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Effects of Periprostatic Nerve Block Versus Combined Periprostatic Nerve Block and Intraprostatic Local Anesthesia in Transrectal Ultrasono Guided Prostate Biopsy

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Abstract **Original Research Article**

Background: Although Transrectal ultrasound (TRUS) guided prostate biopsy is safe, patients experience significant pain during the procedure. In recent times, periprostatic nerve block (PNB) is the most preferable method for prostate biopsy, however, several studies suggested that PNB does not completely eliminate pain. ***Objective:*** This study aimed to compare the effect of PNB alone versus a combination of PNB and intraprostatic local anesthesia on pain reduction in TRUS guided prostate biopsy. ***Methods:*** A quasi-experimental study was conducted at Dhaka Medical College Hospital from January to December 2021. A total of 124 patients undergoing TRUS guided prostate biopsy were purposively included. Patients were divided into two groups using alternate sequence allocation: Group A (combined PNB and intraprostatic local anesthesia) and Group B (PNB alone). Pain was measured using the Visual Analogue Scale (VAS) during probe insertion, anesthetic infiltration, biopsy, and 30 minutes post-procedure. Biopsy-related complications were also recorded. ***Results:*** There were no significant differences between groups in terms of age ($p=0.115$), number of nodules ($p=0.471$), PSA levels ($p=0.201$), prostate volume ($p=0.597$), or procedure time ($p=0.903$). Pain scores during probe insertion and anesthetic infiltration were similar between the groups ($p>0.05$). However, during biopsy, Group A had significantly lower VAS scores (3.00 ±0.36) compared to Group B (4.79 ±0.58) ($p<0.001$). Thirty minutes after the procedure, Group A also reported significantly lower pain (VAS: 1.14 ±0.35) than Group B (VAS: 2.84 ±0.37) ($p<0.001$). Complications such as hematuria, dysuria, hematochezia, hematospermia, and UTI showed no significant difference between groups ($p>0.05$). ***Conclusion:*** Combining PNB with intraprostatic local anesthesia significantly reduces pain compared to PNB alone, without increasing complications.

Keywords: Prostate biopsy, Periprostatic nerve block, Pain management, TRUS.

INTRODUCTION

Prostate cancer is the second most common cancer diagnosed in men worldwide, following lung cancer. In 2020, approximately 1,414,259 new prostate cancer cases were reported, accounting for 7.3% of all cancer cases globally, along with 375,304 deaths, representing 3.8% of all cancer-related deaths [1]. Early diagnosis and effective treatment are crucial for improving survival rates and enhancing the quality of life for affected patients. Transrectal ultrasound-guided prostate biopsy (TRUS PBx) using an extended core protocol is the gold standard for diagnosing prostate cancer [2]. While generally considered a simple procedure, studies indicate that 65-90% of patients experience significant discomfort or pain during the biopsy. This pain leads over 20% of patients to refuse the procedure. The discomfort arises from the placement and movement of the probe in the anal canal and rectum, as well as needle penetration of the prostatic capsule.

Various anesthetic techniques are used during prostate biopsy to mitigate pain, including xylocaine gel, caudal block, short-acting inhalational anesthesia (Entonox), intravenous anesthesia like propofol, subarachnoid block, and periprostatic nerve block (PPNB) [3]. Among these, PPNB with lidocaine injection has proven to be the most effective. This

technique is based on anatomical understanding since the major sources of pain are the prostatic capsule and stroma, which are richly innervated by autonomic fibers. Despite its effectiveness, randomized trials have shown that PPNB is insufficient for biopsies involving 12 cores or more [4]. The exact anatomy of the extrinsic neuronal cell bodies of the prostate's autonomic and sensory innervation is unclear. Some nerve fibers terminate in the prostate after perforating the capsule, making PPNB less effective as it does not block all sensory nerves, especially those in the stroma and prostatic capsule [5].

Attempts to enhance pain control by combining PPNB with other methods, such as tramadol, have shown mixed results. For example, reported that combining tramadol with PPNB reduced pain during the procedure, whereas found no additional analgesic benefit from this combination [6]. This inconsistency highlights the need for an optimal analgesic approach to minimize pain effectively. Recent studies suggest a new technique, intraprostatic anesthesia (IPPNB), which involves blocking all sensory nerves from both posterior and anterior sides of the prostate [7]. Adding IPPNB to PPNB could provide more effective pain control by blocking sensory fibers from the anterior side, which PPNB alone might miss.

