Cumhuriyet Dental Journal

Volume 18 Issue 1

doi: 10.7126/cdj.58140.5000070159

available at http://dergipark.ulakbim.gov.tr/cumudj/

RESEARCH ARTICLE

Computed tomographic findings of maxillofacial SCC and undifferentiated carcinoma

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ARTICLE INFO

Article history:
Received 24 September 2014
Accepted 23 December 2014

Keywords:
Computed tomography,
SCC,
Undifferentiated carcinoma,
Naxillofacial region

ABSTRACT

Objectives: Tomographic findings contribute enormously to the accurate diagnosis of malignant lesions in due time and/or at imminent stages. This study investigates CT-scan findings of maxillofacial squamous cell carcinoma and undifferentiated carcinoma.

Materials and Methods: CT images of 61 maxillofacial malignant tumors included 42 SCCs and 19 undifferentiated carcinomas were evaluated based on the location, internal density, border, bone destruction and expansion, periosteal reaction, emphysema, calcification, loss of facial and fat plane, and fat plane reticulation, by two expert radiologists separately. The data were analyzed, using Chi-square and Fisher's exact test.

Results: Isodense/homogeneous (78.7%) and total heterogeneous enhancement (87.8%) appearance were the most common internal patterns detected before and after injection of contrast, respectively. There was a significant association between borders and pathology of our two lesions (p= 0.007).

Conclusions: It is highly unlikely to diagnose the tumor histopathology based merely on its tomography patterns; however it is feasible to determine its aggressive nature.

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INTRODUCTION

If the oral cavity malignancy is suspected, the assessment of the malignancy's type, depth of invasion structures and its relation to the surrounding is necessary for treatment planning.[1]

Plain radiographs can provide only two-dimensional images, failing to reveal bone destruction and its extent, due to superimposition, and also soft tissue invasion.[2] A recent study attested to the accuracy of CBCT (Cone Beam Computed Tomography) in diagnosing bone involvement in oral malignancies, competing with MSCT (Multi Slice Computed Tomography) and SPECT (Single Positron Emission Computed Tomography) in this respect. Nevertheless, it failed to detect soft tissue involvement.[1] A study conducted by Arya et al showed that the multi- detector computed tomography (MDCT) provides the highest specificity for bone erosion.[3] Mukherji et al.[4] demonstrated that conventional CT with bone and soft-tissue algorithms had a high specificity of 87% for mandibular invasion in oral cavity SCC. In addition, CT scan also obviates the possibility of super-imposition that is why it is the method of choice for diagnosing neoplastic and infectious processes of the paranasal sinuses and maxillofacial region.[2,5] Another study conducted by Kushraj et alrevealed that CT has an acceptable degree of sensitivity and specificity in detecting bone tumor infiltration.[6]

Knowledge and correct understanding of tomographic features of malignant lesions play an essential role in the early diagnosis as well as planning the appropriate treatment of these lesions. Oral squamous cell carcinoma (SCC) represents 90% to 95% of all malignant neoplasms of the oral cavity.[7] Sinonasal undifferentiated carcinoma is a rare tumor with a routinely shown aggressive behavior and poor prognosis for survival.[8] This study was undertaken with an objective to evaluate tomographic findings of maxillofacial SCC and undifferentiated carcinoma.

MATERIALS AND METHODS

CT images of 85 malignant maxillofacial tumors were analyzed. The studies were performed over 4 years between 2001 and 2005. Common malignant tumors in this study were squamous cell carcinoma (42 cases), and undifferentiated carcinoma (19 cases), so in this paper we descried the tomographic features of these two lesions (61 cases).

This study is approved by the research deputyship of Mashhad University of Medical Sciences regarding both ethical and methodological issues. An informed consent was obtained from each individual following offering them full introduction about aims and procedures of the study.

