Comparison of the effect of intravenous phenylephrin and ephedrine in treatment of hypotension after spinal anesthesia in cystoscopic surgery

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Abstract

Background: Hypotension may accompany cystoscopy during spinal anesthesia for which a variety of measures have been considered and none of which has accepted wide agreement. For that reason the present study was conducted.

Aim of the study: The objective was to study the changes in blood pressure during cystoscopy under spinal anesthesia in two groups of patients, one on ephedrine and the other on phenylephrin.

Patients and Methods: 100 patients were randomly assigned to two equal groups (n = 50). Randomization was done according to surgery list. Group 1 received ephedrine while group 2 received phenylephrine.

Results: Regarding systolic blood pressure, there was no significant difference in mean systolic blood pressure at baseline reading (P> 0.05); however, it was significantly higher in group 2 than in group 2 during follow up. Regarding diastolic blood pressure, there was no significant difference in mean diastolic blood pressure at baseline reading (P> 0.05); however, it was significantly higher in group 2 than in group 1 during follow up (P< 0.05). Regarding heart rate, there was no significant difference in mean heart rate at baseline reading (P> 0.05); however, it was significantly lower in group 2 than in group 1 during follow up (P< 0.05).

Conclusion: Phenylephrine is better than ephedrine in controlling hypotension after spinal anesthesia in cystoscopy.

Key words: Phenylephrine, ephedrine, spinal anesthesia, hypotension

Introduction

Spinal anesthesia (SA) consists of the temporary interruption of nerve transmission within the subarachnoid space produced by injection of a local anesthetic solution into cerebrospinal fluid (CSF). SA is a routinely used anesthetic technique for operations involving the lower limbs, lower abdomen, pelvic and perineal surgeries [1- 3]. An increasing proportion of the patients undergoing these surgical procedures are the elderly [4]. Age related changes in physiology and pharmacology can affect every aspect of peri-operative care [5]. The use of spinal anesthesia is increasing in popularity compared to general anesthesia [1, 2, 6]. Spinal anesthesia has many potential advantages over general anesthesia which include; less post operative pain, faster recovery time, less post-operative deep venous thrombosis, less blood loss and less post-operative confusion in the elderly age group, compared to general anesthesia (GA) [3, 7, 8, 9]. However, along with the analgesia, anesthesia and motor blockade, spinal anesthesia also induces a sympathetic block

that may cause hypotension, bradycardia, nausea, vomiting, dysarhythmia and rarely, cardiac arrest [10, 11, 12, 13].

Maintenance of hemodynamic stability from a sympathetic blockade after neuroaxial anesthetic techniques for cesarean delivery remains a significant clinical problem [14]. To counteract maternal hypotension, intravenous fluid and vasopressor drugs are required. Historically, ephedrine was considered the preferred vasopressor for management of spinal-induced hypotension in healthy parturient. Ephedrine has a relatively slow onset and long duration of action compared to phenylephrine and has a predominantly β-agonist effect [15]. Studies in pregnant ewes demonstrated that ephedrine was effective in maintaining arterial blood pressure and was associated with greater preservation of uteroplacental blood flow compared with other vasopressors [16, 17]. Historically, phenylephrine, a direct α1-agonist, was avoided due to concerns regarding potential uterine blood flow reduction [16]. However, more recent clinical evidence has consistently demonstrated that phenylephrine is effective for maintaining blood pressure during elective cesarean deliveries with spinal anesthesia, does not exert an adverse effect on the fetus and is associated with a lower rate of fetal acidosis compared to ephedrine [18, 19]. In 2002, a quantitative systemic review by Lee et al. examined the role of ephedrine and phenylephrine in obstetric patients. The authors reported that phenylephrine use was associated with higher umbilical arterial (UA) pH values compared to ephedrine [15]. Subsequent studies conducted in healthy parturient undergoing elective cesarean deliveries have consistently demonstrated that phenylephrine use reduces incidence of fetal acidosis compared to ephedrine [18-22] and is more effective at maintaining maternal blood pressure [20, 21] and preventing intraoperative nausea and vomiting (IONV) [18 - 21] compared to ephedrine. It has been demonstrated that ephedrine crosses the placenta to a greater extent than phenylephrine and stimulation of β-adrenergic receptors in the fetus results in an increased fetal metabolic rate [18 - 21]. Ephedrine-induced fetal tachycardia and acidosis appears to depend on dosage and timing of drug administration prior to delivery [21 - 23].

