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ORIGINAL ARTICLE

Associations between oral complications and days to death in palliative care patients

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Abstract
Purpose Adverse oral symptoms gradually appear in advanced cancer patients as the disease progresses. We retrospectively investigated the associations between the incidence of oral problems and the days to death (DTD) in patients receiving palliative care.
Methods The dental assessment sheets and medical charts of 105 patients who had been admitted into the palliative care unit at our hospital were examined. Case data included evaluations of organic and functional oral conditions at the time of admission for all patients. The cohort was divided into two groups according to the DTD as the short group (<28 days from the time of dental assessment until death) and the long group (≥28 days). We compared the incidences of organic and functional oral problems between these groups.
Results Dry mouth, tongue inflammation, and bleeding spots were significantly more frequent in the short group than in the long group (78 vs. 54 % for dry mouth, 67 vs. 46 % for tongue inflammation, 35 vs. 14 % for bleeding spots, respectively; $p<0.05$). Tongue coating and candidiasis were comparable between the two groups. Dysphagia was significantly more common in the short group (43 %) than in the long group (20 %) ($p=0.01$), as was assistance with oral health care (76 vs. 50 %) ($p=0.01$).
Conclusions Our findings suggest that, during palliative care, oral complications appear more frequently when the DTD period is shorter. These symptoms may be useful indicators when deciding on the proper timing of intensive oral care intervention to decrease oral problems and pain in terminally ill patients.

Keywords Palliative care · Oral problems · Dry mouth · Dysphagia · Oral care

Introduction

Various adverse oral symptoms appear in advanced cancer patients due to deterioration in systemic conditions and the side effects of chemotherapies [16]. Xerostomia is a common manifestation among such patients that are associated with dehydration, metabolic unbalance, poor general condition, and cancer treatment and medication [9]. Taste alteration caused by xerostomia and chemotherapies is also frequent, and oral candidiasis has been observed in a wide range (8 to 94 %) of terminal cancer patients as well [3]. Collectively, these problems deteriorate oral condition and adversely influence social activities in affected individuals over time [5]. In terminally ill patients, oral self-care may become insufficient and worsen oral condition due to impairments in activities of daily living (ADL).

The ability of oral feeding gradually deteriorates along with disease progression in advanced cancer patients. Anorexia occurs in up to 70 % of cases, which hampers oral feeding

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and leads to weight loss and malnutrition [14]. Dysphagia and mucositis also often manifest and disturb oral feeding as the disease worsens. Previous studies have reported that anorexia and the inability of oral feeding are strongly associated with a poor prognosis in cancer patients and accordingly have included these parameters in the palliative prognostic index [10] and palliative prognostic score [11].

Although there have been several reports on oral complications in advanced cancer patients, few have addressed the effects of intervention on oral health care for improvement of quality of life (QOL). Temel et al. described that early palliative care improved QOL and enabled longer survival in non-small cell lung cancer patients [13]. Multidisciplinary early intervention for oral complications may also improve QOL in palliative care patients by preventing oral health contamination. However, as the timing of oral complication appearance is as variable as that of patient admission into palliative care units, the optimal timing and frequency of intensive interventions remain unknown. We therefore preliminarily investigated the associations between the incidence of oral complications and the days to death (DTD) in palliative care patients.

Patients and methods

Study design/setting

This retrospective single-center investigation was conducted in the palliative care unit of our hospital from April 2013 to March 2014. The study protocol was approved by the Institutional Review Board of Fujita Health University (Approval ID: 14-103).

Patients and study measure

Bedside screening assessments of oral condition are performed as standard clinical practice at our hospital to all patients newly admitted into the palliative care unit by a dentist and dental hygienist. We retrospectively reviewed the assessment sheets obtained between April 2013 and March 2014. Of the 135 patient assessments collected, 30 patients who had undergone continuous dental treatment or professional oral care in our hospital's dentistry department before admission were excluded. Ultimately, a total of 105 data sets (56 men and 49 women; mean age 73.0±9.9 years) were used in this investigation.

