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The relation between prostate-specific antigen and whole-body bone scan result

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Abstract

The nuclear medicine bone scan is a versatile tool because of its high sensitivity for tumors, infection, and trauma, as well as its ability to image the entire skeleton at a reasonable cost, In this study we evaluate the correlation between the prostate-specific antigen number and bone scan result in patients that were diagnosed with prostate cancer. Method: Tc99m-MDP whole body bone scan was analyzed for 100 patients whose ages range between 66-92 years with a mean of 77 years, PSA level ranges from 0-100ng/ml,50% of bone scan result was normal and 50% of patient results had bone metastases. Results: The results show that there is no correlation between the PSA level of the patient and the bone scan result, and there is no correlation between the patient's ages and PSA levels. Conclusions: There was no correlation between PSA level and whole-body scan results in this study.

Keywords: Nuclear medicine; Prostate-specific antigen; Whole body bone scan; Prostate cancer.

1 Introduction

Nuclear medicine bone scans are a multipurpose tool because of their high sensitivity to malignancies, infection, and damage and their ability to image the complete skeleton at a reasonable cost. As a result, despite technological breakthroughs in magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET), bone scintigraphy remains popular. Because bone scans have a low specificity, it is critical to know the patient's history, recognize when radiographic correlation is required, and know how to use it (HarveyAzeissman et al 2014).

In individuals with newly diagnosed prostate cancer, bone scanning has been frequently used to detect bone metastases. However, it is a costly and time-consuming staging method. The number of patients with bone metastases or local extension of the disease at diagnosis has been decreasing in the prostate-specific antigen (PSA), and most patients with the condition have a low risk for bone metastasis (1). Click or tap here to enter text.

Prostate cancer is becoming more widespread in Asia, and it is the most common malignancy diagnosed in men in the United Kingdom. The digital rectal examination (DRE) and a serum prostate-specific antigen (PSA) test are currently the most often used methods for diagnosing prostate cancer. The combination of DRE and PSA testing improves the identification of prostate cancer. If both tests produce abnormal results, a prostate biopsy is suggested for a conclusive tissue diagnosis of prostate cancer. (2)

PSA, or prostate-specific antigen, is a protein produced by both normal and cancerous cells of the prostate gland. The PSA test determines the amount of PSA in the blood. A blood sample is submitted to a laboratory for analysis for this

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test. The results are typically reported in nanograms of PSA per milliliter of blood (ng/mL). PSA levels in the blood are neither normal nor abnormal. PSA readings of 4.0 ng/mL or lower were previously considered normal. However, some men with PSA values below 4.0 ng/mL have prostate cancer, while many men with higher PSA levels between 4 and 10 ng/mL do not. (3)

The PSA test is used to evaluate men after prostate cancer surgery or radiation therapy to check if their cancer has recurred (come back). If a man's PSA level begins to rise following treatment for prostate cancer, this could be the first symptom of a recurrence. A "biochemical relapse" of this type usually occurs months or years before the recurrence creates symptoms. However, a single increased PSA level in someone with a history of prostate cancer does not automatically indicate that the cancer has returned. A person who has had prostate cancer treatment should address a high PSA level with their doctor. Instead of a single elevated PSA reading, the doctor may look for a trend of increased PSA levels over time. A rising trend in PSA levels over time, together with other findings such as abnormal imaging test results, may lead the doctor to urge additional cancer treatment.

2 Previous Study

Positive bone scan findings in newly diagnosed prostate cancer (CaP) patients have been associated favorably with blood prostate-specific antigen (PSA) levels in various large-scale investigations undertaken in Western countries. The purpose of these studies is to show a possible link between PSA levels, bone scan results, and Gleason scores, as well as to validate that the trend exists in Asian populations as well. The results of bone scans, PSA levels, and Gleason scores were analyzed retrospectively in the records of 116 CaP patients. 34 people got bone metastases as a result of a positive bone scintigraphy test. None of these patients' PSA levels were less than 10 ng/ml. PSA levels ranged from 11 to 20 in two patients and from 21 to 200 in 15 others. On bone scintigraphy, 17 people with a PSA level of more than 201 had bone metastases. They find that the PSA level can predict the likelihood of a positive bone scintigraphy outcome. Staging examinations for people with confirmed CaP may be more selective depending on PSA levels. Patients with PSA levels less than 10 ng/ml are exempt from having a bone scan since the likelihood of a positive result is so low. When the Gleason score and PSA level or bone scan data were reviewed, no statistically significant correlation was discovered. (4)

