# Body Surface Area and Age as a Guidance of the Dose of Intrathecal 0.5% Heavy Bupivacaine and Fentanyl in Transurethral Procedures

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***Objective:*** *Observe the potency of various drugs doses as milliliters of 0.5% heavy bupivacaine with or without fentanyl for spinal block in transurethral cystoscopic procedures. These doses were calculated from patients and drugs' characteristic risk factors that interfered with intrathecal drugs spread as weight, height, age, volume, and baricity. Various doses of fentanyl were also added to increase potency of block as necessary except the oldest group.*

***Material and Method:*** *One hundred fifty two ASA I-III adult patients, of both sexes, aged 19 to 80 years, and scheduled for elective transurethral cystoscopic surgery, were allocated into four groups of age and doses (formulated by earlier studies and the authors' own experiences). Group 1 was the 16 to 59-years-old, n = 32, and received [0.5% hyperbaric bupivacaine in ml (= 5/4 body surface area) + 12.5 mcg fentanyl]. Group 2 was the 60 to 70-years-old group, n = 65, and received [0.5% hyperbaric bupivacaine in ml (= 1 body surface area) + 10 mcg fentanyl]. Group 3 was the 71 to 75-years-old group, n = 35, and received [0.5% hyperbaric bupivacaine in ml (= 3/4 body surface area) + 7.5 mcg fentanyl]. Finally, group 4 was the > 75 years old, n = 20, and received [0.5% hyperbaric bupivacaine in ml (= 3/4 body surface area) without fentanyl]. The statistical analysis included hemodynamic parameters and side effects. Post-hoc analysis was done using ANOVA among the four groups and logistic regression to find any association with successful outcomes.*

***Results:*** *Eighty-eight percent of the blocks were successful without analgesic supplements (VAS < 2). The mean onset time (sensation loss to T10) of patients started at 5.4 ± 1.4 minutes, time to regress to T11 (expected duration of operable time) was 119.7 ± 37.9 (45-255) minutes, time to leg up (expected ready to discharge) 132 ± 39 (65-250) minutes. Hypotension was strikingly low in the study (8%), while bradycardia was 16%, similar to other reports. The other side effects were pruritus 2%, nausea 7%, and vomiting 1%. Total successful without any supplement was 87.5% but increase to 93.4% with low dose of fentanyl < 50 mcg intravenously. The formulas predicted less successful blocks for the oldest age groups that LA dose less than 1 BSA, and fentanyl added had a significant weight on the outcomes (OR 1.2635, 95% CI 1.0719 -1.4894).*

***Conclusion:*** *Age and body surface area guided spinal anesthesia is safe. The dose of bupivacaine is lower when combined with fentanyl. Furthermore, hemodynamic stability is better. The technique is suitable for transurethral procedure within 60 minutes but not in longer operation time. Additionally, it needs patients' cooperation due to less potent of motor and pressure sensation block.*

***Keywords:*** *Hyperbaric bupivacaine, Intrathecal fentanyl, Spinal anesthesia, Transurethral cystoscopic surgery, Body surface area (BSA)*

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Spinal anesthesia is a common procedure in anesthetic practice because of its high quality and safety. Undesirable effects of the technique are well known. They are hypotension, bradycardia, shivering, and even cardiac arrest. In general, related factors that involve the extent of dermatome blockade are patient (age, weight, height, and CSF volume), drugs (volume, concentration, baricity, and temperature), and technique (site, midline or paramedian, and barbotage)[1,2]. These factors cause variation of drug dosage chosen by each anesthesiologist. Spinal anesthesia is preferred in transurethral cystoscopic surgery (TCS) especially for

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geriatric patients in terms of less confusion and delirium in early postoperation[3]. The addition of narcotics such as fentanyl can decrease local anesthetic dose and maybe the adverse sequels, especially as cardiovascular effect[4,5]. Because there are no exact doses recommended for patients, the authors proposed doses by using drug factors (volume and baricity), patient risk factors (age, height, and weight) from other studies[1,2,4-9], and the authors' own experience to estimate drug doses. The authors classified into four groups and combined two of patient's risk factors (weight and height) to form one risk factor (body and surface area).