All tumors had a final pathology report. The following CT characteristics were studied:

1. The location of the involvement, which was divided into several areas, including the mandible, maxilla, sinonasal airway, lips, tongue, salivary glands, nasopharynx, skin and muscles.
2. Bone destruction patterns including, geographic or gross (a large defect in cortical bone with trabecular bone destruction), permeative(multiple and separate defects in cortical bone with trabecular bone destruction), and spotty(small defects in cortical bone without trabecular bone destruction) (Figure 1).
3. Periosteal reaction, including onion- skin (lift the periosteum off the surface of the cortical bone and then stimulate the periosteum to lay down new bone for more than once), sun ray (new bone formed at right angles to the outer cortical

plate), Codmans' triangle(destruction of cortical bone with periosteal reaction at the periphery) and irregular (without characteristic shape) (Figures 2, 3).
3. Lesion boundary definition, including ill-defined and well-defined (Figure 3)
4. The presence or absence of emphysema (abnormal accumulation of gas in the lesion).
5. The presence or absence of calcification.
6. The presence or absence of bone expansion.
7. Loss of facial and fat plane, and fat plane reticulation (Figure 4).
8. Internal density: internal density without contrast was classified as isodense (similar to the adjacent muscles), hypodense (less than the adjacent muscles) and hyperdense (higher than the adjacent muscles). They were also homogenous (uniform) or heterogeneous (non-uniform), including isodense-hyperdense, isodense-hypodense and hyperdense-hypodense. Internal density with contrast injection included increasing total homogenous or heterogeneous enhancement, rim enhancement and ring enhancement. Images were reviewed in consensus by two radiologists with long experience in CT interpretation blinded to histopathology reports. In cases where the two experts did not concur, a third observer opinion was requested.

Statistical tests were performed, using SPSS software (SPSS Inc., Chicago, IL) Chi-square test and Fisher's exact test.

RESULTS

CT images of 61 patients involved with SCC or undifferentiated carcinoma, 47 males and 14 females, ranging from 19 to 84 years of

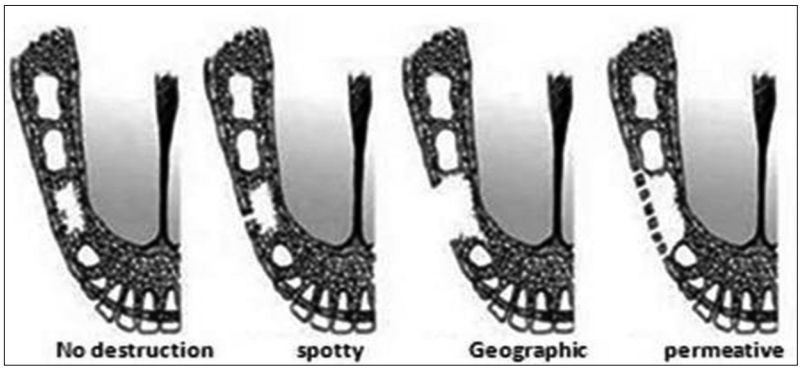

Figure 1. Schematic representation of cortical bone destruction patterns.

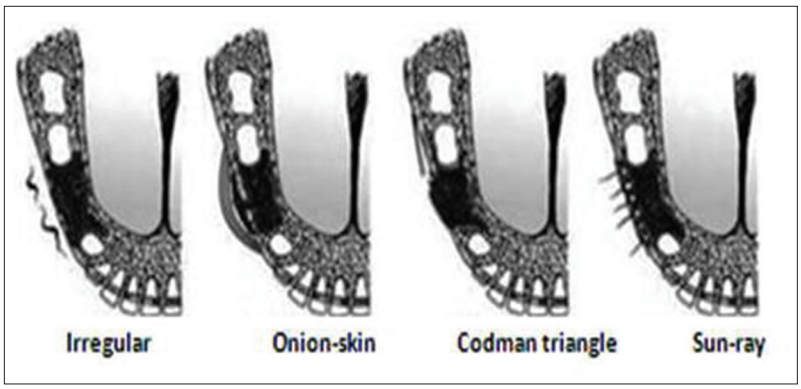

Figure 2. Diagram showing the four patterns of periosteal reaction.

