Monitoring Prostate Cancer Response via PSA Sandwich ELISA

Elwood Fong | 510444907

1 INTRODUCTION

Prostate-specific antigen (PSA) is a prostate-derived biomarker extensively used for screening and longitudinal monitoring of prostate cancer (Feltes Benitez et al., 2025). We quantified serum PSA by sandwich ELISA - using a standard curve to interpolate unknowns -to evaluate response to radiation therapy in a 60-year-old patient across pre-, 6-, and 12-month samples (Ramos et al., 2001). Tracking PSA trends post-radiotherapy - such as PSA bounce or sustained rises above nadir - provides critical insights into treatment response and recurrence risk (Liaqat et al., 2023). See Figure 1 for the clinical rationale for PSA screening and monitoring.

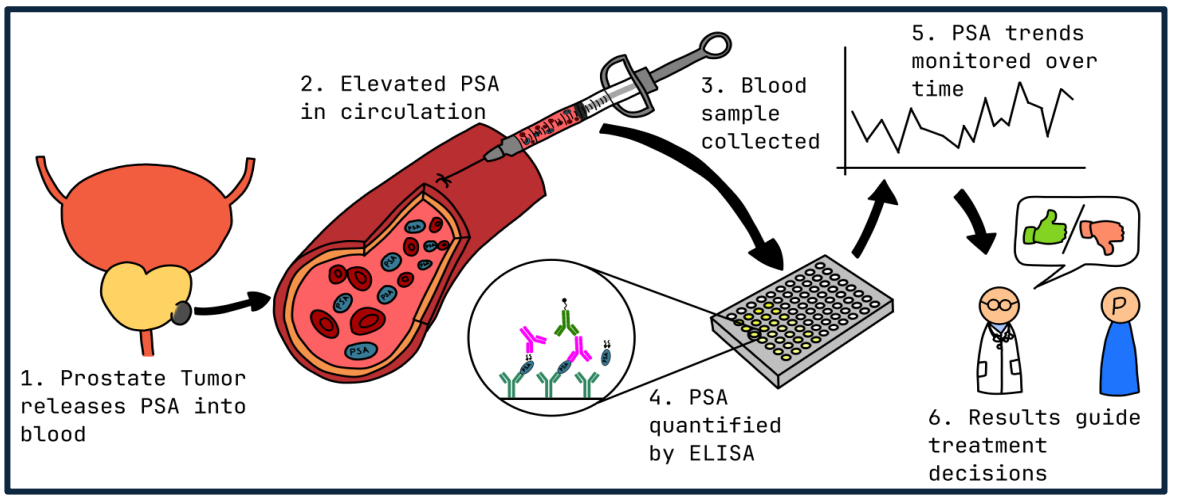

Figure 1. PSA screening schematic. Prostate releases PSA into blood, measured by ELISA, enabling monitoring of treatment response.

2 METHODS

96-well sandwich ELISA on anti-PSA–coated strips. After blocking, standards (1.5–12 ng/mL) and patient sera (duplicate wells) were incubated, followed by HRP-conjugated detector. TMB was developed and stopped with 1 M HCl; OD450 with 540-nm reference was blank-subtracted. A 4-point nonlinear (4PL) standard curve was fitted and unknowns interpolated. Assay performance was monitored with Levey–Jennings charts and Westgard rules using historical QC mean ± SD. Graphs (standard curve, longitudinal PSA, QC) were produced in GraphPad from plate-reader exports.

Notation: error bars = SD; n = replicates; 4PL = four-parameter logistic; QC = quality control.

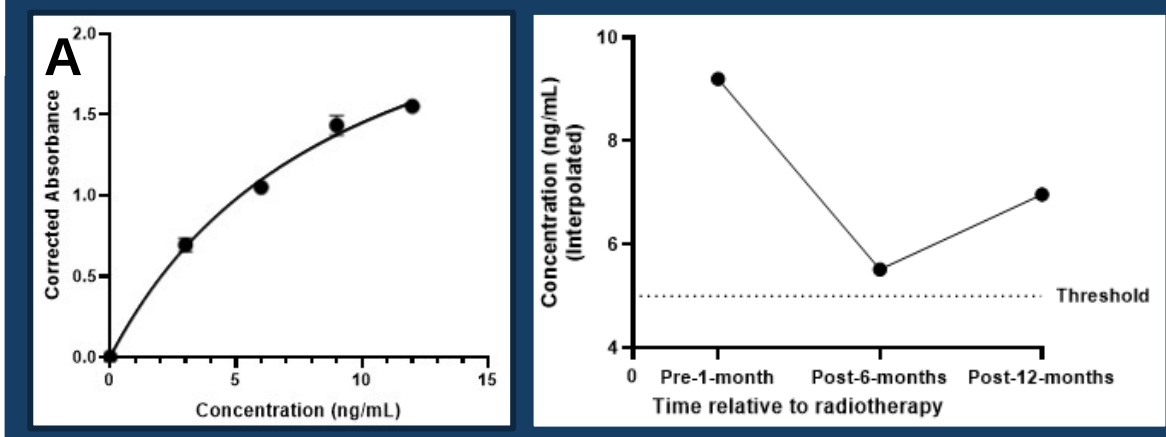

Figure 2. (A) PSA standard curve (1.5, 3.0, 6.0, 12.0 ng/mL. ng/mL), mean ± SD; 4PL fit for interpolation. (B) Patient PSA (mean ± SD) versus radiotherapy timeline; dotted 5 ng/mL threshold.