The objective of the present study was to assess the age and BSA-guided dose of spinal anesthesia and verify the hypothesis about safety-related superiority of this technique over arbitrarily chosen dose for urologic procedures. Calculation of BSA[10] was BSA = [Height (cm) + Weight (kg) - 60] /100

**Material and Method**

After approval by the Institutional Ethics Committee of Siriraj Hospital, Mahidol University, Thailand and obtaining written informed consents, 152 patients scheduled for TCS were enrolled in the prospective descriptive study. The exclusion criteria were age < 16 or > 85 years old, ASA status > III, allergy to bupivacaine and/or fentanyl, weakness of lower extremities or muscle diseases, history of drug abuse, pregnancy, and other contraindications to spinal anesthesia.

The patients were allocated by age into four groups. The spinal local anesthetic dosage was categorized by age and calculated by body surface area (BSA) using the following formulas:

Group 1, age 16 to 59: Drug dose = [(5/4 x BSA) ml of 0.5% hyperbaric bupivacaine] + [12.5 mcg fentanyl]

Group 2, age 60 to 70: Drug dose = [(BSA) ml of 0.5% hyperbaric bupivacaine] + [10.0 mcg fentanyl]

Group 3, age 71 to 75: Drug dose = [(3/4 BSA) ml of 0.5%hyperbaric bupivacaine] + [7.5 mcg fentanyl]

Group 4, age 76 to 85: Drug dose = [(3/4BSA) ml of 0.5%hyperbaric bupivacaine]

On the day of surgery, the patients were premedicated with midazolam 1 to 2 mg intravenously as required, and drugs for their coexisting diseases before anesthesia. In the operating room, standard monitoring of vital signs was initiated. Prior to anesthesia, patients were administered intravenous infusions of crystalloid solutions 10 to 15 ml/kg for 30 minutes, lower extremities were wrapped with elastic bandage and oxygen via face-mask was given. Spinal anesthesia was done in the lateral decubitus position using intrathecal drugs as the calculated dose.

The subarachnoid space was identified from a midline or paramedian approach, at the level of the L3-L4, using a 26- or 27-G Quincke needle with the guide. Once free outflow of CSF was obtained, the solution was injected for 10 to 15 seconds. During the anesthetic administration, the needle bevel was directed parallel to the spine without barbotage. Then, the patient was put on a plane supine position, noninvasive blood pressure was recorded every 2.5 minutes until stable and changed to every 5 minutes afterwards. Dermatome level of sensory blockade was determined by pin- prick sensational loss bilaterally. The surgery was started after sensory loss at least above T10. The movement of toes was assessed at 5 and 10 minutes for intensification of motor blockade.

Hypotension was defined as a decrease in systolic arterial blood pressure by over 20% compared to baseline values or systolic blood pressure < 90 mmHg. In such cases, the rate of crystalloid administration was increased. If this management failed, patients received ephedrine and/or norepinephrine (Levophed@) as necessary. Bradycardia was diagnosed as a reduction in heart rate below 50 beats per minute. Incidence of bradycardia was managed using atropine 0.4 to 0.6 mg, if the heart rate was less than 45 and or with hypotension.

Statistical calculations were based on Numbers (Universal) with Mac OS X 10.7.1. The means, standard deviations, and ranges were calculated. Post hoc analysis was conducted using SPSS ANOVA and logistic regression calculation online at http://statpages.org/logistic.html. $P < 0.05$ was considered statistically

**Results**

One hundred fifty two patients were enrolled and divided in the four age-groups. Mean ± SD (range) of ages, weight, height, body surface area, milliliters of intrathecal 0.5% hyperbaric bupivacaine, and micrograms of intrathecal fentanyl are shown in Table 1. There was statistically significant difference in LA dose, $p < 0.05$.

