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Assessment of Osteoporosis in Patients with Prostate Cancer using Gamma Camera

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Abstract: ***Background: Prostate cancer is one of the most common diseases in the world. can primarily disseminate to the bone, causing bone metastases, which in turn can lead to death. To treat the disease, it is important to diagnose bone metastases as soon as possible. Bone metastases are diagnosed usually by bone scan imaging (Gamma Camera). However, interpretation of bone scan images is not always an easy task for physicians. One way of minimizing the risk of misinterpretation is quantitative analysis of bone scan images in order to ascertain whether they show any metastatic lesions, and if so, to what extent. The aim of the thesis was to assessment of osteoporosis in patients with prostate cancer using Gamma Camera and computed radiography (x.ray). Methods: patients osteoporosis with prostate cancer imaging with gamma camera and computed radiography (x.ray), analysing the image with Interactive Data Language IDL software version 6.1 to measure the grey level variation of images with spine and hip area, data was available for 200 patients, 100 patients with x.ray images for hip and spine and 100 for patients with bone scan using Gamma Camera. Results: The mean of up normal G.C hip and normal CR for hip regions was 630.67±92.64 and 619.67±86.39, and the mean for up normal G.C spine and normal CR spine the mean was 582.57±87.57 and 598.77±73.34. Using T.Test show that there is significant difference between normal CR and up normal G.C for hip regions (0.00). And between normal CR and up normal G.C spine (0.00).Linear regression results show that the rate of change between normal CR hip and up normal G.C hip Increasing by 0.8301. And 0.6607 for normal CR and up normal G.C spine. Conclusion: there is significant difference between normal CR and up normal G.C for hip regions, and between normal CR and up normal G.C spine, and the rate of change increasing for normal CR and up normal G.C spine.***

Keywords: osteoporosis, prostate cancer, Gamma Camera, Computed Radiography

1. Introduction

Prostate cancer is the second most common cancer in men,accounting for 1 in 9 of all new cancers, and with more than670,000 new diagnoses annually worldwide. The metastatic spreadis primarily in the skeleton (supporting the 'seed-and-soil'hypothesis described by Paget in 1889) in which lesions are oftenlocated in vertebra and ribs because of dissemination throughBatson's venous plexus. The spread in bone also follows thedistribution of adult red bone marrow, that is, skull, thorax, pelvis,spine, proximal long bones [1,2],subsequently progressing to involve adjacent cortical bone.

Preclinical models confirm that skeletal sites rich in cellularmarrow with active turnover show increased cancer localization [3]. Although predominantly osteoblastic, osteoclast activation also has an important role in the growth ofsclerotic metastases in the bone. In a study of 68 men withprostatic bone metastases who underwent surgery for stabilization of pathological fracture or impending fracture, most metastaseswere osteoblastic, but 29.1% had metastases that were osteolytic ormixed [4].

Skeletal metastases occur in approximately 90% of patientspresenting with advanced prostate cancer, and the burden of bonedisease directly correlates with survival [5,6]. After treatment of the primary site, bone isthe first site of relapse in more than 80% of cases [7]. Plain film and bone scintigraphy studies form the mainstayof detection, but they underestimate true incidence. In one autopsyseries of 1589 men with prostate cancer (47% were unsuspected), the incidence of metastatic bone disease was 90% [8].

The detection of bone metastases indicates progression to lethalprostate carcinoma [2]. At this stage, complete remissions are rare and onset of the complications of bone metastases are likely [7]. The investigation oftherapeutic interventions to slow the progression of bone diseaseand its complications make the need for accurate assessment ofdisease burden in the bone and its response to treatment offundamental importance. PSA is used widely to monitor responseto therapy, with a decrease in PSA to the normal range aftertreatment used as a predictor of prolonged response in manypatients [9]. However, PSA levels are influenced byboth soft tissue and bony disease and PSA does not always correlate with tumour burden.

The most widely used imaging modality for detection of pathologicalchanges in bone – osteoblastic activity – is bone scintigraphy. The mainclinical indication for bone-scan imaging is evaluation of metastatic disease.

