The Effects of Stellate Ganglion Block on Intraoperative Hemodynamics and Postoperative Side Effects in Laparoscopic Day-Case Surgery

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Abstract

The objective of this study was to evaluate intraoperative hemodynamics and side effects following preoperative unilateral SGB in patients undergoing day-case laparoscopy. Before the anesthesia, the patients in the SGB group (n = 22) received right SGB using 8 mL of 1% lidocaine, and an equal dose of lidocaine was injected intramuscularly to the patients in the control group (n = 23). As the results, preoperative SGB could not only alleviate the hyperdynamic responses of blood pressures and heart rates after tracheal intubation and gas insufflation with head-down position, but also decrease the incidences of postoperative nausea and analgesic requirements.

Keywords: Hemodynamics; postoperative side effect, stellate ganglion block.

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Introduction

Hemodynamic changes observed during laparoscopy result from combined effects of peumoperitoneum, patient position, and anesthesia. Peritoneal gas insufflation to intraabdominal pressures more than 10 mmHg induces significant alterations of hemodynamics. The disturbances are characterized by decrease of cardiac output, elevations of arterial pressure, and increases of systemic and pulmonary vascular resistances. [1,2] This increase in afterload can be considered to be a reflex sympathetic response to decreased cardiac output. [3] The increase in systemic vascular resistance is also affected by patient position. Cadaver studies show that when the needle is correctly placed, and the agent is injected into the correct fascial plane, 10 mL of injectate spreads from the upper part of the C5 to the T3. [4,5] It will, therefore, interrupt sympathetic and visceral afferent and efferent pathways to the head and neck, upper limb, and thoracic viscera. [6,7] We hypothesized that if pneumoperitoneum with head-down position for the laparoscopic surgery facilitates sympathetic response, then stellate ganglion block (SGB) might suppress the cervicothoracic sympathetic nerves with alleviation of the hemodynamic disturbance. However, no study examined the hemodynamic response to the surgical procedure after SGB.

The objective of this randomized, controlled, and single-blinded study was to evaluate the intraoperative hemodynamics and the postlaparoscopic side effects following preoperative unilateral SGB in patients undergoing day-case diagnostic laparoscopy.

Methods

After approval from the hospital's institutional review board and signed informed consent, 50 female ASA physical status I patients scheduled for laparoscopic surgery in day-case infertility clinic were enrolled. A power analysis using an α-value of 0.05, and power of 0.9 was performed to determine sufficient sample sizes required to establish a significant difference in the systolic and diastolic blood pressures and incidences of postoperative side effects based on the results of preliminary study. The calculated sample size was at least 43 of the two groups. They were randomized into two groups using a computer generated block number put inside a sealed envelope. No premedication was given.

Ten minutes before the induction of anesthesia, with the head hyperextended and under aseptic condition, 8 mL of 1% lidocaine without epinephrine were injected after locating the transverse process of the right sixth cervical vertebra in the SGB group (n = 22). In the control group (n = 23), an equal dose of lidocaine was injected intramuscularly into the deltoid muscle on the ipsilateral side. A sympathectomy was diagnosed by the presence of an ipsilateral Horner syndrome and an increase in temperature of the affected extremity of at least 1°C. The skin temperature was taken from the thenar area (Temp M1029A; Agilent, Boeblingen, Germany) before the SGB as a baseline and at 5 min intervals thereafter. The patients were excluded from the SGB group if a skilled anesthesiologist had difficulty identifying either the osseous landmark of the sixth cervical vertebral tubercle. The managements of anesthesia during the surgery and postoperative care in the recovery room were done by an anesthesiologist blinded to the preoperative procedure.

All patients were monitored with continuous electrocardiographic monitoring (lead II 4 and V5) and pulse oximetry. Autonomic noninvasive blood pressures and heart rates were measured before the block as a baseline value (T0), after induction of anesthesia (T1), after tracheal intubation (T2), after CO2 gas insufflation (T3), after head-down position with peumoperitoneum (T4), after neutral position with exsufflation (T5), and in the recovery room (T6). Anesthesia was induced with propofol 2 mg.kg-1, and maintained by sevoflurane 2-4 vol% with oxygen-nitrous oxide and recuronium 20-30 mg for the muscle relaxation. No opioids were administered.

At the end of surgery, the nitrous oxide and sevoflurane were stopped abruptly without tapering; the patients then received 100% oxygen at the same flow rate. Emergence time was evaluated by recording the

time from the end of surgery until the patient was able to open their eyes, and be fully oriented as to the time and place. The patients were assessed regularly to establish their readiness for discharge, stable vital sign, pain controllability, ability to walk without side effects, and ability to retain oral fluids. Discharge time was the time from the end of surgery to the discharge.

