COMPUTED TOMOGRAPHY IN ORAL AND MAXILLOFACIAL SURGERY

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SYNOPSIS

Computed tomography is the most useful diagnostic modality available in the evaluation of maxillofacial disease. The superiority of computed tomography is due to the clear soft tissue differentiation and the fine bone detail it provides. CT scans enable identification of mass lesions and an evaluation of the total extent of the disease. Computer tomography is superior to conventional tomography and radiography in the evaluation of maxillofacial disease.

INTRODUCTION

Radiography, tomography and computerd tomography are the radiological investigations usually performed for evaluation of maxillofacial disease and in selected cases angiography. Radiographs represent a two dimensional image of a three dimensional object. There is considerable difficulty in identifying the structures by radiography alone. This is therefore supplemented by tomography and more recently computed tomography. Tomography consists of a series of focused radiographs or tomo cuts of the area of interest. This enables a layer by layer demonstration of soft tissue and bony structures. Tomography was the investigation of choice prior to CT. Image unsharpness and poor contrast are major problems in tomography. In CT scanning there is satisfactory delineation of facial planes, muscles, fat, other soft tissue structure and bone.

In 1972 the first CT scan of the human brain was successfully performed by Hounsfield and Ambrose at the Atkinson Morley Hospital in London, England. CT scanner technology has come a long way since. Due to major improvements in the computer components the more recent CT scanners are able to delineate the complex anatomy of the maxillofacial region in great detail. Each CT scan represents the reconstructed image derived from a finely focused pencil of xray beam traversing the object. This image is recorded on a floppy disc, displayed on a CRT screen and reproduced on xray films. A CT examination consists of a set of axial scans. In some cases a further set of coronal scans may be required.

MATERIAL AND METHODS

A fourth generation CT scanner was commissioned at the University Hospital, Kuala Lumpur in June 1981. Patients requiring CT scans of the head and neck region are referred to the department from the various disciplines within the University Hospital and from private physician specialising in head and neck surgery e.g. neuro surgeon, ENT surgeon, ophthalmologist and oral surgeons.

We review our initial experience of seven patients referred by the Oral Surgery and ENT Departments for CT scanning of the head and neck region.

Case 1

A thirty-eight years old Chinese female presented with a painful swelling on left side of neck of two months' duration. It was increasing in size and she had some difficulty in swallowing. On examination a mass was seen in the left posterior nasal space. Nasopharyngeal carcinoma was suspected. The CT scan however showed a mass in the left infratemporal fossa and appeared to be related to the deep medial portion of the parotid gland. The tumour was excised and the histology revealed a parotid adenoma. (Fig. 1)

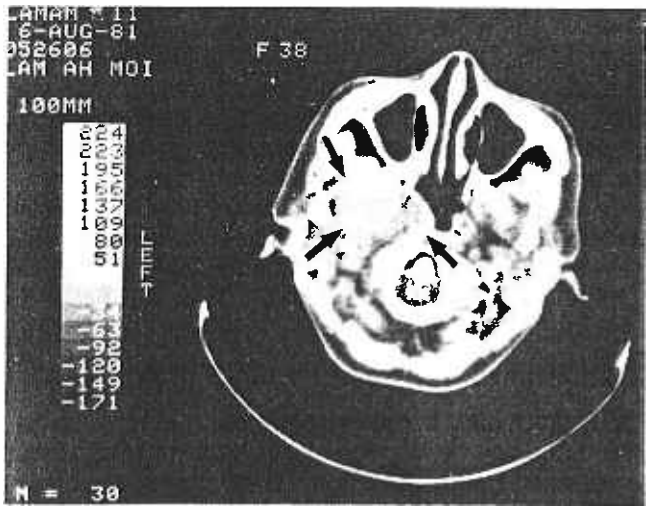

Fig. 1:
Case 1: Tumour of deep lobe of left parotid.

