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Original Research Article

# Clinical Outcomes of Spinal Anesthesia Performed with or Without Barbotage: A Comparative Study

Md Afzal Hossain Khan[a]*, Rajib Dhali[b], Mahedi Hasan[b], Dilip Golder[b]

[a] Associate Professor and Head, Department of Anesthesia at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore
[b] Assistant Professor, Department of Anesthesia at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore

***Correspondence to:**
Md Afzal Hossain Khan

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**Abstract:** ***Background*:** Spinal anesthesia is commonly used for lower limb and lower abdominal surgeries. Barbotage, the technique of aspirating and reinjecting cerebrospinal fluid during anesthetic delivery, may influence the spread and effectiveness of anesthesia. Although previous studies show mixed results regarding its benefits, clinical data on onset time, block level, duration, and patient satisfaction remain limited. This study compares outcomes of spinal anesthesia with and without barbotage in elective surgical patients. ***Objectives:*** To compare sensory and motor block onset, block level, duration, and hemodynamic outcomes in spinal anesthesia with or without barbotage. ***Methods and Materials:*** This comparative cross-sectional study was conducted at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore and Kings Hospital Pvt. Ltd., Jashore, from June 2023 to May 2024. Fifty-six patients were equally divided into barbotage and non-barbotage groups. Data were collected using standardized forms after consent. Statistical analysis was done using SPSS v26. Ethical clearance was obtained, and all procedures followed the Declaration of Helsinki for human research ethics. ***Result:*** Among 56 patients, barbotage significantly improved outcomes: 71.4% had sensory block onset within 3 minutes vs. 42.9% without barbotage 78.6% had motor block onset ≤5 minutes vs. 57.1%. Higher sensory levels (T4–T6) were more frequent (60.7% vs. 35.7%), and longer block duration (2–3 hours) occurred more with barbotage (64.3%). Hypotension was lower (21.4% vs. 39.3%), and satisfaction scores were higher in the barbotage group (53.6% vs. 32.1%). ***Conclusion:*** Barbotage enhances spinal anesthesia by improving block onset, duration, sensory level, hemodynamic stability, and patient satisfaction compared to non-barbotage.

**Keywords:** Spinal Anesthesia, Barbotage, Sensory Block Onset, Motor Block Onset, Sensory Block Level.

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## Introduction

Spinal anesthesia is a widely utilized regional anesthetic technique involving injection of local anesthetics into the subarachnoid space, producing sensory, motor, and sympathetic blockade for lower abdominal and lower limb surgeries.[1] Its efficacy is influenced by multiple factors including patient positioning, baricity, injection speed, and technique.[2–4] Among the procedural modifications, barbotage—defined as the aspiration and reinjection of cerebrospinal fluid (CSF) during administration—has been proposed as a means of enhancing drug distribution .[5] Early investigations into barbotage's effect on the extent of analgesic spread yielded mixed

results. In a study of isobaric bupivacaine, Nightingale found no significant difference in dermatome level at 30 minutes between barbotage and single-injection techniques .[6] Similarly, Schröder and colleagues reported similar onset times and block heights using hyperbaric bupivacaine with or without barbotage .[7] These findings suggest limited clinical benefit of barbotage under certain conditions. However, more recent evaluations have highlighted nuanced effects. Janik *et al.*, observed that barbotage accelerated motor block onset and increased block intensity, although sensory level remained unaffected .[8] Daly *et al.*, noted that clinical practice around barbotage varies widely and called for more robust comparative studies to establish evidence-based guidelines .[9] Additionally, work on intrathecal drug characteristics has confirmed that drug spread is highly sensitive to technique-related variables, including injection dynamics .[10–12] Patient characteristics such as age, BMI, and CSF volume have also been shown to influence spinal block outcomes .[13] Kim *et al.*, demonstrated that obesity prolongs duration of hyperbaric bupivacaine block, independent of dosage.[14] These findings underscore the complexity of factors interacting with procedural modifications like barbotage. Despite decades of research, large-scale, well-controlled trials comparing barbotage versus no-barbotage techniques, particularly within defined patient groups, remain limited. Furthermore, there is inadequate data on crucial clinical endpoints such as hemodynamic stability, duration of sensory/motor block, and patient satisfaction.

**Objective**

**General Objective**

To compare the clinical outcomes of spinal anesthesia performed with barbotage versus without barbotage in patients undergoing elective lower abdominal and lower limb surgeries.

**Specific Objectives**

To compare the onset time of sensory block between the barbotage and non-barbotage groups.

To assess and compare the onset time of motor block in both groups.

