



Original Research Article

Study of lesions of prostate after surgery and its correlation with PSA level and expression of p504s IHC marker in malignant lesions of prostate

Geetika Agarwal^{1*}, Deepak Mittal¹, Deepali Gupta¹, Hemant Kumar¹, Divya Pursnani¹, Tanmeet Kaur¹, Asmita¹

¹Dept. of Pathology, F.H. Medical College, Agra, Uttar Pradesh, India

Abstract

Background: Prostate lesions encompass a spectrum of benign and malignant pathologies, with prostate-specific antigen (PSA) serving as a key biomarker in their evaluation. Immunohistochemical (IHC) markers, such as α -methylacyl-CoA racemase (P504S), have emerged as adjuncts in distinguishing malignancies. This study aims to analyse post-surgical prostate lesions, correlate histopathological findings with PSA levels, and assess the expression of P504S in malignant cases.

Materials and Methods: This hospital-based observational study was conducted in 150 prostate specimens which were obtained post-surgery. After the thorough analysis. Histopathological classification was performed and PSA levels were analysed in relation to lesion type. IHC staining for P504S was conducted in malignant cases to determine its diagnostic utility. Statistical analysis was applied to assess correlations between PSA levels, histological diagnosis, and P504S expression.

Results: We analysed a total of 150 cases, with the highest proportion (48.67%) in the 60–70 years age group and a mean age of 67.40 ± 8.69 years. Non-neoplastic lesions were predominant (94%), while neoplastic cases accounted for 6%. Benign lesions were most common in the 60–70 years group, whereas malignancy was more frequent in individuals over 80 years (44.44%). Retention of urine (30%) was the most common symptom. Histopathological analysis showed benign prostatic hyperplasia (41.33%) as the most frequent diagnosis, followed by chronic nonspecific prostatitis (25.33%) and adenocarcinoma (6%). PSA levels above 20 ng/mL were predominantly associated with malignancy. Higher Gleason scores (9 and 8) were common, indicating aggressive tumors. A significant correlation was observed between age, PSA levels, and Gleason's score ($p < 0.0001$).

Conclusion: Our study concludes that, histopathological evaluation remains the gold standard for diagnosing prostate lesions, while PSA serves as a useful but non-specific biomarker. P504S IHC staining enhances the diagnostic accuracy for malignancy. The combination of PSA levels with histopathological and IHC findings improves the stratification of prostate lesions, easing early and accurate diagnosis.

Keywords: Prostate lesions, PSA levels, P504S, Immunohistochemistry, Prostate cancer, Histopathology.

Received: 09-04-2025; **Accepted:** 05-07-2025; **Available Online:** 17-10-2025

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Prostate cancer predominantly affects the elderly male population, with over 75% of cases diagnosed in men aged 65 years and older.¹ In recent decades, it has emerged as a significant global health concern.^{2,3} Prostate cancer ranks as the second most frequently diagnosed malignancy among men worldwide and the fifth overall in terms of incidence.⁴

Alarmingly, this disease is associated with an estimated loss of 4.04 million years of healthy life globally,

underscoring its impact not only on individual patients but also on public health systems.^{5,6} Furthermore, it accounts as the sixth leading cause of cancer-related mortality in men.⁷

PSA attends as a crucial biomarker in the diagnosis and management of prostate cancer.⁷⁻⁹ Elevated PSA levels are often associated with the presence of malignant lesions.¹⁰ However, the specificity of PSA as a standalone indicator remains a topic of ongoing debate.¹¹ Conditions such as

*Corresponding author: Geetika Agarwal
Email: dr.geetikaagarwal@gmail.com

inflammation, benign prostatic hyperplasia, and post-surgical changes can confound PSA interpretations, highlighting the need for adjunctive diagnostic modalities to enhance accuracy and patient outcomes.¹²⁻¹⁴

Recent advancements in IHC have introduced markers such as P504S, which has shown promise in differentiating malignant from benign prostatic lesions. P504S, also known as alpha-methylacyl-CoA racemase (AMACR), is overexpressed in prostate cancer cells and has been utilized to improve the accuracy of histological evaluations.¹⁵⁻¹⁷ The correlation between P504S expression, PSA levels, and postoperative lesion characteristics could provide valuable insights into tumor biology and recurrence risk.