Operative times and effectiveness of studied drugs doses in each group were recorded. According to the requirement of the least sensory loss at the block level at T10 needed for transurethral procedure, the authors found mean onset time from finishing block to the time of pinprick sensation loss at T10 were 5.4 ± 1.4 minutes. The authors had limitation when observing for motor blockade because surgery had to begin as soon as possible. Therefore, the authors could only measure motor block as ability to move legs at 10-minute and found that only 34% of the patients could not move their feet. The authors recorded the time as return of pinprick sensation down to T11. Based on this, the mean expected operable duration of block of the recent studied drug doses was 119.7 ± 38 minutes. However, most patients had partial recovery of pressure and touch sensation that caused unpleasant feeling when the operation was still going on. Thus, some of them needed some more drugs intravenously as supplement (small doses of narcotic or sedative). Safety time for discharge from recovery room was the time when the patient could raise the legs up. The mean time was 132.0 ± 39.1 minutes. These parameters are shown as in Table 2. Onset of sensory block at T10, number of patients who had complete motor block at 10 minutes and regression of sensory block to T11 assessment were done but there was no statistical significance.

Success of blockage with studied doses was recorded if visual analog pain scale < 2 during operation. It was found in 88% of the patient from all groups. The authors grouped those who could not tolerate the operation and needed Total IV Anesthesia with propofol and or fentanyl > 50 mcg as failure group. The authors grouped as supplement group if the operation was a success with ≤ fentanyl 50 mcg or less were added to enable operable conditions within 60 minutes. Percentages of patients in the four groups

**Table 1.** Allocation of 4 groups that had equal mean body surface area (BSA) characteristic but varied in intrathecal doses of 0.5% hyperbaric bupivacaine + fentanyl in each group according to age groups

| Group; number, gender | Age; yr (min-max) | Weight; kg (min-max) | Height; cm (min-max) | BSA (min-max) | HBP 0.5% (ml) | Fen (mcg) |
|---|---|---|---|---|---|---|
| Gr 1; n = 32 (21.1%)<br>M = 27, F = 5 | 48.2 ± 9.9<br>(19-59) | 64.7 ± 10.9<br>(49.2-87.0) | 163.2 ± 8.3<br>(150-179) | 1.7 ± 0.2<br>(1.4-2.1) | 2.1 ± 0.2<br>(1.8-2.6) | 12.5 |
| Gr 2; n = 65 (43.4%)<br>M = 63, F = 2 | 65.3 ± 3.2<br>(60-70) | 65.5 ± 10.14<br>(42.1-89.0) | 164.4 ± 6.4<br>(146-181) | 1.7 ± 0.1<br>(1.3-2.1) | 1.7 ± 0.1<br>(1.3-2.1) | 10.0 |
| Gr 3; n = 35 (23%)<br>M = 34, F = 1 | 73.3 ± 1.3<br>(71-75) | 61.7 ± 8.9<br>(47.0-90.0) | 162.6 ± 8.3<br>(150.5-179.5) | 1.7 ± 0.2<br>(1.4-2.1) | 1.3 ± 0.1<br>(1.1-1.7) | 7.5 |
| Gr 4; n = 20 (12.5%)<br>M = 18, F = 2 | 78.2 ± 1.5<br>(76-80) | 63.3 ± 10.9<br>(44.0-81.0) | 162.2 ± 7.3<br>(148-175) | 1.7 ± 0.2<br>(1.4-2.0) | 1.3 ± 0.1<br>(1.1-1.5) | - |
| Total; n = 152 (100%)<br>M = 142, F = 10 | 65.2 ± 11.1<br>(19-80) | 64.2 ± 10.1<br>(42.1-90.0) | 163.5 ± 7.3<br>(146-181) | 1.7 ± 0.2<br>(1.3-2.1) | 1.6 ± 0.4<br>(1.1-2.6) | 8.6 |

M = male; F = female; HBP = hyperbaric bupivacaine; Fen = fentanyl
Statistically significant difference in LA dose, $p < 0.05$