Systematic reviews and meta-analyses indicate that combining PPNB with IPPNB is effective and safe for reducing pain during TRUS-guided prostate biopsy [8]. However, this combination's effectiveness has not been extensively studied in the Bangladeshi population. Given this context, the present study aimed to compare the outcomes of PPNB alone versus combined PPNB and IPPNB in TRUS-guided prostate biopsy among patients in Bangladesh. Specifically, the study focused on pain reduction during the procedure and the incidence of biopsy-related complications [9].

In study while PPNB remains the standard anesthetic technique for TRUS-guided prostate biopsy, its limitations necessitate the exploration of additional methods for improved pain management. Combining PPNB with IPPNB shows promise in providing more comprehensive pain control by targeting sensory nerves not adequately blocked by PPNB alone. This study aims to contribute to the evidence base by evaluating the effectiveness and safety of this combined approach in the Bangladeshi context. Further research and clinical trials are essential to establish the best practices for pain management during prostate biopsy, ultimately improving patient outcomes and acceptance of this critical diagnostic procedure.

OBJECTIVES

General Objective

- To compare the effect of periprostatic nerve block with combined periprostatic nerve block and intraprostatic local anaesthesia in TRUS guided prostate biopsy

Specific Objectives

- To determine the pain score of periprostatic nerve block in TRUS guided prostate biopsy
- To measure the pain score of combined periprostatic nerve block and intraprostatic local anaesthesia in TRUS guided prostate biopsy
- To compare the pain score label between periprostatic nerve block versus combined periprostatic nerve block and intraprostatic local anaesthesia in TRUS guided prostate biopsy
- To record and compare procedure time between the two groups
- To detect and compare complications (Vaso-vagal attack, Hematuria, Dysuria, Hematochezia, Hematospermia, UTI, Uro-sepsis)
- To observe and compare the detection rate of carcinoma prostate between the two groups

MATERIAL AND METHODS

Study design

This quasi-experimental study was conducted to compare the effects of periprostatic nerve block (PPNB) with a combination of periprostatic nerve block and intraprostatic local anesthesia (PPNB + IPNB) during TRUS-guided prostate biopsy. The study was carried out in the Department of Urology at Dhaka Medical College Hospital (DMCH), Dhaka, from January 2021 to December 2021. The study population included patients with suspected carcinoma of the prostate from both inpatient and outpatient departments. The participants were selected based on specific inclusion and exclusion criteria to ensure a comprehensive analysis of the anesthesia techniques.

Inclusion criteria

- Patients who were suspected carcinoma prostate by history, clinical examination and investigation (USG in inpatient and outpatient Department of Urology in DMCH
- Elevated prostate specific antigen (PSA) level
- Abnormal digital rectal examination (discrete nodule, focal induration, diffusely hard prostate)
- Both elevated prostate specific antigen (PSA) level and abnormal digital rectal examination

Exclusion criteria

- Patients with painful anorectal conditions
- Bleeding diathesis
- Active infections (UTI or Prostatitis)
- H/o previous prostate biopsy
- Local anaesthetic allergy

- Patients with neurological deficit and long-standing diabetes mellitus

Data Collection

Data were collected using a structured data collection sheet. This sheet included patient demographics, clinical history, prostate-specific antigen (PSA) levels, digital rectal examination findings, and ultrasound results. Pain levels were measured using the Visual Analog Scale (VAS) during various stages of the biopsy procedure, including probe insertion, anesthetic infiltration, biopsy sampling, and 30 minutes post-procedure. Additionally, any complications such as vasovagal attacks, hematuria, dysuria, hematochezia, hematospermia, urinary tract infections (UTIs), and urosepsis were recorded. Data confidentiality was strictly maintained, and informed consent was obtained from all participants or their legal representatives.

Data Analysis

The collected data were analyzed using SPSS version 26. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as mean (±SD). The chi-square test and Fisher's Exact test were used to compare categorical variables between the two groups. Independent sample t-tests were utilized for comparing continuous variables. A p-value of less than 0.05 was considered statistically significant in two-tailed tests. This analytical approach ensured a robust comparison of pain scores, procedure times, and complication rates between the periprostatic nerve block and combined anesthesia groups.

