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Original Article

Radiology Section

Multi-Parametric MR Imaging in Characterisation of Benign and Malignant PhyllodesTumours

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ABSTRACT

Introduction: Phyllodes tumours are rare tumours of the breast.They present as painless nodules with rapid growth. Mammography and Ultrasound breast cannot provide adequate evaluation when the size of the phyllodes tumours are very large. MRI is very useful and excellent modality for evaluation of size, extent, pectoralis muscle and chest wall involvement. It is very helpful to differentiate the benign and malignant phyllodes tumour.

Aim: To characterize the phyllodes tumour on MR imaging and to evaluate the MRI findings in differentiating benign and malignant phyllodes.

Materials and Methods: A retrospective descriptive study was conducted on histologically proven phyllodes tumour of the breast in which 23 patients were included. Multi-parametric MRI of breast was performed on 1.5 Tesla Siemen's Avanto machine using dedicated breast coil. Pre contrast, post contrast dynamic MRI and DWI sequences were obtained. Post processing and kinetic curve analysis was done using mean curve technique. Histo-pathological reports were accepted as standard of reference.

Results: Out of 23 phyllodes tumour, five were malignant (21.7%), 18 (78.2%) were benign phyllodes tumour. Multiple septations were seen in the 18 lesions (78.26%). Cystic areas are seen in the 15 lesions (65.21%).On post-contrast study, these lesions showed heterogeneous enhancement. An eleven (47.82) lesions showed type I kinetic curve, seven (30.43%) showed type II curve and five (21.73%) lesions showed type III kinetic curve. Three malignant and one benign lesion showed restriction on DWI with corresponding low ADC values. MR spectroscopy was done in five patients and in two malignant patients it showed choline peak, three benign lesions did not show choline peak on spectroscopy.

Conclusion: MRI is an excellent non-invasive modality for the characterization and evaluation of the phyllodes tumour as they are very large many times and could not properly evaluate on mammography and USG breast.

Keywords: Diffusion weighted, Painless Nodules, Spectroscopy, Ultrasound

INTRODUCTION

Phyllodes tumours are rare neoplastic lesions of breast accounting for less than 1% of all breast tumours.They usually presents as painless round, mobile, nodules with rapid growth clinically. Histologically, it can be divided into three types – benign, borderline and malignant. About 35 to 64 % of all phyllodes tumour have been described as benign with malignant lesions accounting for approximately 25 % of all resected tumours [1]. The exact aetiology of phyllodes tumours is unknown however; factors like trauma, lactation, pregnancy and increased oestrogen activity occasionally have been implicated as causes of stimulating tumour growth[2]. On histopathological findings, phyllodes tumour shows double layered epithelial component arrayed in clefts and surrounded by hypercellular stromal mesenchymal component [3].

Dynamic gadolinium contrast enhanced Magnetic Resonance Imaging (MRI) with Diffusion Weighted Imaging (DWI) play significant role in the diagnosis as well as the distinction of benign phyllodes tumours from borderline and malignant types. We describe 23 cases of phyllodes tumour and role of MRI in differentiating benign from malignant tumours.