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patients receiving ephedrine and those receiving phenylephrine for the incidence of hypotension (seven RCTs), umbilical arterial pH values (two RCTs) and venous pH values (four RCTs). Substantial heterogeneity was observed for the outcomes of hypotension (I^2=67%) and umbilical arterial pH values (I^2=92%) [36].

Patients and methods

Prior to this study, all patients signed an informed written consent. The study was approved by the scientific council of Iraqi board of anesthesia and intensive care unit. The present randomized controlled clinical trial was carried out on 100 people, divided into two groups of 50 patients. The participants were in the age range of 35–65 years, with American Society of Anesthesiologists (ASA) physical status I–II (ASA I: Normal healthy patient, ASA II: Patient with mild systemic disease; no functional limitation) and were a candidate for elective cystoscopic surgery under spinal anesthesia. On arrival to the operating room all patients had a wide bore 18 G intravenous (IV) line, patients had one blood pressure and heart rate (HR) reading record, while lying comfortable in the bed in supine position before giving spinal anesthesia. Monitoring was standard and included non-invasive blood pressure, heart rate and pulse oximetry. The participants were randomly allocated to one of two groups (with 50 patients in each group, respectively). Immediately following spinal block, patients received a 2 ml bolus of the study drugs (ephedrine = 2.5 mg/ml or phenylphrine 25 mcg/ml) and thereafter another 5 mg bolus dose of ephedrine if the blood pressure dropped 20% below the baseline and repeated as necessary and in other group giving 50 mcg of phenylphrine if blood pressure decrease 20% below the base line and repeated as necessary. The block height was assessed by response to cold sensation using alcohol swab every 3 min until maximum block was achieved. Surgery was started as soon as upper level of sensory block reached T8. Oxygen 3-4 L/min was administered via a facemask throughout the operation. SBP, diastolic blood pressure (DBP), MAP, and HR was measured at 5-min intervals beginning immediately after spinal injection until 20 min and continuous monitoring till discharging from recovery room. Bradycardia (HR less than 60 beats/min) if associated with hypotension was treated with 0.5 mg IV atropine and patients were dropped from study. A backup plan was designed anticipating some critical events. These situations allowed the anesthesiologists to adopt any measure to manage all events. The data were recorded by the anesthetist conducting the spinal anesthesia. At the end of operation the total dose of vasopressor was noted. SBP, DBP, HR and O_2 saturation of patients were recorded at the admission to operating room (baseline), immediately after anesthesia (displayed as time 0), every 5 min till the end of the operation and discharge from recovery. Statistical analysis was done using SPSS software (version 20). Data were presented as mean ± SD unless mentioned otherwise. Analysis of mean fall of SBP in each groups were done by an independent sample *t*-test. Demographic data (mean ± SD) were compared between two groups by an independent sample *t-t*est. Outcome measures were compared by number needed to treat (NNT), proportion, and Chi-square tests as required. For all quantitative characteristics 95% confidence intervals were given.

