UIJ UroToday International Journal®

www.urotodayinternationaljournal.com
Volume 2 - December 2009

Patient Response to Total Intravenous Sedation (TIVS) for Outpatient Ultrasound-Guided Prostate Biopsy

Avi Raman,[1] Ahmed Al-Sameraaii,[1] Ruban Thanigasalam,[2] Raji Kooner[3]
[1]St. Vincent's Hospital, NSW, Australia; [2]Garvan Institute of Medical Research, Darlinghurst, NSW, Australia; [3]St Vincent's Clinic, Darlinghurst, NSW, Australia
Submitted August 20, 2009 - Accepted for Publication October 12, 2009

ABSTRACT

INTRODUCTION: Transrectal ultrasound (TRUS) guided biopsy is a common office urology procedure. Pain or discomfort associated with this procedure has been addressed with the use of periprostatic or intraprostatic infiltration and nerve block, local anesthesia, general anesthesia, suppository or oral analgesia, or lidocaine gel. The present study is an investigation of patient response to total intravenous sedation (TIVS) for TRUS-guided prostate biopsy. The authors describe the steps of the TIVS technique and critically examine the subsequent intraoperative and postoperative effects.

METHODS: Between December 2006 and April 2007, 100 patients underwent TRUS-guided prostate biopsy by a single surgeon (RK). TIVS sedation was achieved by intravenous administration of fentanyl (0.5-2 µg/kg), midazolam (0.03-0.05 mg/kg) and propofol (dosage titrated). Patients completed a modified Aldrete scoring system and modified postanesthetic discharge scoring system. The quality of the analgesia was assessed with a numerical pain rating scale. Patients were given a questionnaire to assess their perception of the pain and tolerability of the procedure.

RESULTS: The mean time between introduction of the probe and the end of the procedure was 10.5 minutes. Mean sedation time was 19 minutes and all patients were ready for discharge 70 minutes after the procedure. A total of 95 patients experienced a mild pain score of 1-3 out of 10 shortly after the procedure. The mean pain intensity score (95% Confidence Interval) was 1.36 (1.19-1.54), standard deviation = 0.865, median = 1. One patient developed intense nausea requiring IV antiemetic therapy. One patient developed urinary retention requiring urinary catheterization for a few days. There were no other complications related to the TIVS or TRUS procedure. Ninety-eight percent of the patients stated that they were not reluctant to have the biopsy repeated in the future if it was necessary.

CONCLUSIONS: TRUS-guided biopsy of the prostate can be accomplished with minimal pain by using TIVS. The authors believe that sedation should be considered and discussed with patients. TIVS provided sufficient analgesia and satisfactory hemodynamic stability. These effects facilitated recovery, allowing patients to be discharged less than 2 hours after the procedure.

KEYWORDS: Transrectal ultrasound; Biopsy of prostate; Procedural intravenous sedation (PIS); Total intravenous sedation (TIVS); Modified Aldrete scoring system, Modified postanesthetic discharge score

CORRESPONDENCE: Dr. Ahmed Al-Sameraaii, Department of Urology, The St. George Hospital, Gray Street, Kogarah 2217, NSW, Australia (ahmedalsameraaii@hotmail.com).

CITATION: *UroToday Int J*. 2009 Dec;2(6). doi:10.3834/uij.1944-5784.2009.12.04

UroToday International Journal®

original study

Patient Response to Total Intravenous Sedation (TIVS) for Outpatient Ultrasound-Guided Prostate Biopsy

INTRODUCTION

Close to 3000 men die from prostate cancer annually in Australia, which is a number similar to that of woman dying from breast cancer [1]. Around 18,700 new cases of prostate cancer are diagnosed annually in Australia; 40% of these cases are less than 65 years of age and 10% require repeated biopsies.

The diagnosis of prostate cancer is usually confirmed following a transrectal ultrasound (TRUS) guided biopsy of the prostate. This test is usually performed after an elevated prostate-specific antigen (PSA) and/or suspicious findings on digital rectal examination (DRE).

There are approximately 8,000 biopsies of the prostate performed annually in Australia. This number has risen sharply in recent years because public awareness of prostate cancer has increased through a variety of effective media campaigns. More patients are undergoing biopsy after recording an elevated PSA value on routine screening or after suspicious DRE findings, and repeat biopsies are often indicated despite initial negative histopathology.

