**DOI:** https://doi.org/10.54393/pbmj.v6i09.912

PAKISTAN BIOMEDICAL JOURNAL

https://www.pakistanbmj.com/journal/index.php/pbmj/index

Volume 6, Issue 9 (September 2023)

**Original Article**

# Comparison of 12, 14 And 16 Core Prostate Biopsies in Detecting Prostate Cancer in Patients: A Comparative Study

**Suleyman Sagır[1*] and Muslum Ergun[2]**

[1]Department of Urology, Mardin Artuklu University, Artuklu/Mardin, Turkey
[2]Department of Urology, Istanbul Atlas University, Istanbul, Turkey

## ARTICLE INFO

***Key Words:***
Cancer, Prostate Glands, Prostate Biopsy, PCA Levels

***How to Cite:***
Sagır, S. ., & Ergun, M. . (2023). Comparison of 12, 14 And 16 Core Prostate Biopsies in Detecting Prostate Cancer in Patients: A Comparative Study: Comparison of 12, 14 and 16 Core Prostate Biopsies. Pakistan BioMedical Journal, 6(09). https://doi.org/10.54393/pbmj.v6i09.912

***Corresponding Author:**
Süleyman Sağır
Mardin Artuklu University Medical School, Department of Urology, Turkey
dr.sagiroglu414@gmail.com

Received Date: 26th July, 2023
Acceptance Date: 15th August, 2023
Published Date: 30th September, 2023

## ABSTRACT

Prostate cancer is one of the most common cancers in men and early detection is vital for effective treatment. The traditional method for diagnosis includes the use of prostate biopsies, where a needle is used to extract tissue samples from the prostate gland to be analyzed for cancerous cells. **Objective:** To evaluate and compare the diagnosis rates of benign, malign, and intermediate conditions in patients subjected to 12-core, 14-core, and 16-core biopsy techniques. **Methods:** The retrospective study was conducted on patients who visited our clinic and underwent prostate biopsy between the years 2013 and 2021. This study revolved around a careful comparative examination of the diagnostic outcomes from three different prostate biopsy techniques – 12-core, 14-core, and 16-core biopsy. **Reults:** The findings indicated that there were no notable variations in age or PSA levels among the groups. The 12-core group showed 44.8% benign, 17.8% malign, and 37.4% borderline cases. The 14-core group revealed 43.1% benign, 31.4% malign, and 25.5% borderline cases. The 16-core group had 32% benign, 42.7% malign, and 25.2% borderline cases ($p<0.001$). **Conclusions:** The 16-core biopsy yielded the highest malignancy detection.

## INTRODUCTION

In the annals of medical history, the inaugural proposition of the ultrasound-guided sextant methodology for the biopsy of prostate by Hodge and his team in 1989 marked a significant milestone [1]. This breakthrough approach demonstrated 20%–30% true-positive rate and 15%–35% false-negative rate. Yet, with 15%–30% of latent cancer cases slipping through the net, the inherent limitations of the six-core biopsy technique in terms of cancer detection became apparent [2]. It was this insufficiency that led Stamey and his colleagues to advocate for a shift towards more lateral biopsies in 1995 [3]. Their proposition emerged from their meticulous examination of histological slices from radical prostatectomies. They noticed that there was a larger tumour volume in the peripheral zone, which was located further lateral to the sextant plane. In the pursuit of enhanced cancer detection rates (CDRs), Ploussard and his team delved deeper and discovered a 19.4% increase in the CDR with the use of the 12-core process, as compared to the sextant method [4]. The American Urological Association (AUA), taking note of these findings, has since recommended the expanded 12-core systematic biopsy. Within the template distribution, this method encompasses apical as well as far-lateral cores. However, our experience in clinical practice, despite following the

DOI: https://doi.org/10.54393/pbmj.v6i09.912

AUA-recommended 12-core biopsy technique, yielded a CDR of merely 17.6%. A clear consensus remains elusive as studies have yet to demonstrate consistent advantages of escalating the number of cores from 12 to 18 [5]. Francisco and his collaborators conducted a randomized controlled trial study where the benefits of an 18-core biopsy were more pronounced, albeit within a restricted sample size. This was the catalyst that inspired us to delve further, expanding our study and adapting the method of 18-core biopsy to implement a much lateral site sampling as compared to the 12-core biopsy method [6, 7]. This study aim was to evaluate and compare diagnosis rates of benign, malign, and intermediate conditions in patients subjected to 12-core, 14-core, and 16-core biopsy techniques.