To evaluate the maximum level of sensory block achieved with and without barbotage.

To compare the duration of sensory and motor block between the two techniques.

To compare patients mild discomforts like tingling, numbness, needle pricking sensation.

## Method And Materials

**Study Design**

This comparative cross-sectional study was conducted in the Department of Anesthesiology at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore, and Kings Hospital, Jessore. The study was carried out over a period of one year, from June 2023 to May 2024. A total of 56 patients undergoing surgical procedures under spinal anesthesia were included in the study. The study population was divided equally into two groups: one receiving spinal anesthesia with barbotage and the other without barbotage.

**Data Collection Procedure**

After obtaining informed written consent, patients were selected based on inclusion and exclusion criteria. They were assigned to either the barbotage or non-barbotage group. Preoperative evaluations were performed, and baseline parameters were recorded. Spinal anesthesia was administered in the sitting position by 25G spinal needle at the L3–L4 or L4–L5 interspace using a standard dose of 0.5% hyperbaric bupivacaine. In the barbotage group, the drug was mixed by 03 times aspiration and reinjection (barbotage) 03 ml. Data regarding the onset and duration of sensory and motor block, level of block, hemodynamic changes, and patient satisfaction were systematically recorded using a structured case record form.

**Inclusion Criteria**

The study included patients aged between 18 and 50 years or older, classified as ASA physical status I or II. Eligible participants were those scheduled for elective lower abdominal or lower limb surgeries requiring spinal anesthesia. Additionally, only patients who provided informed written consent were included in the study.

**Exclusion Criteria**

Patients were excluded if they had a known hypersensitivity to local anesthetics, any coagulopathy, or were using anticoagulant medications. Other exclusion factors included the presence of a local infection at the injection site, pre-existing neurological disorders, spinal deformities, or a history of previous spinal surgery.

### Statistical Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics were used to express frequency and percentage for categorical variables and mean ± standard deviation (SD) for continuous variables. Comparison between groups was done using Chi-square test or Fisher's exact test for categorical data, and Independent Sample t-test or Mann-Whitney U test for continuous data, depending on the normality of distribution. A p-value <0.05 was considered statistically significant.

### Ethical Consideration

The study protocol was approved by the Institutional Review Board (IRB) of Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore. Written informed consent was obtained from all participants prior to enrollment. Confidentiality of patient data was strictly maintained, and all procedures were conducted in accordance with the Declaration of Helsinki guidelines for ethical research involving human subjects.

## Result

**Table 1: Distribution of Patients by Age, Gender, Occupation, Mean Age, and Standard Deviation**

| Variable | Frequency (n=56) | Percentage (%) |
|---|---|---|
| **Age Group (years)** | | |
| 18–29 | 14 | 25.0% |
| 30–39 | 18 | 32.1% |
| 40–49 | 13 | 23.2% |
| ≥50 | 11 | 19.6% |
| **Mean Age ± SD** | 38.1 ± 10.7 yrs | |
| **Gender** | | |
| Male | 33 | 58.9% |
| Female | 23 | 41.1% |

Table 1 shows among the 56 patients, the most common age group was 30–39 years, comprising 18 individuals (32.1%). This was followed by 14 patients (25.0%) aged 18–29 years, 13 patients (23.2%) in the 40–49 age group, and 11 patients (19.6%) who were aged 50 years or older. The mean age was 38.1 ± 10.7 years, indicating a predominantly middle-aged population. Males made up the majority of the sample with 33 individuals (58.9%), while females accounted for 23 (41.1%).

**Table 2: Group Distribution Based on Barbotage Technique**

| Group | Frequency | Percentage (%) |
|---|---|---|
| With Barbotage | 28 | 50.0% |
| Without Barbotage | 28 | 50.0% |

Table 2 shows an equal number of patients were assigned to each study group: 28 patients (50.0%) received spinal anesthesia with barbotage, while 28 patients (50.0%) received it without barbotage. This balanced distribution ensures comparability and limits selection bias between the intervention and control groups.