This study aims to explore the lesions of the prostate following surgical intervention and their correlation with pre-operative PSA levels and P504S IHC marker expression in malignant lesions. By elucidating these relationships, we hope to enhance the diagnostic accuracy and prognostic stratification of patients undergoing prostate surgery, ultimately contributing to improved patient management and outcomes.¹⁸

2. Materials and Methods

A prospective hospital-based study was conducted on 150 patients who presented to the surgery OPD and were admitted for a variety of static and dynamic urinary symptoms. Post-surgery specimens of prostate were referred to the Department of Pathology at F.H. Medical College and Hospital, Agra.

During the research period the following parameters were documented for each patient; name, age, occupation, address and presenting complaints along with their serum PSA level. Each specimen underwent thorough gross and microscopic examination. After fixation in formalin, microscopic analysis was conducted on H & E stained sections. For IHC analysis, two additional sections were prepared on positively charged slides from the paraffin blocks.

2.1. Statistical analysis

The categorical variables were presented as the number and percentage of patients. These variables were compared across groups using Pearson's Chi-square test for Independence of Attributes. Continuous variables were reported as mean and standard deviation and were compared between the two groups using the Z test for two means.

3. Results

The study included various parameters including age, symptoms at presentation, distribution according to lesions, Gleason scoring and grading amongst other categories. Amongst the 150 cases, highest proportion of cases (48.67%) was observed in the 60–70 years age group, followed by

22.67% in the 70–80 years group. Patients between 50–60 years comprised 18.67% of the study population, while those above 80 years accounted for 10%. The study categorized prostatic lesions into Non-neoplastic and Neoplastic types. Following which, 141 cases (94.00%) were reported as non neoplastic, while 9 cases (6.00%) were neoplastic.

The age-wise distribution of prostatic lesions, as shown in **Table 1**, revealed that benign cases were most prevalent in the 60–70 years age group (50.35%), followed by the 70–80 years group (22.70%), the 50–60 years group (19.15%), and the >80 years group (7.80%). In contrast, malignant cases were most commonly observed in individuals aged >80 years (44.44%), followed by the 60–70 years group (22.22%) and the 70–80 years group (22.22%), with the lowest occurrence in the 50–60 years group (11.11%). This indicated that while benign lesions are more common across all age groups, malignancy is significantly more prevalent in older individuals, particularly those over 80 years. The analysis of clinical symptoms in the study group showed that retention of urine was the most common complaint, occurring in 45 cases (30.00%). This was followed by a weak stream, reported in 38 cases (25.33%), and increased urinary frequency, noted in 24 cases (16.00%). Other frequently observed symptoms included urgency (11.33%), nocturia (9.33%), hesitancy (7.33%), and haematuria, which was the least common, recorded in only 1 case (0.67%), indicating a rather aggressive tumor. The histopathological examination of the study group showed (elaborated in **Table 2**) that BPH was the most frequently diagnosed condition, observed in 62 cases (41.33%). Chronic nonspecific prostatitis was the second most common finding, accounting for 38 cases (25.33%), followed by chronic granulomatous prostatitis in 15 cases (10.00%). Among other inflammatory conditions, acute prostatitis was identified in 18 cases (12.00%). PIN was noted in 8 cases (5.33%), while adenocarcinoma, representing malignant lesions, was diagnosed in 9 cases (6.00%). The correlation between PSA levels and prostatic lesions, as shown in **Table 3**, revealed that most benign and inflammatory conditions had PSA levels within the 0–4 ng/mL range, including 12 cases of acute prostatitis, 29 cases of chronic nonspecific prostatitis, 5 cases of chronic granulomatous prostatitis, 31 cases of BPH, and 3 cases of PIN, while no adenocarcinoma cases were observed in this range. In the intermediate PSA range (4–20 ng/mL), 6 cases of acute prostatitis, 9 cases of chronic nonspecific prostatitis, 9 cases of chronic granulomatous prostatitis, 29 cases of BPH, 5 cases of PIN, and 2 cases of adenocarcinoma were recorded. PSA levels above 20 ng/mL were predominantly associated with malignancy, with 7 cases of adenocarcinoma falling in this range, whereas only 1 case of chronic granulomatous prostatitis and 2 cases of BPH exhibited PSA levels exceeding 20 ng/mL. The correlation between PSA levels and age groups showed that most cases across all age groups had PSA levels within the 0–4 ng/mL range, with the highest occurrence in the 60–70 years group (37 cases), followed by the 50–60 years group (21 cases) as seen in