**Table 2.** Effectiveness of drugs in each groups: onset as sensational loss at T10, number patients with complete motor block at 10thmin, sensory block regress to T11 (operable time), discharge and operation times

| | Sensory loss at T10 (minute) (min-max) | $10^{th}$ min complete motor block | Regress to T11 (minute) (min-max) | Discharge (minutes)* (min-max) | Operation time (minutes) (min-max) |
|---|---|---|---|---|---|
| Gr 1 | 5.2 ± 0.9 (5-10) | 14/18 (44%) | 123.8 ± 36.0 (55-190) | 138.7 ± 29.7 (75-190) | 46.3 ± 28.2 (20-160) |
| Gr 2 | 5.4 ± 1.3 (5-10) | 19/45 (30%) | 124.4 ± 37.9 (65-230) | 136.8 ± 44.0 (65-250) | 57.4 ± 32.6 (15-130) |
| Gr 3 | 5.7 ± 1.7 (5-10) | 13/22 (37%) | 119.1 ± 42.8 (50-255) | 127.8 ± 36.6 (65-210) | 56.1 ± 33.3 (20-150) |
| Gr 4 | 5.3 ± 1.1 (5-10) | 5/14 (26%) | 99.1 ± 25.9 (45-150) | 112.5 ± 29.8 (65-165) | 61.5 ± 28.2 (30-150) |
| Total | 5.4 ± 1.4 (5-10) | 51/99 (34%) | 119.7 ± 37.9 (45-255) | 132.0 ± 39.1 (65-250) | 55.3 ± 31.3 (15-160) |

Sensory loss test by pinprick, $10^{th}$ min complete motor block = could not move toes, Regress to T11 (minute), Discharge time* = time that patients could raise up their legs (no statistical Significant difference among group; $p = 0.05$)

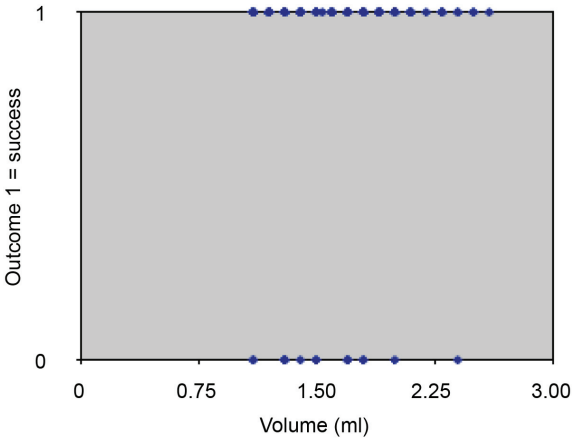


**Fig. 1** Association between successful outcomes and milliliter of ml 0.5% hyperbaric bupivacaine (some single dot represent an overlap of data). No statistic significant by using logistic regression (p = 0.05)

who underwent surgery without any supplements were 90.6, 92.3, 88.6, and 65% respectively. The highest success rate was in group 2 (92.3%), and highest failure rate was in group 4 (25%), which received the lowest dose of local anesthetic drug and no fentanyl added in spinal block as in Table 3.

Logistic regression found the statistical association between volumes derived from BSA-guided formulas plus fentanyl and successful spinal blocks (p = 0.0057). Odds ratio (OR) for every added fentanyl is 1.2635 with 95% CI = 1.0719-1.4894. All ages also correlate with the outcomes, OR 0.9344 (95% CI 0.8747-0.9981) as in Fig. 1. Association was found between doses of 0.5% hyperbaric bupivacaine (ml) and successful outcomes (n = 152).

Side effects as pruritus, nausea, or vomit were less than 3%. Bradycardia was found in 16% and hypotension in 8% (Table 4.) There was neither respiratory depression nor postdural puncture headache in the present study follow-up.

Relation between receiving antihypertensive drugs and rate of bradycardia and hypotension are shown as in Table 5. Bradycardia seemed to correlate with frequency of antihypertensive medication use in older age groups but occurrence of hypotension were equal in patients who received or did not receive antihypertensive drugs. (History of previous antihypertensive drugs used was asked and recorded only in 131 from 152.)

