



## Original Article

## Intrathecal Fentanyl with Small-Dose Bupivacaine: Stable Hemodynamics in Geriatric Population Undergoing Orthopedic Surgery

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## ABSTRACT

Fentanyl (FNL) has been used since long for the management of intense pain due to cancerous and non-cancerous diseases. Bupivacaine (BVP) is also a widely used local anesthetic used in surgery and obstetrics. **Objective:** To examine the clinical effect of small-dose (20 mcg) fentanyl added to spinal anesthesia with small-dose dilute bupivacaine (6 mg of 0.7% bupivacaine) on anesthesia quality and recovery. **Methods:** This study was conducted in Ayub Teaching Hospital after taking the ethical approval from hospital review board. Informed consent was obtained from all patients. Patients accepted for the study were all ASA I or II physical status presenting for ambulatory arthroscopic surgery of the knee. Sample size of 60 were determined by power analysis based on standard deviation data from our previously published report, P % 0.05, and the assumption of a 90% power to detect a 30-min difference in mean time to complete sensory recovery. **Results:** Total 60 patients were enrolled in current study. The mean age of patients was 78.52±8.22. There were 47(78.3%) male and 13(21.7%) were female. The hemodynamic changes from start of the procedure after 30 minutes were noted. The mean systolic blood pressure at base line was 120.65±18.197 and at 30 minutes was 118.98±14.39. The mean diastolic blood pressure at base line was 74.83±16.569 and at 30 minutes was 73.70±13.41. The mean heart rate at base line was 62.73±5.90 and at 30 minutes was 62.61±5.87. The mean heart rate at base line was 89.72±16.728 and at 30 minutes was 88.38±13.26. **Conclusion:** Intrathecal fentanyl with reduced dose bupivacaine in elderly patients undergoing orthopedic surgery maintains hemodynamic stability.

## INTRODUCTION

Spinal anesthesia is a neuraxial anesthesia technique where a regional anesthetic is injected directly in the intrathecal space or subarachnoid space. This space contains cerebrospinal fluid (CSF) that bathes the brain and spinal cord. It has approximately 130-140ml of CSF which remains in cycling throughout the day. An estimated of 500 ml of CSF is produced on daily basis [1]. Spinal anesthesia has been widely used for routine surgical procedures and cesarian sections as it is easy to operate, minimal hindrance to the normal physiology, patients remain conscious during the procedure and reduced risks of general anesthesia [1]. Fentanyl (FNL) was introduced approximately 60 years ago and has become the most

commonly used opioid for intraoperative analgesia. It has least cardiovascular effects, does not potentiate the release of histamine in plasma, rapid action and high efficacy, easy to use, cost-effective, easily available [2]. Previously used analgesics had side effects such as incomplete amnesia, histamine related reaction, respiratory depression after surgery. FNL provided a solution for these problems due to its lipophilicity [3]. Bupivacaine (BPV) is assumed as gold standard which has long-term local anesthetic effects during perioperative procedures [4]. Plain and hyperbaric BPV both are used and have distinctive pharmacologic properties but the cardiac output is same [5]. In a study the spinal anesthesia with 3

mL of 0.25% BPV in 4% glucose provided satisfactory anesthesia in all patients for arthroscopic knee surgery, with a recovery profile appropriate for ambulatory surgery (from the time of injection, 186 min until micturition and 202 min until discharge home). It has been observed that the combination of opiates and local anesthetics administered intrathecally has a synergistic analgesic effect [6-8]. Theoretically, there may be a clinical application for this phenomenon by using an opiate such as fentanyl in combination with a low-dose dilute solution of spinal bupivacaine. The latter may be short-acting but by itself is insufficient to provide neural blockade adequate for performing surgery. The addition of fentanyl potentiates the afferent sensory blockade to provide an acceptable surgical anesthetic. However, there is reason to believe that added fentanyl would not prolong the recovery of patients. This study was therefore designed to examine the clinical effect of small-dose (20 mcg) fentanyl added to spinal anesthesia with small-dose dilute bupivacaine (6 mg of 0.7% bupivacaine) on anesthesia quality and recovery.