## METHODS

This study was conducted on patients who visited our clinic and underwent prostate biopsy between the years 2013 and 2021. The research began post-receipt of ethical approval from the Atlas University Local Ethics Committee, granted under the reference number 11873, dated 28th January 2022. The crux of our study revolved around a careful comparative examination of the diagnostic outcomes from three different prostate biopsy techniques 12-core, 14-core, and 16-core biopsy. The study's patient population was drawn from a group of men who had either a high level of PSA or an abnormal digitally rectal test. This study was a retrospective comparative study. Type 3 Descriptive Study. Biyopsies were performed on patients over the age of 18 who have prostate hypertrophy and are at risk for prostate cancer. Those who had a biopsy using the 12-14 or 16 core biopsy technique were included. The patients received a cleaning enema and a prophylactic parenteral fluoroquinolone antibiotic the day before the operation. The antibiotic was given for one day before to the surgery. The prostate examination for the biopsy procedure was guided by ultrasound to look for hypoechoic regions. Images were captured in both axial and sagittal orientations using a biplanar side-fire probe with a multifrequency range of 5–10 MHz on a BK Medical device. The volumes of the transition zone (TZ) and prostate zone were calculated using the prostate ellipsoid formula, and the division of PSA by the prostate volume determines the PSA density. All patients were given a local anesthetic cream (rectal proctogylovenol) and positioned on their left side with knees and hips bent at 90 degrees. A biplane probe was used to identify the biopsy locations in each patient, and to collect the samples 18-gauge needle along with a spring-loaded biopsy gun were utilized. The data from our study were processed using the SPSS software version 22.0. Descriptive data were articulated in terms of n, % values for categorical variables, and as median interquartile range that is 25-75 percentile values for continuous variables. The Pearson Chi-square test was used to see whether there were any differences between groups for categorical variables. The Kolmogorov-Smirnov test was used to determine the normality of the distribution for continuous data. The Kruskal-Wallis test was used to compare more than two variables. Statistical significance was defined as a p-value of 0.05.

## RESULTS

Our study delineated a distinct classification of patients, as shown in Table 1, predicated on the core biopsy technique used: 12-core (163 participants, 44.3%), 14-core (102 participants, 27.7%), and 16-core (103 participants, 28%). In this cohort of 368 patients, the average age was 64 (58-69) years. The median PSA level was situated at 7.2 (5.6-10) ng/mL. Concerning diagnostic outcomes, 150 patients diagnosed by benign (40.8%). A malign diagnosis was identified in 105 patients (28.5%). Meanwhile, borderline diagnosis, falling between benign and malign, was diagnosed in 113 patients(30.7%).

**Table 1:** All characteristics of the data included in the study

| | | N (%) | Age, median (IQR) | PSA, median (IQR) |
|---|---|---|---|---|
| Group | 12 core | 163 (44.3) | 64 (58-69) | 7.2 (5.6-10) |
| | 14 core | 102 (27.7) | | |
| | 16 core | 103 (28.0) | | |
| Diagnosis | Benign | 150 (40.8) | | |
| | Malign | 105 (28.5) | | |
| | Intermediate | 113 (30.7) | | |

The median age for the 12-core group was 63 (57-69), for the 14-core group, it was 65 (60-70), and for the 16-core group, it stood at 64 (57-70). A statistical examination revealed that there was no significant difference in age across the groups (p=0.188). Regarding the PSA levels, a similar trend was noted. The median PSA levels for the 12-core, 14-core, and 16-core groups were 7.4 (5.7-11.0), 7.0 (5.5-9.7), and 6.8 (5.6-9.4) ng/mL respectively. The differences were deemed statistically insignificant with a p-value of 0.202. However, the diagnostic outcome varied significantly among the groups. For the 12-core group, 44.8% of the cases were benign, 17.8% were malign, and 37.4% were borderline. The 14-core group showed a distribution of 43.1% benign, 31.4% malign, and 25.5% borderline. Meanwhile, the 16-core group results consisted of 32% benign, 42.7% malign, and 25.2% borderline cases. The variation in diagnosis among the groups was significant (p<0.001) as shown in Table 2 and Figure 1.

