ORIGINAL ARTICLES

Spread of odontogenic infections in the elderly: Prevalence and characteristic multidetector CT findings

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ABSTRACT

Purpose: To analyze spread of odontogenic infections in the elderly, especially the prevalence and characteristic multidetector computed tomography (MDCT) findings.

Materials and methods: Ninety-seven patients with odontogenic infection who underwent 64-row MDCT were evaluated in this study. The study patients comprised 31 elderly patients ($\geq$ 60 years) and 66 adults (< 60 years). Age, gender, location of causal tooth, and spread of odontogenic infections with MDCT were analyzed.

Results: The elderly patients (74.2%) had higher ratio with female compared to the adults (57.6%). The buccal space (93.5%) was the most common spread of odontogenic infections for the elderly patients, followed by the masticator space (54.8%) and submandibular space (45.2%), whereas the buccal space (97.0%) was the most common spread of odontogenic infections for the adults, followed by submandibular space (65.2%) and masticator space (51.5%). Logistic multivariate regression analysis for odontogenic infections in the elderly demonstrated that the gender (odds ratio = 3.462, *P* = .024) and submandibular space (odds ratio = 0.168, *P* = .013) were significant variable.

Conclusions: The study showed the prevalence and characteristic MDCT findings of spread of odontogenic infections in the elderly.

Key Words: Computed tomography, Odontogenic infections, Fascial spaces, Elderly, Head and neck

1. INTRODUCTION

Odontogenic infections can extend to adjacent fascial spaces, if not properly controlled.[1,2] Odontogenic infections in elderly with systemic diseases were the most important predictive factors in deep neck infections.[3] These infections were grave and potentially life-threatening infection,[3,4] because the extension should be very grave and rapid, and lead to critical airway obstruction.[5–7]

Realization of the anatomy in head and neck region is essential for the diagnosis and treatment of odontogenic infections, because the fascia is an effective barrier to the infection expansion.[8,9] Computed tomography (CT) can very contribute to evaluation on the spread of odontogenic infections.[10–12]

In recent years, multidetector computed tomography (MDCT) has become a standard imaging modality of maxillofacial lesions because of the exquisite sensitivity of this

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imaging technique.[13, 14] Furthermore, MDCT enable realization of the region and spread of abscesses to masticator space derived from severe odontogenic infection.[15–17] The present study analyzed spread of odontogenic infections in the elderly, especially the prevalence and characteristic MDCT findings.

2. MATERIALS AND METHODS

Ninety-seven patients with odontogenic infection who underwent 64-row MDCT were evaluated in this study. The study patients comprised 31 elderly patients ($\geq$ 60 years) and 66 adults (< 60 years). The diagnosis of odontogenic infection was diagnosed from the clinical course of patient. Surgical drainage and/or tooth extraction of origin of infection were performed in all patients after CT imaging. Clinical signs and symptoms of all cases were reduced after antibiotic treatment.

Imaging was scanned by a 64-row MDCT (Aquilion 64, Toshiba Medical Systems, Otawara, Japan) by protocol at our hospital of the oral and maxillofacial lesions. In this study, CT imaging was performed without use of contrast agent because immediate treatment is necessary. The two oral and maxillofacial radiologists evaluated the region of an abscess and cellulitis to the different components of the buccal space, submandibular space, sublingual spaces, masticator space and parapharyngeal space using soft-tissue algorithm CT images.[18, 19]

The data collected included age, gender, location of causal tooth, and spread of odontogenic infections with MDCT were compared with elderly and adults using logistic multivariate regression analysis.

3. RESULTS

Table 1 shows comparison between elderly and adult patients with odontogenic infections. The elderly patients had lower ratio with male in compared to the adults (25.8% *vs.* 42.4%) and multiple spaces involved (71.0% *vs.* 77.3%). Regarding location of facial space, the buccal space (93.5%) was the most common spread of odontogenic infections for the elderly patients, followed by masticator space (54.8%), whereas buccal space (97.0%) was the most common spread of odontogenic infections in the adults, followed by submandibular space (65.2%).

