ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.5336/healthsci.2017-59260

Evaluation of Pain with Visual Analog Scale in Renal Biopsy

Böbrek Biyopsisinde Ağrının Görsel Analog Skala ile Değerlendirilmesi

Simge BARDAK,[a]
Kenan TURGUTALP,[a]
Mürşide Esra DÖLARSLAN,[a]
Kaan ESEN,[b]
Merve TÜRKEGÜN,[c]
Serap DEMİR,[a]
Ahmet KIYKIM[a]

Departments of
[a]Nephrology,
[b]Radiology,
[c]Biostatistics and Medical Informatics,
Mersin University Faculty of Medicine,
Mersin, TURKEY

Received: 09.01.2018
Received in revised form: 22.03.2018
Accepted: 23.03.2018
Available online: 16.11.2018

Correspondence:
Simge BARDAK
Mersin University Faculty of Medicine,
Department of Nephrology, Mersin,
TURKEY/TÜRKİYE
bardaksimge@gmail.com

ABSTRACT Objective: The aim of study was to investigate the perception of pain associated with renal biopsy with visual analog scale (VAS), and the factors that might influence pain perception. **Material and Methods:** A total of 100 patients who had undergone native kidney biopsy in our hospital between May 2014-November 2016 were enrolled. Patients were not receiving analgesics, sedatives, nonsteroidal anti-inflammatory drugs or antihistamines at the time of biopsy. Renal biopsy was performed under ultrasound guidance following local anesthesia. Pain was rated by VAS (1-10) when anesthetic agent was injected (VAS-1), when biopsy was performed (VAS-2), and 30 minutes after biopsy (VAS-3). Associations of clinical, laboratory, and radiological data with pain scores were analysed. **Results:** A total of 100 patients undergoing renal biopsy were enrolled. VAS-2 was found significantly higher than VAS-1, and VAS-3 scores. Patient age, past surgical history, serum creatinine, biopsy side, vertical length and paranchimal thickness of the kidney in which biopsy was performed, needle size, number of cores taken were not associated with VAS 1-2-3 scores. Proteinuria (≥3.5 g/dL) was found associated with VAS scores. **Conclusion:** Perception of pain associated with renal biopsy was independent from many clinical and anatomical factors, and was difficult to be predicted.

Keywords: Pain perception; pain measurement; kidney; biopsy

ÖZET Amaç: Bu çalışmada böbrek biyopsine bağlı ağrı algısını görsel analog skala (VAS) ile değerlendirmeyi, ağrı algısını etkileyebilecek faktörleri araştırmayı hedefledik. **Gereç ve Yöntemler:** Mayıs 2014-Kasım 2016 tarihleri arasında hastanemizde yapılan 100 nativ böbrek biyopsisi çalışmaya alındı. Biyopsi yapılan dönemde hastalar analjezik, sedatif, steroid olmayan antiinflamatuar ilaç veya antihistaminik kullanmıyordu. Böbrek biyopsisi lokal anestezi altında ultrason eşliğinde yapıldı. Ağrı VAS'a göre; anestezik ajanın yapıldığı an (VAS-1), biyopsinin yapıldığı zaman (VAS-2) ve biyopsiden 30 dakika sonra (VAS-3) olacak şekilde derecelendirildi. Ağrı skorları ile klinik, laboratuvar ve radyolojik bilgiler analiz edildi. **Bulgular:** Böbrek biyopsisi yapılan toplam 100 hasta çalışmaya alındı. VAS-2 skoru, VAS-1 ve VAS-3'e göre anlamlı olarak daha yüksek bulundu. Hasta yaşı, ameliyat öyküsü, serum kreatinin değeri, biyopsinin yapıldığı taraf, biyopsi yapılan böbreğin vertikal uzunluğu, parankim kalınlığı, iğne çapı, alınan kor sayısı ile VAS 1-2-3 skorları arasında ilişki saptanmadı. Proteinüri (≥3.5 g/dL) ise VAS skorları ile ilişkili bulundu. **Sonuç:** Böbrek biyopsisi ile ilişkili ağrı algısı birçok klinik ve anatomik faktörden bağımsızdı. Bu nedenle öngörülebilmesi zordur.