DOI: https://doi.org/10.54393/pbmj.v6i09.912

**Table 2:** Comparison of age, PSA and diagnosis of the groups

| Groups | | 12 core N (%) | 14 core N (%) | 16 core N (%) | p-value |
|---|---|---|---|---|---|
| Age, median (IQR) | | 63 (57-69) | 65 (60-70) | 64 (57-70) | 0.188* |
| PSA, median (IQR) | | 7.4 (5.7-11) | 7 (5.5-9.7) | 6.8 (5.6-9.4) | 0.202* |
| Diagnosis | Benign | 73 (44.8) | 44 (43.1) | 33 (32.0) | <0.001** |
| | Malign | 29 (17.8) | 32 (31.4) | 44 (42.7) | |
| | Borderline | 61 (37.4) | 26 (25.5) | 26 (25.2) | |
| *Kruskal Wallis test, **Chi-square test | | | | | |

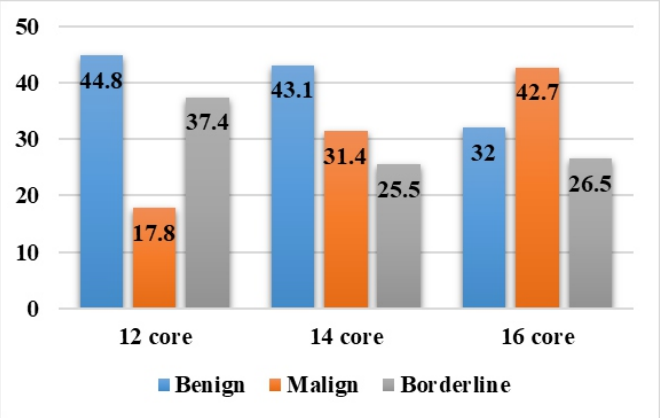


**Figure 1:** Graphical representation of groups according to diagnoses

## DISCUSSİON

Prostate cancer ranks as the second most prevalent cancer among men and stands as the fifth primary cause for cancer-linked fatalities [1]. Typically, prostate cancer screening involves measuring PSA serum levels and conducting a digital rectal examination. To confirm a prostate cancer diagnosis, professionals often utilize the transrectal ultrasound-guided prostate biopsy (TRUS-B) [2]. In the period before imaging techniques were available, prostate biopsies were conducted through direct touch or palpation. With the advent of transrectal ultrasound in the early 1970s, the traditional sextant biopsy method—which involves six cores collected from the base, middle, and apex on both sides—was developed to improve detection over manual guiding [8]. An extensive review of 87 studies revealed that increasing the number of cores in the typical 6-sextant pattern from six to twelve and includes medial and lateral cores increased cancer detection by 31% [9]. The 12-18 core systematic biopsy method as a result spread throughout the 2000s. There was no discernible increase in problems following the biopsy when the number of biopsy cores was increased from six to twelve [10]. Based on this, the entire gland is sampled during a procedure known as a "saturation biopsy," which is often performed on individuals who have persistently elevated PSA levels and previously negative biopsy results [11-14]. The systematic six-core biopsy, as first introduced by Hodge *et al.*, was the inaugural method of TRUS-B to gain clinical acceptance [3]. As the years progressed, prostate needle biopsies employing varying numbers of samples - 10, 12, 18, 26 cores - were proposed, igniting a debate about the optimal number of cores for a systematic prostate needle biopsy [15]. Philip and colleagues evaluated the cancer detection rates of 8-core, 10-core, and 12-core prostate biopsies in their study with 445 patients [7]. The researchers advised a 10-core prostate needle biopsy as the standard for patients with Prostate-Specific Antigen (PSA) values ranging from 4 to 10 ng/ml since they discovered equivalent rates of cancer detection for 10-core and 12-core biopsies [8, 9]. Similar cancer detection rates were observed using 10-core and 12-core transrectal ultrasound-guided biopsies (TRUS-B) in patients with PSA levels less than 20 ng/ml in a significant retrospective series published in 2018 with 1211 patients [10]. While biopsy cores increased number does not necessarily contribute to major complications, reports have noted a rise in minor complications, such as hematuria. This has lent support to the concept that "the highest diagnostic rates should be achieved with the minimal number of samples" [7]. Presently, there is no consensus on the precise number of cores required for a standard systematic prostate biopsy, with the systematic 10-12 core prostate biopsy method most frequently administered [16-18]. In our study we compared the diagnosis rates of benign, malign, and intermediate conditions in patients subjected to 12-core, 14-core, and 16-core biopsy techniques. Our results, showing a higher detection rate of cancerous cases with an increased number of cores during biopsy, align with findings previously documented in scientific literature. Various research efforts, including those led by Li *et al.*, have highlighted that elevating the number of samples in a prostate biopsy to saturation levels may enhance the ability to detect clinically important Prostate Cancer (PCa) [19]. While these studies did not find a meaningful difference in uncovering higher-grade cancer as the number of biopsy samples increased, they stressed the significance of raising the core count in substantially improving PCa detection rates. However, it must be noted that not all studies have reached a consensus on this issue. Few studies have specifically looked at whether increasing the number of biopsy cores improves detection rates for more severe or substantial PCa. However, Wang *et al.*'s research offers strong proof that an 18-core biopsy method may boost the detection rate of major PCa without doing the same for less serious Pca [20]. In a thorough retrospective investigation, contrast-enhanced Doppler ultrasonography targeted biopsy had a detection rate for individual patients of 27% compared to 23% with systematic biopsy. When both approaches were applied,

