

Computed tomography in detecting bone metastases of breast carcinoma

Is it better than plain x-ray?

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ABSTRACT

Objective: To compare 5mm slice computerized tomography (CT) and conventional x-ray (XR) in the detection of bone metastases in breast carcinoma patients.

Method: Ninety-eight female breast cancer patients treated in Ankara Oncology Hospital, Ankara, Turkey between September 1997 and March 2002 were assigned into 3 groups with respect to their Tc bone scan (Sc) results. Group 1 included patients with overt bone metastases, group 2 included patients with suspicious of metastases and group 3 were those patients with normal Sc results with back pain complaint. All patients underwent XR, and 5mm contiguous slice CT imaging for the related metastatic sites. For the third group, lumbosacral region was examined.

Results: A total 33 bone metastases have been diagnosed out of 98 patients. The Sc result showed 26/33 metastatic

cases, XR 19/33 and CT 22/33 cases. There were no false positive results for CT and XR. Results of CT have 11 and XR has 14 false negatives out of 33 metastases. For XR the calculated sensitivity was 65.6, specificity was 100, diagnostic accuracy was 88.7, whereas for CT, sensitivity was 71.8, specificity was 100 and diagnostic accuracy was 90.8. When CT and XR were compared to detect bone metastases, results were not statistically significant ($p>0.05$).

Conclusion: Our results suggest that 5mm slice CT is not superior than XR to detect metastatic bone lesions. Larger series comparing different slice thickness of CT are needed to clarify the issue.

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Skeleton is the most frequent metastatic site of breast cancer.^{1,2} Identification of these lesions is important for staging and as well as initiation of proper therapy to prevent fracture and pain. X-ray (XR), computerized tomography (CT), Tc bone scan (Sc), magnetic resonance imaging and positron emission tomography or single-photon emission computed tomography are the current modalities to detect skeletal metastases.³⁻⁷ Today, Sc is the most effective and preferred optimal imaging modality in screening the

whole skeleton for metastases, but in elderly patients benign conditions such as degenerating bone diseases and osteoporosis are confusing and suspicious lesions need differential diagnosis.^{3,8} In diagnosing and confirming bone metastases, CT is accepted as more precise technique than plain XR by most authors.^{3,9-11} In our clinical experience, we noticed that it was not as useful as it was told in the literature. The present study compares CT with plain XR in detecting bone metastases from breast carcinoma.

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Methods. Ninety-eight female patients, all with histologically proven invasive breast cancer, treated in Ankara Oncology Hospital, Ankara, Turkey between September 1997 and March 2002, whose 2 years follow up were available were included in this study. The Sc is accepted as the gold standard technique, and metastases of the patients were clinically confirmed after 2 years follow up period. The histopathologic proof of the metastatic lesions has not been obtained. Patients were initially evaluated by Sc then assigned to 3 groups in respect to Sc results. The first group was composed of patients with overt bone metastases, the second group with suspicion of metastases and the third group was patients with normal Sc results but with back pain complaint. All patients underwent plain XR and CT imaging for the related sites. In plain XR anteroposterior and lateral projections were used. CT examinations were made with 5mm contiguous slices in all cases (General Electric, Syntec 4000 i). For the third group of patients with lumbar back pain, lumbosacral region was examined, as it is also the most frequent site of breast carcinoma metastases.⁶ Patients with normal Sc results but without back pain were not included in the study.

The results were compared by Fisher's Exact Test and Pearson's Chi Square test. The sensitivity, specificity and diagnostic accuracy were assessed for CT and XR procedures. Definitions of terms are as follows: 1) True positive CT or XR was defined as the one positive for malignancy with subsequent 2 years follow up confirmation. 2) True negative CT or XR was defined as the one negative for malignancy with subsequent 2 years follow up confirmation. 3) False positive was that with positive findings for malignancy but no evidence of carcinoma on subsequent 2 years follow up confirmation. 4) False negative was that negative for malignancy with diagnosis of malignant disease on subsequent 2 years follow up confirmation. 5) Sensitivity was defined on the basis of metastases detection using CT or XR technique [true positives (true positives + false negatives)]. 6) Specificity was defined on the basis of benign disease detection [true negatives / (true negatives + false positives)]. 7) Diagnostic accuracy represents the combination of sensitivity and specificity [(true positives + true negatives) / (true positives + false positives + true negatives + false negatives)].