Anahtar Kelimeler: Ağrı algısı; ağrı ölçümü; böbrek; biyopsi

Renal biopsy provides valuable information for the diagnosis of specific renal diseases, determination of disease activity, prognosis, and treatment planning. Percutaneus renal biopsy was first performed in 1950 and improved thereafter.[1] Complications of renal biopsy like hemorrage, AV fistula, page kidney, soft tissue infection, adjacent organ injuries like puncture of liver, pancreas, spleen, and even death are rare nowadays.

However pain continues to be a disturbing problem. Most of the complications, particularly bleeding, were observed within 8 hours of observation time.[2,3]

Use of real time ultrasound for needle guidance and automated biopsy guns may help to achieve more successful biopsies with lower complication rates.[4] Renal biopsy is performed under local anesthesia today. However, some patients report different level of pain during and immediately after the procedure. Periprocedural pain and its related factors have not been well investigated in native kidney biopsy, yet.

Visual analog scale (VAS) is a valid method to evaluate perception of pain more objectively.[5] The main objective of this study was to investigate pain intensity in patients undergoing elective native kidney biopsy. In addition, we aimed to investigate the factors that might influence pain perception, and determine whether premedication was needed.

MATERIAL AND METHODS

The study was conducted in accordance with the Declaration of Helsinki. Informed consent was taken from all participants enrolled in the study. A total of 100 patients who had undergone elective native kidney biopsy in our hospital between May 2014 and November 2016 due to suspicious renal paranchymal disease were enrolled in our study. Patients with a history of renal cell carcinoma or a suspicious renal mass except for a Bosniak category I or II cystic mass, and patients with hydronephrosis or suspected upper urinary tract infections, and patients suffering from chronic pain were excluded. Renal biopsy was not performed for small-sized kidneys.

Coagulation parameters were studied before the procedure to check that activated partial thromboplastin time (aPTT), international normalized ratio (INR), platelet count are in normal range. Patients were asked to discontinue antiplatelet and anticoagulant drugs seven days before the procedure whereas unfractionated heparin was withheld one day before the procedure. Blood pressure was measured before renal biopsy to make sure that it was below <140/90 mmHg. Patients were not receiving opioid non opioid analgesics, sedatives, non steroidal anti-inflammatory drugs or antihistamines at the time of biopsy.

The patients were asked to lie in lateral position, and the skin over the biopsy site was cleaned with an antiseptic solution. Renal biopsy was performed under ultrasound (LOGIQ S8, GE healthcare, USA) with a 3-5 MHz curvilinear transduce) guidance with automated 16 or 18 gauche (G) biopsy needles following local anesthesia (2% lidocain, 100 mg) by a single operator with 5 years experience of interventional radiology (K.E.). After the biopsy, a compressive bandage was applied to the biopsy site, and patients were required to rest in bed for 6 hours in a supine posture, with a roll on biopsy site.

Age, gender, place of birth, surgery experience were questioned. Serum creatinine, albumin, proteinuria level, ultrasonographic evaluation, biopsy needle size and number of needle passes were written. Side of the kidney (left or right) in which biopsy was performed was noted.

Visual analog scale was used to assess the pain. Normative values of VAS are not available. The following cut points for the pain intensity by using VAS have been recommended: no pain (0-4 mm), mild pain (5-44 mm), moderate pain (45-74 mm), and severe pain (75-100 mm).[6] Patients were asked to rate their pain after renal biopsy by using a VAS. Visual analog scale scores range between minimum 0 and maximum 10 (Figure 1). Pain was measured by VAS when anesthetic agent was injected (VAS-1), when biopsy was performed (VAS-2) and 30 minutes after biopsy (VAS-3). Visual analog scale change score was defined as the difference between VAS-1, VAS-2, and VAS-3 scores.