For evaluation of organic oral condition, the existence of dental decay was evaluated with a dental mirror. The presence of coating on the papillae of the dorsal tongue surface was judged by visual observation. Inflammation of the tongue, gingiva, or other oral mucosa was deemed to exist with ulcers, swelling, or redness on those surfaces. Candidiasis was evaluated by visual observation, as were bleeding spots, clots, or crust on oral mucosa. Microbiological culture was not performed for candidiasis. Dry mouth was noted when the dryness of the oral mucosa was moderate (bubbly or ropey) or severe (no saliva) [7].

The functional aspects of oral condition were assessed using the parameters of ability of oral feeding and dysphagia. If the patient could not ingest more than 10 % of the amount of a meal, we judged that there was no ability of oral feeding. Dysphagia was determined from medical charts at the time of admission. Assistance need for oral care was also assessed with regard to ADL.

As indicators of inflammation and nutrition, the serum data of white blood cell (WBC) count, C-reactive protein (CRP, mg/dL), and serum albumin level (g/dl) were obtained from medical charts at the time of admission. Body mass index (BMI) was calculated from subject height and weight.

All patients remained under palliative care until death. The date of death of each subject was determined from medical records to calculate the DTD from the day of initial oral assessment. The distribution of the DTD is shown in Fig. 1. Since the median DTD was 28 days (interquartile range 15 to 50 days), the patients were divided into the short group (DTD <28 days) and the long group (DTD ≥28 days) for further analysis.

The incidences of oral problems were statistically compared between the two groups using the chi-square test. Any significant factors associated with the DTD in univariate analysis were then analyzed in a log regression analysis. The critical value for rejecting the null hypothesis was $p<0.05$. Statistical analyses were performed using IBM SPSS statistics 20.0 software (IBM Corp., Armonk, NY, USA).

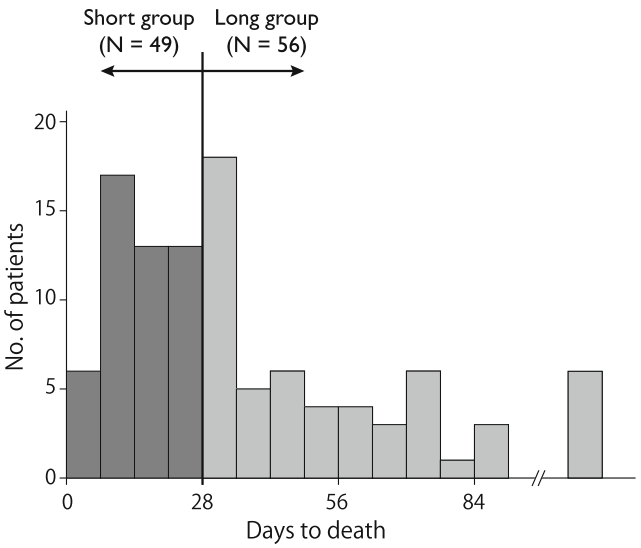

Fig. 1 Histogram of days to death (*DTD*). The median number of DTD from admission into the palliative care unit until death was 28 (range 4 to 171 days). Patients were subsequently divided into two groups according to the DTD as the short group (<28 days) and long group (≥28 days)

Results

The underlying patient diseases are listed in Table 1. In the short group, pancreas/biliary cancer (18 %) was most frequently encountered, followed by upper gastrointestinal (GI) cancer (16 %). In the long group, upper GI cancer (25 %) and colon and pancreas/biliary cancer (20 %, respectively) were the most prominent.

The relationships between organic oral problems and the DTD are shown in Table 2. Dry mouth was observed in 54 % of long group patients and in 78 % of short group patients. The incidence of dry mouth was significantly higher in the short group (p=0.010). Tongue inflammation was also significantly more frequent in the short group (67 vs. 46 %; p=0.031), as were bleeding spots (35 vs. 14 %; p=0.014). Candidiasis was observed in approximately 10 % of patients in both groups. The incidences of dental caries, gingival inflammation, and tongue coating were also similar between the groups.