Ethical Consideration

The study protocol was reviewed and approved by the Research Review Committee and the Ethical Review Committee of Dhaka Medical College Hospital (DMCH). Informed consent was obtained from all participants or their legal representatives before inclusion in the study. Confidentiality of patient data was strictly maintained, and all collected information was securely stored and used solely for research purposes. Ethical guidelines and standards were rigorously followed throughout the study to ensure participant safety and data integrity.

RESULTS

Table 1: Age Distribution Between Groups (n=124)

Age group (in years)	Group A (n=62) n (%)	Group B (n=62) n (%)
56-65	19 (30.6)	28 (45.2)
66-75	19 (30.6)	21 (33.9)
76-86	24 (38.7)	13 (21.0)
Mean ± SD	71.1 ± 9.3	68.5 ± 8.9

Table 1 shows the age distribution of patients in both groups. In group A, 19 (30.6%) patients were aged 56-65 years, another 19 (30.6%) were aged 66-75 years, and 24 (38.7%) were aged 76-86 years. In group B, 28 (45.2%) patients were aged 56-65 years, 21 (33.9%) were aged 66-75 years, and 13 (21.0%) were aged 76-86 years. The mean ages were 71.1 (±9.3) years in group A and 68.5 (±8.9) years in group B.

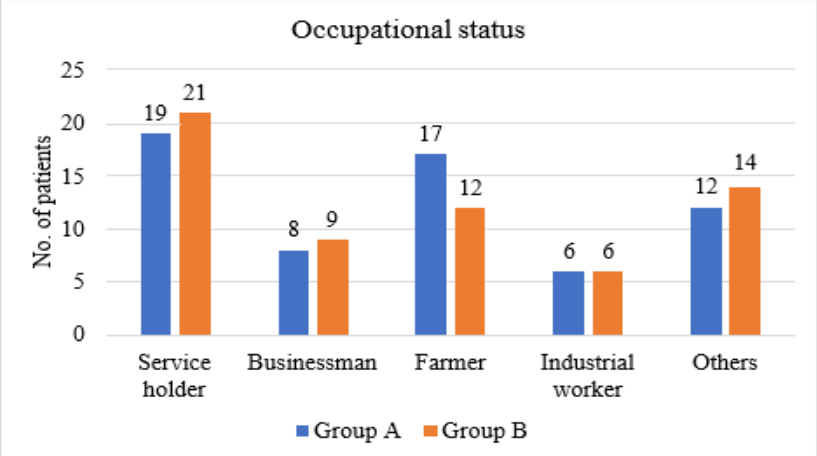

Figure 1: Occupational Status Distribution

Figure 1 illustrates the occupational status of the patients. In group A, 19 (30.6%) were service holders, 8 (12.9%) were businessmen, 17 (27.4%) were farmers, and 6 (9.7%) were industrial workers. In group B, 21 (33.9%) were service holders, 9 (14.5%) were businessmen, 12 (19.4%) were farmers, and 6 (9.7%)

were industrial workers. Group A = Patients receiving combined periprostatic nerve block and intraprostatic local anesthesia, Group B = Patients receiving periprostatic nerve block.

Table 2: Number of Nodules Between Groups (n=124)

No. of nodules	Group A (n=62) n (%)	Group B (n=62) n (%)
0	18 (29.0)	12 (19.4)
1	33 (53.2)	34 (54.8)
2	10 (16.1)	13 (21.0)
3	1 (1.6)	3 (4.8)

Table 2 shows the distribution of nodules. In group A, 18 (29.0%) patients had no nodules, 33 (53.2%) had one nodule, and 10 (16.1%) had two nodules. In group B, 12 (19.4%) patients had no nodules, 34 (54.8%) had one nodule, and 13 (21.0%) had two nodules.

Table 3: Prostate Volume (PV) and PSA Levels Between Groups (n=124)

Criteria	Group A (n=62) Mean ± SD	Group B (n=62) Mean ± SD
Prostate volume (mL)	33.9 ± 4.7	33.4 ± 5.5
PSA (ng/ml)	24.8 ± 12.5	28.6 ± 19.2

The mean prostate volume was 33.9 ± 4.7 mL in group A and 33.4 ± 5.5 mL in group B. The mean PSA levels were 24.8 ± 12.5 ng/ml in group A and 28.6 ± 19.2 ng/ml in group B.