Paracetamol was prescribed for postoperative pain relief and found that: enough for 47 patients while 26 needed combined narcotics like morphine, pethidine, or tramadol. Seventy-four patients' pain medications were not recorded.

**Table 3.** Success rate of allocation groups (%)

| Group (n) | Success (n) | Failure (n) | Supplement (n) |
|---|---|---|---|
| 1 (32) | 90.6% (29) | 6.3% (2) | 3.1% (1) |
| 2 (65) | 92.3% (60) | 1.5% (1) | 6.2% (4) |
| 3 (35) | 88.6% (31) | 5.7% (2) | 5.7% (2) |
| 4 (20) | 65.0% (13) | 25.0% (5) | 10.0% (2) |
| Total (152) | 87.5% (133) | 6.6% (10) | 5.9% (9) |

Success = success of operation with VAS < 2 without any supplement, failure = need added TIVA and or fentanyl > 50 mcg, supplement = need added only fentanyl < 50mcg

**Table 4.** Side effects and hemodynamic changes (n = 152)

| Parameters | Data |
|---|---|
| Pruritus | |
| No | 149 (98%) |
| Yes | 3 (2%) |
| Nausea | |
| No | 142 (93%) |
| Yes without treatment | 7 (5%) |
| Yes with treatment | 3 (2%) |
| Vomiting | |
| No | 151 (99%) |
| Yes | 1 (1%) |
| Bradycardia | |
| No | 129 (84%) |
| Yes without treatment | 8 (5%) |
| Yes with treatment (if heart rate < 50 beat per minute, and or with hypotension) | 15 (11%) |
| Hypotension | |
| No | 140 (92%) |
| Yes | 12 (8%) |

**Table 5.** Relationship of receiving antihypertensive drugs and risk for bradycardia and hypotension

| | Hypotensive drugs | | Total |
|---|---|---|---|
| | No | Yes | |
| No bradycardia | 61 (55.5%) | 49 (44.5%) | 110 (100%) |
| Bradycardia | 6 (28.6%) | 15 (71.4%) | 21 (100%) |
| No hypotension | 61 (51.3%) | 58 (48.7%) | 119 (100%) |
| Hypotension | 6 (50%) | 6 (50%) | 12 (100%) |

**Discussion**

The present study was done to prove the authors' main theory that BSA and age could determine dose of drugs usage for regional block in TSC. Weight and height might reflect of area that the authors want to block and reflect length of spine that might also represent volume of CSF. These should be a main risk factor to predict doses of drugs spread. Feingold A. preferred BSA to body weight (height also correlates to length of spine that interfered to drug spread) in calculating local anesthetic dose for spinal anesthesia in both children and adults[11].

The authors intended to use lower drug doses, less than BSA, in the elderly[2,8] who were at greater risk from their own systemic diseases (Gr 3, 4; Table 1). Some studies suggest decreasing dose according to anatomical and physiological change by age. Furthermore, hyperbaric local anesthetic drugs had additive effect among volume, dose, and gravity for cephalic distribution of drugs in higher ages[1,13-15]. However, this caused less intense motor, pressure, and tactile block that more adjuvant drugs needed.

In general, body weight is usually used for drug doses calculation. Spinal anesthesia is popular for TCS for which the level of sensory blockade required is T10 and the duration of the surgical procedure rarely exceeds 60 minutes. The lumbosacral cerebrospinal fluid (CSF) volume is the most important factor identified that contributes to the spread of spinal anesthesia[12]. Since CSF volume cannot be readily predicted, uncertainty in the extent and duration of spinal anesthesia is inevitable. Although some believed that age or height are minor and these factors alone could not predict block level[11,12]. The current practice depends on individual experience technique. Based on the belief and the authors' observations, 0.5% hyperbaric bupivacaine less than 5mg (1 ml) will not produce adequate surgical condition.