After the biopsy, vital signs were closely monitored. Patients were observed for early complications. Post-biopsy urine sample was collected and checked for macroscopic hematuria. Patients who had stable vital signs and no macroscopic hematuria were discharged with post-procedure instructions. Associations of clinical, laboratory and radiological data with pain scores were analysed.

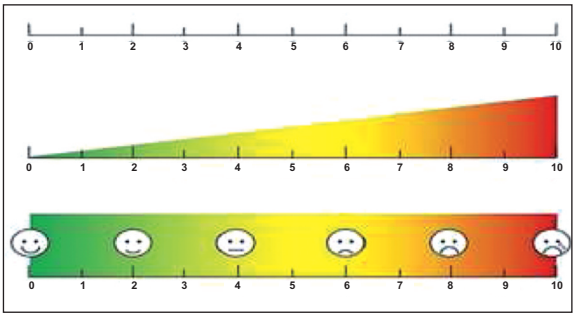

FIGURE 1: Visual analog scale (VAS).

2.1 STATISTICAL ANALYSIS

Descriptive statistics were shown as mean value, standard deviation, median, minimum, and maximum values for continuous variables, whereas numbers and percentage values were given for categorical variables. The normality of distribution of data was tested with Kolmogorov-Smirnov test. Analysis of variance (ANOVA) for Repeated Measures was used to evaluate differences between repeated measurements of VAS-1, VAS-2, VAS-3 scores, and variables that may influence these scores. In this analysis, assumption of sphericity was tested by Mauchly's Test of Sphericity. Greenhouse-Geiser test results were used when the assumption of sphericity was not violated, whereas Sphericity Assumed test results were used when the assumption of sphericity was violated. Among parametric tests, Student t test was used to analyze the difference between two independent groups, whereas ANOVA test was used when they were more than two groups. The Tukey Test, a multiple comparison test, was used to identify which groups differed from others. Chi-square statistics was used to compare two categorical variables, and Fisher Exact test results were used. Statistical significance was set at $p<0.05$ for all comparisons.

RESULTS

A total of 100 patients aged 18-80 years (mean: 47.8±16 years) undergoing native kidney biopsy were enrolled. Demographic, clinical, laboratory and radiological features of the patients were summarized in (Table 1). Mean values for VAS-1, VAS-2, and VAS-3 were 2.46±2.16, 3.58±2.81, and 2.53±2.45 respectively (Figure 2). There is statistical significance between VAS-1 and VAS-2 ($p<0.05$). Statistical significance was also present between VAS-2 and VAS-3 ($p<0.05$). No statistical significance was present between VAS-1 and VAS-3 ($p>0.05$).

Patients with and without past surgical history did not have significantly different VAS 1-2-3 scores and VAS change scores ($p>0.05$). Effects of covarients like age, serum creatinine, serum albumin, proteinuria, side, vertical length and paranchimal thickness of the kidney in which biopsy was performed were evaluated, and only proteinuria had effect on VAS scores ($F=7.513$, $p<0.001$), but not on VAS score changes. Patients with ≥3.5 g/dL proteinuria had significantly higher VAS-2 (4.23±3.02) scores than VAS-1 (2.26±2.08) and VAS-3 scores (3.16±2.80) ($p<0.001$, $p=0.04$ respectively), whereas no statistical difference was obtained between mean values of VAS-1 and VAS-3 ($p>0.05$). There was no statistical difference between VAS scores in patients who had proteinuria

TABLE 1: Demographic, clinical, laboratory, and radiological features of the patients.