The TRUS procedure has associated pain and morbidity that has been extensively reviewed in the literature. These known effects have influenced patient acceptance of the procedure [2] as well as willingness to undergo a repeat biopsy. Many patients have described the discomfort caused by placement of the TRUS probe as being worse than the needle biopsy itself [3]. This discomfort has led some authors to advocate methods to reduce pain before and during probe insertion as well as during the procedure [4]. Moreover, men having a TRUS prostate saturation biopsy or a repeat procedure experience considerable psychological stress that may be attributable to a number of factors. These factors include the fear of the potential diagnosis of cancer, the route of penetration and anal stretch, the fact that the examined organ is part of the male sexual system, and the anticipated pain. Patients therefore perceive the procedure as traumatic and anxiety-provoking.

Although some physicians use no analgesia or anesthesia, a variety of pain-relieving techniques are currently in use. Options include a periprostatic nerve block, anesthetic gel, oral analgesia, sedation, or a combination of these pain relievers. Periprostatic injection with local anesthetics remains the most widely used technique. Periprostatic and intraprostatic injection are considered by many the gold standard approaches.

Total intravenous sedation (TIVS) and other forms of sedation are based on the administration of one or combined anesthetic agents (eg, fentanyl, midazolam, propofol). Such sedation has been widely used for outpatient colonoscopies with excellent results [5].

A few papers have described the use of intravenous sedation using a single agent to lessen patient discomfort for the purpose of TRUS biopsy [6-8]. The present study is an investigation of the patient's response to TIVS or combination sedation for TRUS prostate biopsy. The authors describe the steps of the TIVS technique and critically examine the subsequent intraoperative and postoperative effects.

METHODS

Participants

A total of 100 male patients underwent TRUS-guided biopsy of the prostate using TIVS between December, 2006 and April, 2007. Their mean age was 64 years (range, 47-71 years). They were referred by their family physician. The patients were fully counseled by the urologist and a trained nurse and all provided informed consent prior to the procedure. Patients were excluded if they: (1) were taking aspirin, clopidogrel, or anticoagulants, (2) had an active lower urinary tract infection, (3) had known sensitivity to fentanyl, propofol, or midazolam, (4) had severe impairment of cardiorespiratory function, psychiatric or emotional disorders, or a history of opioid and/or sedative addiction.

Presurgical Assessment

Patients completed an assessment preadmission questionnaire for the anesthesia department 2 weeks before arrival for the TIVS/TRUS procedure. They were asked to fast and stop medications 6 hours before the procedure, but were allowed to drink clear liquids up to 3-4 hours before sedation. They were given oral norfloxacin 400 mg twice per day, one day prior to the procedure.

On the procedure day, all patients were reassessed by the anesthetist. They were also seen by the urologist (RK) for a detailed general and urological history, including an international prostate symptom score (IPSS). The urologist also performed a focused urological examination, including a DRE.

If a TRUS biopsy was indicated, the patient was given the option of biopsy with or without sedation. If sedation was considered, the urology staff nurse assessed the patients to assure that they met inclusion criteria. No laboratory or imaging studies were completed at this stage.

TIVS Procedure

All patients were placed in a left lateral decubitus position at the edge of the bed before sedation was administered, to

http://www.urotodayinternationaljournal.com
doi:10.3834/uij.1944-5784.2009.12.04
ISSN 1944-5792 (print), ISSN 1944-5784 (online)

UroToday International Journal®
original study
Avi Raman, Ahmed Al-Sameraaii, Ruban Thanigasalam, Raji Kooner
www.urotodayinternationaljournal.com

Table 1. Modified Aldrete Scoring System.
doi: 10.3834/uij.1944-5784.2009.12.04t1

Category	Description	Score
Activity	4 extremeties 2 extremeties No extremities	2 1 0
Respiration	Ability to breathe deeply and cough freely Dyspnea Apnea	2 1 0
Circulation	BP < 20 mm Hg of preoperative level BP = 20 to 50 mm Hg of preoperative level BP > 50 mm Hg of preoperative level	2 1 0
Consciousness	Fully awake Arousal in response to voice Unresponsive	2 1 0
Oxygen saturation	Saturation > 92% on room air Saturation > 92% only with supplementary oxygen	2 1

facilitate the biopsy and reduce the need for repositioning throughout the sedation.

