Bone Scintigraphy Use in Prostate Cancer Staging

Reflective Practice Towards an Environmentally Sustainable NHS

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1 Introduction

Bone scintigraphy is commonly used for prostate cancer staging despite national guidance recommending against its routine use in Cambridge Prognostic Group (CPG) 1-2 disease, while uncertainty persists regarding its role in CPG 3 (evidence gap). Unnecessary imaging exposes patients to avoidable radiation, prolongs diagnostic pathways, and increases financial and environmental burdens. Reducing low-value imaging could improve diagnostic stewardship, streamline patient pathways, and support the NHS Greener programme and Net Zero ambitions through more sustainable cancer care.

Aim:

1. To evaluate the appropriateness of bone scintigraphy requests against NICE guidance (NG131) and assess diagnostic yield across risk groups.
2. To identify opportunities to improve the sustainability and evidence-based use of bone scintigraphy in prostate cancer staging.

2 Methodology

Design - Retrospective single-centre observational study at ELHT

Population - First 100 patients with newly diagnosed prostate cancer who underwent bone scintigraphy for initial staging from January 2024

Exclusion - Prior metastatic cancer, restaging scans post-therapy, scans done externally without full records

Data Collection - PSA at diagnosis, Gleason score, bone scintigraphy findings, CPG classification, symptom status

Analysis - NG131 guideline compliance, bone scintigraphy positivity rates across risk groups, estimated avoidable imaging costs

3 Results

Non-adherence to NICE NG131 for bone scintigraphy requests - 6%

Overall bone scan positivity rate - 7%

Bone scan positivity rate by subgroup

A. Based on CPG classification

CPG	n	Positive	Equivocal	Positivity rate (%)
1	-	-	-	-
2	6	0	0	0
3*	21	0	0	0
4	26	0	0	0
5	47	7	1	14.89

** Gleason 3+4=7 & PSA 10-20 microgram/litre & Stages T1-T2* ***OR*** *Gleason 4+3=7 & Stages T1-T2*

B. Based on PSA (microgram/litre)

PSA	n	Positive	Equivocal	Positivity rate (%)
<10	37	0	1	0
10 - 20	30	0	0	0
>20	33	7	0	21.21

C. Based on Gleason Score

Gleason	n	Positive	Equivocal	Positivity rate (%)
6	1	0	0	0
3+4	24	0	0	0
4+3	31	0	0	0
8	14	1	1	7.1
9	26	3	0	11.5

Note: In 4 cases, Gleason score was not accurate as hormonal therapy had already been initiated based on malignant DRE, PSA >40, and MRI stage T3a-T3b.

4 Discussion

1. Bone scan positivity

The overall bone scintigraphy positivity was low (7%), with all metastatic disease detected exclusively in CPG 5 patients and no positive findings in CPG 2-4. These findings support current NICE NG131 recommendations that routine bone scintigraphy offers limited value in lower-risk prostate cancer and may represent low-value imaging.[1] While further evidence is required to clarify the role of bone scintigraphy in CPG 3 disease, a more risk-stratified approach to staging could reduce unnecessary investigations.

2. Sustainability impact

Low-value imaging contributes to unnecessary healthcare resource utilisation, including radiopharmaceutical production, scanner energy consumption, single-use consumables and patient travel, all of which increase the environmental footprint of diagnostic imaging.[2,3] Furthermore, avoiding unnecessary bone scintigraphy reduces patient exposure to ionising radiation (approximately 2.9-4.0 mSv for Tc-99m bone scintigraphy, with additional exposure if SPECT-CT is subsequently performed).[4] Based on local estimates, each bone scan (£256), when followed by SPECT-CT (£226), represents a potential saving of up to £482 per patient, while improving utilisation of limited nuclear medicine resources and offering potential environmental and economic benefits.

Examples of impact:

Category	Description / Examples
	Production of Tc-99m (generator, transport, packaging)
	Scanner operation, lighting, air-conditioning, IT workstations
CO_2	Patient and staff travel
	Syringes, IV sets, gloves, disinfection, radioactive waste
	Appointment slots, waiting time

3. MDT and education

These findings support a multidisciplinary approach involving referring clinicians, urologists and radiologists alongside coordinated national efforts to strengthen the evidence base and optimise risk-stratified imaging pathways. Reinforcing NICE adherence through clinician education, integrating clinical decision support and developing standardised local imaging pathways may reduce low-value imaging. In addition, optimising scheduling, protocol standardisation and minimising scanner idle time may further improve service efficiency and support more sustainable imaging practice.

5 Limitations

As a retrospective, single-centre study with a modest sample size, our findings may be limited by reduced statistical power and generalisability. The low number of metastatic events restricted subgroup analyses and limited confidence in conclusions regarding the role of bone scintigraphy in CPG 3 disease. Future multicentre prospective studies should further define the clinical utility of bone scintigraphy in CPG 3 and inform future evidence-based, risk-stratified staging pathways for prostate cancer.

6 Conclusion

1. Bone scintigraphy demonstrated low diagnostic yield in low- to intermediate-risk prostate cancer, while local practice suggests potential overutilisation.
2. Sustainable healthcare requires critical evaluation of routine investigations to minimise low-value imaging without compromising patient care.
3. Reducing unnecessary bone scintigraphy may minimise radiation exposure, improve utilisation of nuclear medicine resources, lower NHS costs, and support the NHS Greener programme and Net Zero ambitions.

7 References

1. Prostate cancer: diagnosis and management (2019) NICE guideline NG131
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3. Amin P, Malik A, Mcinnes MDF, Brown MJ, Szava-Kovats A. Environmental Sustainability and Cancer Imaging. Canadian Association of Radiologists Journal. 2025;76(4):611-22.
4. Van den Wyngaert T, Strobel K, Kampen WU, et al. The EANM practice guidelines for bone scintigraphy. Eur J Nucl Med Mol Imaging. 2016;43(9):1723–38.