Sex (female/male) (n,%)	38/62 (38%, 62%)
Previous operation or biopsy (n,%)	59 (59.6%)
Vertical length of the kidney (mm)	112.5 (86-156)
Paranchymal thickness of the kidney (mm)	18 (9-28)
Serum creatinine (mg/dl)	1.42 (0.5-13.1)
Serum albumin (g/dl)	3.3 (1.35-4.82)
Proteinuria (mg/g) (<3.5/ >3.5 g/dL) (n,%)	56/43 (56%, 43%)
Diameter of biopsy needle (16/18 gauge) (n,%)	70/ 28 (71.4%, 28.6%)
Number of the biopsy core (1/2/3/4) (n,%)	1/6/87/4 (1%, 6.1%, 88.8%, 4.1%)
Side of kidney (left/right) (n,%)	85/9 (88%, 12%)

Values for vertical length, and paranchymal thickness of the kidney, serum creatinine, and serum albumin were expressed as median (minimum-maximum).

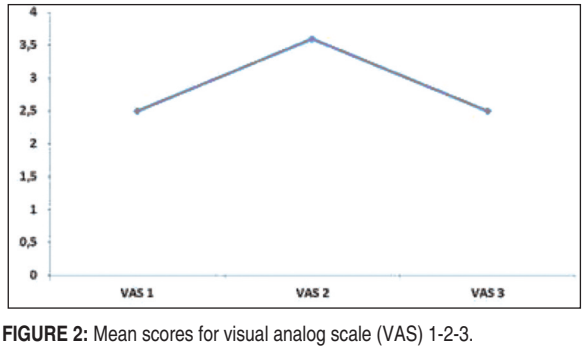

FIGURE 2: Mean scores for visual analog scale (VAS) 1-2-3.

<3.5 g/dL (p>0.05). Mean VAS-2 and VAS-3 scores were higher in patients with ≥3.5 gr/d proteinuria than patients with <3.5 gr/d proteinuria (p<0.05), whereas mean VAS-1 scores were similar (p>0.05).

There was not statistical significance difference between VAS 1-2-3 scores of biopsies performed with 16 and 18 G needles (p>0.05). VAS 1-2-3 scores were not significantly different in patients who had 1 (n=1), 2 (n=6), 3 (n=87), 4 (n=4) cores of biopsy (p>0.05). Despite lack of interaction between sex and VAS 1-2-3, sex had significant effect on VAS change score (F=3.456, p=0.033). Females had VAS change score (VAS2-1) higher than males (p=0.02) (Figure 3).

Only one patient had macroscopic hematuria which was resolved spontaneously. Blood transfusion was not required in any patient. There was not statistical significance between needle size and hematuria (p>0.05).

DISCUSSION

Patients who are encouraged for native kidney biopsy may sometimes refuse the biopsy due to their anxiety about biopsy associated pain. Although patients are informed about rarity of biopsy related complications which were reported in various studies, pain, a common consequence of renal biopsy, may be the one which mostly scares them.[7-10] However, periprocedural pain and its related factors have not been well investigated in native kidney biopsy, yet. In fact we know very little about the patient experiences about renal biopsy.[11]

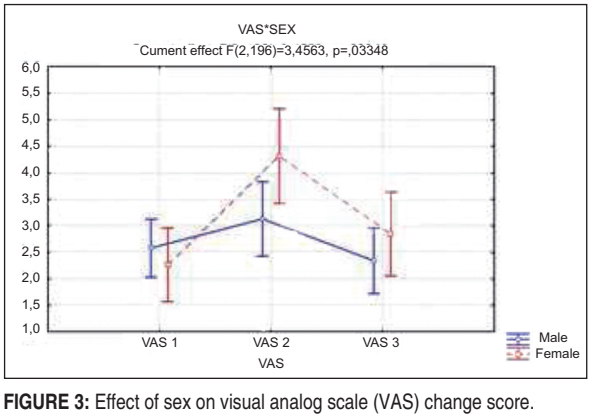

FIGURE 3: Effect of sex on visual analog scale (VAS) change score.

TABLE 2: Association of different factors with visual analog scale (VAS) score.

