Ultrasound Guided Peri-Prostatic Neurovascular Infiltration for Biopsy and Minimally Invasive Prostate Surgery

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Citation

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Abstract

Purpose: We evaluated the feasibility, effectiveness, tolerance, and morbidity of transrectal ultrasound (TRUS) guided periprostatic infiltration with lidocaine / bupivacaine for provision of anesthesia during biopsy or minimally invasive surgery of the prostate. Methods: The study has two arms, with two groups per arm. The first arm, TRUS guided prostate biopsy, comprises patients with peri-prostatic block (n=10) and patients without such a block (n=10). The second arm, combined thermotherapy for symptomatic benign prostatic hyperplasia, had patients with transurethral lidocaine jelly and periprostatic block (n=10), and patients with transurethral jelly only (n=5). A mixture of equal volumes of 1% lidocaine and 0.25% bupivacaine, each with epinephrine (1:100,000 concentration ratio) was used. 5-10cc of the mixture was infiltrated at the base of the prostate, mid aspect and apex. No sedation, narcotic, or analgesic was required. All patients were monitored during their procedures. Pain control was assessed using a visual analog scale, a 10-point linear analog pain scale, and a global pain questionnaire. Results: Arm 1: Mean pain scores following peri-prostatic nerve block were significantly lower compared with control (2.1 ± 0.48 versus 8.2 ± 0.55, p<.0001). All patients in the infiltration group reported that they were satisfied with pain control, whereas only 5 control patients (50%) were satisfied. Arm 2: Mean pain scores of those following combined peri-prostatic infiltration and topical transurethral lidocaine jelly were significantly lower than transurethral lidocaine jelly only (2 ± 0.42 versus 7.2 ± 0.49, p=0.0004). All patients in the double block group reported that they were satisfied with their pain control, whereas only 3 control patients (60%) were satisfied. During the study no patient had any adverse effect. All procedures were performed in the outpatient setting. Conclusions: Peri-prostatic nerve block results in significant pain control during TRUS guided prostate biopsy and prostatic thermotherapy. The method is safe, convenient, does not require monitoring, and is well accepted by patients. For thermotherapy or other minimally invasive procedures, considerable cost is saved because of the absent need for anesthesia team support, recovery room facility and conscious sedation monitoring

INTRODUCTION

The treatment of symptomatic benign prostatic hyperplasia (BPH) has changed greatly in recent years. The reasons include the introduction of medical therapy; reassessment of the outcomes of transurethral prostate surgery; the availability of new, lower morbidity technologies; and a shift from hospital-based practices to ambulatory care or office facilities.

Transrectal ultrasound guided biopsy of the prostate is integral in the diagnosis of prostate cancer. Although the biopsy is reasonably well tolerated by most patients, 65-90% have significant discomfort [1]. The amount of pain is partly associated with the number of biopsies obtained. When the biopsy shows high grade PIN, or if the PSA remains elevated after an initial biopsy is negative for malignancy, a second set of biopsies is indicated. The use of free-to-total PSA ratio has mitigated the need for subsequent biopsies for those with a PSA level in the range of 4 to 10. However, multiple sequential biopsies are not uncommon.

The objective of lidocaine / bupivacaine peri-prostatic infiltration is to anesthetize the prostate at the local level. This can be achieved transperineally [2-4], transperineally with transrectal digital guidance (periprostatic) [5, 6] transurethrally (intraprostatic) [7, 8], transabdominally via a superior hypogastric plexus block (under fluoroscopic guidance) [9, 10], retropubically or suprapubically [11], and by epidural block [12, 13]. Traditionally, few urologists have administered a prostate block for minor procedures in fear of causing discomfort as a result of the infiltration itself. In an effort to improve patient comfort we adopted the technique described by Nash et a1, [14] and Vasselli, which was based on the report by Reddy [5]. We used the modified Nash technique by injecting lidocaine

continuously along the region of the neurovascular pedicle of the lateral aspect of the prostate. A similar technique has been reported by Soloway recently. [15].

MATERIALS & METHODS

The study has two arms, with two groups per arm. All patients were studied prospectively with informed consent. The first arm, TRUS guided prostate biopsy, comprises patients with peri-prostatic block (n=10) and patients without such a block (n=10). The second arm, combined thermotherapy for symptomatic benign prostatic hyperplasia, had patients with transurethral lidocaine jelly and peri-prostatic block (n=10), and patients with transurethral jelly only (n=5).