The relationship between functional oral problems and the DTD are summarized in Table 3. Dysphagia was significantly more frequently observed in the short group (43 %) than in the long group (20 %) (p=0.012). Oral feeding was less predominant in the short group (67 vs. 79 %), but this difference was not statistically significant (p=0.19). In the long group, 50 % of patients required support for their oral care versus 76 % of such patients in the short group (p=0.007).

Logistic regression analysis showed that oral self-care (p=0.043) and dry mouth (p=0.048) were significantly related to the DTD and bleeding spots tended to be associated with the DTD (p=0.051) (Table 4). The values of WBC, CRP, serum albumin, and BMI did not differ significantly between the two groups (Table 5).

Table 1 Distribution of underlying diseases

Underlying disease	Short group	Long group
Pancreas/biliary	9 (18.4)	11 (19.6)
Upper GI	8 (16.3)	14 (25.0)
Lung	6 (12.2)	4 (7.1)
Lymphoma/leukemia	6 (12.2)	3 (5.4)
Gynecological	5 (10.2)	3 (5.4)
Colon	4 (8.2)	11 (19.6)
Brest	3 (6.1)	2 (3.6)
Prostate	3 (6.1)	0 (0.0)
Renal/urinary tract	2 (4.1)	4 (7.1)
Craniofacial	2 (4.1)	3 (5.4)
CNS	0 (0.0)	1 (1.8)
Other	1 (2.0)	0 (0.0)
Total	49 (100.0)	56 (100.0)

Data are presented as number (%)

GI gastrointestinal, *CNS* central nervous system

Table 2 Relationship between organic oral problems and days to death

Problem	Group	Present	Absent	p value
Dental caries	Short	8 (16.3)	41 (83.7)	0.399
	Long	6 (10.7)	50 (89.3)	
Gingival inflammation	Short	25 (51.0)	24 (49.0)	0.307
	Long	23 (41.1)	33 (58.9)	
Tongue coating	Short	13 (26.5)	36 (73.5)	0.231
	Long	21 (37.5)	35 (62.5)	
Candidiasis	Short	5 (10.2)	44 (89.8)	0.932
	Long	6 (10.7)	50 (89.3)	
Tongue inflammation	Short	33 (67.3)	16 (32.7)	0.031
	Long	26 (46.4)	30 (53.6)	
Dry mouth	Short	38 (77.6)	11 (22.4)	0.010
	Long	30 (53.6)	26 (46.4)	
Bleeding spots	Short	17 (34.7)	32 (65.3)	0.014
	Long	8 (14.3)	48 (85.7)	

Data are presented as number (%)

Discussion

The present study analyzed the associations between oral complications and the DTD using oral assessment sheets completed during patient admission into the palliative care unit. We witnessed that dry mouth and bleeding spots appeared significantly more frequently and assistance was more often needed for oral care as the DTD period became shorter. Similarly to previous reports, we encountered various oral problems in our cohort of advanced cancer patients, especially when the time of death was close. In such individuals, ADL were adequate upon admission and they had no complaints about mouth condition or eating orally. However, oral disorders began to appear gradually along with progression of the disease. It is important to recognize these symptoms early for prompt intervention with intensive care; for this, the need for oral care assistance along with the manifestation of dry mouth and bleeding spots appear to be clinically relevant indicators when considering the proper timing of oral care intervention for palliative care patients. Regular oral assessment by care staff may be useful to detect relevant clinical signs and commence oral care support to decrease oral problems and pain in terminally ill patients.