Case 2

A forty-six years old Indian male presented with a malignant ulcer on the left side of the hard palate of one month's duration with trismus and pain. No submandibular or cervical nodes were seen. Biopsy of the ulcer showed squamous cell carcinoma. Erosion of the alveolar margin of left maxilla was seen on the radiographs. CR scan however demonstrated the extensive nature of the lesion and showed involvement of the ethmoid sinus and posterior nasal space. There was destruction of the medial wall of maxillary antrum and the pterygoid plate. Because of the extensive disease, surgery was not contemplated and the patient was referred for radiotherapy. (Fig. 2)

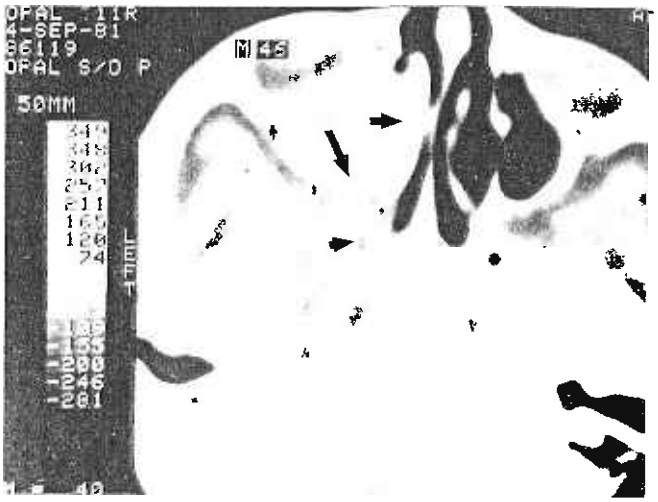

Fig. 2:
Case 2: Extensive squamous cell carcinoma left antrum with involvement of ethmoid sinus and posterior nasal space.

Case 3

A thirty-one year old Indian male presented with an ulcer of the hard palate on the left of two months duration. Biopsy showed squamous cell carcinoma. No submandibular or cervical nodes were seen. Radiographs showed an opaque and expanded left maxillary antrum but no evidence of bony involvement could be seen. CT scan showed the lesion well confined to the antrum. Bone involvement was seen of the anterior antral wall. There was no posterior extension and the posterior wall of antrum and the pterygoid plate were intact. Ethmoid sinus was clear. A left hemimaxillectomy was performed. No evidence of recurrence was seen in the follow-up examinations. (Fig. 3)

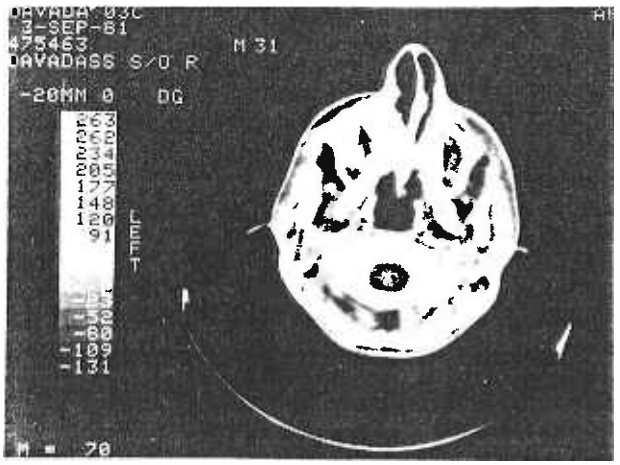

Fig. 3:
Case 3: Expanded left antrum with destruction of anterior wall.

Case 4

A sixty-seven years old Malay female presented with complaint of epistaxis with blockage of left nostril and proptosis of left eye. She had weight loss and had foul smelling discharge from left nostril. Carcinoma of maxillary antrum or ethmoid sinus was suspected. CT scan showed a large mass lesion in left maxillary antrum extending anteriorly into the retroorbital space causing proptosis. Medially it was filling the nasal cavity and superiorly involving the ethmoid sinus. Biopsy showed a non-Hodgkin lymphoma. Patient refused radiation therapy and was lost to follow-up examinations. (Fig. 4)

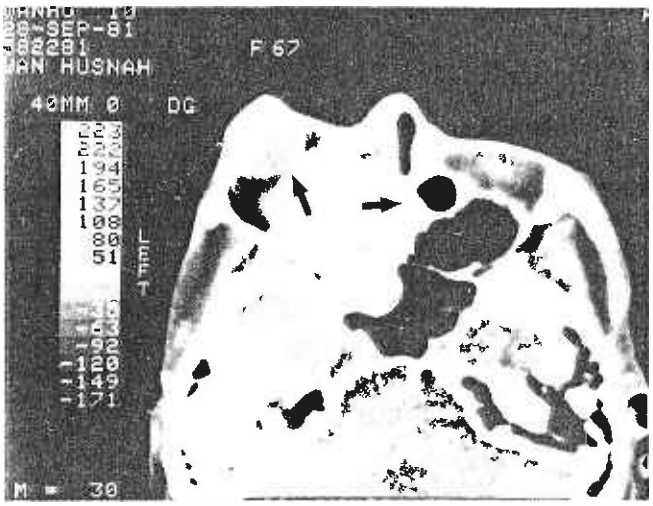

Fig. 4:
Case 4: Large mass occupying left antrum and ethmoid sinus with proptosis left eye. (Non-Hodgkin's lymphoma).