Table 4. The biopsy Gleason score distribution according to **Table 5**, showed that the majority of cases (33.33%) had a score of 9, indicating high-grade tumors. Scores of 7 and 8 were observed in 22.22% of cases each, while scores of 6 and 10 were present in 11.11% of cases each. Higher Gleason scores were more frequent, suggesting a predominance of aggressive tumors in the study population. The histopathological grading of prostate cancer using the Gleason grading system showed that the majority of cases were classified as Gleason grade 5 (44.44%), followed by equal distribution between Gleason grade 3 (22.22%) and Gleason grade 4 (22.22%), only 1 case (11.11%) fell in the category of Gleason grade 1. These findings indicate that higher Gleason grade 5 was more prevalent in an institutional study, suggesting a predominance of poorly differentiated tumors in the study population. **Table 6**, shows that in our study, IHC was positive in eight H&E-positive cases and negative in none. In this study, histopathological examination initially revealed a negative result for adenocarcinoma in one

case. However, further immunohistochemical analysis revealed P504S positivity, strongly suggestive of adenocarcinoma. This highlighted that, the combined use of H&E staining and IHC is an effective diagnostic tool for accurate diagnosis and improved patient care. **Table 7** and **Table 8** demonstrate the correlation analysis between age, serum PSA levels, and Gleason's score revealed a statistically significant association. The correlation between age and serum PSA level had a Pearson's correlation value of 0.036 with a p-value < 0.0001, indicating a weak but significant positive relationship. Similarly, the correlation between age and Gleason's score had a Pearson's correlation value of 0.13 with a p-value < 0.0001, also demonstrating a significant positive correlation. These findings showed that age had a slight but meaningful correlation with PSA levels and tumor aggressiveness (Gleason's score) in the study population. Our study revealed that, PSA levels had a slight but meaningful association with tumor aggressiveness (Gleason's score) in the study population.

Table 1: Age-wise distribution of prostatic lesion

Age (Years)	Benign		Malignant	
	No of cases	Percentage	No of cases	Percentage
50-60	27	19.15%	1	11.11%
60-70	71	50.35%	2	22.22%
70-80	32	22.70%	2	22.22%
>80	11	7.80%	4	44.44%
Total	141	100.00%	9	100.00%

Table 2: Histopathological diagnosis in the study group

S. No.	Histopathological Diagnosis	No. of Cases	Percentage (%)
1	Acute Prostatitis	18	12.00%
2	Chronic Nonspecific Prostatitis	38	25.33%
3	Chronic Granulomatous Prostatitis	15	10.00%
4	BPH (Benign Prostatic Hyperplasia)	62	41.33%
5	PIN (Prostatic Intraepithelial Neoplasia)	8	5.33%
6	Adenocarcinoma	9	6.00%
	Total	150	100.00%

Table 3: PSA level in correlation with prostatic lesion

Prostatic Lesion	Acute Prostatitis	Chronic Nonspecific Prostatitis	Chronic Granulomatous Prostatitis	BPH (Benign Prostatic Hyperplasia)	PIN (Prostatic Intraepithelial Neoplasia)	Adenocarcinoma
PSA level	No. of Cases	No. of Cases	No. of Cases	No. of Cases	No. of Cases	No. of Cases
0-4	12	29	5	31	3	0
4-20	6	9	9	29	5	2
>20	0	0	1	2	0	7

Table 4: PSA level in correlation with age

Age group	50-60	60-70	70-80	>80
PSA level	No. of Cases	No. of Cases	No. of Cases	No. of Cases
0-4	21	37	15	7
4-20	6	33	17	4
>20	1	3	2	4

Table 5: Biopsy Gleason score

Gleason Score	No. of Cases	Percentage (%)
6	1	11.11%
7	2	22.22%
8	2	22.22%
9	3	33.33%
10	1	11.11%

Table 6: Comparison of diagnosis of adenocarcinoma on H&E Stain and P504s IHC

Diagnosis of Adenocarcinoma	P504S stain positive	P504S stain negative
H and E stain positive	8	0
H and E stain negative	1	0

Table 7: Correlation of age with serum PSA level and Gleason’s score

Correlation	Pearson’s Correlation Value	p-value
Age and Serum PSA Level	0.036	<0.0001
Age and Gleason’s Score	0.13	<0.0001

