ROLE OF MULTIPHASE CT IN DIFFERENTIATING PLEOMORPHIC ADENOMA FROM OTHER PAROTID NEOPLASMS

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ABSTRACT

BACKGROUND
Pleomorphic adenoma of parotid gland shows mild enhancement immediately after IV contrast injection. This property can be used in differentiating it from other parotid neoplasms. The aim of this study was to register the delayed CT enhancement characteristics of pleomorphic adenoma and to compare these results with the enhancement characteristics of other parotid gland tumors.

MATERIALS AND METHODS
Twenty pathologically proven parotid gland neoplasms were reviewed on preoperative CT scans. Lesions included two cases of Warthin’s tumors, two cases of squamous cell carcinomas, ten cases of pleomorphic adenomas, two cases of acinic cell carcinoma, three cases of mucoepidermoid cancers and one case of metastasis. CT scans were performed after administration of 140 mL of IV contrast at three serial intervals -first immediately after contrast injection, second after 8 minutes & the last one after 24 minutes. The mean normalized Hounsfield unit (HU) attenuation of these lesions was calculated by drawing ROI around the entire mass. This CT HU was divided by that of the contralateral uninvolved parotid gland without changing the location within parotid gland and size of ROI.

RESULTS
Progressive homogeneous contrast enhancement was detected with time in all pleomorphic adenomas. Mean enhancement within the lesion was 1.25±0.30 at 8 minutes and 2.33±0.60 at 24 minutes. For non-pleomorphic adenomas, degree and pattern of contrast enhancement between the immediate and delayed CT scans remained same. In our study, A multiphasic CT for pleomorphic adenoma and non-pleomorphic adenoma had high sensitivity, specificity, positive and negative predictive values (98.5% vs. 82.5%, 94.5% vs. 97.5%, 90.7% vs. 94.5%, 100% vs. 91.7% respectively).

CONCLUSION
Pleomorphic adenomas show delayed CT contrast enhancement with an increase in homogeneity with time. This feature is useful in differentiating it from other parotid neoplasms.

KEYWORDS
Parotid Neoplasms, Pleomorphic Adenoma, Multiphase CT Scan.


BACKGROUND
Pleomorphic adenoma (PA), also known as a benign mixed tumor, is the most common salivary tumor, establishing up to two-thirds of all salivary gland neoplasms.1 Mostly, PA is sited in the parotid glands (85%), minor salivary glands (10%), and the submandibular glands (5%).2 In the majority of cases, tumours arise from the superficial lobe of the parotid gland. However, infrequent cases may involve the deep lobe of the parotid gland and the para-pharyngeal space. PA is usually apparent as a slow succeeding asymptomatic, parotid gland swelling without facial nerve involvement.3

Parotid masses are evaluated preoperatively by both CT and MR imaging. MR imaging may be more consistent in the detection of malignant and benign parotid lesions. However, some literature has addressed delayed post-contrast augmentation pattern of pleomorphic adenomas, this feature can be utilized for differentiation of pleomorphic adenoma from other parotid neoplasms.4 The aim of the study is to determine CT protocol using this delayed post contrast enhancement pattern of pleomorphic adenoma which might improve the lesion detection and distinguish parotid adenomas from surrounding normal parotid tissue.
MATERIALS AND METHODS
This study was approved by our institutional review board, and an informed patient consent was obtained before participation in the study according to the institutional and native guidelines. This prospective study was performed from February 2016 to December 2017. Twenty-seven patients were included in the study. Seven patients were excluded from all analysis; 3 patients were excluded due to missed final pathological diagnosis and 4 patients were proved to have inflammatory lesions. The final study group included 20 patients. There were 11 male and 9 female patients. All patients underwent examination with the complete clinical examination, history taking including drug administration, routine serum creatinine evaluation, and preliminary ultrasound examination. The final diagnosis was confirmed by post-operative pathology specimen.

CT scans were obtained in patients with palpable parotid masses preoperatively. These masses included two cases of Warthin’s tumours, ten cases of pleomorphic adenomas, two cases of squamous cell carcinomas, two cases of acinic cell carcinoma, three cases of mucoepidermoid carcinoma and one case of metastasis. The pleomorphic adenoma group had 2 men and 8 women patients, ranged from 32 to 66 years in age (mean age, 50 years). The non-pleomorphic adenoma group had 9 men and 1 woman; patients ranged age from 40 to 80 years (mean age 60 years). 140 mL IV contrast was administered; the first scan was taken at 45 seconds followed by the second scan at 8 minutes and next one at 24 minutes. (Figure-1) “Time after injection” was defined as the time in minutes between CT scanning and the initial administration of contrast material. Scans were reported by us but reporting was blinded by pathological diagnosis. The degree of enhancement was graded as no enhancement, mild enhancement, moderate enhancement and intense enhancement. The Pattern of enhancement was graded as heterogeneous or homogeneous.