Peri-prostatic neurovascular infiltration: Antibiotic prophylaxis with oral quinolone started the night before biopsy, given one hour before biopsy, and continued for 24 hours after biopsy. Patients were instructed to use a Fleet's enema at home before coming for the procedure. Transrectal ultrasound guided biopsies were performed using the BK 3535 System with a 5-7.5 MHz. Probe. Patients were put in the left lateral position. After transrectal placement of the probe, the prostate was imaged in the transverse and sagittal planes. A mixture of five ml of 1% lidocaine and five ml 0.25% bupivacaine was used; epinephrine (1:100,000 concentration ratio) was included. With the prostate viewed in sagittal plane, an 8-inch 22 gauge Chiba needle (Boston Scientific) was introduced under ultrasound guidance into the region of the bladder neck, at the base of prostate, just lateral to the junction between the prostate and seminal vesicle. Transrectal ultrasound monitoring also facilitated correct localization of the needle and confirmed that anesthetic infiltrated the correct plane. When the plane between the prostate and Denonvilliers fascia is entered a hypoechoic area of increasing size is visualized on screen. Injection was also done at the ipsilateral prostatic apex. Approximately 2.5ml was injected at each site on each side of the prostate. The syringe was aspirated before injection to ensure that the vascular system had not been entered. Immediately after injection, biopsy of the prostate was done with an 18-gauge biopsy needle fired by a spring action biopsy gun.

Topical transurethral block: All patients in Arm 2 (thermotherapy for BPH) were injected with 10cc of viscous 1% lidocaine ([manufacturer]) transurethrally after sterile preparation of the genitalia.

Pain assessment: All patients were questioned regarding pain on a scale of 1 to 10. Pain control during instillation of the peri-prostatic block was assessed using visual analog scale, a 10-point linear analog pain scale and global pain questionnaire.

STATISTICAL ANALYSIS

All statistical analyses were performed using the Stat-View 5.01 software (SAS Institute, Inc Cary, NC). Student's t test was used to compare the groups. Data was considered significant at $P<0.05$. All data are expressed as mean ± SEM

RESULTS

Figure 1

Table 1: Visual pain analog score and tolerance of TRUS guided biopsy and thermotherapy of the prostate

Characteristics	Arm 1: TRUS Guided Biopsy		Arm 2: Thermotherapy	
	Peri-prostatic block (N=10)	No Block (N=10)	Peri-prostatic block and topical transurethral lidocaine) (N=10)	Topical transurethral lidocaine only (N=5)
Patient estimate				
No pain	8	None	6	None
Slight pain	2	None	4	3
Mild pain	None	7	None	2
Severe pain	None	2	None	None
Intolerable pain	None	1	None	None
Would do it again	10/10	5/10	10/10	3/5
Would not do it again	None	5/10	None	2/5
Tolerance				
Good to excellent	10	None	10	None
Fair	None	7	None	4/5
Poor	None	3	None	1/5

Arm 1: Mean pain scores following peri-prostatic nerve block were significantly lower compared with control (2.1 ± 0.48 versus 8.2 ± 0.55, p<0.0001). All patients in the infiltration group reported that they were satisfied with pain control and would do it again, whereas only 5 control patients (50%) were satisfied.

Arm 2: Mean pain scores of those following combined peri-prostatic infiltration and topical transurethral lidocaine jelly were significantly lower than transurethral lidocaine jelly only (2 ± 0.42 versus 7.2 ± 0.49, p=0.0004). All patients in the double block group reported that they were satisfied with their pain control and would do it again, whereas only 3 control patients (60%) were satisfied.

During the study no patient had any adverse effect from the injection. There were no instances of infection, significant bleeding, urinary retention, fever, diaphoresis or hypotension. There was no morbidity associated with the

infiltration of local anesthesia into the periprostatic neurovascular plexus. There were no symptoms suggesting systemic toxicity. No sedation, narcotic or analgesic was required. All procedures were performed in an office setting.

DISCUSSION

In the era of PSA, prostatic biopsy is an important part of urologic practice. The procedure is frequently performed in offices and outpatient urology centers worldwide. In 1963 Takahashi and Ouchi first performed transrectal ultrasonography to scan the prostate [16] and in 1981 Holm and Gammelgaard described transperineal biopsy of the prostate guided by transrectal ultrasound. [17]. However, patient acceptance was low because of the discomfort associated with biopsy through such a sensitive area. Since that time, the precise methodology of prostatic biopsy has changed relatively little. In 1989 Torp-Pedersen et al reported the results of transrectal ultrasound guided biopsy of the prostate with an 18 gauge needle loaded in a spring action biopsy device [18]. This method resulted in improved patient tolerance because of the relative insensitivity of the rectal wall and rapid firing of the thin needle by an automatic device. In our experience, a significant proportion of patients undergoing transrectal ultrasound guided prostatic biopsy finds the procedure uncomfortable, and tolerance appears to be proportional to the number of biopsies performed. In 2 recent reviews of transrectal ultrasound guided biopsy of the prostate, between 65% and 90% of patients reported discomfort. [citations]