Table 2 shows the profiles of fascial space involvement by odontogenic infection in 97 patients. The buccal space (8 patients: 25.8%) was the most frequent in 31 patients in the elderly, followed by the buccal, submandibular and masticator spaces (5 patients: 16.1%), and buccal and masticator spaces (5 patients: 16.1%). In 66 patients in the adults, the

buccal, submandibular and masticator spaces (17 patients: 25.8%) were the most frequent, followed by buccal space (15 patients: 22.7%), and buccal and submandibular spaces (11 patients: 16.7%).

Table 1. Comparison between elderly and adult patients with odontogenic infections

Parameter	Elderly	Adults	Total
Number of patients	31 (32.0%)	66 (68.0%)	97 (100%)
Age (years)			
Mean $\pm$ SD	70.7 $\pm$ 7.8	42.3 $\pm$ 10.4	51.4 $\pm$16.4
Range	60-87	21-59	21-87
Gender			
Male	8 (25.8%)	28 (42.4%)	36 (37.1%)
Female	23 (74.2%)	38 (57.6%)	61 (62.9%)
Location of causal tooth			
Maxilla	6 (19.4%)	13 (19.7%)	19 (19.6%)
Mandible	25 (80.6%)	53 (80.3%)	78 (80.4%)
Spread of odontogenic infections with MDCT			
Number of spaces involved			
Single	9 (29.0%)	15 (22.7%)	24 (24.7%)
Multiple	22 (71.0%)	51 (77.3%)	73 (75.3%)
Location of fascial space			
Buccal space	29 (93.5%)	64 (97.0%)	93 (95.9%)
Submandibular space	14 (45.2%)	43 (65.2%)	57 (58.8%)
Sublingual spaces	5 (16.1%)	6 (9.1%)	11 (11.3%)
Masticator space	17 (54.8%)	34 (51.5%)	51 (52.6%)
Parapharyngeal space	8 (25.8%)	15 (22.7%)	23 (23.7%)

Note. SD: standard deviation; MDCT: multidetector computed tomography.

Table 2. Profiles of fascial space involvement by odontogenic infection in 97 patients

Fascial space with MDCT	Elderly n = 31	Adults n = 66	Total n = 97
BS	8 (25.8%)	15 (22.7%)	23 (23.7%)
BS, SMS, MS	5 (16.1%)	17 (25.8%)	22 (22.7%)
BS, SMS	2 (6.5%)	11 (16.7%)	13 (13.4%)
BS, MS	5 (16.1%)	7 (10.6%)	12 (12.4%)
BS, SMS, MS, PPS	3 (9.7%)	6 (9.1%)	9 (9.3%)
BS, SLS, SMS, MS, PPS	1 (3.2%)	4 (6.1%)	5 (5.2%)
BS, SMS, PPS	0 (0%)	3 (4.5%)	3 (3.1%)
BS, PPS	1 (3.2%)	1 (1.5%)	2 (2.1%)
BS, MS, PPS	2 (6.5%)	0 (0%)	2 (2.1%)
SLS, SMS	1 (3.2%)	1 (3.2%)	2 (2.1%)
BS, SLS, SMS, MS	1 (3.2%)	0 (0%)	1 (1.0%)
BS, SLS, SMS, PPS	1 (3.2%)	0 (0%)	1 (1.0%)
SLS	1 (3.2%)	0 (0%)	1 (1.0%)
SLS, SMS, PPS	0 (0%)	1 (1.5%)	1 (1.0%)

Note. MDCT: multidetector computed tomography; BS: buccal space; SMS: submandibular space; SLS: sublingual space; MS: masticator space; PPS: parapharyngeal space.

Logistic multivariate regression analysis for odontogenic infections in the elderly demonstrated that the gender (odds

ratio = 3.462, *p* = .024) and submandibular space (odds ratio = 0.168, *p* = .013) were significant variable (see Table 3).