The most common patient group referred for bone scans is prostate-cancerpatients who are being examined to diagnose metastatic disease. Referrals areespecially common in high-risk patients and for evaluation of treatmentresponse. Prostate cancer has a tendency to disseminate to lymph nodes andthe skeleton as the preferred organs [10].

This non-invasive nuclear-medicine imaging examination is performed using a gamma camera (Fig. 1). Whole-body bone scans are obtained three to four hours after administration of 600 MBq 99 16 m -technetium methylene diphosphonate (MDP) [11]. The scanning procedure takes about 25 minutes and the result is two two-dimensional images – an anterior and a posterior image. These two-dimensional images are usually enough to show whether there are any pathological changes in the skeleton.

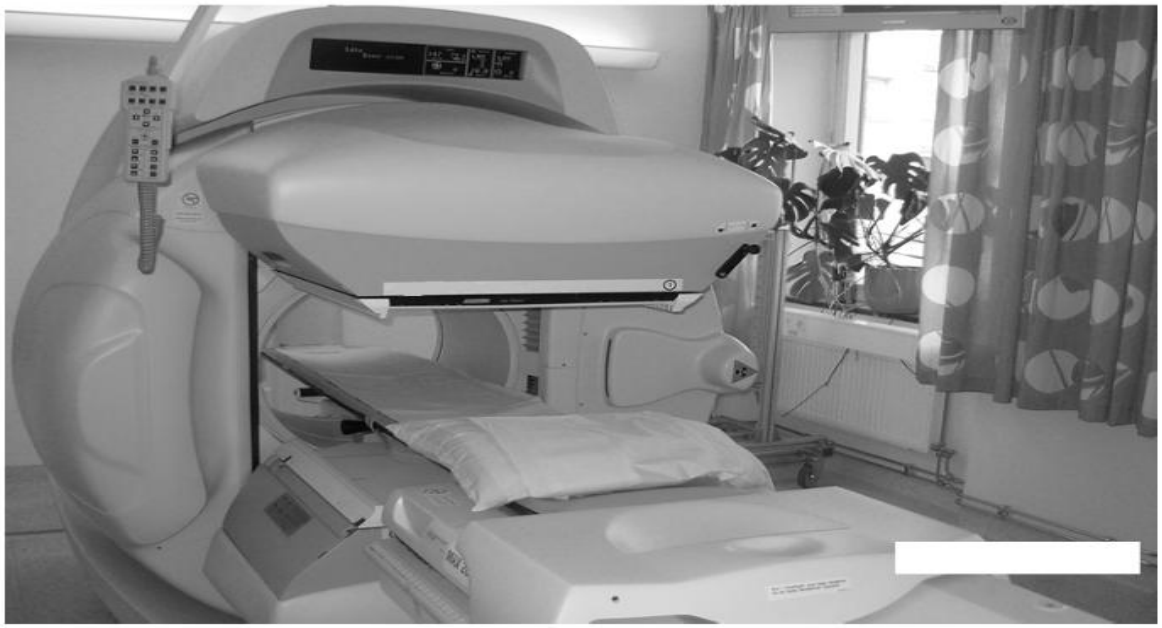

Figure 1: A gamma camera with capability to acquire planar whole-body and tomography images

2. Material and Method

The data collected from Radiation and Isotopes Center of Khartoum (RICK) and Antalyia Diagnostic Center, where 200 patients, used medical imaging system gamma camera model Mediso, and x.ray machine philps, patients osteoporosis with prostate cancer imaging with gamma camera and x.ray analysing the image with Interactive Data Language IDL software version 6.1 to measure the grey level variation of images with spine and hip area, data was available for 200 patients, 100 patients with x.ray images for hip and spine and 100 for patients with bone scan using Gamma Camera