Figure 3. Peripheral SCC with invasion to the mandibular bone in a 50- year-old male. Axial CT scan shows an ill-defined soft tissue mass which has grossly destroyed the adjacent mandibular bone. Codmans' triangle periosteal reaction can also be seen.

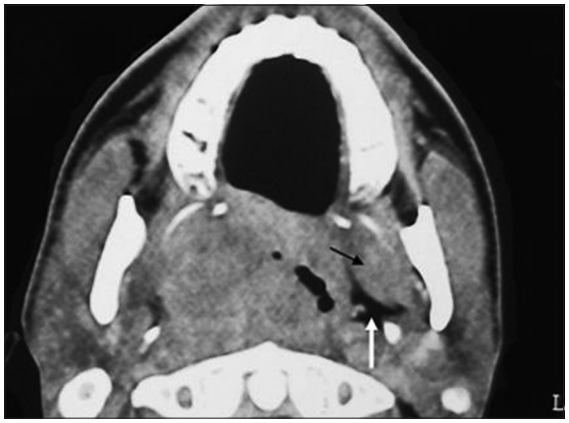

Figure 4. The loss of facial and fat plane by nasopharyngeal undifferentiated carcinoma: Axial CT scan shows the loss of parapharyngeal fat space and internal pterygoid muscle on the left side. Normal parapharyngeal space (white arrows) and internal pterygoid muscle (black arrows) on the opposite side are also shown.

age with a mean age of 55.82± 16.34 years, were analyzed.

The most common sites of involvement included the nasopharynx (32.8%) and sinonasal airway (21.3%) respectively.

Isodense/homogeneous appearance (78.7%) was the most common internal pattern detected without injection of contrast in these two maxillofacial malignant tumors. This pattern was more common in SCCs than undifferentiated carcinomas (72.9 and 27.1%, respectively). According to the Fisher's exact test, there was no association between internal patterns before injection and pathology of these two lesions (p=0.31).

Contrast media injection was performed in 67.2% of lesions (41 cases) which total heterogeneous enhancement was the most common pattern (87.8%), whereas total homogenous contrast enhancement was observed only in 12.2 % of cases. SCCs have no total homogenous contrast enhancement. Rim or ring enhancement was not observed in our cases. According to the Fisher's exact test, there was no association between internal patterns after injection and pathology of these two lesions (p=0.29).

Emphysema was observed in 16.4% (10 cases) of the lesions, majority of them (9 cases) were SCCs. However according to the Fisher's exact test, there was no association between emphysema and pathology of our two lesions (p=0.15) (Table1).

Ill-defined borders were found in 93.4% (57 cases) of the lesions, including all SCCs and 78.9% of undifferentiated carcinomas. Well-defined border was observed in four nasopharyngeal undifferentiated carcinomas. According to the Fisher's exact test, there was a significant association between borders and pathology of these two lesions (p= 0.007) (Table1).

Bone expansion and cortical destruction were found in 6.6% and 82% of those lesions respectively, and Fisher's exact test showed no association between two variables and pathology of our lesions (p=0.30 and 0.29, respectively) (Table1).

Geographic and permeative destruction were observed in 75.5% and 32.8% in order.

Table 1. Relationship between pathology of lesions and tomographic findings

	Pathology		Total	p-value
	SCC	Undifferentiated carcinoma		
Emphysema				
Yes				
No	9	1	10	0.15
%	14.8	1.6	16.4	
No				
No	33	18	51	
%	54.1	29.5	83.6	
Border				
Ill-defined				
No	42	15	57	0.007*
%	68.8	24.6	93.4	
Well-defined				
No	0	4	4	0.007*
%	0	6.6	6.6	
Bone expansion				
Yes				
No	4	0	4	0.30
%	6.6	0	6.6	
No				
No	38	19	57	
%	62.3	31.1	93.4	
Geographic cortical destruction				
Yes				
No	34	12	46	0.19

(*Contd*...)