Lumbar block for operations on legs, groin, and hernias recommends 2 to 3 ml of 0.5% hyperbaric bupivacaine[15]. For 3-ml dose in the elderly, the median time to reach the highest level T7 was reported to be approximately 15 minutes[16], while 2-segment regression from T10 in the other report of the same dose in 30-degree elevation of torso was over 240 minutes[17]. Michele C et al studied 2 mg (< 0.5 ml) durations of pinprick anesthesia, walking and voiding abilities to be 86 ± 37,129 ± 18, and 184 ± 36 minutes respectively[18]. Gentili found that 6 to 8 mg (1.2-1.6 ml) of hyperbaric bupivacaine provide adequate sensory block within about 1 hour of mean duration[11]. The authors used average 1.64 ml of 0.5% local anesthetic with the onset over 90% at the fifth or sixth minute, time to regress from T10 above 100 minutes, leg up and discharge after 132 minutes (Table 2).

The others important factors that determine block height are baricity, specific gravity of local anesthetic solution, position, doses, and site of injection. The use of fentanyl could change the baricity of the solution. Hare et al calculated the final density of 0.5% hyperbaric bupivacaine 1.5 ml and fentanyl 25 mcg to be 1.013 gm. per ml, which was still higher than that of CSF[11]. The authors also measured specific gravity of mixed drugs solution (fentanyl + 0.5% heavy bupivacaine) then compared to patient's CSF and found that fentanyl did decrease specific gravity of mixed drugs, anyhow always still higher than CSF. Because the doses that were used were small, they avoided head up or down position that might interfere with the height of the block. The addition of fentanyl intensifies and increases the duration of sensory blockade but neither of motor nor prolonging recovery. In the present study, 12.5, 10, and 7.5 mcg of fentanyl were added to the first three groups (failure rate 5.7-6.3%) but not in the fourth group (failure rate 25%). Based on the authors' observations that all groups had equal mean BSA, decreasing dose to less than BSA in Group 3 and 4 could increase the failure rate. Even in the elderly, volume ¾ BSA of pure 5% hyperbaric bupivacaine is not enough for TCS. This dose needed to be adjusted. Dinesh M et al (15) found that 2.5 or 5 mg (1 ml) plus 25 mcg fentanyl provided a suitable block for urologic procedure but 43% needed intravenous midazolam. In the present study, overall quality of analgesia was acceptable (VAS < 2) for 88% of the patients. The presented patients requested 3 to 10% supplement (Table 3). Only 10/152 (6.6%) patients needed intravenous propofol and/or big doses of fentanyl and felt discomfort during operation and rated spinal anesthesia as inadequate for them. Nine patients (5.9%) needed only supplement with small doses of intravenous fentanyl (50 mcg or less), especially when the operation was longer than 60 minutes. Operating conditions were rated as fair to good by surgeons.

Many authors assessed the spinal anesthetic technique of interest as to the incidence of adverse events. However, the reported results vary. The incidence of hypotension in all groups of patients was 8%, compared to Liu SS et al study that the incidence of hypotension was around 33%[19]. Vorrakitpokatorn P et al reported the incidence of hypotension in spinal anesthesia for TURP (during

year 2008-2009) was 36.7% and one of the risks was the dose of hyperbaric bupivacaine over 12.5 mg (2.5 ml) ($p = 0.007$, adjusted OR = 2.84)[20]. Hypotension is common during spinal anesthesia and can be fatal to the elderly patients. Sixty-nine percent of the elderly required treatment for hypotension[12] while the authors did only 8% (Table 4). In these patients, four in 12 hypotensive patients were treated with two or three repeated doses of norepinephrine and ephedrine, while the other eight hypotensive patients needed only one dose of 4 mg of norepinephrine or 6 mg of ephedrine. No statistical correlation exists between antihypertensive medications and intra-operative hypotension (Table 5).

