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Short communication

The effects of graduated compression stocking on blood pressure and heart rate during spinal or epidural anesthesia

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Hypotension occurring during spinal or epidural anesthesia is commonly treated by fluid loading, adminstration of vasopressor agents, or compression bandaging after elevation of the legs. However, these methods are potentially harmful. Thigh-length graduated compression stockings (TED stocking, Kendall, London, UK) fitted on both legs, and correctly measured, increase the femoral vein blood flow velocity to 138.4% of the base line, and thereby prevent deep venous thrombosis [1]. This study was designed to find out if a simpler method using the present stocking would be prophylactic for spinal or epidural hypotension.

Eighty adult patients from elective surgery (Table 1) (except cesarean section) under spinal ($n = 40$) or epidural ($n = 40$) anesthesia were randomly divided into a TED(+) group (TED stockings of thigh length on both legs) and a TED(−) group (no fitting) after informed consent had been obtained. Spinal anesthesia was performed by injecting 0.3% dibucaine 2.0 ml in the 4th–5th lumbar interspace in the lateral position, immediately followed by the supine position. Epidural anesthesia was performed by injecting 2% mepivacaine 0.2 ml·kg^{-1} in the supine position through an 18 G epidural catheter inserted in the 4th–5th lumbar interspace. Lactated Ringer's solution was administered at 10 ml·kg^{-1}·h^{-1} flow rate during anesthesia. Systolic blood pressure and heart rate were measured pre-anesthesia and 5, 10, 15, and 20 min after injecting local anesthetic. Data were expressed as mean ± standard deviation. Statistical analysis was done using Stat View SE+ (Abacus Concepts Inc., USA) employing the Wilcoxon signed-rank test for paired data and the Mann–Whitney U test for unpaired data. Statistical significance was indicated as $P < 0.05$.

There were no statistically significant differences between TED(+) and TED(−) groups with regard to age, height, weight, and anesthetized spinal segments achieved 20 min later in spinal or epidural anesthesia (Table 2). In spinal anesthesia, systolic blood pressures and heart rates showed no statistical differences between the groups in the pre-anesthesia period. Systolic blood pressure decreased significantly after injecting local anesthetic in both groups, but at 10, 15, and 20 min after injection the TED(+) group showed significantly higher values compared with the TED(−) group. Although heart rate in the TED(+) group decreased 15 and 20 min later, while in the TED(−) group it decreased only 20 min later, there were no statistical differences in heart rate between the groups. In epidural anesthesia also, systolic blood pressures and heart rates showed no statistical differences between the groups in the pre-anesthesia period. Although systolic blood pressures in both groups significantly decreased after injecting local anesthetic, there were no statistical differences between the groups. Heart rates showed no statistical differences, either compared with pre-anesthesia values or between groups (Fig. 1).

The present study suggests that a graduated compression stocking seems to maintain blood pressure during spinal anesthesia, although it is not effective under epidural anesthesia. The mechanism for preventing spinal hypotension is believed to be restraint of cutaneous venous dilatation of the lower extremities and an increment in femoral vein blood flow. While a graduated compression stocking is reported not to prevent spinal or epidural hypotension in cesarean section without left uterine displacement [2,3], it seems that a gravid uterus suppresses the venous return from the lower extremities. Moreover, the stocking used in this study does not impair the peripheral circulation of the legs and is safe for long-term fitting [4]. Consequently, it is concluded

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Table 1. Proposed operations

	TED(+) group	TED(−) group
Spinal anesthesia (n = 20 in each group)		
Hysterectomy	6	8
TUR-Bt	5	1
Laparoscopy	4	1
Ovarian cystectomy	1	3
Others	4	7
Epidural anesthesia (n = 20 in each group)		
Hysterectomy	6	7
Arthroscopy	5	1
TUR-P	3	2
Ovarian cystectomy	1	2
TKA	0	2
ORIF (tibia)	0	2
Others	5	4

TED(+), thigh-length TED stockings fitted on both legs; TED(−), no TED stocking; TUR-Bt, Transurethral resection of the urinary bladder; TUR-P, Transurethral resection of the prostate; TKA, Total knee arthroplasty; ORIF, Open reduction internal fixation.