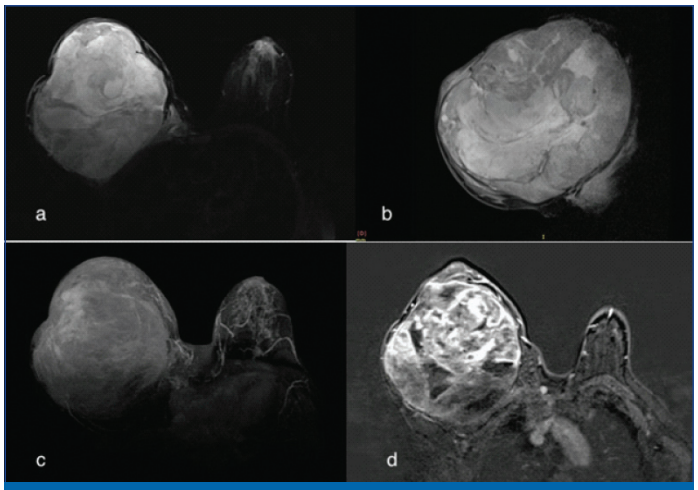
MATERIALS AND METHODS

A retrospective descriptive study was carried out in the radiology department of the university hospital in India in which 23 patients of histologically proven phyllodes tumour were included. Multiparametric MRI of breast was performed on 1.5 Tesla Siemen's Avanto machine using dedicated breast coil. Patient was positioned in prone position. MRI examination included image acquisition followed by post processing. Field Of View (FOV) 300-360 mm and slice thickness 3 mm. T1WI, T2WI and STIR in axial plane, STIR, T2WI coronal, T2WI and STIR in sagittal plane images were acquired. Diffusion weighted images were obtained using diffusion weighted echo-planer imaging sensitizing diffusion gradients with b value of 0,400 and 800 s/mm^2 were applied. Dynamic study Post-gadolinium T1WI Fat sat obtained in axial plane. Pre-contrast fat-suppressed T1W gradient echo images were first obtained followed by intravenous contrast injection. MultiHance (GdDTPA-BMA) 0.1 mmol/kg body weight was injected as a bolus, with a flow rate of 2.0 mL/s, followed by a flush of 20 mL of saline. Post-processing was done by digitally subtracting the pre-contrast. Pre-contrast, post-contrast dynamic MRI and DWI sequences were obtained. Post-processing and kinetic curve analysis was done using mean curve technique. MR Spectroscopy was done using single voxel spectroscopy to localise the chemical signal centered in the area of interest. Voxel should be placed so that it contains as much of the lesion as possible and exclude the normal fibroglandular tissue and fat. Observe the choline peak in the lesion for detection of malignancy.

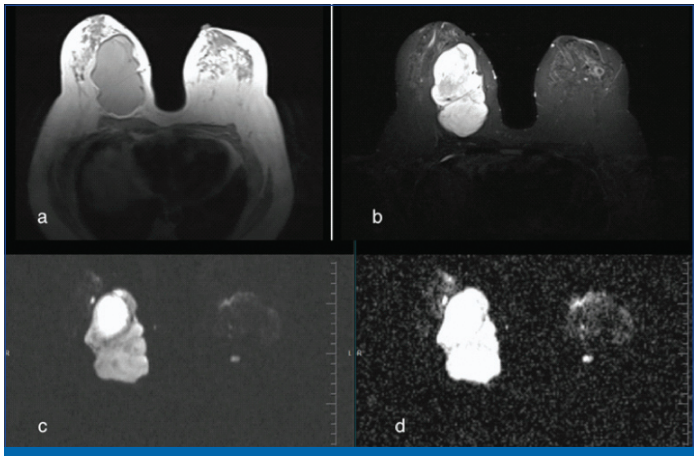
RESULTS

Out of 23 phyllodes tumour five were malignant (21.7%) [Table/Fig-1] and 18 (78.2 %) were benign phyllodes tumour [Table/Fig-2]. Phyllodes lesions were of large sizes ranging from 2.5 cm to 30 cm in size. All the lesions showed smooth, circumscribed margins. Multiple septations were seen in the 18 lesions (78.26 %). Cystic areas are seen in the 15 lesions (65.21%). On post-contrast study, these lesions showed heterogeneous enhancement. Enhancement of the septae was seen in the malignant lesions and in benign lesions the septae did not show enhancement. Out of 23 lesions, 11 (47.82%) lesions showed type I kinetic curve, seven (30.43%) showed type II curve and five (21.73%) lesions showed type III kinetic curve. Three