Pain associated with prostate biopsy arises from either the prostatic capsule or stroma, where there is a rich innervation of autonomic fibers. These autonomic nerves convey visceral sensation to the spinal cord. As based on neuroanatomy studies of the prostate, the peri-prostatic approach appeared to be the best way to anesthetize the prostate. Experience with anatomical radical prostatectomy has well elucidated the nerve supply of the prostate [19, 20]. Recently Hollabaugh et al also studied the neuroanatomy of the prostate using fresh cadavers [21, 22] The preganglionic fibers from the sacral roots form the pelvic nerves (pelvic splanchnic nerves or nervi erigentes) and are joined by fibers from the inferior hypogastric nerves (sympathetic) to form the pelvic plexus (a.k.a.: inferior hypogastric plexus) in the pelvic fascia on the lateral side of the rectum, seminal vesicles, prostate and posterior bladder. These nerves also receive additional sympathetic fibers from the sacral sympathetic chain ganglia, via the grey rami. The prostatic capsule has a rich innervation of autonomic fibers that convey sensation to the spinal cord. These fibers ramify in the prostatic plexus and subsequently travel with the prostatic vascular pedicles that are located at the posterolateral aspect of the prostatic base. The cavernous nerve runs with branches of the prostatovesical artery and veins as the so-called neurovascular bundle. After passing the tip of the seminal vesicle (nerve supply to the prostate originates from the inferior hypogastric plexus at the tip of the seminal vesicles) nerves lie within the leaves of the lateral endopelvic fascia near its juncture with Denonvilliers fascia (along the plane between the prostate and rectum). It passes anterior to Denonvilliers' fascia and travel at the posterolateral border (an inferolateral relation) of the prostate and on the surface of the rectum (lateral to the prostatic capsular arteries and veins). As it passes posterolaterally to the prostate, the bundle gives off fine branches to supply the prostatic capsule. At the prostatic apex the nerve passes very near to the urethral lumen at the 3 and 9 o'clock positions and enters the penile crura more anteriorly, at 1 and 11 O'clock. In contrast, the anterior and superolateral aspect of the prostate has no significant neural input.

Sinha et al [8] performed TURP on small to medium sized prostates (< 50 gram) using transurethral local anesthesia (lidocaine jelly, plus injection into 4 quadrants of the bladder neck and veramontum), or transurethral anesthesia combined with transperineal block (intraprostatic injection). Patients with the combination block had much reduced pain and symptoms. Transurethral needle ablation (TUNA) of the prostate has been performed using topical lidocaine alone but frequently requires intravenous sedation/analgesia and, in some instances, a regional block [23]. Using the Targis (T3) microwave device, Peterson and co-workers reported that 60% of patients were treated with topical urethral lidocaine alone, whereas 40% also required oral Toradol. Pain was evaluated using a 0 to 10 visual analog scale score. Bladder spasm due to postoperative detrusor muscle irritability may result in sudden changes in pain intensity and consequent patient discomfort.

We used a modified Nash technique [14] of transrectal ultrasound guided prostatic nerve infiltration. With reimbursements favoring office-based procedures, the trend towards outpatient minimally invasive treatments is likely to continue. This highlights the importance of such anesthetic techniques, and we have, in fact, used them in our clinics for

prostate biopsy, and microwave thermotherapy (including transurethral balloon dilation).

It is important for the urologist to follow the pharmacological guidelines by not exceeding the maximum recommended dosage of anesthetic agent, which is approximately 7 mg/kg body weight for lidocaine (with epinephrine), and approximately 3 mg/kg body weight for bupivacaine (with epinephrine). The addition of epinephrine allows for larger doses of anesthetic solution to be used as it slows systemic absorption. It also lengthens the duration of the anesthetic effect.

CONCLUSION & SUMMARY

Many patients have significant pain during transrectal ultrasound guided biopsies of the prostate and few clinicians provide a peri-prostatic nerve block before this procedure. Trans-rectal ultrasound guided peri-prostatic local anesthesia before prostate biopsy is safe, and patient comfort or tolerance is dramatically improved. By eliminating undue patient movement, and because of the ease of obtaining multiple tissue cores, biopsy of digital and sonographic abnormalities may be more accurate. We have found this technique to be efficacious in pain control as determined by visual analog scale, linear pain scale, and global pain questionnaire. The technique of peri-prostatic block is simple. We recommend this procedure for general use by the urologic community.

Periprostatic block is a safe, convenient, effective and satisfactory method of minimally invasive anesthesia for thermotherapy or minimally invasive surgery of the prostate in an outpatient office setting. Considerable cost may be saved as the result of omission of charges related to anesthesia team support, recovery room facility and conscious sedation monitoring.

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