Similar to Pollard JB[21], bradycardia was 16% (23/152) of whom 15 patients (11%) received intravenous atropine. The patients who received highest doses of fentanyl mixed with hyperbaric bupivacaine did not have an increased risk of bradycardia, which supported Khan's study that spinal narcotics only enhance the sensory blockade of local anesthetics without affecting the sympathetic activity[22]. The present study found the incidence of nausea was 7% and vomiting 1%. This was lower than Khan et al study of 15% after 2 ml of 0.75% bupivacaine plus 10 mcg of fentanyl. The incidence of pruritus after fentanyl 25 mcg is generally 22.5%[23], much higher than 2% in the present study (Table 4). Severe pruritus is rare, occurring in only about 1%. None of the three patients needed treatment. The overall view of side effects from BSA-guided spinal anesthesia is thus acceptably safe.

With this technique, the profile of spinal anesthesia such as onset, duration, regression of sensory blockade, leg up time, and so forth is another useful alternative for TCS lasting within 60 minutes.

Post hoc analysis confirmed the correlation between BSA-guided doses (ml) of 0.5% hyperbaric bupivacaine plus fentanyl (mcg) and the successful blocks, predicting 1.2635 times success for every step of adding the narcotics. In overall view, for each year older, the success decreases 0.9344. There was no statistical significance between only volume of 0.5% hyperbaric bupivacaine and successive rate ($p = 0.05$) as in Fig. 1.

Limitation of the present study was the non-uniform distribution of patients in the four groups, non-thorough assessment of blockade quality of both sensory and motor in draped lithotomy position, and poor communication in old age. Lastly, because the hospital is the center for referral of complicated patients and it is the location for resident training, the operative time is often longer.

**Conclusion**

1. The BSA-guided spinal anesthesia with lower doses of local anesthetics provides good conditions of intraoperative analgesia for TCS especially with duration not more than 60 minutes.

2. The technique is not complicated but the surgical team needs to understand the effects of having patients with less intense motor blockade.

3. The technique ensures higher intraoperative hemodynamic stability.

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**Potential conflicts of interest**

None.

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## การกำหนดขนาดยาชา 0.5% bupivacaine ชนิดหนักผสมกับ fentanyl โดยใช้อายุและจำนวนพื้นผิวกายเพื่อใช้ในการให้ยาชาเข้าช่องสันหลัง สำหรับการผ่าตัดภายในกระเพาะปัสสาวะโดยวิธีส่องกล้อง

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***วัตถุประสงค์:*** *เพื่อศึกษาความเป็นไปได้ถึงการนำขนาดต่าง ๆ ของพื้นที่ผิวกายของผู้ป่วย และอายุ เพื่อใช้ในการทำผ่าตัดส่วนล่างของทางเดินปัสสาวะ โดยวิธีส่องกล้องผ่านทางเดินปัสสาวะส่วนล่างเข้าสู่กระเพาะปัสสาวะ (transurethral cystoscopic surgery; TCS)*

***วัสดุและวิธีการ:*** *ทำการศึกษาโดยวิธี prospective descriptive study หลังจากได้รับอนุญาตจาก ethic committee ของโรงพยาบาลศิริราช มหาวิทยาลัยมหิดลแล้ว ผู้ป่วยที่ทำการศึกษาคือ ผู้ป่วยชายหญิงทั้งหมด 152 คน อายุ 19-80 ปี ASA I-III ที่มาทำผ่าตัด transurethral cystoscopic surgery และจัดแบ่งตามอายุเป็น 4 กลุ่ม และได้รับขนาดยาดังนี้: กลุ่ม 1 16-59 ปี จำนวน 32 คน ได้รับ 0.5% hyperbaric bupivacaine คิดเป็น 5/4 BSA มิลลิลิตร + 12.5 ไมโครกรัม ของ fentanyl, กลุ่ม 2 อายุ 60-70 ปี จำนวน คน ได้รับ 0.5% hyperbaric bupivacaine จำนวน = 1 BSA มิลลิลิตร + 10 ไมโครกรัม ของ fentanyl กลุ่ม 3 อายุ 71-75 จำนวน 35 คน, ได้รับ 0.5% hyperbaric bupivacaine 3/4 BSA มิลลิลิตร + 7.5 ไมโครกรัม ของ fentanyl และกลุ่ม 4 อายุ > 75 ปีจำนวน 20 คน ได้รับเพียง 0.5% hyperbaric bupivacaine อย่างเดียวจำนวน 3/4 BSA มิลลิลิตร โดยไม่ได้ fentanyl การศึกษาเพื่อวัดผลสำเร็จ ทำโดย Post hoc analysis โดยใช้ ANOVA ระหว่าง 4 กลุ่ม และ logistic regression สำหรับดูความเกี่ยวข้องระหว่างกลุ่มผลแทรกซ้อนและปัจจัยเสี่ยง*