	VAS score (p value)
Age	> 0.05
Past surgical history	> 0.05
Serum creatinine	> 0.05
Vertical length of the kidney	> 0.05
Paranchymal thickness of the kidney	> 0.05
Side of the kidney biopsy performed	> 0.05
Number of the core	> 0.05
Size of the needle	> 0.05

In this preliminary study, we focused on the pain intensity and pain perception related with native kidney biopsy, and we noticed that mean values for VAS scores were quite lower than we expected. Although lumbar pain was usually expected to occur at the end of anaesthesia, we found that pain score was highest at the time of renal biopsy.[8]

Perception of pain which has quite complex and subjective nature may be influenced from many factors like personality, cultural background and pain experience.[12] Pain associated with the biopsy procedure may differ among patients. In our study we concluded that perception of pain can not be predicted by the patient age, serum creatinine, side, vertical length, and paranchimal thickness of the kidney in which biopsy performed. Despite lack of interaction between sex and VAS 1-2-3, females were found to have significantly higher VAS change score (VAS2-1) than males. Females may perceive pain severity between different stimulus better than men. Hormonal factors and the way of expression of the pain may be the underlying reasons.

Exposure to painful stimuli might be expected to increase pain tolerance. However we didnot find association between past surgical history and VAS scores. Interestingly, patients with proteinuria ≥3.5 g/dL had higher VAS-2 and VAS-3 scores than patients who had proteinuria <3.5 g/dL in our study. Patients with proteinuria ≥3.5 g/dL were more likely to have lower albumin levels which may cause subcutaneous edema and may diminish the effect of local anaesthetic. However, this was not

supported as no statistical significance was found between serum albumin and VAS scores.

We found that needle size, and number of the cores taken were not associated with pain scores. However, Nicholson et al. reported that larger needles were associated with more pain. They compared 14, 16 and 18 G needles in percutaneous renal transplant biopsies, and reported that lineer analog scale scores for 14 G, 16 G and 18 G were 22, 13, 12/100 respectively. Although they concluded that pain scores were in acceptable range, they demostrated that 14 G needles were associated with more pain.[13] However, in our study, we only compared 16 G and 18 G needles. That might cause the main difference between the results of two study. All of these results indicated how difficult it is to predicit severity of the pain the patient going to face as it is independent from many factors. On the other side, psychological characteristics of patients may affect perception of pain and this may be a confounding factor.

Onset of greater pain may be an alarm symptom implicating severe complication.[8] Bleeding after renal biopsy may be into collecting tubules, into renal capsul or into perinephritic space.[14] Bleeding complications may cause increased hospital stay and treatment costs.[10] However, many of these hemorrhages are not clinically significant.[15] Bleeding into collecting system may lead to microscopic or macroscopic hematuria.[14] As renal biopsies are performed by automated needles and under ultrasonographic imaging, prevalence of macroscopic hematuria and need for blood transfusion were decreased.[9] Macroscopic hematuria rate was reported 8% in one trial, whereas 3% or less was also reported in other trials.[13,16] In our study only one patient had macroscopic hematuria, and none of the patients needed transfusion. This implicated the relatively small risk of hemorrhage. Smaller gauge needles were found to be associated with lower complication rates.[9] Renal biopsy of the patient with macroscopic hematuria in the current study was performed with 16 G needle.

Premedication with analgesics or sedatives is an alternative method to control biopsy-associated pain. However, admistration of analgesics is unfavourable due to its side effects and may delay the detection of painful complications including retroperitoneal bleeding. Low mean values for VAS scores were found in acceptable range which also disfavor the common use of premediction as in our study subjects. Therefore, premediction may only be considered in selected patients, but it was quite difficult to predict more sensitive patients.

CONCLUSION

Elective native kidney biopsy is relatively painless procedure. Perception of pain associated with renal biopsy was independent from many clinical and anatomical factors, and thus it was difficult to be predicted.