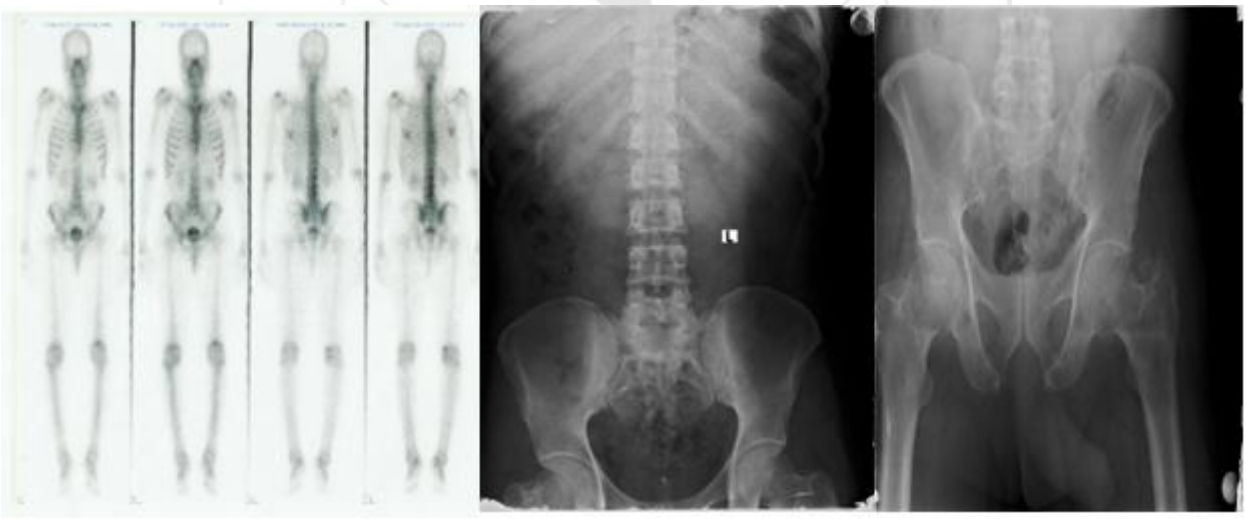

Figure 2: Bone scan using gamma camera and spine, hip x.ray examinations

And The collected variables: age, Body Mass Index, weight, height and bone scan image. x.ray images of lumber spine and hip bone (DXR), PSA, and period of starting hormone therapy.

3. Results and Discussion

Table 1: Show statistical parameters for all patients

	Mean	Median	SD	Min	Max
Age	69.43	70.5	10.52	45	89
P of T	2.41	2	1.28	1	7
High	169.9	169.5	8.34	149	192
Weight	75.33	74	12.25	42	114
PSA	5.36	5.30	2.33	0.02	10.4
BMI	25.96	26.35	3.46	15.43	33.49
Up normal G.C Hip	630.67	620.5	92.64	440	760
Up normal G.C Spine	582.57	584.5	87.57	357	711
Normal CR Hip	619.67	618.5	86.39	440	760
Normal CR Spine	598.77	599	73.34	417	711

Table 2: Show sample for all images:

Paired Samples Statistics			
		Mean	Std. Deviation
Pair 1	Up normal G.C Hip	630.67	92.64
	Normal CR Hip	619.67	86.39
Pair 2	Up normal G.C Spine	582.57	87.57
	Normal CR Spine	598.77	73.34

