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Original Contribution

The effect of spinal versus general anesthesia on intraocular pressure in lumbar disc surgery in the prone position: A randomized, controlled clinical trial

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ABSTRACT

Objective: To compare IOP changes between spinal anesthesia (SA) and general anesthesia (GA) in patients who underwent lumbar disc surgery in the prone position.
Design: Prospective, randomized, controlled trial.
Setting: Operating room.
Patients: Forty ASA I–II patients scheduled for lumbar disc surgery in prone position.
Intervention: Patients were randomly allocated to the SA or GA groups.
Measurements: IOP was measured before anesthesia (IOP1), 10 min after spinal or general anesthesia in supine position (IOP2), 10 min after being placed in the prone position (IOP3), and at the end of the operation in the prone position (IOP4).
Main results: There was no significant difference between baseline IOP1 (group GA = 19.4 ± 3.2 mmHg; group SA = 18.6 ± 2.4 mmHg) and IOP2 values (group GA = 19.7 ± 4.1 mmHg; group SA = 18.4 ± 1.9 mmHg) between and within the groups. IOP values after prone positioning and group GA measurements (IOP3 = 21.6 ± 3.1 mmHg; IOP4 = 33.9 ± 3.1 mmHg) were significantly higher when compared with the SA group (IOP3 = 19.3 ± 2.7 mmHg, IOP4 = 26.9 ± 2.4 mmHg) ($p = 0.018$ and $p < 0.001$, respectively). Furthermore, IOP3 was significantly increased when compared with IOP2 in the GA group but not in the SA group ($p = 0.019$ and $p = 0.525$, respectively). In both groups, IOP4 values were significantly higher than the other three measurements ($p < 0.001$).
Conclusion: The results indicated that IOP increase is significantly less in patients who undergo lumbar disc surgery in the prone position under SA compared with GA.

1. Introduction

Perioperative vision loss, defined as full or partial vision loss that develops after a surgical procedure, is a rare but severe complication [1]. While its frequency in all patients undergoing general anesthesia is between 0.000016% and 0.000008% [2], it mainly occurs after spinal surgery in the prone position with a frequency of 0.03% [3].

The reasons for vision loss after spinal surgery are anterior or posterior ischemic optic neuropathy, central retinal artery occlusion, central retinal vein occlusion, cortical blindness, posterior reversible encephalopathy, direct compression, and acute angle-closure glaucoma [4]. According to the American Society of Anesthesiologists' (ASA) Postoperative Visual Loss Registry data, with a rate of 89%, the major reason for postoperative vision loss after spine procedures is one of the two forms of ischemic optic neuropathy [5].

Intraocular pressure (IOP), which is the tissue pressure of the intraocular content, ranges between 10 and 20 mmHg under normal circumstances. Ocular perfusion pressure is the difference between mean arterial pressure (MAP) and IOP. An acutely raised IOP in the perioperative setting may lead to retinal artery occlusion and retinal ischemia [6]. Therefore, maintenance of normal IOP within the normal range or attenuating an increase during lumbar surgeries in the prone position remains one of the targets of anesthetic management.

Both general and regional anesthesia are used safely for lumbar

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spine surgeries. Mclain et al. showed in their series of 400 patients that spinal anesthesia provided a better hemodynamic profile, and reduced the need for analgesics and postoperative nausea-vomiting rates in lumbar decompression surgery [7]. When all complication rates are taken into consideration, regional anesthesia has a significantly lower complication rate (13.1–28.6%, respectively) [7] and a lower cost compared with general anesthesia [8,9].

Although there have been studies on IOP in patients in the prone position receiving general anesthesia in recent years, no similar studies have been conducted for spinal anesthesia. The aim of the present study was to determine whether there was a difference between the two anesthetic methods in the prone position in terms of IOP.

2. Patients and methods

Following ethics committee approval from Baskent University Ethical Committee (KA 13/103), 40 American Society of Anesthesiology (ASA) stage I–III patients aged 18 to 65 years and scheduled for lumbar discectomy surgery were included in this prospective, randomized controlled study. Written consent was obtained from all patients. The study was registered on the Australian New Zealand Clinical Trial Registry (No: ANZCTRN12617001042336). The study was conducted in a tertiary university hospital between March and August 2017. A flow chart of the study is presented in Fig. 1.

Patients underwent comprehensive ophthalmic examinations, which included preoperative IOP, visual acuity, auto refraction, central corneal thickness, and anterior and posterior segment examinations to rule out any ocular pathology. Preexisting acute or chronic eye disease, history of eye surgery, current use of systemic β blockers, and patient refusal were accepted as exclusion criteria.

A computer-generated table of random numbers, which were placed in sealed envelopes, was used to randomly assign patients in a 1:1 ratio either as general anesthesia (group GA, $n = 20$) or spinal anesthesia (group SA, $n = 20$). On arrival to the operating room, patients received standard monitoring including electrocardiogram, pulse oximetry, and blood pressure. After intravenous access, all patients received lactated Ringer's solution at a rate of 5 mL/kg/h.