Table 8: Correlation of Gleason’s score with PSA value

Correlation	Pearson’s Correlation Value	p-value
Serum PSA Level and Gleason’s Score	0.20	0.0046

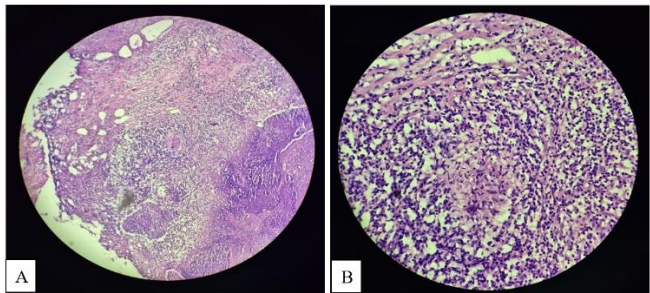


Figure 1: Showing epithelioid cell granuloma at 4x and 20x

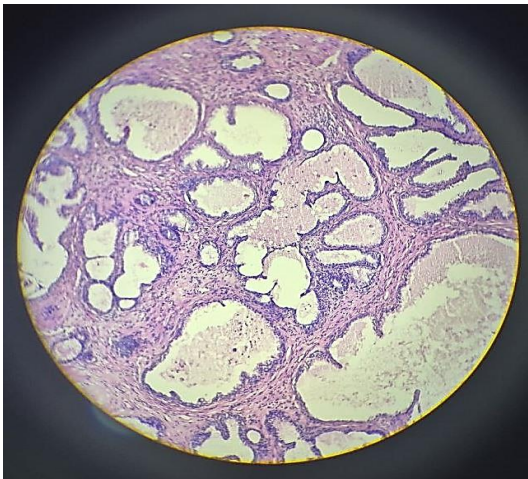


Figure 2: Showing cystically dilated glands with papillary infoldings at 20X

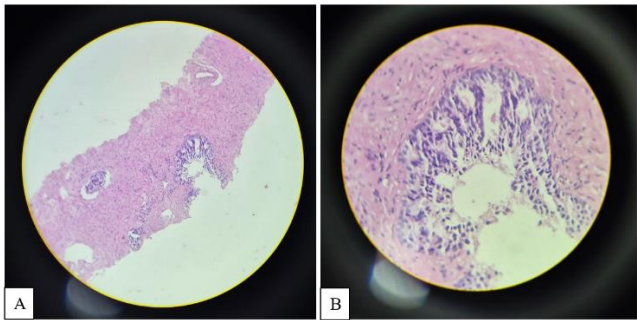


Figure 3: Showing core biopsy of prostate gland with foci of atypical cells at 10x and 40x

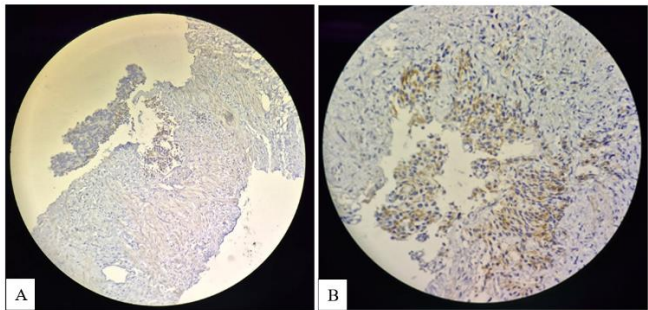


Figure 4: P504S staining of the same bit showing cytoplasmic staining confirming the diagnosis of Adenocarcinoma at 10x & 40x

4. Discussion

In the current investigation, a total of 150 prostate specimens were promptly collected post-surgically from patients in the department of pathology. Our comprehensive analysis of demographic data revealed that the mean age of the study cohort was 67.40 ± 8.69 years. With respect to PSA levels, 48% of the study population exhibited PSA values exceeding 10 ng/mL. In the present study, a total of 150 prostatic lesions were examined, of which 141 cases (94%) were classified as non-neoplastic, while only 9 cases (6%) were identified as neoplastic. These findings underscore the predominance of non-neoplastic lesions in our study cohort. The observed