A radionuclide bone scan (BS) was previously the test of choice for detecting osseous metastases in prostate cancer. With the availability of serum prostate-specific antigen (PSA) testing, doctors can swiftly and economically identify patients who are unlikely to have osseous metastases. We investigate the utility of PSA in predicting the presence of skeletal metastases on BSs in prostate cancer patients. The medical records of 322 prostate cancer patients who got BS over a long period were examined retrospectively. The BS and PSA values were calculated. Tc99m methylene diphosphonate (MDP) BS was performed according to the protocol. The data showed that 56% of patients had good BS effects, whereas 46% experienced negative impacts. Only 2% of men had blood PSA levels less than 20, whereas 70% had levels greater than 100 ng/ml. All patients with PSA values greater than 100 ng/ml had many bone metastases. Conclusions: Serum PSA concentrations less than 20 ng/ml are highly predictive of skeletal metastasis exclusion. Our findings reflect previous research findings that BS should be performed only if PSA levels reach 20 ng/ml. Using this cut-off, you may avoid unnecessary exploration. Avoiding BS would result in significant financial savings as well as lower physical and psychological stress in this group of patients. (5)

The ISHIZUKA trial evaluated prostate-specific antigen (PSA) levels and bone metastases in Japanese patients. Between November 1998 and June 2004, they performed ultrasound-guided biopsies on 709 people (mean age: 70.5 years, range: 39-90). Prostate cancer was discovered in 339 people (47.8%), with 297 (87.6%) having a radionuclide bone scan. Bone computed tomography scans, bone magnetic resonance imaging, and/or simple roentgenograms were performed in close collaboration with orthopedists for patients who were difficult to identify as bone metastases using radionuclide bone scans alone. They detected 61 (20.6%) cases of bone metastases in 296 people. A simple linear regression analysis revealed a significant relationship between [PSA] and bone metastases (n = 296) (P 0.05). When we established the cut-off PSA value for the indication of a bone scan at 15 ng/mL, the risk of bone metastasis was 10%. However, none of the individuals with Gleason scores below five had bone metastases, based on our observations. Based on the study of PSA, Gleason sum, and clinical T stage, we propose that a bone scan is not required for persons with a PSA level of less than 15 ng/mL. (6)

The association between PSA level and the occurrence of metastases supports the utility of bone scan scintigraphy in prostate cancer staging. In the Indian setting, all [TAG2] patients with PSA levels greater than 10 ng/ml should get a screening bone scan at the time of initial diagnosis. (7)

In patients with a clinical stage of T4, a PSA level of 20 ng/ml, and a Gleason score of 7 (with significant Gleason pattern 4, staging bone scan can be safely skipped unless the symptoms lead to metastasis), staging bone scan can be safely skipped. (8)

Patients with a prostate-specific antigen level of 20 ng/ml and a Gleason score of 6 had a low incidence of bone metastases. In general, a bone scan is not necessary as a routine check for these individuals during their initial prostate cancer staging. (9)

Bone scans may not be indicated in persons with serum PSA levels of 10 ng/ml or less due to the low likelihood of bone metastases. Furthermore, those with T1 illness and Gleason scores of 6 or less may not need to be scanned if their PSA levels are between 10 and 20 ng/ml. (10)

Staging bone scans in newly diagnosed prostate cancer patients with a PSA level of 20 and a Gleason score of 8 can be safely avoided; in our dataset, these parameters had a 100% negative predictive value. (2)

The researchers discovered a link between bone metastasis, tumor aggressiveness, and PSA level. This group had a prostate cancer prevalence of 35.39%. There was a greater probability of identifying prostate cancer when the PSA level was greater than 20 ng/mL than when the PSA level was less than 20 ng/mL. (1)

Bone scans may be indicated in men with blood PSA readings between 10 and 20 ng/mL. New guidelines for avoiding bone scans in patients with newly diagnosed Pca are essential, particularly in Asian individuals. (11).

3 Methods

This retrospective study included 100 consecutive patients with diagnosed adenocarcinoma of the prostate (prostate cancer), ages between 60 and 92 years, they came to Alneilien Diagnostic Center For bone scintigraphy, patients in this study were referred for diagnosis and follow-up, with the permission of the nuclear medicine department has been granted. Whole-body bone scans were performed 3 h after intravenous injection of 20-25 Tc-99m methylene diphosphate (MDP) and waiting for 2-3 hours before the bone scan equipment used in this study was SPECT gamma camera for bone scan, Results were reported by one radiologist, patients should do the prostate-specific antigen (PSA) blood test before the scan time.