Table 4: Comparison of Operation Time and Age Between Groups (n=124)

Characteristic	Group A (n=62) Mean ± SD	Group B (n=62) Mean ± SD	p value
Operation Time (minutes)	38.9 ± 4.0	39.0 ± 3.5	
Age (years)	71.1 ± 9.3	68.5 ± 8.9	0.115

The operation time was nearly identical between the two groups, with group A at 38.9 ± 4.0 minutes and group B at 39.0 ± 3.5 minutes, showing a negligible difference of only 0.25%. This indicates that adding intraprostatic local anesthesia did not prolong the procedure. The age difference between the groups was not statistically significant (p=0.115), with group A having a mean age of 71.1 ± 9.3 years and group B at 68.5 ± 8.9 years, a difference of about 3.7%. This suggests that age did not influence the study's outcomes on pain management effectiveness.

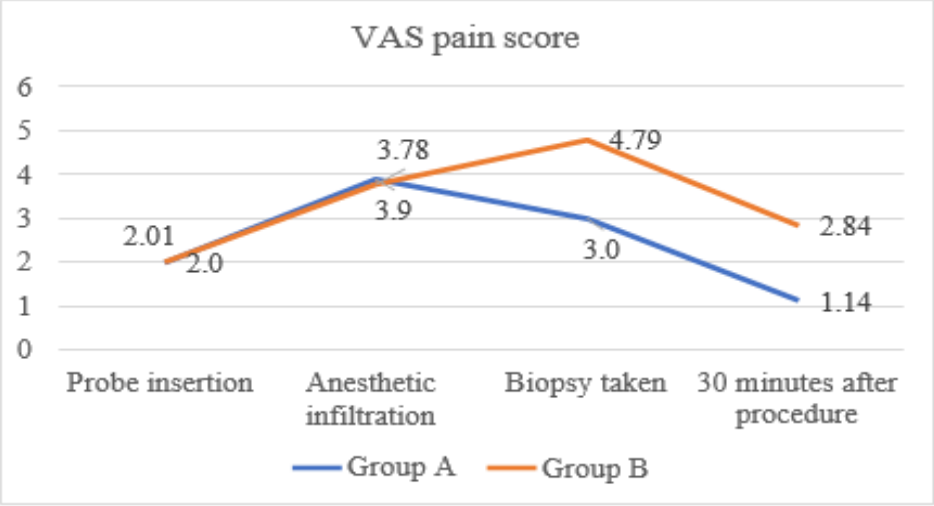

Figure 2: Distribution of patients by visual analogue scale (VAS) pain scores

Figure 2 shows that in group A, the VAS score was 2.0 during probe insertion which increased to 3.90 during anesthetic infiltration and further increased to 3.0 during biopsy taken. After 30 minutes of procedure, the VAS score decreased to 1.14. On the other hand, in group B, the VAS score was 2.12 during probe insertion which increased to 3.78 during anesthetic infiltration and further increased to 4.79 during biopsy taken. After 30 minutes of procedure, the VAS score decreased to 2.84.

Table 5: Summary of Key Characteristics and Outcomes Between Groups (n=124)

Characteristic	Group A (n=62) Mean ± SD	Group B (n=62) Mean ± SD	p value
PSA (ng/ml)	24.8 ± 12.5	28.6 ± 19.2	0.201
Prostate Volume (mL)	33.9 ± 4.7	33.4 ± 5.5	0.597
Procedure Time (minutes)	38.9 ± 4.0	39.0 ± 3.5	0.903
VAS (Visual Analog Scale)			
Probe insertion	2.00 ± 0.26	2.01 ± 0.22	0.708
Anesthetic infiltration	3.90 ± 0.39	3.78 ± 0.61	0.165
Biopsy	3.00 ± 0.36	4.79 ± 0.58	<0.001
30 minutes after procedure	1.14 ± 0.35	2.84 ± 0.37	<0.001
Histopathological Diagnosis			
BPH	13 (21.0)	15 (24.2)	0.668
Carcinoma	49 (79.0)	47 (75.8)	

The PSA levels, prostate volumes, and procedure times were comparable between groups, with no significant differences observed (p>0.2). VAS scores revealed significantly lower pain in group A during the biopsy, showing a 37.4% reduction (p<0.001), and 30 minutes post-procedure, showing a 59.9% reduction (p<0.001) compared to group B. Histopathological diagnosis rates of carcinoma were similar between the groups (79.0% in group A vs. 75.8% in group B, p=0.668). These findings suggest that combining periprostatic nerve block with intraprostatic local anesthesia significantly reduces pain without affecting procedure time, PSA levels, prostate volume, or diagnostic outcomes.