Table 3. Logistic multivariate regression analysis of patients with odontogenic infections in the elderly

	Odds ratio	95% CI	*P* value
Gender	3.462	1.174-10.204	.024
Location of causal tooth	2.214	0.550-8.911	.263
Spread of odontogenic infections with MDCT			
Number of spaces involved	0.858	0.137-5.379	.870
Buccal space	0.295	0.014-6.114	.430
Submandibular space	0.168	0.041-0.687	.013
Sublingual spaces	2.046	0.317-13.190	.451
Masticator space	1.851	0.466-7.354	.382
Parapharyngeal space	1.603	0.457-5.625	.461

Note. MDCT: multidetector computed tomography; CI: confidence interval.

Figure 1 demonstrated the spread of mandibular odontogenic infections in buccal, submandibular and masticator spaces. Figure 2 showed the spread of mandibular odontogenic infections in sublingual space.

4. DISCUSSION

Bassiony et al.[6] showed that the most commonly involved fascial space spread of odontogenic infections extended in buccal spaces followed by submandibular and masticator spaces. In our study, the most commonly involved fascial space spread of odontogenic infections extended in buccal spaces followed by submandibular, masticator, parapharyngeal, and sublingual spaces. This is in agreement with previous studies.
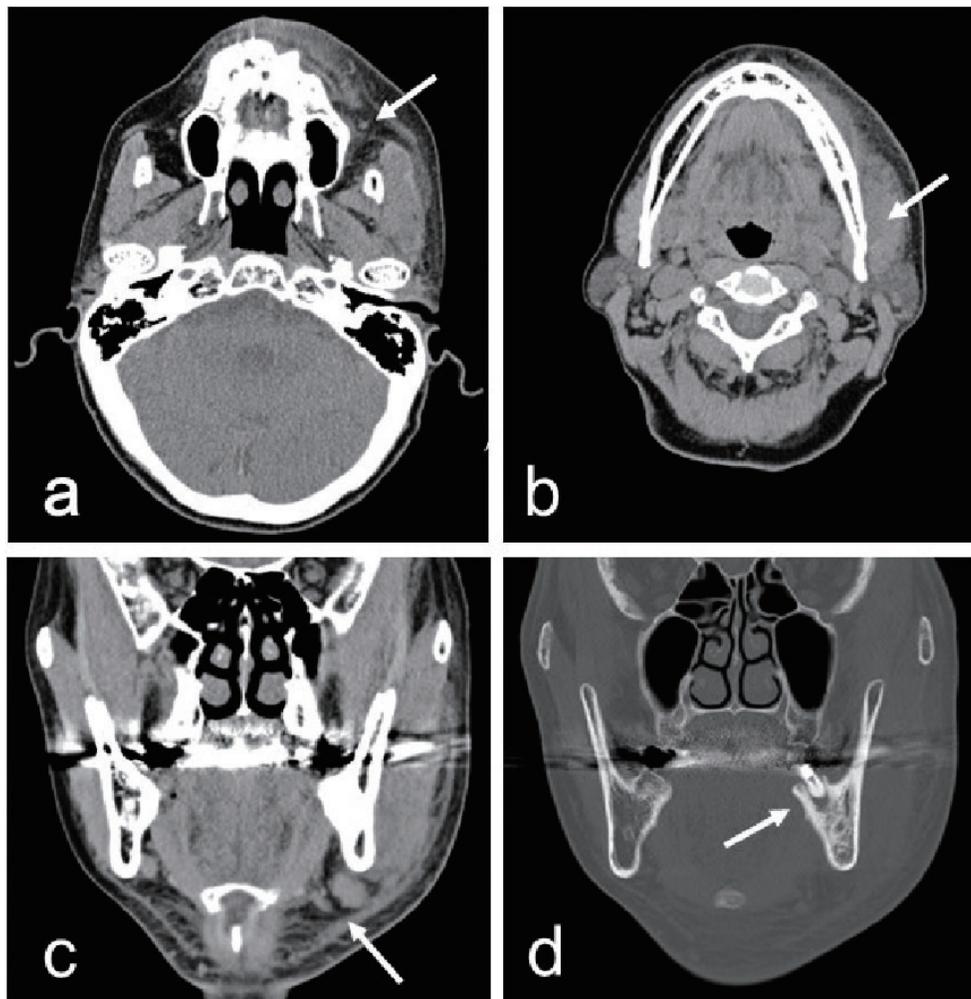
Figure 1. A 68-year-old female with odontogenic infections. a. Axial soft-tissue algorithm CT image demonstrates the spread of odontogenic infections in buccal space (arrow); b. Axial soft-tissue algorithm CT image demonstrates the spread of odontogenic infections in masticator space (arrow); c. Coronal soft-tissue algorithm CT image demonstrates the spread of odontogenic infections in submandibular space (arrow); d. Coronal bone-algorithm CT image demonstrates mandibular periapical lesion (the second molar teeth, arrow)
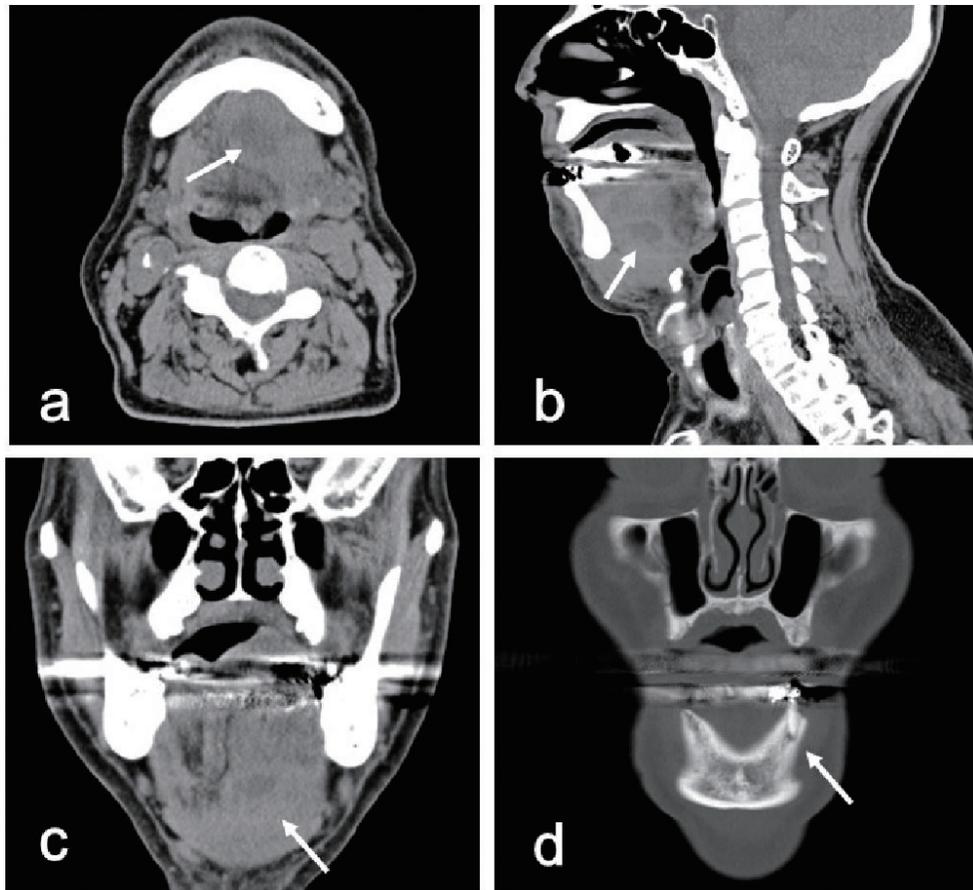
Figure 2. A 82-year-old male with odontogenic infections. a. Axial soft-tissue algorithm CT image demonstrates the spread of odontogenic infections in sublingual space (arrow); b, c. Sagittal and coronal soft-tissue algorithm CT image to better advantage shows the spread of odontogenic infections in sublingual space (arrow); d. Coronal bone-algorithm CT image demonstrates mandibular periapical lesion (the first premolar teeth, arrow)