Results. The mean age of the patients was 58.1 ± 11.4 years (minimum 35 years, maximum 78 years). The first group was composed of patients with overt bone metastases (n=26), second group with suspicion of metastases (n=40) and in the third group normal Sc results with a back pain complaint (n=32). In the first group, Sc revealed 26 (26.5% of all cases) patients with overt metastatic disease, without false

positive results after 2 years of follow up. Sixteen of these cases diagnosis was confirmed by CT and in 14 of the same 16 cases by plain XR. The CT has 10, and XR has 12 false negatives for this group. In the second group, Sc revealed 40 (40.8%) patients with suspicion of metastases in which CT showed 6, and plain XR 5 of the same 6 cases as metastatic. After 2 years follow up, no false positives for both CT and XR was reported but one patient with back pain proved to be metastatic in the 6 months period with Sc, but still could not be detected with both CT and XR with a total metastatic of 7 patients out of 40 suspicious lesions. The CT has one and XR has 2 false negatives for this group. In the third group with back pain, Sc revealed 32 (32.6%) patients with normal results. The CT examination of the lumbosacral region (the most common metastatic site)⁶ and plain XR showed no metastases either. There were no false negative results for the 3 imaging techniques after 2 years follow up in this group. A total of 33 out of 98 patients have been diagnosed to have bone metastases. The Sc showed 26/33 metastatic cases, XR a total of 19/33 and CT a total 22/33 cases (**Table 1**). There were no false positive results for CT and XR. Results of CT have 11 and XR has 14 false negatives out of 33 metastases. When CT and plain XR were compared to detect bone metastases, there was no statistically significant difference for this series ($p=0.598$). The calculated sensitivity, specificity, diagnostic accuracy for plain XR and CT techniques are shown on **Table 2**.

Discussion. In general, bone scan detects metastatic lesions before they are evident on plain radiographs but suspicious lesions need to be verified.¹² The CT is usually accepted as more precise technique in differential diagnosis than plain XR.^{3,9-11,13,14} But our clinical experience was contrary, and this study was conducted to find out the sensitivity, specificity and the diagnostic accuracy of CT and plain XR in detecting bone metastases of breast carcinoma.

The histopathological proof of the metastatic lesions has not been obtained in this study, but a 2-year follow up of the patients has been carried out. Metastases of the patients were clinically confirmed after 2 years follow up period. A clinical evaluation was initiated with Sc. According to the results, patients are grouped as metastatic, suspicious and normal scans. The CT results showed 1 more metastatic patient, which was not detected by plain XR in the suspicious group, and also 2 more patient in the metastatic group. As Sc reflects the metabolic reaction of bone to several disease processes, including neoplasia, trauma, or inflammation, it is reported to be sensitive but has a lower specificity due to false positive results.⁷ No false positive results were obtained for Sc in this series during a

Table 1 - Results of patients in respect to imaging methods.

Groups	Tc scan findings	CT findings		Plain XR findings	
		Metastatic	Normal	Metastatic	Normal
1	Metastatic	26	16	10	14
2	Suspicious	40	6	34	5
3	Normal	32	0	32	0
Total		98	22	76	19

CT - computerized tomography, XR - x-ray

Table 2 - Sensitivity, specificity and diagnostic accuracy of the 2 methods.

Methods	XR	CT
Sensitivity	65.6	71.8
Specificity	100	100
Diagnostic accuracy	88.7	90.8

CT - computerized tomography, XR - x-ray

2 years follow up. This could be explained by lack of histopathological proof and high suspicious rates in our study (40/98, 41%). The accuracy of CT and plain XR was compared in patients with metastatic, suspicious and normal lesions on bone scintigraphy. Accordingly, both CT and XR could not obtain any metastatic lesion in normal Sc group. The CT with 5mm slices only detected 16 out of 26 metastatic Sc patients, where XR could reveal 14 metastases assuming that 5 mm slice CT is not superior than XR ($p>0.05$). In suspicious group CT could show 6 metastatic patients but 5 of the same 6 patients were detected by XR ($p>0.05$). One more metastases has been obtained during the 2 years follow up in this group. According to our results, 5mm slice CT seems to add little, which is not significant in the statistical analyses. In the literature, CT is mostly reported to be more sensitive than XR.^{3,7,9,11,13,14} but 2mm CT slices was mostly taken into account in this studies. In higher slices like 4mm and 8mm, CT is reported to have a decline in sensitivity.³ The 5mm slices of CT could be the explanation of why CT adds little to XR in this study.

As there is no false positive result in any group for each technique, specificities were found to be 100%. The CT has a slightly higher sensitivity and diagnostic accuracy than XR, but statistical analysis did not reveal a significant result ($p>0.05$). For XR sensitivity was 65.6, specificity was 100 and diagnostic accuracy was 88.7, whereas for CT, sensitivity was 71.8, specificity was 100 and diagnostic accuracy 90.8. According to our results, in confirming the bone

metastases of breast carcinoma, 5mm slice CT is not superior than plain XR and could be neglected from the algorithm, as it adds little to the plain XR results with no statistical significance.

We conclude that CT with 5mm slices is not superior to XR to confirm suspicious lesions and in the diagnosis of metastatic lesions detected by Sc. Larger series comparing different slice thickness of CT are needed to clarify the issue, and newer techniques such as multidetector CT (spiral CT), magnetic resonance imaging and positron emission tomography should be compared.

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