Case 5

A seventy-nine years old Chinese female presented with a history of epistaxis from the right nostril. A polypoid mass was seen occluding the affected nostril. In CT scan, a well defined oval mass was seen filling the posterior right nostril. Superiorly, the mass was compressing and eroding the posterior ethmoid sinus and appeared to represent a benign soft tissue lesion. The tumour was excised and on histology was found to be a neurilemmoma. (Fig. 5)

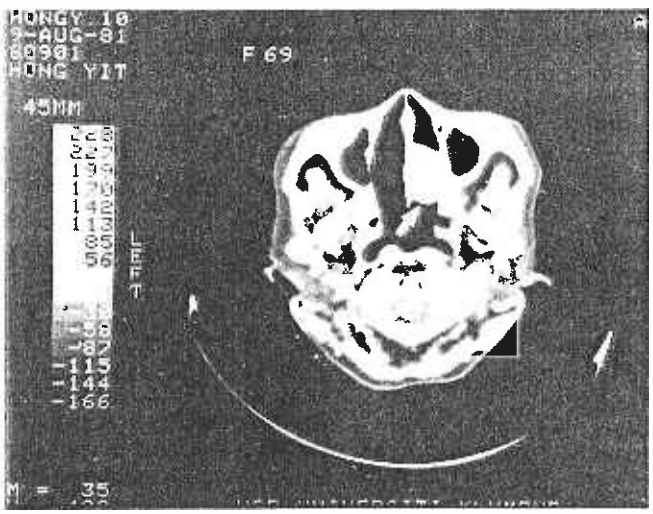

Fig. 5:
Case 5: Mass right nostril (neurilemmoma).

Case 6

A fifty years old Indian female presented with a history of epistaxis from the right nostril and nasal obstruction of six months' duration. Radiographs showed an opaque right maxillary antrum. On CT the right maxillary antrum showed soft tissue filling the affected antrum. Calcification was noted in the soft tissue. The lesion was well confined to the antrum and no bony involvement was seen. A biopsy was obtained under general anaesthesia. The histology was that of chronic granuloma, and phycomycosis was isolated. The lesion was curretted out followed by broad spectrum antibiotics. No recurrence is seen so far. (Fig. 6).

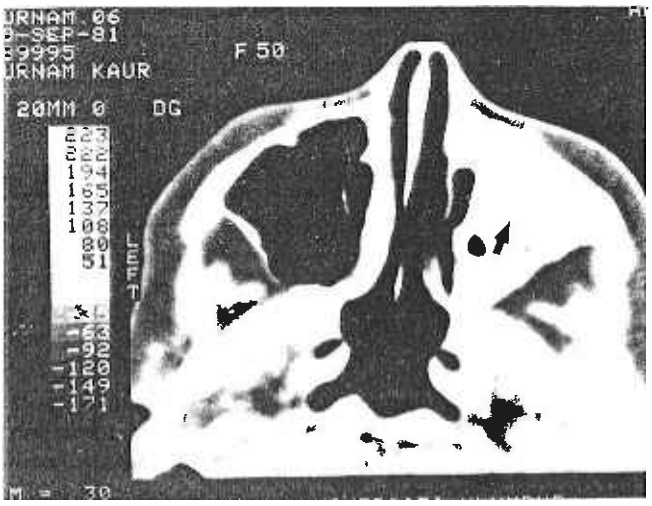

Fig. 6:
Case 6: Mass right antrum (Phycomycosis).