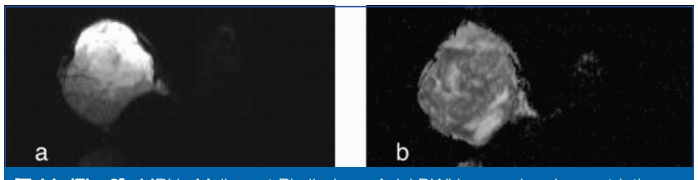
malignant and one benign lesion showed restriction on DWI with corresponding low ADC values [Table/Fig-2]. Benign phyllodes (n=17) did not show restriction on DWI with high corresponding ADC values [Table/Fig-3]. MR spectroscopy was done in five patients; in which two malignant phyllodes lesions showed choline peak [Table/Fig-4], three benign lesions did not show choline peak on spectroscopy.



[Table/Fig-1]: MRI in Malignant Phyllodes: a) Axial T2WI image showing a large heterogeneous mixed signal intensity mass involving the entire right breast.It showed multiple septations and few cystic spaces; b) Sagittal T2WI image showing septations and cystic spaces more clearly; c) Post contrast MIP image showing heterogeneous enhancement; d) Post contrast subtracted image showing enhancement of the septae and non-enhancing cystic spaces.



[Table/Fig-2]: MRI in benign phyllodes a) Axial T1WI showing a large irregular mass in right breast with few hypointense septae; b) Axial T2WI showing large mass which is hyperintense and showing multiple hypointense septae; c): Axial DWI image did not show restriction with; d) high corresponding ADC values.

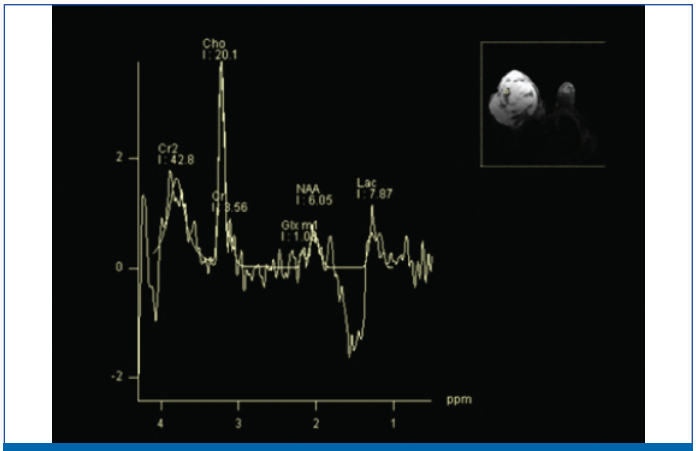


[Table/Fig-3]: MRI in Malignant Phyllodes a.Axial DWI image showing restriction with b: corresponding low ADC.

DISCUSSION

Muller first described Cystosarcoma phyllodes (phyllodes tumour) of the breast in 1838 as a rare fibroepithelial lesion [4]. They constitute up 0.3 to 0.5% of all female breast tumours with an incidence of about 2.1 per million and average age peaking at about 45 to 49 years [5]. Phyllodes tumour should be suspected in patients who presents with a large breast lump which is rapidly increasing in size and ultrasound features suggestive of fibroadenoma [3]. Axillary lymph nodal involvement is rarely seen. There is high rate of local recurrences of these tumours.

Histologically, these tumours are composed of stromal and epithelial elements undulating arrangement and multiple slit-like spaces and crevices with surrounding increased growth of mesenchymal cells. Its stromal part protruding into the ductal lumen [5].



[Table/Fig-4]: MRI in Malignant Phyllodes. MR Spectroscopy showing Choline peak in the mass lesion.

Phyllodes tumours of the breast arise from the periductal stroma. On MRI, benign phyllodes are seen as fairly large mass lesion with well-circumscribed margins, internal septations and high signal intensity on fat-suppressed T2-weighted sequences. T1WI may show hyperintense foci representing haemorrhage. Few cases of phyllodes tumour of breast demonstrated in-homogeneous signal intensities on T1WI and T2WI due to cystic areas with internal septations within [6]. The morphological characteristics of these cystic areas can help differentiate between benign and malignant phyllodes.The cystic spaces in benign tumours usually presented with smooth margins and homogeneous signal intensity on T2WI whereas the malignant and borderline phyllodes tumour had irregular margins and heterogeneous signal intensities. The irregular margins and heterogeneous signal intensity was attributed to rapid growth in case of malignant phyllodes [7].