TIVS sedation was administered by the same consultant anesthetist, who used a peripheral intravenous line. Patients were given a single dose of fentanyl 0.002 mg/kg, a single dose of midazolam 0.02-0.04 mg/kg, and propofol at a starting dose of 0.5 mg/kg followed by boluses of 1-10 mg. Oxygen was delivered by venturi face mask (FiO_2 = 0.35) to all patients throughout the procedure. The jaw thrust maneuver was applied to all patients receiving TIVS.

Heart rate, noninvasive blood pressure monitoring, pulse oximetry (SpO_2), respiratory rate, and end-tidal carbon dioxide ($EtCO_2$), were measured every 30- 60 seconds and recorded using automated monitors.

TRUS-Guided Prostate Biopsy Procedure

A standard rectal examination was done 2 minutes after TIVS, followed by gentle insertion of the probe by the urologist (RK). Any additional sedation was given at this stage, but no local, infiltration, or periprostatic anesthesia was used. Intravenous gentamicin was given at the time of biopsy.

The prostate was imaged with an ultrasound probe (BK Medical, Herlev, Denmark; 2101 Falcon; 6.5 MHz- 7.5 MHz frequency) and any hypoechoic lesions were selectively sampled. Additional biopsies were taken from any abnormal areas detected by ultrasound or palpation. This was followed by a routine systematic sampling of 12 biopsies, using an end-fire technology for better sampling of the prostate apex.

Patients completed the modified Aldrete scoring system (Table 1) in the recovery station. The patients were transferred to the day unit when they achieved at least 9 points on this scale.

After the patients were in the day unit observation lounge, they completed a modified postanesthetic discharge scoring system (PADS) (Table 2). Patients were ready for discharge after they achieved a bleeding score of 2 and an overall score of 9 or 10 on this scale.

Table 2. Modified Postanesthetic Discharge Scoring System. doi: 10.3834/uij.1944-5784.2009.12.04t2

Category	Description	Score
Vital signs	< 20% of preoperative value 20-40% of preoperative value > 40% of preoperative value	2 1 0
Ambulation	Steady gait; no dizziness With assistance No ambulation; dizziness	2 1 0
Nausea or vomiting	Minimal Moderate Severe	2 1 0
Pain	Minimal Moderate Severe	2 1 0
Surgical bleeding	Minimal Moderate Severe	2 1 0

Figure 1. Questionnaire and Visual Analog Scale for Transrectal Ultrasound (TRUS) Using Total Intravenous Sedation (TIVS). doi: 10.3834/uij.1944-5784.2009.12.04f1

1. When did you have the prostate biopsy?
2. Did you find the actual taking of the biopsy from the prostate painful?
3. Did you find the manipulation of the ultrasound probe in the rectum painful?
4. How bad was the pain experienced during the actual prostate biopsy on a scale of 0 to 10? (Where zero is no pain and 10 is the WORST pain you have ever experienced)

   0 1 2 3 4 5 6 7 8 9 10

5. How bad was the pain experienced during the manipulation of the probe on a scale of 0 to 10? (Where 0 is no pain and 10 is the WORST pain you have ever experienced)

   0 1 2 3 4 5 6 7 8 9 10

6. Would you be willing to undergo the procedure again if needed?
7. When given the medications during the procedure did you experience any unpleasant side effects? (if yes, go to number 8)
8. If you experienced any unpleasant side effects, would these prevent you from having the procedure again?
9. Have you experienced any complications as a direct result of the biopsy (eg, infection or bleeding)?
10. How long did the pain or discomfort last following your prostate biopsy?
11. Any further comments?

Oral norfloxacin 400 mg twice per day was continued for 3 days after the procedure. Within 2-24 hours after the procedure, the patients completed a questionnaire to assess tolerability of the prostatic biopsy (Figure 1). The questionnaire was mailed to the authors in a sealed envelope.

Data Analysis

The total procedure time, mean sedation time, and time from sedation to discharge were recorded.