**DOI:** https://doi.org/10.54393/pbmj.v6i09.912

the detection rate rose to 31% [15]. In our study, the results clearly pointed to a notable surge in the detection of malignant cases in the 16-core group. Specifically, 42.7% of cases in this group were classified as malignant, which was a higher proportion relative to the 12-core (17.8% malignant cases) and 14-core groups (31.4% malignant cases). This results are indicative of the potential benefits that a more extensive biopsy approach, such as the 16-core biopsy, could offer in enhancing the detection rates of malignancies in prostate cancer screening. Nevertheless, it remains imperative to balance the benefit of higher detection rates with the potential for increased complications and patient discomfort with larger biopsy samples. Hence, future research should focus on fine-tuning the optimal number of cores to sample that would maximize cancer detection while minimizing potential harm to the patients. The limitations of the article include its retrospective structure, which could introduce selection bias. There wasn't adequate control for possible confounding elements, and the study's design being centered on a single facility might raise concerns about its wider applicability. Additionally, the study did not evaluate the pain and complications stemming from various biopsy methods.

## CONLUSIONS

Our study indicates an enhanced detection rate of malignant prostate cancer with an increased number of biopsy cores. The 16-core biopsy yielded the highest malignancy detection, suggesting potential benefits of a more extensive biopsy.

## Authors Contribution

Conceptualization: SS, ME
Methodology: SS, ME
Formal Analysis: SS, ME
Writing-review and editing: SS, ME

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

## REFERENCES

[1] Nazir B. Pain during transrectal ultrasound-guided prostate biopsy and the role of periprostatic nerve block: what radiologists should know. Korean Journal of Radiology. 2014 Oct; 15(5): 543-53. doi: 10.3348/kjr.2014.15.5.543.

[2] Norberg M, Egevad L, Holmberg L, Sparen P, Norlen BJ, Busch C. The sextant protocol for ultrasound-guided core biopsies of the prostate underestimates the presence of cancer. Urology. 1997 Oct; 50(4): 562-6. doi: 10.1016/S0090-4295(97)00306-3.

[3] Ploussard G, Nicolaiew N, Marchand C, Terry S, Vacherot F, Vordos D, *et al*. Prospective evaluation of an extended 21-core biopsy scheme as initial prostate cancer diagnostic strategy. European Urology. 2014 Jan; 65(1): 154-61. doi: 10.1016/j.eururo.2012.05.049.

[4] Guichard G, Larré S, Gallina A, Lazar A, Faucon H, Chemama S, *et al*. Extended 21-sample needle biopsy protocol for diagnosis of prostate cancer in 1000 consecutive patients. European Urology. 2007 Aug; 52(2): 430-5. doi: 10.1016/j.eururo.2007.02.062.

[5] Bjurlin MA, Carter HB, Schellhammer P, Cookson MS, Gomella LG, Troyer D, *et al*. Optimization of initial prostate biopsy in clinical practice: sampling, labeling and specimen processing. The Journal of Urology. 2013 Jun; 189(6): 2039-46. doi: 10.1016/j.juro.2013.02.072.

[6] Rodríguez-Covarrubias F, González-Ramírez A, Aguilar-Davidov B, Castillejos-Molina R, Sotomayor M, Feria-Bernal G. Extended sampling at first biopsy improves cancer detection rate: results of a prospective, randomized trial comparing 12 versus 18-core prostate biopsy. The Journal of Urology. 2011 Jun; 185(6): 2132-6. doi: 10.1016/j.juro.2011.02.010.

[7] Philip J, Ragavan N, Desouza J, Foster CS, Javle P. Effect of peripheral biopsies in maximising early prostate cancer detection in 8-, 10-or 12-core biopsy regimens. BJU International. 2004 Jun; 93(9): 1218-20. doi: 10.1111/j.1464-410X.2004.04857.x.