Table 2. Age, height, weight, and anesthetized spinal segments for both groups in spinal or epidural anesthesia

	TED(+) group	TED(−) group
Spinal anesthesia (n = 20 in both groups)		
Age	49.4 ± 14.0	45.2 ± 13.3
Height (cm)	151.4 ± 6.5	155.7 ± 8.7
Weight (kg)	55.5 ± 7.6	55.6 ± 7.1
Anesthetized spinal segments	11.7 ± 2.3	11.8 ± 2.2
Epidural anesthesia (n = 20 in both groups)		
Age	51.0 ± 18.7	51.1 ± 16.8
Height (cm)	156.6 ± 7.4	153.7 ± 8.7
Weight (kg)	57.3 ± 7.6	55.9 ± 10.3
Anesthetized spinal segments	12.0 ± 3.2	12.1 ± 3.0

Values are expressed as mean ± SD.
No statistically significant differences between the two groups.

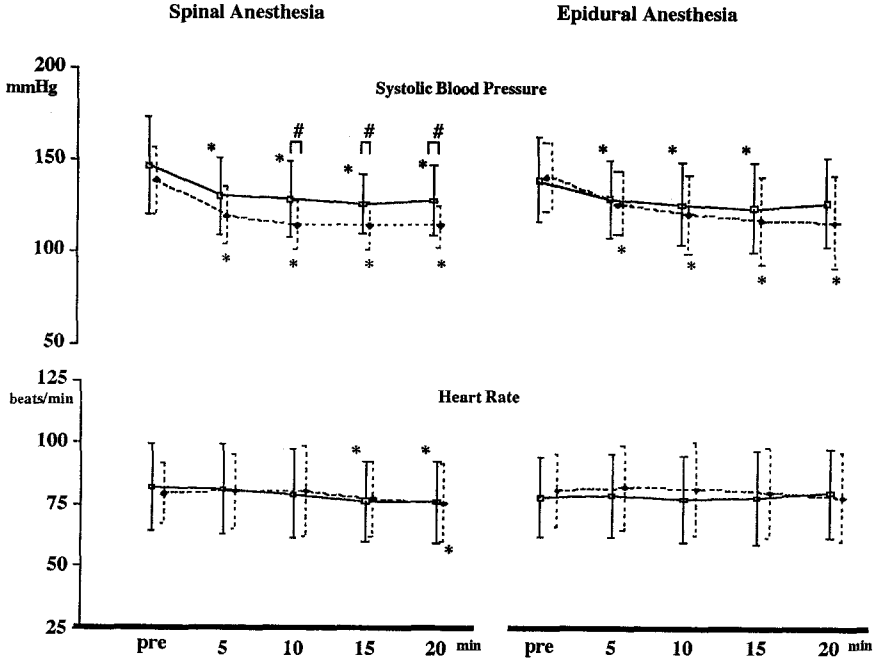

Fig. 1. Systolic blood pressure and heart rate in spinal and epidural anesthesia. *Upper* and *lower* graphs on *left* show changes in systolic blood pressure and heart rate, respectively, in spinal anesthesia. Graphs on *right* show the same in epidural anesthesia. *TED(+)* (*solid line*), thigh-length TED stockings fitted on both legs; *TED(−)* (*broken line*), no TED stocking. $^{*}P < 0.05$ *vs* pre-value; $^{\#}P < 0.05$ TED(+) *vs* TED(−). Mean ± SD

that fitting graduated compression stockings on both legs seems to be a noninvasive, simple and safe procedure to prevent hypotension during spinal anesthesia, except for cesarean section.

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