The authors also measured: (T_1) the time between the completion of the TRUS procedure and the time when the Aldrete score reached 10 points; (T_2) the time between the last drug administration and the time when the Aldrete score reached 10 points; (T_3) the time between the completion of the TRUS procedure and the time when the modified postanesthetic discharge score reached 9-10 points; T_4 the time between the last drug administration and the time when the modified postanesthetic discharge score reached 9-10 points.

Results of the questionnaire were summarized. Cost analysis was not assessed because it was outside the scope of the study.

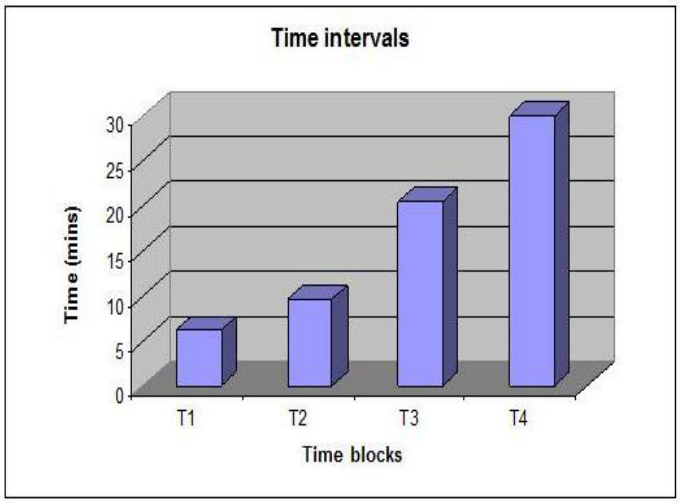
RESULTS

Time Intervals

The mean time between introduction of the probe to the rectum and the end of the procedure was 10.5 minutes. Mean sedation time was 19 minutes and all patients were ready for discharge 70 minutes after the procedure.

The time between the completion of the TRUS procedure and the time of maximum Aldrete score (T_1) and the time between the last drug administered and the time of maximum Aldrete score (T_2) are shown in Figure 2. This figure also contains the results of the time between completion of the TRUS procedure and the time of maximum modified postanesthesia discharge score (T_3) and the time between the last drug administered and the time of maximum postanesthesia discharge score (T_4).

Figure 2. Mean Time Intervals Related to Aldrete and Maximum Modified Postanesthesia Discharge Scores.
doi: 10.3834/uij.1944-5784.2009.12.04f2



(T1) the time between the completion of the TRUS procedure and the time when the Aldrete score reached 10 points; (T2) the time between the last drug administration and the time when the Aldrete score reached 10 points; (T3) the time between the completion of the TRUS procedure and the time when the modified postanesthetic discharge score reached 9-10 points; T4 the time between the last drug administration and the time when the modified postanesthetic discharge score reached 9-10 points.

The mean times for T_1, T_2, T_3 and T_4 were 5.2, 8.6, 18, and 28.5 minutes, respectively. The variables of nausea (3%), dizziness (1%) and problems with locomotion (1%) were the most frequent factors influencing the time to achieve a maximum postanesthesia score of 10.

Questionnaire

All patients completed the questionnaire. A total of 95 patients experienced a mild pain score of 1-3 out of 10 on the numerical rating score, administered shortly after the procedure. The mean pain intensity score (95% Confidence Interval) was 1.36 (1.19-1.54), standard deviation = 0.865, median = 1. Figure 3 shows the intensity of pain during the manipulation or insertion of the ultrasound probe. Figure 4 shows the intensity of pain during the actual puncture biopsies.

Only 3% of patients found that introducing the probe was significantly painful during or after the procedure; 20% felt that the probe was uncomfortable. The biopsy was painful for 2% of patients and uncomfortable for 20%. Only 2 patients (2%) were reluctant to have a repeat biopsy if required.

Adverse Events

One patient developed intense nausea requiring IV antiemetic therapy. One patient developed urinary retention requiring urinary catheterization for a few days. There were no other complications related to the TIVS or TRUS procedure, including fever or bleeding.

DISCUSSION

TRUS-guided prostate biopsy has been known as an uncomfortable and unpleasant procedure for almost all patients. For nearly 10 years after its introduction, the majority of urologists used little or no anesthesia for prevention of biopsy-related pain and discomfort.