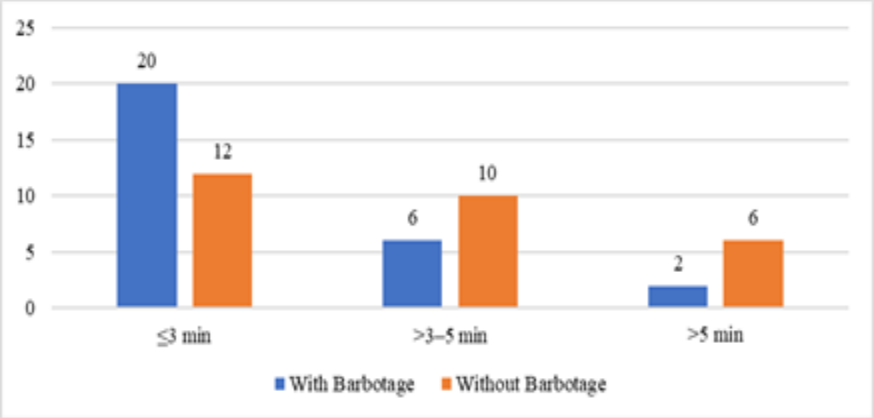


**Figure 1: Onset Time of Sensory Block**

Figure 1 shows, In the barbotage group, a majority of patients (20 out of 28, 71.4%) experienced a rapid

sensory block onset within 3 minutes. In contrast, only 12 patients (42.9%) in the non-barbotage group had a similar response. A moderate onset time (3–5 minutes) was seen in 6 patients (21.4%) with barbotage and 10 patients (35.7%) without. The slowest onset (>5 minutes) was noted in 2 patients (7.1%) from the barbotage group and 6 patients (21.4%) from the non-barbotage group.

**Table 3: Onset Time of Motor Block**

| Onset Time (Minutes) | With Barbotage | Without Barbotage |
|---|---|---|
| ≤5 min | 22 (78.6%) | 16 (57.1%) |
| >5 min | 6 (21.4%) | 12 (42.9%) |

Table 3 shows, faster motor block onset (≤5 minutes) was observed in 22 patients (78.6%) in the barbotage group compared to 16 patients (57.1%) in the non-barbotage group. Delayed motor block onset (>5 minutes) was seen in 6 patients (21.4%) in the barbotage group and 12 patients (42.9%) without barbotage.

**Table 4: Maximum Level of Sensory Block Achieved (Headend of O.T. table 5° up position)**

| Level Reached | With Barbotage | Without Barbotage |
|---|---|---|
| T4–T6 | 17 (60.7%) | 10 (35.7%) |
| T7–T10 | 11 (39.3%) | 18 (64.3%) |

Table 4 shows, a higher sensory block level (T4–T6) was achieved in 17 patients (60.7%) who received barbotage, whereas only 10 patients (35.7%) in the non-barbotage group reached that level. Conversely, a lower sensory level (T7–T10) was more common without barbotage (18 patients, 64.3%) than with (11 patients, 39.3%).

**Table 5: Duration of Sensory Block**

| Duration | With Barbotage | Without Barbotage |
|---|---|---|
| <2 hours | 5 (17.9%) | 12 (42.9%) |
| 2–3 hours | 18 (64.3%) | 13 (46.4%) |
| >3 hours | 5 (17.9%) | 3 (10.7%) |

Table 5 shows the duration of sensory block lasted between 2–3 hours for 18 patients (64.3%) in the barbotage group, compared to 13 patients (46.4%) in the non-barbotage group. A shorter duration (<2 hours) was more common without barbotage (12 patients, 42.9%) than with it (5 patients, 17.9%). A longer duration (>3 hours) was observed in 5 patients (17.9%) in the barbotage group and only 3 patients (10.7%) in the non-barbotage group.

**Table 6: Incidence of Intraoperative Hypotension**

| Blood Pressure Drop | With Barbotage | Without Barbotage |
|---|---|---|
| Present | 6 (21.4%) | 11 (39.3%) |
| Absent | 22 (78.6%) | 17 (60.7%) |

Table 6 shows the occurrence of intraoperative hypotension was lower in the barbotage group, affecting only 6 patients (21.4%), while it was more frequent in the non-barbotage group (11 patients, 39.3%). Stable hemodynamics (absence of hypotension) was maintained in 22 patients (78.6%) with barbotage and 17 patients (60.7%) without it.