DISCUSSION

Transrectal ultrasound (TRUS)-guided prostate biopsy is an essential procedure for diagnosing prostate cancer. Despite its clinical importance, the procedure is invasive and can cause significant pain, necessitating effective anesthesia [10]. Various local anesthetic techniques have been employed, but there remains no consensus on the most effective method. This study aimed to compare the outcomes of periprostatic nerve block (PPNB) alone versus a combination of PPNB and intraprostatic local anesthesia (IPNB) in TRUS-guided prostate biopsy. This quasi-experimental study was conducted on 124 patients who underwent TRUS-guided prostate biopsy at the Department of Urology, Dhaka Medical College Hospital (DMCH). The absence of randomization classified it as quasi-experimental. The study found no significant difference in pain scores between the two groups during probe insertion and anesthetic infiltration [11]. However, during biopsy and 30 minutes post-procedure, patients in the combined PPNB and IPNB group experienced significantly lower pain scores compared to those who received PPNB alone.

The mean ages of patients were 71.1 (±9.3) years in group A (combined anesthesia) and 68.5 (±8.9) years in group B (PPNB alone). Most patients were over 65 years old, a finding consistent with other studies conducted in similar settings, such as [12]. The mean prostate volume was also similar between the groups, with no significant differences, aligning with the results from studies by [13]. Pain during prostate biopsy arises from two main factors: the discomfort of inserting the ultrasonography probe into the anal canal and the pain from needle penetration of the prostate capsule. The rectal wall, which comes into contact with the biopsy needle, is located above the dentate line and has a diminished sensorium. Hence, the majority of pain is due to the needle piercing the prostate capsule [14]. Blocking the sensory fibers of the prostatic capsule can significantly reduce pain, making the procedure more tolerable for patients.

The VAS (Visual Analog Scale) is a subjective yet widely used method for assessing pain. In this study, the mean VAS scores during probe insertion were around 2, comparable to other studies [15]. During anesthetic infiltration, the mean VAS scores were lower than those reported in some other studies, which might be due to variations in individual pain perception. During biopsy sampling and 30 minutes post-procedure, the mean VAS score in the combined anesthesia group (1.14 ±0.35) was significantly lower than in the PPNB alone group (2.84 ±0.37). These findings are consistent with previous studies by, which also reported better pain control with the combined anesthesia approach [16]. The advantage of combining PPNB and IPNB is the more effective blockage of sensory fibers from both posterior and anterior sides of the prostate, rather than just the posterior fibers targeted by PPNB alone.

Complications within seven days post-biopsy included hematuria, dysuria, hematochezia, hematospermia, and UTIs, with no significant statistical difference between the groups. No cases of urosepsis or vasovagal attacks were reported in either group. These findings suggest that adding intraprostatic infiltration does not increase the morbidity rate, corroborating results from studies by. The systematic review and meta-analysis by reported that a combination of PPNB and IPNB is effective and safe for alleviating pain during TRUS-guided prostate biopsy [17, 18]. However, pain perception and reporting can vary across cultures due to differences in cultural upbringing and societal norms

[19-22]. Despite these limitations, the evidence strongly suggests that combined periprostatic nerve block and intraprostatic local anesthesia is superior to periprostatic nerve block alone for managing pain during prostate biopsy.

In this study, 79.0% of patients in group A and 77.4% in group B were diagnosed with carcinoma. These rates are higher than those reported in other studies. DMCH, being a tertiary referral center, attracts patients from across the country, which might explain the higher detection rates. This study demonstrates that combining periprostatic nerve block and intraprostatic local anesthesia significantly reduces pain during and after TRUS-guided prostate biopsy compared to periprostatic nerve block alone. The complication rates are similar between the two approaches, indicating that the combined method does not increase the risk of morbidity. These findings support the use of combined anesthesia techniques to enhance patient comfort during prostate biopsy.

CONCLUSION

Combining periprostatic nerve block and intraprostatic local anesthesia provide significantly better pain reduction than periprostatic nerve block alone during biopsy taken and 30 minutes after procedure. Complications of combined anesthesia procedure is same as periprostatic nerve block alone.

Recommendations

A prospective, double-blind, randomized studies in a larger number of patients are required to establish the optimal method of TRUS guided prostate biopsy.

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