Pain Reduction

In 2000, Soloway and Obek [2] reported their experience with periprostatic lidocaine instilled at the base, mid gland, and apex of the prostate before needle biopsy. Only 2% of the patients in this study reported pain or discomfort using this method. Additional studies suggested that topical anesthetic gel before probe insertion provides an analgesic effect by decreasing pain associated with insertion of the ultrasound probe and the needle puncture of the rectal wall [16]. In a randomized prospective trial, Alavi et al reported a 50% reduction in pain score with periprostatic injection vs intrarectal gel [17]. Ashley et al [18] suggested intraprostatic injection. Although their patients tolerated periprostatic injection better than intraprostatic injection, the latter controlled pain better during biopsy.

Regardless of which technique is adopted, it is clear that the proper use of local anesthesia provides a significant benefit to patients undergoing prostate biopsy and obviates the need for general anesthesia or complicated sedation in the majority of cases. This procedure has been adopted by urologists in the United States, where the majority of these procedures occur in an office setting, as well as in Australia.

If local anesthesia is used, the authors prefer a small volume of periprostatic nerve blockade in combination with intrarectal gel before probe insertion. The additional use of topical intrarectal gel improves the discomfort associated with probe insertion.

The authors always offer TIVS or other sedation for patients who: (1) are young and require surveillance or saturation biopsy, (2) have known anxiety or needle phobia, (3) experienced low pain threshold or anal pain during the first TRUS procedure in the office setting.

The number of published papers addressing the reduction of pain associated with TRUS-guided biopsy has increased

Figure 3. Pain Intensity During Probe Manipulation or Insertion. doi: 10.3834/uij.1944-5784.2009.12.04f3

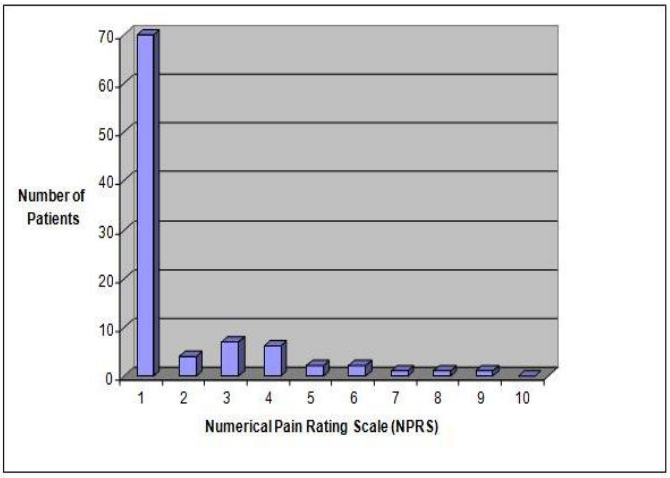
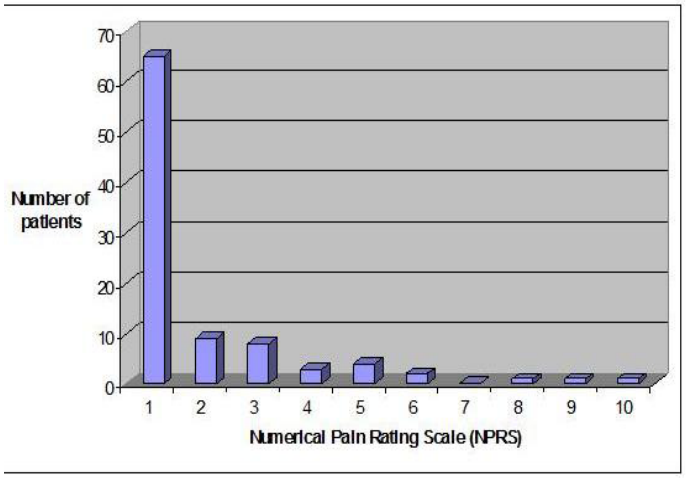


Figure 4. Pain Intensity During Puncture Biopsy. doi: 10.3834/uij.1944-5784.2009.12.04f4



dramatically in recent years (see Figure 5). Many studies involve the use of periprostatic nerve block [9-12]. This method remains the most commonly used. However, the studies show considerable variance in the volume, exact location, and dosage of the anesthetic as well as in the mean pain score. This variance suggests that other factors such as anxiety and surgeon technique are also important. A randomized trial by Schostak et al [13] suggested that needle punctures for administration of periprostatic nerve block are more painful than probe insertion and the actual biopsy.