[8] Hodge KK, McNeal JE, Terris MK, Stamey TA. Random systematic versus directed ultrasound guided transrectal core biopsies of the prostate. The Journal of Urology. 1989 Jul; 142(1): 71-4. doi: 10.1016/S0022-5347(17)38664-0.

[9] Eichler K, Hempel S, Wilby J, Myers L, Bachmann LM, Kleijnen J. Diagnostic value of systematic biopsy methods in the investigation of prostate cancer: a systematic review. The Journal of Urology. 2006 May; 175(5): 1605-12. doi: 10.1016/S0022-5347(05)00957-2.

[10] Berger AP, Gozzi C, Steiner H, Frauscher F, Varkarakis J, Rogatsch H, *et al*. Complication rate of transrectal ultrasound guided prostate biopsy: a comparison among 3 protocols with 6, 10 and 15 cores. The Journal of Urology. 2004 Apr; 171(4): 1478-81. doi: 10.1097/01.ju.0000116449.01186.f7.

[11] Jones JS, Patel A, Schoenfield L, Rabets JC, Zippe CD, Magi-Galluzzi C. Saturation technique does not improve cancer detection as an initial prostate biopsy strategy. The Journal of Urology. 2006 Feb; 175(2): 485-8. doi: 10.1016/S0022-5347(05)00211-9.

**DOI:** https://doi.org/10.54393/pbmj.v6i09.912

[12] Pinto PA, Chung PH, Rastinehad AR, Baccala AA, Kruecker J, Benjamin CJ, *et al*. Magnetic resonance imaging/ultrasound fusion guided prostate biopsy improves cancer detection following transrectal ultrasound biopsy and correlates with multi-parametric magnetic resonance imaging. The Journal of Urology. 2011 Oct; 186(4): 1281-5. doi: 10.1016/j.juro.2011.05.078.

[13] Yacoub JH, Verma S, Moulton JS, Eggener S, Oto A. Imaging-guided prostate biopsy: conventional and emerging techniques. Radiographics. 2012 May; 32(3): 819-37. doi: 10.1148/rg.323115053.

[14] Wolf AM, Wender RC, Etzioni RB, Thompson IM, D'Amico AV, Volk RJ, *et al*. American Cancer Society guideline for the early detection of prostate cancer: update 2010. CA: A Cancer Journal for Clinicians. 2010 Mar; 60(2): 70-98. doi: 10.3322/caac.20066.

[15] Hong CW, Amalou H, Xu S, Turkbey B, Yan P, Kruecker J, *et al*. Prostate biopsy for the interventional radiologist. Journal of Vascular and Interventional Radiology. 2014 May; 25(5): 675-84. doi: 10.1016/j.jvir.2013.12.568.

[16] Carter HB, Albertsen PC, Barry MJ, Etzioni R, Freedland SJ, Greene KL, *et al*. Early detection of prostate cancer: AUA Guideline. The Journal of Urology. 2013 Aug; 190(2): 419-26. doi: 10.1016/j.juro.2013.04.119.

[17] Borghesi M, Ahmed H, Nam R, Schaeffer E, Schiavina R, Taneja S, *et al*. Complications after systematic, random, and image-guided prostate biopsy. European Urology. 2017 Mar; 71(3): 353-65. doi: 10.1016/j.eururo.2016.08.004.

[18] Kuru TH, Roethke MC, Seidenader J, Simpfendörfer T, Boxler S, Alammar K, *et al*. Critical evaluation of magnetic resonance imaging targeted, transrectal ultrasound guided transperineal fusion biopsy for detection of prostate cancer. The Journal of Urology. 2013 Oct; 190(4): 1380-6. doi: 10.1016/j.juro.2013.04.043.

[19] Li YH, Elshafei A, Li J, Gong M, Susan L, Fareed K, *et al*. Transrectal saturation technique may improve cancer detection as an initial prostate biopsy strategy in men with prostate-specific antigen< 10 ng/ml. European Urology. 2014 Jun; 65(6): 1178-83. doi: 10.1016/j.eururo.2013.05.047.

[20] Wang BR, Chen CC, Zheng RH, Hu JC, Ou YC. Comparison of cancer detection between 18-and 12-core prostate biopsy in Asian patients with prostate-specific antigen levels of 4–20 ng/mL. Journal of the Chinese Medical Association. 2018 Dec; 81(12): 1044-51. doi: 10.1016/j.jcma.2018.06.003.