36.5 °C, indicating the feasibility and efficiency of the underbody warming system in preventing intraoperative hypothermia during laparoscopic gastrointestinal surgery. Moreover, with anesthesia and operation time increased, there was no significant change of coagulation function, hemoglobin level

* Corresponding author. Tel.: +86 21 63240825; fax: +86 21 63240825.

** Co-corresponding author.

E-mail addresses: fang_fang0604@yahoo.com.cn, jeff820722@gmail.com (F. Fang).

¹ Contributed equally to this work as co-first author.

as well as less intraoperative hemorrhage, less postoperative shivering and lower visual analog scale score in Intervention group comparing to Control group. Multivariate logistic regression analysis revealed that anesthesia time and volume of CO₂ were independent risk factors for perioperative hypothermia.

Conclusions: Cutaneous warming with an underbody warming system is a feasible and effective method to prevent intraoperative hypothermia during laparoscopic gastrointestinal surgery.

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What is already known about the topic?

- Intraoperative hypothermia is a common complication of surgery.
- Intraoperative hypothermia is also observed during laparoscopic procedures.

What this paper adds

- The underbody warming system is feasible and efficient in preventing intraoperative hypothermia during laparoscopic gastrointestinal procedure.
- The intraoperative nursing care should focus on intraoperative hypothermia prevention.

1. Introduction

Perioperative hypothermia, defined as a core temperature below 36 °C (Hooper et al., 2009, 2010), is a common and serious complication of anesthesia and traditional open surgery (Insler and Sessler, 2006; Knaepel, 2012; Putzu et al., 2007; Sessler, 2008), occurring in more than 70% of patients (Galvao et al., 2010). The primary complications of intraoperative hypothermia will increase mortality rates (Fiedler, 1999; Mahoney and Odom, 1999; Quiroga et al., 2010; Sessler, 2001), with increasing of perioperative complications, including susceptible infection at the surgical site (Beilin et al., 1998), cardiac conduction block and arrhythmia (Fish and Antzelevitch, 2004; Kapetanopoulos et al., 2007), postoperative shivering (Schmied et al., 1996), an increase in blood loss (Schmied et al., 1996), prolonged as well as altered effects of anesthetic drugs (Leslie et al., 1995) and impaired coagulation function (Putzu et al., 2007).

Over the past two decades, the range of laparoscopic abdominal surgical procedures has grown enormously (Jakimowicz, 2006), with the vast majority of common conventional operations on the abdomen now performed safely, quickly and efficiently through laparoscopic techniques (Kuwabara et al., 2011). Hypothermia is an important complication of open abdominal operations (Burger and Fitzpatrick, 2009; Pagnocca et al., 2009; Torossian, 2008), as heat loss occurs from exposure of the surgical wound and abdominal organs to the ambient room environment (Diaz and Becker, 2010; Severens et al., 2010). However, although intraoperative hypothermia was also observed during laparoscopic procedures (Nguyen et al., 2001), the mechanism underlying intraoperative hypothermia during laparoscopic procedures has not been well elucidated.

In this study, we have testified that intraoperative hypothermia occurred during laparoscopic gastrointestinal procedure. Moreover, we also investigated the feasibility and efficiency of underbody warming system in preventing intraoperative hypothermia during laparoscopic gastrointestinal procedure. Furthermore, a quantitative, correlation analysis on the incidence of intraoperative hypothermia during laparoscopic gastrointestinal was performed. This study elucidated that anesthesia time and volume of CO₂ inflated as the possible risk factors for hypothermia during laparoscopic procedure, which can apply evidence-based guidance for the intraoperative hypothermia-preventing nursing care. It also provides a potential feasible and efficient nursing care protocol on prevention for intraoperative hypothermia during laparoscopic gastrointestinal surgery, which may be extended to larger category of minimally invasive surgeries worldwide.

2. Materials and methods

2.1. Study design and patient selection

The present study is a randomized single-blinded trial to evaluate the feasibility, efficacy and safety of intraoperative cutaneous warming with an underbody warming system during laparoscopic gastrointestinal surgery. Warming intervention can be considered to be promising as preventing hypothermia (<36 °C) and keeping body temperature at normal range (~37 °C). The hypothetical noninferiority settings of this study are as follows: According to our preliminary investigations, ~45% patients were suffered by intraoperative hypothermia if there was no warming intervention (Suppl Fig. 1); assuming the number of patients who show intraoperative hypothermia would reduce to 15% after warming intervention; set the level of $\alpha=0.05$ (1-sided) and $\beta=0.90$. Therefore, the estimated sample size is 94, with 47 cases per arm. In case of irresistible lost of cases, the study population was set at 110, with 55 cases per arm. This sample size provides 89% chance of satisfying the above criteria, under the hypothesis that the expected complication rate in each arm is less than 10%. This study was approved by the ethical committee of the Affiliated First Hospital, Shanghai Jiao Tong University, and written informed consent was obtained from all patients enrolled in the study.

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