3.1 Statistical analysis

Statistical significance between serum PSA and other clinical variables was determined with the SPSS

Table 1 Frequency distribution of Age in the case group

Age category					
Age group		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	60-70 YEARS	21	21.0	21.0	21.0
	71-80 YEARS	44	44.0	44.0	65.0
	81-90 YEARS	32	32.0	32.0	97.0
	91-100 YEARS	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

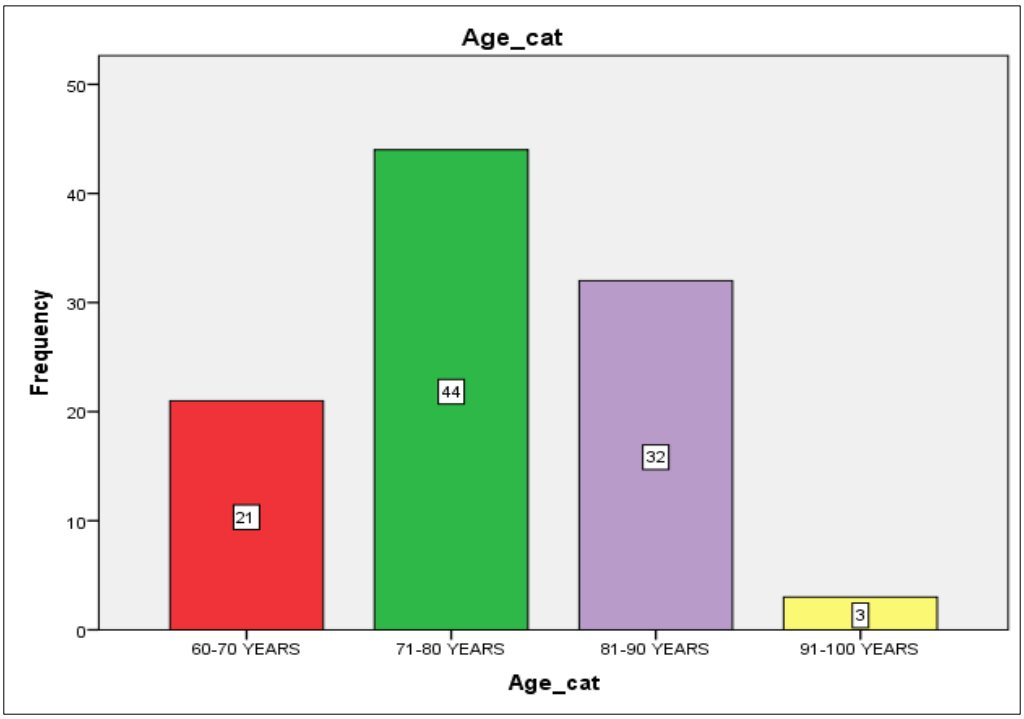

Figure 1 Frequency distribution of age group in the case group

Table 2 Frequency distribution of Rang of PSA level in case group

Rang_of_PSA_level					
Rang_of_PSA_level		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0-10	55	55.0	55.0	55.0
	11-20	16	16.0	16.0	71.0
	21-30	3	3.0	3.0	74.0
	31-40	10	10.0	10.0	84.0
	41-50	9	9.0	9.0	93.0
	51-60	1	1.0	1.0	94.0
	61-70	1	1.0	1.0	95.0
	71-80	1	1.0	1.0	96.0
	81-90	1	1.0	1.0	97.0
	91-100	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

Table 3 Frequency distribution of Bone scan result

Bone scan result		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Mets	50	50.0	50.0	50.0
	Normal	50	50.0	50.0	100.0
	Total	100	100.0	100.0	