Furthermore, the authors indicated that buccal space and masticator space was the most common spread in odontogenic infections for the elderly patients, whereas the buccal space and submandibular space were the most common spread of odontogenic infections in the adults. Obayashi et al.[11] showed that changes in the alveolar cortical plates were found more frequently in the labial and buccal side than in the palatal side, and masticator space changes were predominantly seen in the patients with infection caused by maxillary molars. Ohshima et al.[12] showed that the cortical the cortical thickness was thinner on the lingual side than the buccal side, and that the extension of odontogenic infection from mandibular teeth is more likely to occur on the lingual side than the buccal side. Alotaibi et al.[20] showed that the frequency of deep neck space infection was significantly higher in patients with mandibular odontogenic infection (29%) than in those with maxillary odontogenic infection (7%). Our data indicated that the frequency of odontogenic infections was higher in cases of mandibular odontogenic infection (80.4%) than in those of maxillary

odontogenic infection (19.6%). Moghimi et al.[21] indicated that infection of maxillary teeth most commonly extension to buccal space, whereas infection originating in mandible mostly extension to the submandibular, pterygomandibular, and buccal spaces. We consider that these anatomical character should explain inflammation easily expansion to buccal space and masticator space in the elderly.

Regarding multiple spaces, in the present study, 75.3% of all patients with odontogenic infection showed involvement in multiple spaces. Furthermore, the authors showed that, compared to the adults, the elderly patients had lower ratio with multiple spaces involved (71.0% *vs.* 77.3%). Chi et al.[22] showed that compared to the adult (aged between 18 and 65) group with deep neck infection, the elderly (older than 65 years of age) group had higher ratio with multiple spaces involved (53.1% *vs.* 30.2%). Ariji et al.[10] showed that the odontogenic infection pathway through the mylohyoid muscle or sublingual space was observed most frequently in patients with submandibular space involvement.

Schuknecht et al.[15] report that medial masticator space abscesses tend to display early extra-spatial parapharyngeal space and soft palate, because the parapharyngeal space is linked to the submandibular space inferiorly. In the present study, buccal space was the most frequent in the elderly, followed by the buccal, submandibular and masticator spaces, and buccal and masticator spaces. The potential spaces that can become involved in an odontogenic infection depends on two factors – the relation of the tooth roots to the thinnest alveolar bone plate (which determines the site of perforation from the bone) and the related muscles (which determine the location of the closest fascial space). This means that the upper molars will initially develop only buccal space infections and the lower teeth will produce submandibular space, masticator buccal or sublingual space infections depending on the associated anatomical factors. Therefore, the buccal space is considered to be important in odontogenic infection, because in this space is often accompanied by changes in other spaces.

In this study, odontogenic infections in the elderly patients had higher ratio with female compared to the adults. We consider that the age and gender distribution is closely related to the circumstance of odontogenic infections, because life span is the difference between male and female. Furthermore,

Huang et al.[3] indicated that elderly and associated systemic diseases were the most important predictive factors in deep neck infections. Opitz et al.[23] showed if well-known risk factors are present in patients affected by odontogenic infection appropriate interdisciplinary management should be considered as early as possible. We consider that the relationship between medical conditions and spread of odontogenic infections is important for future studies.

5. Conclusions

The study showed the prevalence and characteristic MDCT findings of spread of odontogenic infections in the elderly. These findings can be helpful for medical and surgical management of odontogenic infections in the elderly.

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