Results

Table 1 showed comparison of systolic blood pressure readings between the study and control group. According to time the systolic blood pressure readings of

ephedrine group were 121.32 ±4.65, 101.52 ±7.31, 89.04 ±6.29, 110.03 ±6.82, 123.10 ±7.29 mmHg as baseline, 5, 10, 15 and 20 minutes, whereas, the readings in phenyleprine group were, 122.71 ±7.26, 118.22 ±5.11, 107.24 ±4.15, 121.09 ±5.23, 122.16 ±6.57 mmHg as baseline, 5, 10, 15 and 20 minutes, as shown in table 3.1. there was insignificant difference at the baseline reading ($P > 0.05$); however, systolic blood pressure was significantly lower in Ephedrine group during 5, 10 and 15 minutes and the level was equalized between the two groups at 20 minutes($P>$ 0.05). After, 20 minutes the readings were not significantly different (P > 0.05); therefore, readings after 20 minutes were not recorded. Table 2 showed comparison of diastolic blood pressure readings between the study and control group. According to time the systolic blood pressure readings of ephedrine group were 81.32 ±6.25, 78.52 ±8.21, 75.04 ±7.19, 70.03 ±7.72, and 81.10 ±6.39 mmHg as baseline, 5, 10, 15 and 20 minutes, whereas, the readings in phenyleprine group were, 82.71 ±6.17, 82.22 ±7.32, 81.24 ±5.07, 80.09 ±6.15 and 82.16 ±7.96 mmHg as baseline, 5, 10, 15 and 20 minutes, as shown in table 2. there was insignificant difference at the baseline reading ($P > 0.05$); however, diastolic blood pressure was significantly lower in Ephedrine group during 5, 10 and 15 minutes and the level was equalized between the two groups at 20 minutes ($P>$ 0.05). After, 20 minutes the readings were not significantly different (P > 0.05); therefore, readings after 20 minutes were not recorded. Table 3 showed comparison of heart rate readings between the study and control group. According to time the heart rate readings of phenyleprine group were 89.31± 8.04, 71.02 ± 6.39, 58.54 ±5.27, 79.53 ± 7.16 and 92.6 ± 8.33 beat / minutes, and 81.10 ±6.39 mmHg as baseline, 5, 10, 15 and 20 minutes, whereas, the readings in ephedrinegroup were, 88.41 ± 7.96, 86.92 ± 7.82, 75.94 ± 6.83, 89.79 ± 8.08 and 90.86 ± 8.18 beat / minute as baseline, 5, 10, 15 and 20 minutes, as shown in table 3. There was insignificant difference at the baseline reading ($P > 0.05$); however, heart rate was significantly lower in phenyleprine group during 5, 10 and 15 minutes and the level was equalized between the two groups at 20 minutes ($P>$ 0.05). After, 20 minutes the readings were not significantly different (P > 0.05); therefore, readings after 20 minutes were not recorded. There was no significant difference in oxygen saturation between the two groups throughout the entire study period, as shown in table 4.

Table 1: Systolic blood pressure in control and study groups

Time	Ephedrine group $n = 50$	Phenylephrine group $n = 50$	*P*
Baseline	121.32 ±4.65	122.71 ±7.26	>0.05
5 minutes	101.52 ±7.31	118.22 ±5.11	<0.05
10 minutes	89.04 ±6.29	107.24 ±4.15	<0.05
15 minutes	110.03 ±6.82	121.09 ±5.23	<0.05
20 minutes	123.10 ±7.29	122.16 ±6.57	>0.05

Table 2: Diasolic blood pressure in control and study groups

Time	Ephedrine group *n* = 50	Phenylephrine group *n* = 50	*P*
Baseline	81.32 ±6.25	82.71 ±6.17	>0.05
5 minutes	78.52 ±8.21	82.22 ±7.32	<0.05
10 minutes	75.04 ±7.19	81.24 ±5.07	<0.05
15 minutes	70.03 ±7.72	80.09 ±6.15	<0.05
20 minutes	81.10 ±6.39	82.16 ±7.96	>0.05

Table 3: Heart rate in control and study groups

Time	Phenylephrine group *n* = 50	Ephedrine group *n* = 50	*P*
Baseline	89.31± 8.04	88.41 ± 7.96	>0.05
5 minutes	71.02 ± 6.39	86.92 ± 7.82	<0.05
10 minutes	58.54 ±5.27	75.94 ± 6.83	<0.05
15 minutes	79.53 ± 7.16	89.79 ± 8.08	<0.05
20 minutes	92.6 ± 8.33	90.86 ± 8.18	>0.05