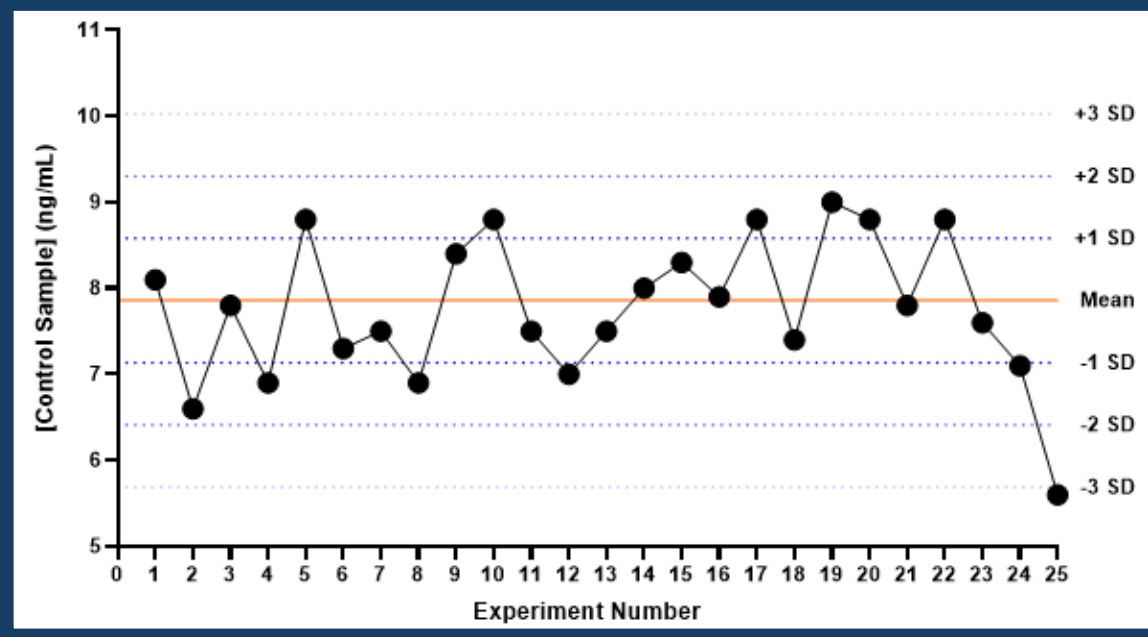

Figure 3. Levey–Jennings QC: historical mean 7.86 ± 0.72 ng/mL; run 25 = 5.6 ng/mL (−3 SD, 1_3s breach).

3 RESULTS

Corrected OD450–540 from PSA standards (1.5–12 ng/mL) generated a 4PL calibration curve (Figure 2A). Patient absorbances were interpolated to concentrations (Figure 2B). PSA fell from ~9.3 ng/mL pre-treatment to ~5.1 ng/mL at 6 months, then rose to ~6.9 ng/mL at 12 months (positivity threshold 5 ng/mL). The concurrent QC control was 5.6 ng/mL versus historical 7.86 ± 0.72 ng/mL, breaching the 1_3s rule on the Levey–Jennings chart (Figure 3). Thus, this batch is out-of-control and patient values are not reportable pending repeat QC.

4 CONCLUSION

Because QC failed (1_3s), this batch is invalid; therapy effectiveness cannot be concluded. If confirmed after repeat testing, PSA fell from ~9.3 to ~5.1 ng/mL at 6 months, then rose to ~6.9 at 12 months—remaining above the 5 ng/mL threshold—suggesting partial response with persistent disease. Next steps: repeat QC and remeasure; trend PSA every 3 months; confirm with an independent assay; consider imaging and urology review.

5 REFERENCES

1. Feltes Benitez, N., Lozano, J., Forero, C.G., Colomer, M.C., Paredes Rubio, S. & Jovell-Fernandez, E. (2025) ‘PSA bounce: understanding temporal fluctuations in prostate cancer after external radiotherapy’, Clinical and Translational Oncology, 27, pp. 3154–3162.
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3. Liaqat, M., Kamal, S. & Fischer, F. (2023) ‘Illustration of association between change in prostate-specific antigen (PSA) values and time to tumor status after treatment for prostate cancer patients: a joint modelling approach’, BMC Urology, 23, Article no. 202.