Dynamic MRI contrast enhancement pattern can be used to differentiate between benign from malignant phyllodes tumour. There are three types of enhancement, namely Type I (progressive enhancement pattern), type II (plateau pattern) and type III (washout pattern) are recognised. Dynamic contrast enhancement MRI shows fast initial intense enhancement pattern without wash-out for benign phyllodes tumour. The rapid dynamic enhancement pattern is attributed to increased angiogenesis in phyllodes tumours. Benign lesions showed type I pattern while type II and III patterns may be indicative of malignancy. MR spectroscopy is another important method to identify malignant process. Malignant lesions demonstrated elevation of choline peak (resonance 3.2 ppm) due to increased turnover by rapid proliferation of tumour cells. Benign lesions do not show elevation of choline peak [8].

In the present study, all the lesions were well circumscribed with smooth margins.It is similar as the study done by Wurdinger S et al., [9]. Study of Duman L et al., showed phyllodes tumour were lobulated, heterogeneous post-contrast enhancement were seen in phyllodes with non-enhancing septae [10]. In the present study we also observed, heterogeneous post-contrast enhancement and non-enhancing septae in benign phyllodes.

A study done by Fan WX et al.,which showed utility of time resolved angiography with dynamic contrast MRI, read out segmentation of long variable echo-trains diffusion weighted MRI (RESOLVE-DWI) and echo-planer imaging diffusion weighted MRI (EPI-DWI) for distinguishing between benign and malignant breast lesions ,they concluded compared with benign group,the malignant group had significant higher K trans, Kep and W-in and significantly lower W-out, TTP, ADCe, and ADCr (all $p<0.05$) [11]. In our study, also malignant lesions showed lower ADC values as compared to benign lesions and type III kinetic curves in the malignant lesions.

Study done by Tse CM et al., on characterisation of breast lesion with proton MR Spectroscopy and they concluded the Proton MR spectroscopy was useful in in-vivo characterisation of breast

masses when the lesion exceeds 1.5 cm in maximum dimension. In their study MR spectroscopy result was positive for choline containing compounds in 17 of 19 patients with breast carcinoma [12]. In present study, MR spectroscopy in five patients (Malignant - n=2 and benign n=3) was done. It showed high Choline content in the two breast carcinoma patients and did not show choline peak in three benign phyllodes tumours.

Surgical removal of tumour is the primary treatment of choice for phyllodes tumour. A sufficient margin of healthy tissue is kept to reduce risk of local recurrence. This is usually done for benign lesions. In case of malignant or borderline lesions and in cases of recurrence, mastectomy is usually preferred option. Follow-up of patients is necessary because of risk of local and distant metastasis [6].Since the management of benign and malignant phyllodes tumour of breast is different, it is important to differentiate between the two. MRI breast with dynamic contrast enhancement along with Diffusion weighted sequences can give better insight to differentiate between malignant and benign lesions [13].

In the present study, characteristic features of phyllodes tumours are well circumscribed masses, multiple septations,cystic areas and clefts were present. MR Spectroscopy and DWI are useful non-invasive functional modalities which can be used with routine post contrast MRI to increase the specificity.

LIMITATION

MRI is an expensive and long investigation. MRI Breast should be done by well trained technologist and reporting need meticulous post processing and long reporting time for good evaluation.

CONCLUSION

MRI is an excellent modality for the characterisation and evaluation of the phyllodes tumour as they are very large many times and could not properly evaluate on mammography and USG breast. Multiparametric MRI breast using dynamic contrast enhancement, Diffusion weighted imaging and Spectroscopy can give better insight to differentiate between malignant and benign lesions.

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