trend aligns with previous studies conducted in the Indian population. The distribution of study participants was analyzed across various age groups, ranging from 50 years to over 80 years. The majority of participants diagnosed with benign prostatic lesions were within the 60–70-year age group, comprising 71 individuals (50.35%). This was followed by 32 participants (22.70%) in the 70–80-year age group, 27 participants (19.15%) in the 50–60-year age group, and 11 participants (7.80%) aged above 80 years. The peak incidence of benign cases was noted in 69.40 ± 9.14 years. In the present study, urinary retention emerged as the most frequently reported symptom, affecting 45 patients (30%), followed by a weakened urinary stream in 38 patients (25.33%). Additional symptoms included increased urinary frequency in 24 patients (16%), urgency in 17 patients (11.33%), and hematuria in a single patient (0.67%). The histopathological examination of prostatic lesions in this study revealed, a predominant occurrence of BPH, which was diagnosed in 62 cases, accounting for 41.33% of the total cases. This was followed by chronic non-specific prostatitis, which was identified in 38 cases (25.33%), and acute prostatitis, observed in 18 cases (12%). Additionally, chronic granulomatous prostatitis was noted in 15 cases (10%), while prostatic intraepithelial neoplasia (PIN) was detected in 8 cases (5.33%). Furthermore, adenocarcinoma was diagnosed in 9 cases, representing 6% of the study population. The present study established a significant correlation between serum prostate-specific antigen (PSA) levels and the spectrum of prostatic lesions. It was observed that, lower PSA levels (0–4 ng/mL) were predominantly associated with benign and inflammatory conditions, including BPH, chronic nonspecific prostatitis, and acute prostatitis. A subset of cases with chronic granulomatous prostatitis, PIN and BPH exhibited intermediate PSA levels (4–20 ng/mL). Notably, PSA levels exceeding 20 ng/mL demonstrated a strong association with malignancy, with the majority of adenocarcinoma cases presenting within this range, underscoring the diagnostic significance of markedly elevated PSA levels in identifying malignant prostatic pathology. Our study analysed the relationship between serum PSA levels and advancing age, revealing a clear trend of increasing PSA levels with age. Among the 150 participants included in the study, distinct variations in PSA distribution were observed across different age groups. In our study, the distribution of biopsy Gleason scores among the cases is as follows; one case (11.11%) had a Gleason score of 6, two cases (22.22%) had a score of 7, another two cases (22.22%) had a score of 8, three cases (33.33%) had a score of 9, and one case (11.11%) had a score of 10. Our study shows a weak but statistically significant positive correlation between age and both serum PSA levels ($r = 0.036$, $p < 0.0001$) and Gleason's score ($r = 0.13$, $p < 0.0001$). Although the correlations are minimal, the findings suggest a slight increase in PSA levels and Gleason's score with age. These results are similar to previous literature, which demonstrates the association between age, PSA levels, and prostate cancer

severity. We found a correlation between serum PSA levels and the GS, revealing a positive association with statistical significance ($p = 0.0046$) and a Pearson's correlation coefficient of 0.20. These findings underscore the potential role of PSA as a biomarker for disease severity in prostate malignancies. In this study, histopathological examination initially revealed a negative result for adenocarcinoma in one case. However, further immunohistochemical analysis revealed P504S positivity, strongly suggestive of adenocarcinoma. This highlighted that, the combined use of H&E staining and IHC is an effective diagnostic tool for accurate diagnosis and improved patient care.

5. Conclusion

The present study provides a complete analysis of prostatic lesions following surgical intervention, correlating them with PSA levels and the expression of the P504s IHC marker in malignant cases. Our findings highlighted, the important role of PSA as a preliminary diagnostic and prognostic biomarker, aiding in the detection and monitoring of prostatic lesions. However, the observed variations in PSA levels emphasized the need for corresponding markers to enhance diagnostic precision.

The expression of P504s in malignant lesions further reinforces its utility as a reliable IHC marker for prostate cancer, distinguishing malignant from benign prostatic conditions with greater accuracy. This highlights the potential of P504s in improving histopathological evaluation, particularly in cases where conventional morphological assessment may be challenging.

The correlation between histopathological findings, PSA levels, and P504s expression emphasized, the significance of a multimodal diagnostic approach for prostate cancer. Future studies with larger cohorts and standardized methodologies are essential to validate these findings and enhance diagnostic algorithms for improved clinical outcomes.

6. Ethical Approval

This study was approved Institute ethical Approval committee with ref. no. FHMC/IEC/R.Cell/2023/26.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Rifkin MD. *Ultrasound of the Prostate*. 2nd ed. Philadelphia: Lippincott-Raven; 1997. p. 3–14.
2. Marx FJ, Karenberg A. History of the term prostate. *Prostate*. 2009;69(2):208–13. <https://doi.org/10.1002/pros.20871>.
3. Goddard JC. The history of the prostate, part one: say what you see. *Trends Urol Mens Health*. 2019;10(1):28–30.

4. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*. 2010;127(12):2893–917. <https://doi.org/10.1002/ijc.25516>.
5. Garcia M, Jemal A, Ward EM, Center MM, Hao Y, Siegel RL, et al. Global Cancer Facts and Figures 2007. Atlanta, GA: American Cancer Society; 2007.
6. Waldron T. A nineteenth-century case of carcinoma of the prostate, with a note on the early history of the disease. *Int J Osteoarchaeol*. 1997;7(3):241–7. [https://doi.org/10.1002/\(SICI\)1099-1212\(199705\)7:3<241::AID-OA354>3.0.CO;2-2](https://doi.org/10.1002/(SICI)1099-1212(199705)7:3<241::AID-OA354>3.0.CO;2-2).
7. Quinn DI, Sandler HM, Horvath LG, Goldkorn A, Eastham JA. The evolution of chemotherapy for the treatment of prostate cancer. *Ann Oncol*. 2017;28(11):2658–69. <https://doi.org/10.1093/annonc/mdx348>.
8. Cary KC, Cooperberg MR. Biomarkers in prostate cancer surveillance and screening: past, present, and future. *Ther Adv Urol*. 2013;5(6):318–29. <https://doi.org/10.1177/1756287213495915>.
9. Stamey TA, McNeal JE. Adenocarcinoma of the prostate. In: Walsh PC, Retik AB, Stamey TA, Vaughan ED, editors. *Campbell's Urology*. 6th ed. Vol 2. Philadelphia: WB Saunders; 1992. p. 1159–221.
10. Heidenreich A, Bellmunt J, Bolla M, Joniau S, Mason M, Matveev V, et al. EAU guidelines on prostate cancer. Part 1: screening, diagnosis, and treatment of clinically localised disease. *Eur Urol*. 2011;59(1):61–71. <https://doi.org/10.1016/j.eururo.2010.10.039>.
11. Denmeade SR, Isaacs JT. A history of prostate cancer treatment. *Nat Rev Cancer*. 2002;2(5):389–96. <https://doi.org/10.1038/nrc801>.
12. Herr HW. The enlarged prostate: a brief history of its surgical treatment. *BJU Int*. 2006;98(5):947–52. <https://doi.org/10.1111/j.1464-410X.2006.06397.x>.
13. Young HH. Four cases of radical prostatectomy. *Johns Hopkins Bull*. 1905;16:315.
14. Aronovitz JN. A century of brachytherapy (from the prostate's perspective). In: Devlin PM, editor. *Brachytherapy: Applications and Techniques*. 2nd ed. New York, NY: Demos Medical Publishing, LLC; 2015. p. 1–36.
15. Evans AJ. Alpha-methylacyl CoA racemase (P504S): overview and potential uses in diagnostic pathology as applied to prostate needle biopsies. *J Clin Pathol*. 2003;56(12):892–7. <https://doi.org/10.1136/jcp.56.12.892>.
16. Gudeli V, Pallivilla UR, Chilkuri S, Reddi H, Raavi K, Thota A. Utility of alpha-methyl acyl-CoA racemase marker in prostatic adenocarcinomas. *Natl J Lab Med*. 2021;10(4):PO05–8. <https://doi.org/10.7860/NJLM/2021/47043:2525>.
17. Luo J, Zha S, Gage WR, Dunn TA, Hicks JL, Bennett CJ, et al. Alpha-methylacyl-CoA racemase: a new molecular marker for prostate cancer. *Cancer Res*. 2002;62(8):2220–6.
18. Coakley FV, Hricak H. Radiologic anatomy of the prostate gland: a clinical approach. *Radiol Clin North Am*. 2000;38(1):15–29. [https://doi.org/10.1016/s0033-8389\(05\)70147-0](https://doi.org/10.1016/s0033-8389(05)70147-0).

Cite this article: Agarwal G, Mittal D, Gupta D, Kumar H, Pursnani D, Kaur T, Asmita. Study of lesions of prostate after surgery and its correlation with PSA level and expression of p504s IHC marker in malignant lesions of prostate. *Indian J Pathol Oncol*. 2025;12(3):335–340.