## METHODS

This study was conducted in Ayub Teaching Hospital after taking the ethical approval from hospital review board. Informed consent was obtained from all patients. Patients accepted for the study were all ASA I or II physical status presenting for ambulatory arthroscopic surgery of the knee. Total 60 patients were enrolled in current study. Patients received no premedication. On arrival in the operating room, an intravenous (IV) infusion was started in all patients as fast running lactated Ringer's solution. All patients were monitored with automated blood pressure, pulse oximetry, and electrocardiogram. Patients were given midazolam 0.025- 0.05 mg/kg IV before turning to the lateral decubitus position for placement of the spinal block. Spinal needle of 25 gauge was introduced at L3-4 or L4-5. Low dose spinal anesthesia i-e, 6 mg bupivacaine + 20 mcg fentanyl was given. Oxygen was administered via a mask. Mean arterial pressure and heart rate were recorded at 0, 2, 10, 20, 30 minutes and at the end of the procedure.

## RESULTS

Total 60 patients were enrolled in current study. The mean age of patients was 78.52±8.22. There were 47(78.3%) male and 13(21.7%) were female. Table 1, shows the hemodynamic changes from start of the procedure after 30 minutes. The mean systolic blood pressure at base line was 120.65±18.197 and at 30 minutes was 118.98±14.39. The mean diastolic blood pressure at base line was 74.83±16.569 and at 30 minutes was 73.70±13.41. The mean Heart rate at base line was 62.73±5.90 and at 30 minutes was 62.61±5.87. The mean Heart rate at base line was 89.72±16.728 and at 30 minutes was 88.38±13.26. The hemodynamic parameters

remain same throughout the study timings..

Variables	Baseline	At 2 min	At 10 min	At 20 min	At 30 min
BP (Systolic)	120.65±18.197	117.80±16.150	118.62±15.38	119.10±15.70	118.98±14.39
BP (Diastolic)	74.83±16.569	71.28±12.648	73.18±13.868	73.75±12.56	73.70±13.41
HR	62.73±5.90	64.10±6.21	62.93±6.09	62.33±5.77	62.61±5.87
MAP	89.72±16.728	86.43±14.20	88.23±13.73	88.43±13.191	88.38±13.26

**Table 1:** Hemodynamics Parameters

## DISCUSSION

Spinal anesthesia causes sympathectomy induced drop in blood pressure. There is decreased venous return and thus hypotension is one the most common complications of spinal anesthesia and require adequate expansion of intravascular volume. The factors associated with the development of hypotension are age, baseline blood pressure, level of spinal puncture, peak block height, anesthetic baricity, volume, addition of phenylephrine in the local anesthetic and combination with general anesthesia [9,10]. Even though it has never been shown to lower mortality in orthopedic surgery, spinal anesthesia is commonly used in the elderly. It has not been shown to lower mortality as compared to epidural or general anesthesia. Due to its benefits like minimal mental status derangement and protection against thromboembolic complications, this mode of anesthesia is often preferred but it also comes with risk of prolonged and severe hypotension since the elderly cannot compensate for the changes in body systems, they are at greater risk. The vasodilation occurred due to effect of spinal anesthesia, the transient loss of accommodation of vasoconstrictive capability of vessels are responsible for this increase in morbidity [11]. There are concomitant diseases in the elderly which make them vulnerable to adverse effects. The growth of total geriatric population and the increase in orthopedic patient pool has led to increased number of orthopedic surgeries on the elderly. Thus, the elderly is at greater risk than before. Continued spinal anesthesia has been found by Favarel-Garrigues J et al., to be of lesser hemodynamic consequence as compared to single dose spinal anesthesia. Even though the same dose of anesthesia was given to the patients and none required further anesthesia administration, almost all of the single dose spinal anesthesia patients received vasopressor ephedrine while only 40% of the continued spinal anesthesia group did. These results were explained by the slower onset of segmental block in continuous anesthesia. As a result, continued spinal anesthesia may be the preferred technique for orthopedic surgery of the lower limb in the elderly population when hemodynamic stability