Case 7

A fifty years old Chinese female presented with a right-sided facial pain and swelling for the past three months. There was no history of epistaxis and no lymph nodes were seen. CT scan showed mucosal thickening of right maxillary antrum and a pedunculated polyp within it. No evidence of bony involvement was seen and a diagnosis of antral polyp was made. Patient was reassured and treated conservatively. (Fig. 7)

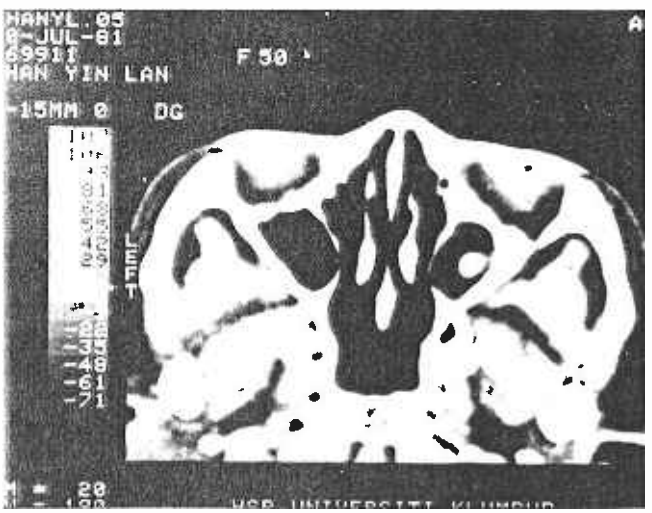

Fig. 7:
Case 7: Polyp right antrum

DISCUSSION

The image quality has improved significantly in the more recent CT scanners enabling excellent depiction of the complex anatomy of the head and neck. Computed tomography provides a fairly satisfactory examination of this region, an area which had hitherto been difficult to evaluate by other radiological methods. Adjustment of mean and window setting, contrast enhancement, region of interests focusing and image reconstruction are some features which are utilised to obtain the requisite information from the CT scan. Each scan can be evaluated both for soft tissue and bone by varying the mean and window settings. Lesions of the middle third of the face, the lower third of the face and the neck are clearly delineated. Periorbital and intra-orbital lesions are particularly well defined because of the high fat content of these areas. The eyeball, optic nerve, ocular muscles and the bony frame work of the orbit and face can be visualised in great detail. Lesions of the paranasal sinuses, posterior nasal space and infratemporal region are also clearly outlined (1). Areas of bone erosion and destruction caused by trauma, inflammatory lesions or malignant disease are demonstrated. Intracranial extension of disease can be detected due to their differential contrast enhancement compared to normal brain tissue.

Differentiation between benign and malignant tumours or between tumour mass, infection and haematoma can often be made by computed tomography. There are some characteristic findings on CT which help in this differentiation. A recent hematoma appears as an area of high density compared to that of normal muscle. Inflammatory disease is associated with diffuse soft tissue changes, obliterating surrounding muscle planes. A tumour is more sharply defined than inflammatory disease and appears as a well defined mass displacing or infiltrating muscle planes. The appearance and distribution of calcification in the lesion may help to differentiate. Benign tumours are slow growing and cause bone expansion rather than bone destruction. Bone destruction is seen in malignant disease and in chronic inflammatory granulomas. Tumours extending into the orbit or intracranial cavity are more likely in malignant lesions but are also seen in inflammatory disease (2).

The advantages of CT scan over conventional radiography lies in the reliability in detecting the differences in density as small as 0.5% whereas the conventional radiography detects differences in density of only 5 – 10% (3). High quality images obtained on dedicated pleuridirectional tomographic machines provide radiological information comparable with CT scans. Contrast resolution is far superior in CT whereas spatial resolution is better in tomography. Thin section scanning has improved the spatial resolution on CT scans (4). High quality image reformation in multiple planes and other refinements of CT are major advantages over tomography. Another important factor is that the radiation dose in CT is much less compared to tomography. A complete series of CT scans provides a peak skin dose of 9 rad compared to a peak skin dose of 30 rad for a complete tomographic examination (5).

CONCLUSION

Pathological anatomy and normal anatomy of the oral and maxillofacial complex are accurately depicted by computed tomography. Furthermore, it provides an accurate assessment of the extent of the lesion and enables the surgeon to determine operability and the approach and extent of surgery contemplated. On the basis of this initial experience our current approach to the evaluation of maxillofacial disease involves CT as the first diagnostic method after plain films. CT represents the most significant technical development in the diagnostic radiology of the head and neck region.

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