Table 1. (*Continued...*)

	Pathology		Total	p-value
	SCC	Undifferentiated carcinoma		
%	55.7	19.7	75.4	
No				
No	8	7	15	
%	13.1	11.5	24.6	
Permeative cortical destruction				
Yes				
No	14	6	20	1.00
%	23.0	9.8	32.8	
No				
No	28	13	41	
%	45.9	21.3	67.2	
Loss of facial plane				
Yes				
No	25	11	36	1.00
%	41.0	18.0	59.0	
No				
No	17	8	25	
%	27.9	13.1	41.0	
Fat plane reticulation				
Yes				
No	14	2	16	0.11
%	22.9	3.3	26.2	
No				
No	28	17	45	

(*Contd...*)

Table 1. (*Continued...*)

	Pathology		Total	p-value
	SCC	Undifferentiated carcinoma		
%	45.9	27.9	73.8	
Loss of fat plane				
Yes				
No	35	15	50	0.72
%	57.4	24.6	82.0	
No				
No	7	4	11	
%	11.5	6.5	18.0	

*significant association

Spotty destruction was not observed in any of the cases. There was no association between type of destruction and pathology of our lesions (Table1).

Periosteal reaction (Codman's triangle) was observed in one patient with mandibular SCC. Loss of facial and fat plane was observed in 59% and 82% of lesions respectively, and there was fat plane reticulation in 26.2% of the lesions. The facial and fat plane destruction and reticulation were more frequently visualized in SCCs, but there was no association between these three variables and pathology of our lesions ($p>0.05$) (Table1).

DISCUSSION

The most common malignancies found in this study included SCC, undifferentiated carcinoma with the former the most prevalent oral malignancy as well (94%).[7]

Non contrast enhanced CT showed that isodense/homogenous pattern in SCC was the most internal pattern. After contrast injection, the most of SCCs showed a total heterogeneous enhancement. There was not calcification in any SCC case. As confirmed by Sigal et al.[9], the internal density of SCC lesions makes them indistinguishable from adjacent muscles on CT-scan whereas contrast CT provides moderate enhancement and thus differentiation.

Geographic destruction was the dominant view with none showing spotty destruction. Codman's triangle, as a sign of periosteal reaction, could be found in a single SCC case. There was evidence of neither periosteal reaction nor spotty destruction in all 12 cases of SCC studied by Hariya et al.[10] They concluded that permeative destruction is a sign of intra-osseous malignant tumors whereas spotty destruction is indicative of osteomyelitis.

In a study on periosteal reaction resulting from diseases of the jaw, Ida et al.[11] concluded that periosteal reaction was mainly observed in metastatic carcinoma and sarcoma. They also found periosteal reaction in 11% of SCC cases, which does not support our findings.

Som and Shugar[12] highlighted the progressive and destructive nature of the tumors with rare bone expansion. Our few cases with bone expansion can possibly be explained as above.

Our second most common tumor was undifferentiated carcinoma with similar internal patterns to SCC on CT scan, which makes it difficult to be differentiated from SCC. Unlike SCC though, this tumor had a well-defined border in approximately 21.1% of cases, which almost always occurred in nasopharyngeal space with a rather small size and relatively low invasion to the surrounding tissues. However, this lesion had an ill-defined margin in 78.9% of cases. Similar to SCC, geographic destruction was the most frequent type and none of our cases revealed periosteal reaction. In another study with consistent findings with ours, Philips et al.[13] reported 11 cases with sinonasal undifferentiated carcinoma with ill-defined borders and bone destruction. They all showed heterogeneous contrast enhancement with no calcification. Also according to the results listed by Smullen et al.[11] radiographic view of sinonasal undifferentiated carcinoma is indistinguishable from SCC which may present as a soft tissue mass, causing adjacent bone erosion, this result was also consistent with our study.