To the authors' knowledge, there are only a handful of studies in the literature that address the efficacy of single agent sedation during prostate biopsy. Peters et al [6] found reduced discomfort and anxiety in patients receiving propofol as sedation during biopsy, especially for those who required repeat biopsies. Levels of patient acceptability and satisfaction were assessed using visual analogue scales. Awsare et al [8] described the use of propofol sedation and concluded that its use is associated with high patient satisfaction and acceptability [8].

Finally, Turqut et al [7] randomly placed 93 candidates for biopsy into 3 groups, receiving: (1) IV midazolam sedation, (2) periprostatic injection, and (3) no anesthetic. The mean discomfort scores for groups 1 and 2 were significantly lower than scores for group 3. The authors suggested that midazolam sedation is an alternative for increasing patient comfort during TRUS-guided prostate biopsy, especially for patients who are anxious, young in age, need repeat biopsies, or have inflammatory anal diseases [7].

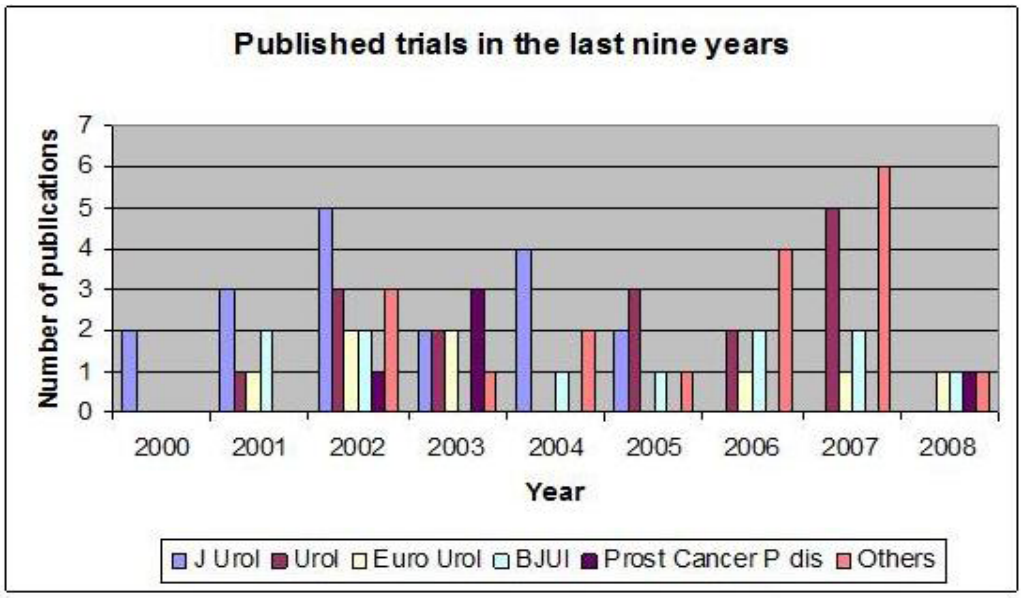
Repeat TRUS Biopsy Procedures

It is every urologist's experience that anxiety is common in men needing a biopsy and that the men who are most anxious are also the most likely to experience pain. Men requiring a second TRUS-guided biopsy often have unpleasant memories from the first procedure. Occasionally, the patient can become diaphoretic because of the degree of anxiety and discomfort. This is not helpful to the clinician, who needs time to accurately locate suspicious areas and target the biopsy needle at specific sites. The problem may be compounded by the fact that some patients need saturation biopsies (a practice implemented by the authors' center for young patients on active surveillance).

The purpose of a saturation biopsy is to increase the number of samples taken in TRUS-guided biopsy during the second session, for the purpose of improving the false negative rate. During saturation biopsy, the surgeon obtains 20 or more cores through either the transrectal or transperineal approach. The present study showed that the patients receiving TIVS were more accepting of a second biopsy should it be clinically indicated.