Each patient was asked to report the pain experienced using the visual analogue pain score (VAS from 0 to 10), 30 minutes and 1 hour after the procedure, at discharge and 24 hours after procedure. Postoperative side effects including nausea, vomiting, dizziness, headache, shoulder pain, epigastric pain, back pain, wound pain and the analgesic use were observed until the discharge, and 24 hours after surgery via telephone interview by another anesthesiologist not involved in the intraoperative procedures. Meperidine 25-50 mg intramuscularly was allowed at a patient's request and after evaluation by an investigator. Metoclopramide 10 mg was administered for treatment of severe nausea or vomiting.

All results are expressed as the mean ± SD or the number of patients with percentage. 5 Student t-test and Mann-Whitney U-test where appropriate were used for the patients' variables. Repeated measured ANOVA was performed to compare the changes of intraoperative hemodynamics. Chi-square and Fisher's exact test were applied to the variables of postoperative assessments. A p-value < 0.05 was considered statistically significant. Statistical analysis was performed using SPSS 10.0.

Results

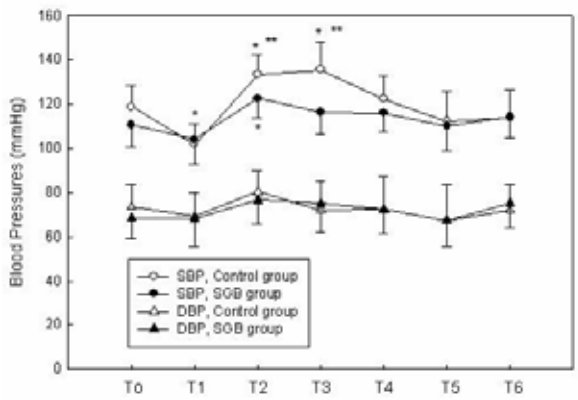
Table 1 shows no significant differences in the demographic data, duration of surgery, and recovery profile between the two groups.

Table 1 Characteristics of patients receiving stellate ganglion block (SGB) or control. Values are mean (SD).

	Control group (n = 23)	SGB group (n = 22)
Weight; kg	54.7 (5.2)	51.1 (4.5)
Height; cm	161.0 (3.7)	160.0 (3.8)
Age; years	32.2 (3.9)	32.6 (3.9)
Duration of surgery; min	29.3 (8.9)	27.9 (9.0)
Emergence time; min	9.7 (2.1)	9.9 (2.6)
Discharge time; min	141.5 (54.2)	140.0 (33.5)

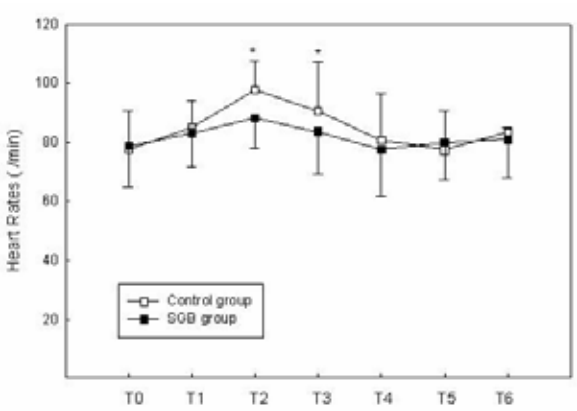
There is no statistical difference between the two groups.

There were significant differences of systolic blood pressures after induction of anesthesia, after tracheal intubation, and after pneumoperitoneum with head-down position comparing to the baseline values in the control group but not in the SGB group (Fig. 1). There were significant differences in the systolic blood pressures between the two groups. In the SGB group, the changes of systolic blood pressures showed more stable course comparing to the control group. Heart rate after tracheal intubation and gas insufflation increased significantly compared to the baseline value in the control group, but not in the SGB group (Fig. 2). The postoperative pain scores were lower in the SGB group than in the control group, but these were not statistically significant (Fig. 3). However, we noticed that more than 30% of patients in the control group requested analgesics for postoperative abdominal pain, but none in the SGB group ($P < 0.05$).