In conclusion, among all of tomographic variables which evaluated in this study there was a significant association only between borders and pathology of our two lesions. CT cannot be an accurate diagnostic tool in determining the tumor histopathology, yet it can be most effectively used to diagnose the nature of lesion and monitor the progression of the disease.

ACKNOWLEDGMENT

This study was made possible by the generous support rendered by the Vice Chancellor for Research of Mashhad University of Medical Sciences, in the form of grant no 85107 for which the authors are very grateful.

CONFLICT OF INTEREST

There are no financial or other relations that could lead to a conflict of interest.

REFERENCES

1. Dreiseidler T, Alarabi N, Ritter L, Rothamel D, Scheer M, Zöller JE, et al. A comparison of multislice computerized tomography, cone-beam computerized tomography, and single photon emission computerized tomography for the assessment of bone invasion by oral malignancies. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011;112:367-374.
2. Hesselink JR, New PF, Davis KR, Weber AL, Roberson GH, Taveras JM. computerized tomography of the paranasal sinuses and face- part II. Pathological anatomy. J Comput Assist Tomogr 1978;2:568-576.
3. Arya S, Rane P, Deshmukh A. Oral cavity squamous cell carcinoma: Role of pretreatment imaging and its influence on management. Clin Radiol 2014;69:916-930.
4. Mukherji SK, Isaacs DL, Creager A, Shockley W, Weissler M, Armao D. CT detection of mandibular invasion by squamous cell carcinoma of the oral cavity. AJR Am J Roentgenol 2001; 177:237-243.
5. Brant-Zawadzki M, Minagi H, Federel MP, Rowe LD. High resolution of CT image reformation in maxillofacial pathology. AJR Am J Roentgenol 1982;138:477-483.
6. Kushraj T, Chatra L, Shenai P, Rao PK. Bone invasion in oral cancer patients: A comparison between

Orthopantamograph, conventional computed tomography, and single positron emission computed tomography. J Cancer Res Ther 2011;7:438-441.

7. Mehanna P, Smith G. Maxillary carcinoma: a wolf in sheep's clothing. Can Fam Physician 2009;55:262-264.

8. Paul J. Donald. Sinonasal Undifferentiated Carcinoma with Intracranial Extension. Skull Base. 2006;16:67–74.

9. Sigal R, Zagdanski AM, Schwaab G, Bosq J, Auperin A, Laplanche A, et al. CT and MR imaging of squamous cell carcinoma of the tongue and floor of the mouth. Radiographics 1996;16:787-810.

10. Hariya Y, Yuasa K, Nakayama E, Kawazu T, Okamura K, Kanda S. Value of computed tomography findings in differentiating between intraosseous malignant tumors and osteomyelitis of the mandible affecting the masticator space. Oral Surg Oral Med Oral Pathol Oral Radiol Endol 2003;95:503-509.

11. Smullen JL, Amedee RG. Sinonasal undifferentiated carcinoma: a review of the literature. J La State Med Soc. 2001;153:487-490.

12. Som PM, Shugar JM. The significance of bone expansion associated with the diagnosis of malignant tumors of the paranasal sinuses. Radiology 1980;136:97-100.

13. Phillips CD, Futterer SF, Lipper MH, Levine PA. Sinonasal undifferentiated carcinoma: CT and MR imaging of an uncommon neoplasm of the nasal cavity. Radiology 1997;202:477-480.

How to cite this article: Imanimoghaddam Mahrokh, Taleb Mehr Mahdieh, Javadian Langaroodi Adineh, Bagherpour Ali, Aghili Mahdi, Mahjoob Omid. Computed tomographic findings of maxillofacial SCC and undifferentiated carcinoma. Cumhuriyet Dent J 2015;18(1):47-55.