***ผลการศึกษา:*** *ความสำเร็จของขนาดยาที่ใช้ในผู้ป่วยทุกกลุ่มในทุกอายุโดยไม่ต้องอาศัยยาอื่นช่วยเลย (VAS < 2) รวม 88% เวลาของการชาถึงระดับที่ผ่าตัดได้ ภายในก่อน 6 นาที (ตอบสนองต่อความแหลมน้อยสูงถึงระดับ T10) มีจำนวน 91% และสิ้นสุดเวลาที่น่าจะผ่าตัดได้สะดวก (ตอบสนองต่อความแหลมน้อยลดลงถึงระดับ T11) 119.7 ± 37.9 (45-255) นาที เวลาที่ผู้ป่วยมีระดับการชาลดลงคือผู้ป่วยสามารถยกขาได้เอง และเวลาที่ผู้ป่วยกลับตึกได้จริงคือ 137 ± 39 (70-255) และ 132 ± 39 (65-250) นาที ตามลำดับ ผลข้างเคียงที่สำคัญคือ ความดันโลหิตตกพบเพียง 8% แต่พบชีพจรเต้นช้าสูงถึง 16% พบอาการคัน 2% คลื่นไส้ 7% อาเจียน 1% ความสำเร็จของการใช้วิธีการนี้พบ 87.5% แต่เพิ่มเป็น 93.6% โดยให้ fentanyl ในขนาดเพียง ≤ 50 ไมโครกรัมเข้าหลอดเลือดเพิ่ม กลุ่มอายุที่ 4 คือที่อายุมากขึ้น พบล้มเหลวมากที่สุดถึง 25% และมีนัยสำคัญ ซึ่งเป็นกลุ่มที่ผู้ศึกษาทีได้รับขนาดยาลดลงเหลือเพียง 3 ใน 4 ของพื้นที่ผิวกาย โดยไม่ได้ผสม fentanyl ให้ในการให้ยาเข้าช่องสันหลัง (OR 1.2635, 95% CI 1.0719-1.4894) เนื่องจากมีเหตุผลว่ามีการเปลี่ยนแปลงทางด้านกายภาพและสรีระตามอายุที่สูงขึ้น และเพื่อป้องกันผลข้างเคียงที่อาจเป็นอันตรายที่รุนแรง*

***สรุป:*** *การใช้พื้นผิวกายและอายุในการกำหนดขนาดยาชาผสมหรือไม่ผสม fentanyl ฉีดเข้าไขสันหลัง ในการทำผ่าตัดโดยวิธีส่องกล้องผ่านเข้ากระเพาะปัสสาวะให้ผลสำเร็จพอประมาณในกลุ่ม 1-3 และในการผ่าตัดที่ไม่เกิน 1 ชั่วโมง ข้อดีคือขนาดยาที่ใช้น้อยทำให้ผลข้างเคียงน้อยกว่า ทั้งต่อการลดลงของความดันโลหิต การที่หัวใจเต้นช้าลง และความรู้สึกคันหรือคลื่นไส้อาเจียน ข้อจำกัดอื่นคือให้ผลต่อการอ่อนแรงของกล้ามเนื้อน้อยกว่าทำให้ผู้ป่วยขยับขณะทำผ่าตัดได้และยังรู้สึกถึงการกดหน้าท้องทำให้ผู้ป่วยพึงพอใจลดลงซึ่งต้องการการศึกษาเพิ่มเติม เพื่อปรับขนาดให้พอเหมาะต่อไป โดยเฉพาะในกลุ่มที่ 4*