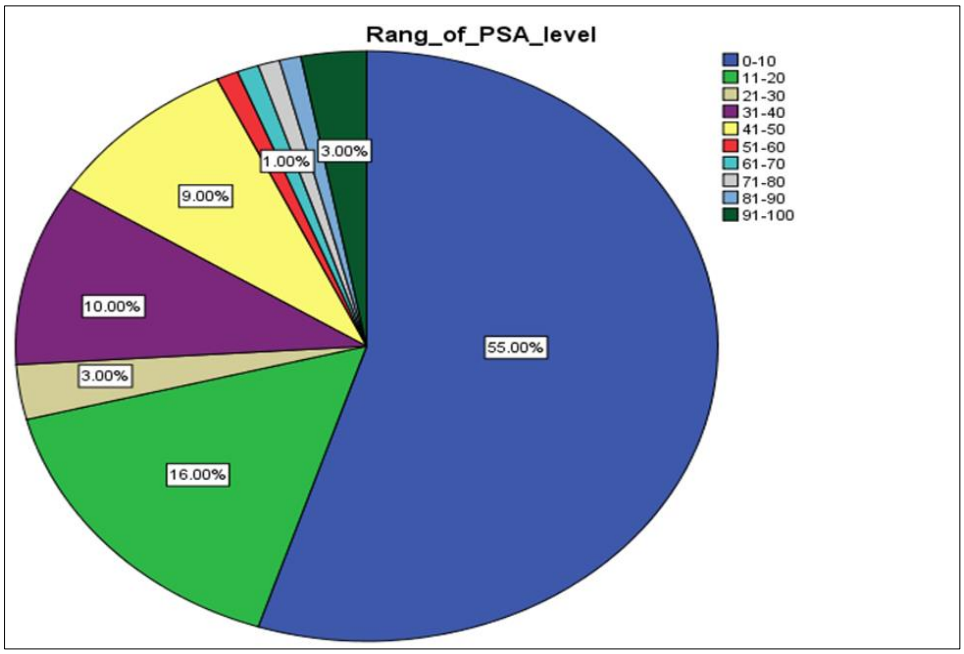

Figure 2 Frequency distribution of Rang of PSA level in the case group

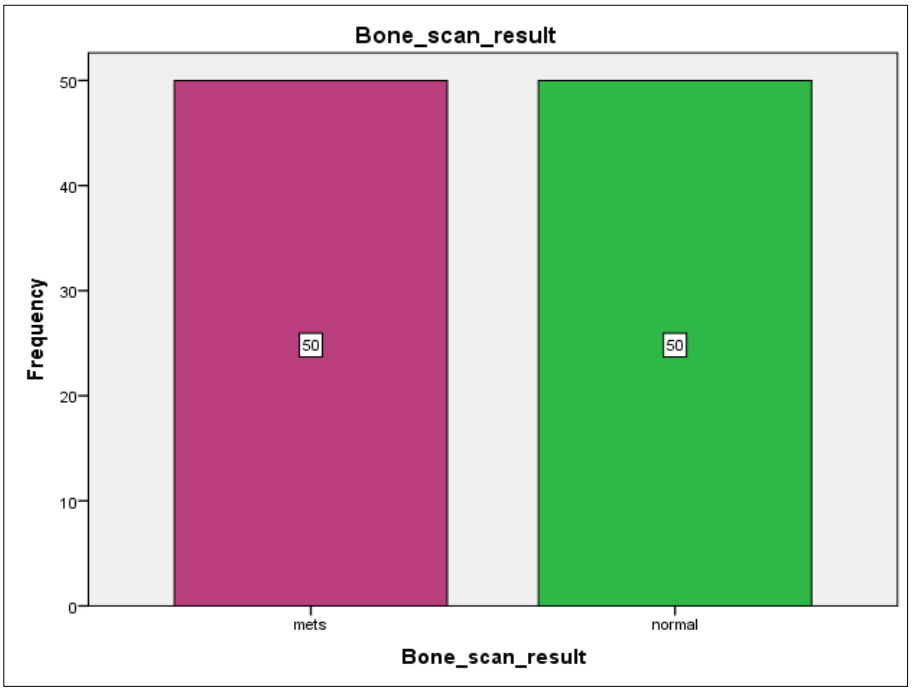

Figure 3 Frequency distribution of Bone scan result

Table 4 Descriptive statistics measurements of minimum, maximum, and mean ±SD of the Age and PSA level

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Age	100	60.00	92.00	77.1200	7.77756
PSA_LEVEL	100	0.50	100.00	19.0100	24.12535
Valid N (listwise)	100				

3.2 Part II: Relationships

Table 5 Correlation between PSA level and age, in the case group

Correlations		**Range_of_PSA_level**	**Age cat**
Range_of_PSA_level	Pearson Correlation	1	0.052-
	Sig. (2-tailed)		0.608
	N	100	100
Age cat	Pearson Correlation	0.052-	1
	Sig. (2-tailed)	0.608	
	N	100	100

There is no correlation

Table 6 Correlation between PSA level and Scanning result, in the case group

Correlations		**Range_of_PSA_level**	**Scan Result**
Range_of_PSA_level	Pearson Correlation	1	0.109
	Sig. (2-tailed)		0.282
	N	100	100
Scan Result	Pearson Correlation	0.109	1
	Sig. (2-tailed)	0.282	
	N	100	101

There is no correlation

4 Results

The majority of patients age was between 72-80 years with a valid percent of 44% as per (table 1) and (figure 1), The majority of PSA level (prostate-specific antigen) in the population is between (0-10 ng/mL) with 55 %percent (table 2)and figure 2, the frequency distribution of bone scintigraphy result is 50% normal and 50% up normal (table 3) (figure 3), the minimum age for the patient age in this article is 60y and the maximum 100 y with mean about 77 years and the standard deviation about 7.7, the minimum number of PSA level is .5ng/ml and the maximum is 100ng/ml with mean about 19ng/ml and standard deviation about 24.1ng/ml (table 3/figure 3), we found in these data there no Correlation between PSA level and age (table 5), and we found then there is no correlation between PSA level and bone scan result.