There are 3 indications for performing a saturation biopsy. First, when clinical suspicion remains high for patients with negative findings on initial biopsy, the saturation technique may allow for reduced sampling error with a higher yield of cancer detection when compared with contemporary extended core biopsy. Second, for patients receiving active surveillance, saturation biopsy may be useful in predicting pathological tumor volume and grade and, therefore, the likelihood of having clinically insignificant cancer. Finally, saturation biopsy

Figure 5. Number of Published Randomized, Controlled Trials on Local and Periprostatic Injection for Pain Control in Major Journals Over 9 Years.
doi: 10.3834/uij.1944-5784.2009.12.04f5



may be performed before focal therapy for prostate cancer to improve tumor localization.

Cost of TIVS

During the past 10 years, intravenous sedation with new sedating agents (eg, propofol) has become a safe and acceptable practice for a variety of office procedures [5]. The procedures are carried out without endotracheal intubation and with full and expert anesthetic monitoring. The results of the present study demonstrate that infusion of fentanyl, propofol, and midazolam was safe and provided patient comfort during the procedure. This resulted in fast recovery and readiness for discharge.

The TIVS procedure can be implemented in a public or private hospital setting. However, cost remains the main issue because the total number of procedures needs to be reduced and the staff needs to be trained in recovery and postoperative assessment.

The authors acknowledge the criticism that practicing TIVS can create a number of logistic and cost concerns. They do not recommend the widespread application of this approach; it should be reserved for a small, select group of patients. In Australia, physicians who perform office urological procedures have faced problems with sterilization of probes and instruments. These problems have forced physicians to move many TRUS-guided biopsy procedures to operating theaters where equipment sterility can be assured.

The authors also acknowledge that the present study is a one-arm analysis of a new procedure with no control group for comparison. There is wide variability of discomfort or pain tolerance during and after the prostate biopsy with and without local periprostatic block anesthesia, a procedure which is site and operator dependent. Without a control group, the authors could not prove that the patients receiving sedation experienced a different level of pain tolerance from patients receiving no or other anesthesia. However, historical data show that the TIVS procedure is not inferior to local infiltration anesthesia in the authors' database and as reported by other physicians.

The authors observe that subgroups of patients have been reluctant to undergo a repeated biopsy because of the procedural pain of infiltration anesthesia. These patients may miss out on effective active surveillance. The subgroups, albeit small, include: (1) young patients with anxiety and low pain threshold, (2) patients with a large prostate needing saturation biopsy, and (3) patients with anal spasm.

Propofol is widely used as an agent to administer sedation. Although it is associated with rapid recovery, patients must have an escort to take them home and are advised not to drive for 24 hours. There are obvious costs associated with this technique for prostate biopsy, given the use of operating theaters as well

as recovery staff. Although the authors did not conduct specific cost analysis, they acknowledge that there are cost implications involved. This must be balanced against the level of comfort and satisfaction experienced by the patient.

The patients in the present study had private insurance and Medicare funding from the Australian Health System. This insurance made the sedation option affordable for the group studied. In recognition of the substantial cost for this approach in other countries, the authors acknowledge that TIVS may have its clinical applications in only select cases in the large public health sector.

CONCLUSION

A large number of patients experience moderate to severe pain or discomfort during TRUS-guided prostate biopsy [6]. The physical and psychological harm caused by prostatic biopsies must not be underestimated. There are currently a number of different methods for reducing pain and anxiety during this commonly performed procedure. Based on the results of the present study, the authors conclude that total intravenous sedation is a safe and satisfactory option that can significantly reduce patient discomfort during prostate biopsy. This is particularly important for men who need repeat biopsies or for the very anxious patient. It is an excellent alternative to periprostatic nerve block, which is currently the most popular method. Sedation with single or combination agents should be discussed and offered as a viable option for patients undergoing prostatic biopsies.

Conflict of Interest: None declared.

REFERENCES

[1] Prostate cancer related statistics. Prostate Cancer Foundation of Australia Web site. http://www.prostate.org.au. Accessed October 16, 2009.

[2] Soloway MS, Obek C. Periprostatic local anesthesia before ultrasound guided prostate biopsy. *J Urol*. 2000;163(1):172-173.