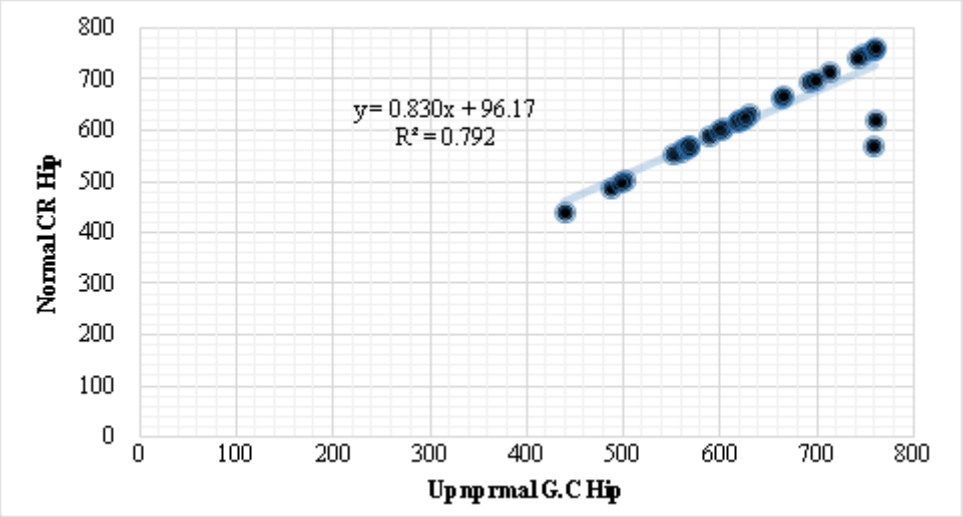

Figure 3: Show correlation between CR normal and G.C up normal for HIP images

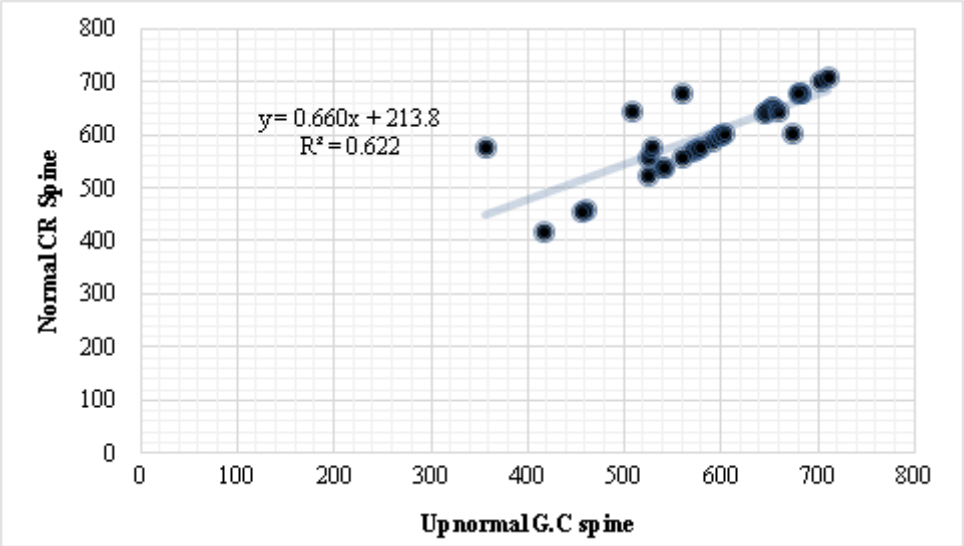

Figure 4: Show correlation between CR normal and G.C up normal for SPINE images

4. Discussions

Assessment of osteoporosis in patients with prostate cancer using Gamma Camera for 200 patients (100 Normal and 100 Up normal patients), and we using statistical parameters to show the data, for age the mean±SD was 69.43±10.52 and for weight, high, body mass index and PSA 75.33±12.25, 169.9±8.34, 25.96.3.46 and 5.36±2.33 respectively, **table 1** . And the values for images measurement the Up normal G.C for hip regions 630.67±92.64, up normal G.C spine582.57±87.57 , for Normal CR hip 619.67±86.39, Normal CR spine 598.77±73.34 **table1.**

For compare the mean of up normal G.C hip and normal CR for hip regions was 630.67±92.64 and 619.67±86.39, and the mean for up normal G.C spine and normal CR spine the mean was 582.57±87.57 and 598.77±73.34 **table2.**

Using T.Test show that there is significant difference between normal CR and up normal G.C for hip regions (0.00) **table 3.** And between normal CR and up normal G.C spine (0.00) **table 3.**

Linear regression results show that the rate of change between normal CR and G.C hip imagesIncreasing by rate 0.8301 for normal CR versus one unit of up normal G.C hip**fig 3.**and by rate of 0.6607of normal CR versus one unit of up normal G.C spine images **fig 4.**

5. Conclusion

Assessment of osteoporosis in patients with prostate cancer using Computed Radiologyand Gamma Camera show that there is significant difference between normal CR and up normal G.C hip and spine regions.

And the Linear regression results show rate of change between normal CR and up normal G.C hip was decreasing by rate 0.0475 for normal CR versus one unit of up normal G.C hip, and by rate of 0.0172 for normal CR spine versus one unit of up normal G.C spine.

And estimated of *values between the normal CR and up normal*G.C hip and spine images calculated using the following linear equations:

CR normal hip = 0.8301(up normal G.Chip) +755.59
CR normal spine = 0.6607(up normal G.C spine) + 632.94

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