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A pattern and distribution of skeletal metastasis in prostate cancer patients in Ghana: A descriptive analysis, with a model-guided digital nomogram

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Objectives:

To characterize the anatomical distribution and burden of skeletal metastases in newly diagnosed prostate cancer patients, and to develop a predictive digital nomogram for oligo- versus polyostotic disease.

Methods:

A one-year cross-sectional review of bone scans from 100 prostate cancer patients with confirmed skeletal metastases was undertaken. Standardized site coding produced frequency tables and descriptive statistics (mean, median, mode, IQR). Metastatic patterns were illustrated with bar charts and skeletal heatmaps. Logistic regression modelling, validated and tested in Stata 17 and Python, supported a digital nomogram predicting polyostotic disease. A 5% alpha was used.

Results:

A total of 470 metastatic sites were recorded among 100 patients (age 51–89 years, mean 68.8). The mean PSA was 924.3 ng/ml (range 5.8–2223), and ALP 239.4 U/L (range 45–3265). The number of metastases per patient ranged 1–19 (mean 4.7, median 5, mode 3). Solitary lesions occurred in 33.0%, while 51.0% had ≥3 lesions; polyostotic/superscan patterns were seen in 33.0%. The most common sites were spine (32.6%), ribs (25.7%), and pelvis (16.1%); skull, hands, and feet were rarely affected. The axial skeleton accounted for 68.1% of all deposits. Logistic regression identified PSA >100 ng/ml with moderate ALP (62–122 U/L) as predictive of oligo-metastatic disease, while PSA >100 ng/ml with ALP ≥222 U/L strongly predicted polyostotic spread. The digital nomogram achieved an AUC of 81.0%.

Conclusion:

Axial skeleton involvement predominates in prostate cancer metastases, with a high burden of polyostotic disease. Early imaging and risk-adapted diagnostic strategies, supported by predictive tools, are essential in resource-limited settings.