5 Discussion

The findings are consistent with prior research in that levels are independent predictors of bone scan positive. As in the first article, (4). 34 people got bone metastases as a result of a positive bone scintigraphy test. None of these patients had a PSA level less than 10 ng/ml; nonetheless, patients with PSA values greater than 100 ng/ml had many bone metastases. (5)

They also discovered that serum PSA concentrations less than 20 ng/ml are highly predictive of avoiding skeletal metastases. According to their statistics, BS should be performed only if PSA levels reach 20 ng/ml. Using this cut-off, you may avoid unnecessary exploration. Avoiding BS would result in significant cost savings and lower physical and psychological stress in this group of patients. (5) The statistical results of our research reveal that there is no association between PSA level and bone scan outcome, which means that every patient with prostate cancer should have a bone scan at least once. In the research of (6) The article about the Prostate-specific antigen (PSA) levels and bone metastases

in Japanese patients were compared in the ISHIZUKA trial and they discovered that There was a significant connection between log[PSA] and bone metastases (n = 296) in a simple linear regression analysis (P 0.05), based on their observations individuals with a PSA level of less than 15 ng/mL, we propose that a bone scan is not essential based on the analysis of PSA and (8) They discovered in their article that patients with a clinical stage of T4, a PSA level of 20 ng/ml, and a Gleason score of 7 (with significant Gleason pattern 4, staging bone scan can be safely missed unless the symptoms lead to metastasis and this result does not match our result data) can safely skip staging bone scan (9) discovered their article Patients with a PSA level of 20 ng/ml had relatively low rates of bone metastases, and a bone scan is not required for these individuals at their initial prostate cancer staging as a routine check, which contradicts our findings that there is no relationship between PSA level and bone scan result. (10) Bone scans may not be essential due to the low risk of bone metastases in persons with blood PSA levels of 10 ng/ml or below, which contradicts our finding that there is no link between PSA level and bone scan result, (2) found that staging bone scans in newly diagnosed prostate cancer patients can be safely avoided with a PSA level of 20 and a Gleason score of 8; in our dataset, these parameters yielded a 100% negative predictive value, and this finding again disagrees with our data numbers, (1) There was a substantial link between bone metastasis, tumor aggressiveness, and PSA level. This group had a prostate cancer prevalence of 35.39%. When the PSA level was greater than 20 ng/mL, there was a greater risk of diagnosing prostate cancer than there was for benign prostatic hyperplasia, which agrees with the findings of our paper, (11) Bone scans may be indicated in men with blood PSA readings between 10 and 20 ng/mL. New guidelines for avoiding bone scans in patients with newly diagnosed prostate cancer are needed, particularly in Asian individuals, and this outcome does not match our findings because we found some patients with PSA levels less than 10ng/ml who had positive bone results. None of the prior studies addressed the relationship between PSA level and patient age. In our article, we discovered that there is no association between age and PSA level.

List of Abbreviations

- Tc99m: Technetium 99 in metastable state.
- MDP: methylene diphosphate.
- PSA: prostate-specific antigen.
- MRI: Magnetic resonance imaging.
- CT: Computerized tomography.
- PET: Positron emission tomography.
- DRE: Digital Rectal Examination.
- CaP: Prostate cancer.
- BS: Bone Scan.
- T4: Stage four.
- SPECT: Single photon emission computed tomography.
- SPSS: Statistical Package for the Social Sciences

6 Conclusion

In summary, both nuclear medicine whole-body bone scan and prostate-specific antigen test results are important tools in the diagnosis and staging of prostate cancer, and in this population of patients we find these results:

- There is no correlation between PSA level and bone scan result
- There is no correlation between the age of the patients and PSA level

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Statement of ethical approval

All study procedures were approved by the Ethical Committee of the Alnelein Medical Diagnostic Center.

Statement of informed consent

approved by the Ethical Committee of the Alnelein Medical Diagnostic Center

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