[3] Chang SS, Alberts G, Wells N, Smith JA Jr, Cookson MS. Intrarectal lidocaine during transrectal prostate biopsy: results of a prospective double-blind randomized trial. *J Urol*. 2001;166(6):2178-2180.

[4] Kravchick S, Peled R, Ben-dor D, Dorfman D, Kesari D, Cytron S. Comparison of different local anesthesia techniques during TRUS-guided biopsies: a prospective pilot study. *Urology*. 2005;65(1):109-113.

[5] Reimann FM, Samson U, Derad I, Fuchs M, Schiefer B, Stange EF. Synergistic sedation with low dose midazolam and propofol for colonoscopies. *Endoscopy*. 2000;32(3):239-244.

[6] Peters JL, Thompson AC, McNicholas TA, Hines JE, Hanbury DC, Boustead GB. Increased patient satisfaction from transrectal ultrasonography and biopsy under sedation. *BJU Int*. 2001;87(9):827-830.

[7] Turgut AT, Ergun E, Kosar U, Kosar P, Özcan A. Sedation as an alternative method to lessen patient discomfort due to transrectal ultrasonography-guided prostate biopsy. *Eur J Radiol*. 2006;57(1):148-153.

[8] Awsare NS, Green JA, Aldwinckle B, Hanbury DC, Boustead GB, McNicholas TA, The use of propofol sedation for transrectal ultrasonography-guided prostate biopsy is associated with high patient satisfaction and acceptability. *Eur J Radiol*. 2007;63(1):94-95.

[9] Zisman A, Leibovici D, Kleinmann J, Siegel YI, Lindner Al. The impact of prostate biopsy on patient well-being: a prospective study of pain, anxiety and erectile dysfunction. *J Urol*. 2001;165(2):445-454.

[10] Obek C, Ozkan B, Tunc B, Can G, Yalcin V, Solok V. Comparison of 3 different methods of anesthesia before transrectal prostate biopsy: a prospective randomized trial. *J Urol*. 2004;172(2):502-505.

[11] Leibovici D, Zisman A, Siegel YI, Sella A, Kleinmann J, Lindner A. Local anesthesia for prostate biopsy by periprostatic lidocaine injection: a double blind placebo controlled study. *J Urol.* 2002;167(2 Pt 1):563-565.

[12] Stirling BN, Shockley KF, Carothers GG, Maatman TJ. Comparison of local anesthesia techniques during transrectal ultrasound-guided biopsies. *Urology.* 2002;60(1):89-92.

[13] Schostak M, Christoph F, Muller M, et al. Optimizing local anesthesia during 10-core biopsy of the prostate. *Urology.* 2002;60(2):253-257.

[14] Stirling BN, Shockley KF, Carothers GG, Maatman TJ. Pain perception during transrectal ultrasound guided prostate needle biopsy: an objective analysis of local anesthesia use. *Prostate Cancer Prostatic Dis*. 2002;5(3):209-211.

doi:10.3834/uij.1944-5784.2009.12.04
ISSN 1944-5792 (print), ISSN 1944-5784 (online)

[15] Inal G, Adsan O, Ugurlu O, Kaygisiz O, Kosan M, Cetinkaya M.Comparison of four different anesthesia methods for relief of all pain during transrectal ultrasound-guided prostate biopsy. *Int Urol Nephrol*. 2008;40(2):335-339.

[16] Yun TJ, Lee HJ, Kim SH, Lee SE, Cho JY, Seong CK. Does the intrarectal instillation of lidocaine gel before periprostatic neurovascular bundle block during transrectal ultrasound guided prostate biopsies improve analgesic efficacy? A prospective, randomized trial. *J Urol*. 2007;178(1):103-106.

[17] Alavi AS, Soloway MS, Vaidya A, Lynne CM, Gheiler EL. Local anesthesia for ultrasound guided prostate biopsy: a prospective randomized trial comparing 2 methods. *J Urol* 2001;166(4):1343-1345.

[18] Ashley RA, Inman BA, Routh JC, et al. Preventing pain during office biopsy of the prostate: a single center, prospective, double-blind, 3-arm, parallel group, randomized clinical trial. *Cancer* 2007;110(8):1708-1714.

doi:10.3834/uij.1944-5784.2009.12.04
ISSN 1944-5792 (print), ISSN 1944-5784 (online)