is an issue [11]. Chan et al., demonstrated a decrease in mean arterial pressure in their study. Hemodynamic measurements of heart rate, arterial pressure, cardiac output, ejection fraction and stroke volume were made after the induction of anesthesia. They found out that there was no significant difference in the maximum drop in mean arterial pressure in the three groups into which he had distributed the participants. Hypotension developed in standard as well as the 50% and 75% titrated dose groups [12]. Valentin et al., studied mortality in patients undergoing surgery above the age of 50 and compared the results of spinal versus general anesthesia where bupivacaine and enflurane or neuroleptics were used respectively. Thirty days after the surgery, the mortality in spinal anesthesia patients was two percent less (6%) the general anesthesia mortality (8%). Six months to 2 years post operatively the mortality was similar. The patient receiving spinal anesthesia had lesser blood loss ( $p < 0.05$ ) as compared to general anesthesia. They also determined that short termed mortality was related to age, trochanteric fracture, males and high ASA scores [13]. Elderly patients of age more than 65 years undergoing orthopedic surgery were also studied by Casati A et al., from anesthesia point of view. A randomized prospective study was conducted and spinal and general anesthesia were compared. Unilateral spinal block via small doses of bupivacaine (hyperbaric) and sevoflurane were used. As far as hypotension is related, 7 (46%) of spinal group versus 12 (80%) of sevoflurane group manifested decline in blood pressure ( $p = 0.05$ ). The heart rates of the patients were found to be such that general anesthesia patients had lower heart rates in the first hour of induction of anesthesia ( $p = 0.01$ ). Bradycardia was seen in 3 (22%) of the general anesthesia patients. The post-operative stay of the patients in the recovery ward was 15 (range 5-30) minutes in spinal patients while it was 55 (15-80) minutes in general anesthesia group. Cognitive function was also more declined in the general anesthesia patients [14]. Pitakanem M et al., also observed changes in cardiovascular parameters in the induction of anesthesia. During induction of blockade, a mean of 22 mmHg blood pressure was dropped during induction. Only patients who required vasopressors were a few elderly patients, because their systolic arterial pressure had declined by 35-70 mm Hg and symptoms of hypotension were developing. The elderly population also showed more decline in blood pressure with the increase in the level of anesthesia. For the height of sensory analgesia and the decrease of the systolic pressure in the first 60 min, a correlation was established which was  $r = 0.7$  and  $0.01 < p < 0.05$ . They also demonstrated that the spread of spinal anesthesia was twice as fast in the elderly as compared to the young, the

elderly being more than 70 years of age in that study, which could explain the faster spread leading to more rapid decrease in arterial blood pressure in this population [15]. Covert CR et al., studied anesthesia for hip surgery in the elderly population. Since hip surgeries are typically performed on elderly patients due to degenerative causes, fractures and joint replacement. If perioperative prophylaxis of deep venous thrombosis is required, regional anesthesia might be contraindicated, as hip fracture patients require adequate pre-operative stabilization. According to their study, the magnitude and frequency of hypotensive episodes is increased in regional anesthesia as compared to general anesthesia. Better oxygenation post operatively was observed in spinal group. Incidence of deep vein thrombosis is decreased in spinal group as well as blood loss, with regional anesthesia although general anesthesia with controlled hypotension also reduces blood loss. Impaction of femoral prosthesis may be followed by intraoperative instability which can be hypoxemia, hypotension and cardiac arrest, and is also related with pulmonary embolism of fat, platelet-fibrin aggregates, air and acrylic cement. Pulmonary embolism was found to be the commonest cause of death in hip surgery in the elderly and operative mortality was less than one percent [16]. Nighingale PJ et al., studied spinal anesthesia for orthopedic procedures in the elderly population. 410 patients undergoing surgeries on their lower limbs for orthopedic indications were studied. The extent of analgesia was for the whole surgery, of a duration of about 250 minutes and successful in 96.6% patients. They recorded that the decline of arterial blood pressure was of higher incidence in the elderly population undergoing orthopedic surgery. It was also the most common complaint and 37.7% of the patients required sympathomimetic therapy [17]. Djokovic et al., studied outcome of anesthesia and surgery in patients over 80 years of age. 500 patients were studied. One-month mortality was 6.2%. American Society of Anesthesiologists scale of class 1 to 5 preoperative evaluation was applied, the class of evaluation was directly proportional to incidence of mortality [18]. FNL is being used widely across the world for the postoperative analgesia and needs further improvements in techniques. BPV is observed to be more hypobaric and the maximum sensory block level achieved for BPV owes to its baricity [19]. BVP produces quicker sensory and motor spinal blockade to a maximum level. BPV is suggested for surgeries which require greater sensory blockade and longer duration of postoperative analgesia as well as in emergency surgical procedures [20].

## CONCLUSION

Intrathecal fentanyl with reduced dose bupivacaine in

elderly patients undergoing orthopedic surgery maintains hemodynamic stability.

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