Table 4: Oxygen saturationin control and study groups

Time	Ephedrine group *n* = 50	Phenylephrine group *n* = 50	*P*
Baseline	98 %	99 %	>0.05
5 minutes	99 %	98 %	>0.05
10 minutes	98 %	99 %	>0.05
15 minutes	99 %	98 %	>0.05
20 minutes	98 %	99 %	>0.05

Discussion

Through and after medical procedure, mortality is influenced by the strategy for anesthesia and medical procedure. Pathophysiological changes related with age, comorbidities, and treatment with different medications make old individuals more touchy to drugs utilized all in all anesthesia for medical procedure. Spinal anesthesia is frequently utilized during cystoscopy. Hypotension is more pervasive in more seasoned individuals in this method [37]. In this study, the preventive impact of IV ephedrine and phenylephrine was contrasted with one another with forestall spinal anesthesia-prompted hypotension. It appears that the whole infusion of IV fluid can't forestall hypotension following the sympathectomy of spinal anesthesia and this impact can make various consequences for some patients [38]. In this study, the decrease in blood pressure was bring down in the gathering accepting IV phenylephrine contrasted with that in ephedrine in 5, 10, and 15 min and this distinction was factually huge. Thus, extra vasopressor measurement was utilized for the gathering accepting ephedrine to counteract hypotension. This distinction was measurably critical as well. Be that as it may, this distinction was not factually huge. Presently, vasoconstrictor is an option for the treatment of hypotension from ephedrine spinal anesthesia while it appears that the impact of the medication isn't appropriate for expanding pulse by invigorating the beta receptors for a more established individual, particularly with a past filled with coronary illness and causes heart complications [39]. So, phenylephrine which has not such reaction can be a reasonable option for these patients. In 2002, Husseini et al. looked at the impact of mucosal phenylephrine and IV ephedrine on the counteractive action of hypotension following spinal anesthesia. In the investigation, they didn't watch any distinction in the rate of hypotension between the two gatherings. Phenylephrine was utilized IV in our study which may mean the distinction in the outcomes got in different examinations contrasted with our study that the lessening of normal pulse was bring down in the IV phenylephrine contrasted with that in ephedrine in 5, 10, and 15 min [40]. In 2011, Alday Muñoz et al. looked at the impact of ephedrine and phenylephrine on the anticipation of hypotension because of the spinal anesthesia. In their examination, the capacity of ephedrine and phenylephrine was demonstrated the same in the aversion of hypotension amid cesarean area which was unique in relation to our investigation. Because of the physiological changes amid pregnancy incorporating changes in intravascular volume, cardiovascular record and pulse in pregnant ladies, the distinction in the kind of partook patients can influence the response of vasopressor drugs [41]. In 2009 in Brazil, Magalhães et al. assessed the effect of ephedrine and phenylephrine on the counteractive action of hypotension in spinal anesthesia for cesarean segment and in addition its consequences for baby and found that ephedrine is more powerful in the anticipation of hypotension than phenylephrine which was not quite the same as what was seen in our study [42]. Aragão et al. led an examination in 2014 in which they explored the preventive impact of metaraminol, phenylephrine, and ephedrine to avoid and treat hypotension in cesarean segment through spinal anesthesia. The rate of hypotension and pulse did not vary from one another which were diverse with our outcomes. Taking atropine did not vary among the gatherings and the quantity of individuals who requirement for atropine likewise did not factually contrast between two our considered groups [43]. This

randomized imminent study thought about the preventive impact of phenylephrine (50 µg IV) and ephedrine (10 mg IV) on counteracting hypotension after spinal anesthesia for cystoscopy. The acquired outcomes demonstrated that the normal hypotension was brought down in the gathering got phenylephrine and the distinction was critical. To acquire better and more precise outcomes, different techniques for utilizing these medications are prescribed in various surgeries.

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