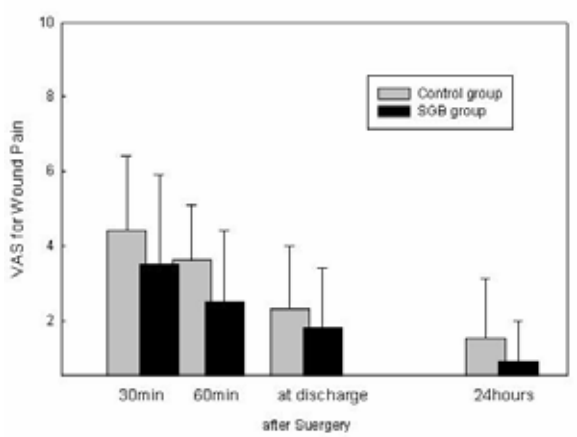
T0: baseline value, T1: after induction of anesthesia, T2: after tracheal intubation, T3: after CO2 gas insufflation, T4: after head-down position with peumoperitoneum, T5: after neutral position with exsufflation, T6: in the recovery room.
The changes of systolic blood pressures showed more stable course in the SGB group comparing to the control group.
* $P < 0.05$ compared to the baseline value. ** $P < 0.05$ compared to the SGB group.

Figure 1 Systolic and diastolic blood pressures after SGB.



T0: baseline value, T1: after induction of anesthesia, T2: after tracheal intubation, T3: after CO2 gas insufflation, T4: after head-down position with peumoperitoneum, T5: after neutral position with exsufflation, T6: in the recovery room.
Heart rates after gas insufflations and after head-down position in the control group increased significantly compared to the baseline value. However, there are no significant differences between the two groups. * $P < 0.05$ compared to the baseline value.

Figure 2 Heart rates after SGB.



The postoperative pain scores were lower in the SGB group than in the control group, but these were not statistically significant.

Figure 3 Intensity of Postoperative Wound Pain.

The incidences of postoperative side effects of two groups are presented in Table 2. The incidence of nausea in the SGB group was significantly lower than in the control group, although the incidences of vomiting requiring treatment were similar. The number of patients complaining of dizziness, headache, and shoulder pain postoperatively was not different between the two groups.

Table 2 Postoperative Complications of patients receiving stellate ganglion block (SGB) or control. Values are number (proportion).

	Control group (n = 23)	SGB group (n = 22)
Nausea	9 (39.1%)	1 (4.5%)*
Vomiting	2 (8.7%)	0 (0%)
Dizziness	5 (21.7%)	3 (13.6%)
Headache	2 (8.7%)	4 (18.2%)
Shoulder Pain	13 (56.5%)	15 (68.1%)
Epigastric pain	2 (8.7%)	0 (0%)
Back Pain	1 (4.3%)	2 (9.1%)
Analgesics	7 (30.4%)	0 (0%)*

* P < 0.05 compared to the control group.

Discussion

There are some reports in which SGB influence the hemodynamic conditions via the sympathetic nerve system. [6-8] In addition, this block has been shown to prevent perioperative hypertension induced by increased sympathetic activity. [9,10] We found the blunting effect on the hemodynamics and the superior analgesic effect of unilateral SGB before laparoscopic surgery compared to the control. These findings might suggest that unilateral SGB with 8 mL of 1% lidocaine suppress activated sympathetic nervous system due to head-down position with pneumoperitoneum, although we did not demonstrated any direct evidence. Further studies including catecholamines are needed to prove this.

We could not determine how SGB alleviated the postoperative nausea. Unfortunately, there is no published report on this. Some studies have reported the lower incidences of nausea after sympathetic block in cancer patients compared to the pharmacologic therapy patients; however, that may be due to the decrease of opioid use rather than the effects of sympathetic block itself.[11] We believe that in the present study, SGB may suppress the excitation of the cervicothoracic sympathetic nerve governing the pathway related to the postoperative nausea, although there is lack of direct evidence.

Postoperative analgesic use for wound pain in the control group was significantly higher than the SGB group in which no one requested analgesics. A possible mechanism may explain this interesting result. Surgical trauma and pain cause endocrine response that increases the secretion of cortisol, cathecholamine, and other stress hormones. [12,13] Yokoyama et al. reported that SGB influences the blood levels of catecholamines. [14] These findings might suggest that sympathetic nerve fibers and nodes regulate neuroendocrine activity and can reversely influence the 8 postoperative pain systemically.

In the present study, although one skilled anesthesiologist carefully performed SGB in the patients without any complications, SGB is not a recommended daily practice. Because there have been potential serious complications associated with block including vertebral artery puncture, subarachnoid or epidural injections, recurrent laryngeal or phrenic nerve block, and pneumothorax. We sometimes experience the hyperdynamic response to gas insufflation or head-down position, even with increments of anesthetics and narcotics. Preoperative SGB might be a useful procedure to prevent the hemodynamic fluctuations in selective cases.

In conclusion, unilateral SGB could alleviate the hyperdynamic response in the laparoscopic surgery. SGB decreased the incidences of postoperative nausea and analgesic requirements for wound pain. Although this is not a recommended routine clinical practice because of uncomfortness and risks, however, the present results might hold some vital clues to the positive effects of SGB on the intraoperatiove hemodynamic response and postoperative side effects.

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