RESULTS
9 out of 10 pleomorphic adenomas showed enhancement which gradually increased with time and became more homogeneous. All Pleomorphic adenomas had well defined margins ranging from 0.5 to 3 cm. Only 1 out of 10 pleomorphic adenomas showed early intense enhancement on a scan obtained at 8 minutes with no further filling of contrast. All pleomorphic adenomas were located in the superficial lobe of parotid gland. Mean early enhancement, normalized to that of contralateral parotid tissue was 1.25±0.30 at 8 minutes and 2.33 ± 0.60 at 24 minutes which was statistically significant (p<0.01). For non-pleomorphic adenomas, no significant change was noted in degree or pattern of contrast enhancement on early and delayed CT scans. Each tumor reached peak enhancement on the early axial scan (Figure-2).

All but one non-pleomorphic adenoma had ill-defined margins. The lesion size varied from 0.8 to 4.5 cm. 9 out of the 10 lesions were located in superficial lobe of parotid gland while the other was located in both lobes; superficial and deep. Mean early tumor enhancement, normalized to contralateral parotid tissue, was 3.95 ± 2.0 at 8 minutes scan and 4.30 ± 2.5 at 24 minutes (p>0.05).

In our study, A multiphasic CT as a predictor for pleomorphic adenoma had high sensitivity, specificity, positive and negative predictive values (98.5%, 94.5%, 90.7%, 100% respectively) while non-pleomorphic adenoma also had high sensitivity, specificity, positive and negative predictive values (82.5%, 97.5%, 94.5%, and 91.7% respectively). (Table 1)

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<th>Pleomorphic Adenoma</th>
<th>Non-Pleomorphic Adenoma</th>
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<tr>
<td>Sensitivity</td>
<td>98.5%</td>
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<td>Specificity</td>
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Table 1. Sensitivity, Specificity, PPV and NPV for the Imaging Methods Under Study

A) Axial plain image shows well-defined hypodense lesion in the left parotid gland.
B and C) Immediate post contrast and 8 minutes delayed images.
D) 24-minute delay image showing homogeneous contrast filled lesion in left parotid. On pathology, the lesion appeared to be a pleomorphic adenoma.
DISCUSSION

Pleomorphic adenoma, also known as a benign mixed tumor, is the most common salivary gland tumor, signifying 70% to 80% of all benign salivary tumors. Approximately 85% of these tumors arise in the parotid gland. Clinically, parotid pleomorphic adenoma usually occurs in patients between the ages of 30 and 50 years as a slow-growing painless mass. The rate of occurrence is slightly higher in women than in men; the tumor is unusual in children. Except for Warthin tumours, females are more prone to develop benign tumours of the parotid gland. The lesions are composed of epidermoid and myoepithelial cells. Dystrophic calcifications are occasionally present. Only in 3% to 5% cases, malignant change has been noted in some reports but there are also reports which state that if the pleomorphic adenoma is left untreated, 25% of them can show the malignant transformation. Due to the high rate of development of carcinoma ex-pleomorphic adenoma, pleomorphic adenomas must be completely resected. Untreated pleomorphic adenoma can turn into carcinoma ex-pleomorphic adenoma. Pleomorphic adenoma shows typical CT appearance as non-significantly enhancing and may show foci of necrosis, haemorrhage or cystic changes.

In various studies, heterogeneous post contrast enhancement pattern of pleomorphic adenoma has been reported suggesting MR being superior to CT in diagnosing pleomorphic adenomas, however, none of these studies included delayed post contrast CT scan. Some studies similar to current study have been reported previously stating delayed enhancement as a property of pleomorphic adenoma, which is concordant with size, margin and degree & pattern of enhancement in pleomorphic adenomas.

In our study, A multiphasic CT as a predictor for pleomorphic adenoma had high sensitivity, specificity, positive and negative predictive values (98.5%, 94.5%, 90.7%, 100% respectively) while non-pleomorphic adenoma also had high sensitivity, specificity, positive and negative predictive values (82.5%, 97.5%, 94.5%, and 91.7% respectively) with the study of Brunese et al most effective in the differential diagnosis between pleomorphic adenoma and non-pleomorphic adenomas, both for the assessment of the degree of the enhancement (in this phase, strong enhancement showed a sensitivity of 61.11%, specificity of 100%, positive predictive value (PPV) of 100% and negative predictive value (NPV) of 53.33%).

Awareness of delayed enhancement pattern of pleomorphic adenoma was the aid in clinical management and improves diagnostic certainty. This could influence the decision to perform fine needle aspiration cytology. Excision biopsy could be performed directly once pleomorphic adenoma is identified with certainty. Needle biopsy is reserved for patients in whom imaging features are uncertain. Treatment of choice for pleomorphic adenoma involving superficial lobe is superficial parotidectomy.

CONCLUSION

Pleomorphic adenomas show delayed post-contrast enhancement on CT images with the homogeneous progressive enhancement. Other non-pleomorphic lesions of parotid gland show early enhancement with no change in degree and pattern of enhancement with time. This feature can be utilized in selecting timing protocol while obtaining CT scan images, while evaluating parotid pleomorphic adenomas. Appropriate timing of contrast administration and obtaining images would help us in the diagnosis of pleomorphic adenoma with certainty and helps in deciding regarding need of MR in the characterization of pleomorphic adenoma.

REFERENCES