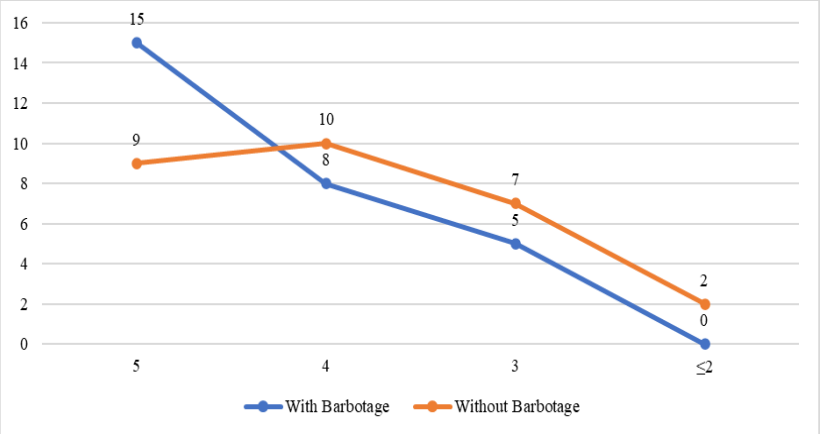


**Figure 2: Patient Satisfaction Score (1–5 Scale)**

Figure 2 shows the, patient satisfaction was generally higher in the barbotage group. A score of 5 (maximum satisfaction) was given by 15 patients (53.6%) in the barbotage group, compared to 9 patients (32.1%) in the non-barbotage group. A score of 4 was given by 8 patients (28.6%) with barbotage and 10 patients

(35.7%) without. Lower scores (≤2) were reported only in the non-barbotage group (2 patients, 7.1%), while none of the barbotage patients rated satisfaction below 3.

## Discussion

In this comparative study of 56 patients, 71.4% (n = 20) of those who received spinal anesthesia with barbotage experienced a sensory block onset within 3 minutes, compared to only 42.9% (n = 12) in the non-barbotage group. Similarly, motor block onset within 5 minutes occurred in 78.6% (n = 22) of barbotage patients, whereas only 57.1% (n = 16) of patients without barbotage achieved the same onset time. These findings indicate that barbotage slightly accelerates both sensory and motor block onset. This aligns with findings by Janik *et al.*, who also observed significantly faster motor block onset in barbotage patients using hyperbaric bupivacaine.[15] Likewise, Schröder and Schwagmeier demonstrated enhanced onset without changes in maximum block height when barbotage was applied .[16] Nightingale noted improved onset times with barbotage compared to standard injection techniques.[17] Regarding sensory block level, 60.7% (n = 17) of patients in the barbotage group achieved a high thoracic level (T4–T6), compared to only 35.7% (n = 10) in the non-barbotage group. Conversely, 64.3% (n = 18) of non-barbotage patients had lower sensory levels (T7–T10), compared to 39.3% (n = 11) in the barbotage group. This suggests barbotage may promote a more cephalad spread of anesthetic. Stienstra *et al.*, highlighted the role of injection technique in block height, suggesting that turbulence from barbotage may aid in more uniform drug distribution .[18] Daly *et al.*, also recommended further study on barbotage, noting its potential to influence block characteristics .[19] In terms of duration of sensory block, 64.3% (n = 18) of barbotage patients had durations of 2–3 hours, whereas only 46.4% (n = 13) in the non-barbotage group had similar results. Additionally, a shorter duration (<2 hours) was more common in the non-barbotage group (42.9%, n = 12) than in the barbotage group (17.9%, n = 5). This reflects findings by Kim *et al.*, who found that controlled injection improved block duration and stability .[20] Intraoperative hypotension occurred in 21.4% (n = 6) of barbotage patients, while it was significantly higher in the non-barbotage group (39.3%, n = 11). Stable hemodynamics were observed in 78.6% (n = 22) of barbotage patients versus 60.7% (n = 17) in the non-barbotage group. These results are consistent with Horlocker *et al.*, who reported that modifications in spinal technique, such as barbotage, may reduce sympathetic block intensity and related hypotension .[21] Patient satisfaction was also higher in the barbotage group: 53.6% (n = 15) gave the maximum satisfaction score of 5, compared to only 32.1% (n = 9) in the non-barbotage group. Lower satisfaction scores (≤2) were reported only in the non-barbotage group (7.1%, n = 2), while none occurred in the barbotage group. Perioperative satisfaction scores have been closely linked to quality and speed of onset of spinal anesthesia, as shown in studies by Perioperative Analgesia Group and Rhee *et al.*, both of which emphasized that faster, more effective blocks with fewer complications contribute to higher patient satisfaction. Macfarlane *et al.*, also observed that optimized regional techniques improve overall perioperative outcomes .[22-24]

## Conclusion

This comparative study demonstrates that spinal anesthesia performed with barbotage offers superior clinical outcomes compared to the non-barbotage technique. Patients in the barbotage group experienced faster onset of both sensory and motor blocks, achieved higher levels of sensory blockade, had longer block duration, more stable intraoperative hemodynamics, and higher satisfaction scores. The study has several limitations. First, the relatively small sample size (n=56) may limit the generalizability of the results. Second, it was conducted at two centers within the same geographic region, which may introduce selection bias.

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