Acknowledgements

The premilinary study was accepted as free communication at the 17th National Hypertension and Kidney Diseases Congress, 2015.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Ahmet Kıykım, Simge Bardak;* ***Design:*** *Ahmet Kıykım, Serap Demir, Merve Türkegün;* ***Control/Supervision:*** *Kenan Turgutalp, Kaan Esen, Simge Bardak;* ***Data Collection and/or Processing:*** *Kaan Esen, Murside Esra Dolarslan, Merve Türkegün;* ***Analysis and/or Interpretation:*** *Merve Türkegün, Serap Demir, Kenan Turgutalp;* ***Literature Review:*** *Simge Bardak, Murside Esra Dolarslan, Kaan Esen;* ***Writing the Article:*** *Simge Bardak, Kaan Esen, Ahmet Kıykım;* ***Critical Review:*** *Serap Demir, Ahmet Kıykım, Kenan Turgutalp;* ***References and Fundıngs, Materials: Kaan Esen, Murside Esra Dolarslan, Serap Demir.***

REFERENCES

1. Iversen P, Brun C. Aspiration biopsy of the kidney. Am J Med 1951;11(3):324-30.
2. Carrington CP, Williams A, Griffiths DF, Riley SG, Donovan KL. Adult day-case renal biopsy: a single-centre experience. Nephrol Dial Transplant 2011;26(5):1559-63.
3. Maya ID, Allon M. Percutaneous renal biopsy: outpatient observation without hospitalization is safe. Semin Dial 2009;22(4):458-61.
4. Mahoney MC, Racadio JM, Merhar GL, First MR. Safety and efficacy of kidney transplant biopsy: Tru-Cut needle vs sonographically guided Biopty gun. AJR Am J Roentgenol 1993;160(2):325-6.
5. Price DD, McGrath PA, Rafili A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and expermental pain. Pain 1983;17(1):45-56.
6. Jensen MP, Chen C, Brugger AM. Interpretation of visual analog scale ratings and change scores: a reanalysis of two clinical trials of postoperative pain. J Pain 2003;4(7):407-14.
7. Prasad N, Kumar S, Manjunath R, Bhadauria D, Kaul A, Sharma RK, et al. Real-time ultrasound-guided percutaneous renal biopsy with needle guide by nephrologists decreases post-biopsy complications. Clin Kidney J 2015;8(2):151-6.
8. Visconti L, Cernaro V, Ricciardi CA, Lacava V, Pellicanò V, Lacquaniti A, et al. Renal biopsy: still a landmark for the nephrologist. World J Nephrol 2016;5(4):321-7.
9. Corapi KM, Chen JL, Balk EM, Gordon CE. Bleeding complications of native kidney biopsy: a systematic review and meta-analysis. Am J Kidney Dis 2012;60(1):62-73.
10. Manno C, Strippoli GF, Arnesano L, Bonifati C, Campobasso N, Gesualdo L, et al. Predictors of bleeding complications in percutaneous ultrasound- guided renal biopsy. Kidney Int 2004;66(4):1570-7.
11. Finderup J, Peschardt L, Sander MR, Nielsen MU. How do patients experience a kidney biopsy? J Ren Care 2016;42(3):137-43.
12. Singer M, Webb AR. Pain and post-operative intensive care. Oxford Handbook of Critical Care. 2nd ed. United States: Oxford University Press; 2005. p.532-5.
13. Nicholson ML, Wheatley TJ, Doughman TM, White SA, Morgan JD, Veitch PS, et al. A prospective randomized trial of three different sizes of core-cutting needle for renal transplant biopsy. Kidney Int 2000;58(1): 390-5.
14. Babaei Jandaghi A, Lebady M, Zamani AA, Heidarzadeh A, Monfared A, Pourghorban R. A randomised clinical trial to compare coaxial and noncoaxial techniques in percutaneous core needle biopsy of renal parenchyma. Cardiovasc Intervent Radiol 2017;40(1):106-11.
15. Kilcoyne A, Gervais DA. Kidney, ureter, and bladder biopsy. Tech Vasc Interv Radiol 2016;19(3):237-44.
16. Appel GB, Saltzman MJ, King DL, Hardy MA. Use of ultrasound for renal allograft biopsy. Kidney Int 1981;19(3):471-3.