Spinal anesthesia was applied to patients in the group SA from the L3–4 or L4–5 intervertebral space with a 25-gauge spinal needle using 3 mL 0.5% hyperbaric bupivacaine. After achieving sufficient block and waiting 10 min, the patient was put into the prone position.

For patients in group GA, anesthesia was induced with propofol and fentanyl. After loss of consciousness, rocuronium 0.6 mg/kg was administered to facilitate tracheal intubation. Anesthesia was maintained in group GA using sevoflurane at 1 minimum alveolar concentration end-tidal concentration in an air-oxygen mixture with an FiO_2 of 0.4 and 0.025–0.2 mcg/kg/min remifentanil infusion. The mean arterial pressure (MAP) was maintained within 20% of the preinduction value. The lungs were ventilated in a volume-control mode with a tidal volume of 7 mL/kg and 10 cmH_2O PEEP. The respiratory rate was adjusted to provide an $ETCO_2$ level between 30 and 35 mmHg. At the end of surgery, reversal of neuromuscular blockade was performed using neostigmine 50 mcg/kg and atropine 10 mcg/kg IV.

Patients in group SA were sedated with midazolam 1–2 mg IV and positioned with a horseshoe-shaped gel ring in the neutral position. When the patients were put into the prone position, the operating table

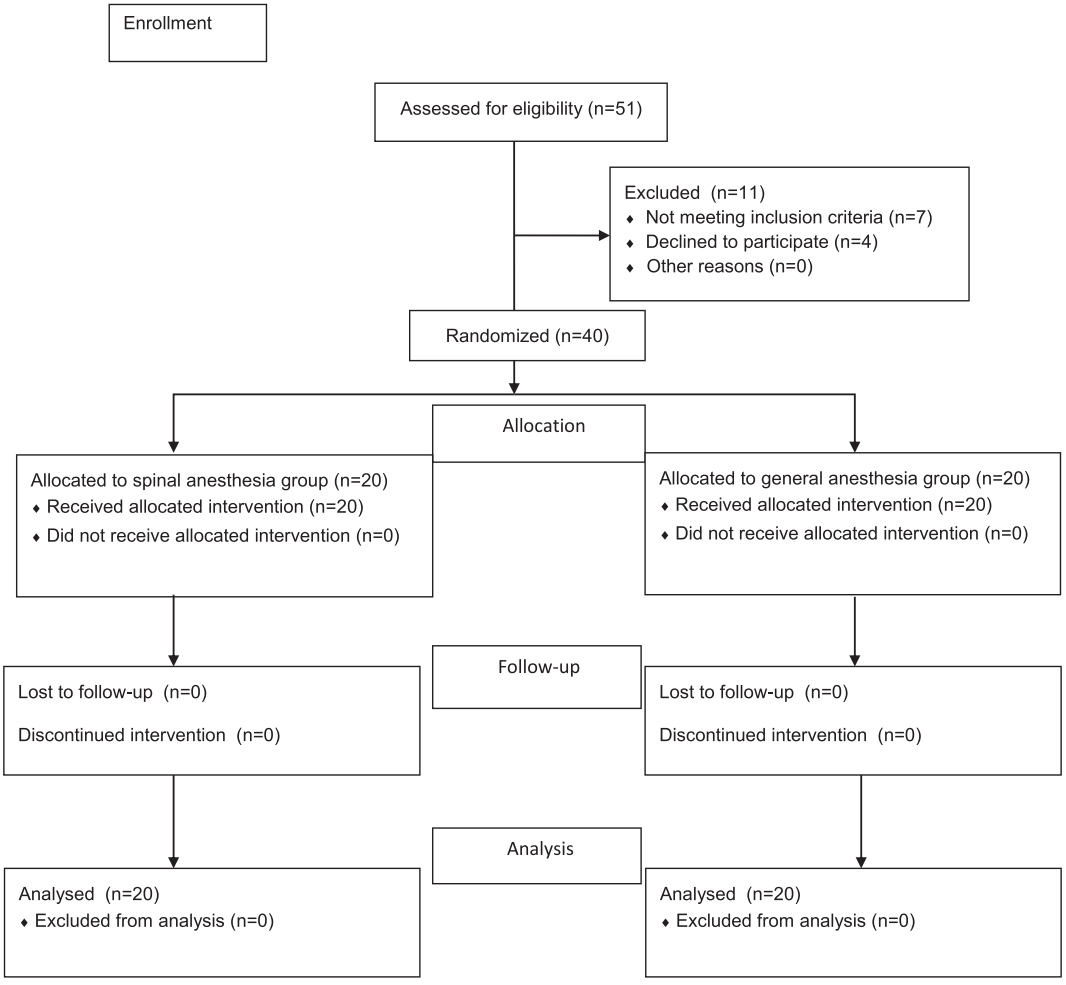

Fig. 1. Flowchart of the study groups.