Organic changes in oral condition

Dry mouth, tongue inflammation, and bleeding spots were significantly more frequent in the short group and were likely due to systemic deterioration. Dry mouth is the most common oral symptom in advanced cancer patients [2, 5, 16]. It was seen in more than 50 % of patients in the long group, which had increased to 75 % in the short group. Our findings confirm that dry mouth manifests more often with disease progression in terminally ill patients. Chronic dry mouth is caused by

Table 3 Relationship between functional oral problems and days to death

Problem	Group	Present	Absent	*p* value
No oral feeding	Short	16 (32.7)	33 (67.3)	0.194
	Long	12 (21.4)	44 (78.6)	
Dysphagia	Short	20 (42.6)	27 (57.4)	0.012
	Long	11 (19.6)	45 (80.4)	
		assistance needed	No assistance needed	
Oral self-care	Short	37 (75.5)	12 (24.5)	0.007
	Long	28 (50.0)	28 (50.0)	

Data are presented as number (%)

dehydration, metabolic unbalance, poor general condition, and opioids [9]. Medication also has a significant influence on salivary secretion; advanced cancer patients often receive many supportive care drugs, including anticancer drugs, antidepressants, anticholinergics, and antiviral drugs, all of which may worsen xerostomia in such patients. Not only is dry mouth a distress symptom in itself, but it also adversely influences oral problems that include dental caries, taste alteration, mucositis, chewing problems, dysphagia, and speaking difficulties. Thus, early identification of dry mouth appears critical to prevent exacerbated deterioration of oral well being.

Bleeding spots and tongue inflammation were both significantly more frequent in the short group. In palliative care patients, the oral mucosa is likely to be damaged due to reduced metabolism. Dry mouth often coexists in such patients, as observed in the present study. The saliva has an important role in oral mucosa protection by moisturizing the soft and hard tissues. Without saliva secretion, the dry tongue surface is abrased by contact with the cusps or edges of dry teeth, resulting in the development of tongue mucositis. If the coagulation system is impaired, bleeding from mucositis or cracks in the dried lips is likely to occur. Indeed, tongue inflammation was significantly more evident in short group patients in this study and gingival inflammation tended to be more frequent. To prevent the deterioration of mucositis, oral care and proper moisturization are essential [8]. If tooth edges or stumps are found during inspection, a dental referral should be made to round or extract those teeth.

Previous studies have reported that oral candidiasis is found over a wide range (8 to 94 %) of advanced cancer patients [3]. The incidence of candidiasis was low at approximately 10 % in both groups in the present investigation. One reason for this may have been study design in that we observed for candidiasis visually, without microbiological fungal culture. Oral candidiasis can be suspected visually but must be confirmed by culture. Therefore, clinical and microbiological findings of *Candida* spp. are not always related, and several discrepancies have been found [2, 16]. Comparisons of both evaluations of *Candida* spp. will be needed in future prospective studies.

Table 4 Relationship between oral problems and days to death according to log regression analysis

	p value	Odds ratio (95 % CI)
Oral self-care	0.043	0.41 (0.17–0.97)
Dry mouth	0.048	2.45 (1.01–5.97)
Bleeding spots	0.051	2.75 (1.00–7.57)

Functional changes in oral condition

We observed that the presence of dysphagia was significantly increased in the short group. Dysphagia is a strong indicator for a palliative prognosis [1, 15], especially as oral feeding performance status declines. The mechanism of dysphagia in terminally ill cancer patients is different from that of neurological diseases or stroke, in which dysphagia is caused by a disturbance in the central or peripheral nerves or muscles. In advanced cancer patients, a reduction in muscle volume or strength due to malnutrition or cachexia is more often the cause of dysphagia. Anorexia and taste disturbance, which are typical symptoms in end-stage cancer patients, also adversely influence the ability of oral feeding. The therapeutic approach to dysphagia in advanced cancer patients is completely different from that in stroke patients, whose swallowing function is largely expected to recover [12]. In the latter case, active swallowing exercises are performed to improve function. However, in terminal cancer patients, it is difficult to expect sufficient recovery of swallowing function,

Table 5 Inflammatory and nutritional data

Parameter	Group	Number	Mean (SD)	*p* value
WBC count	Short	49	10.8 (8.9)	0.705
	Long	56	8.6 (3.6)	
CRP	Short	49	6.2 (5.5)	0.217
	Long	55	5.0 (4.7)	
Serum albumin	Short	49	2.6 (0.6)	0.405
	Long	56	2.7 (0.6)	
BMI	Short	44	18.9 (4.8)	0.379
	Long	48	18.4 (6.1)	

WBC white blood cell, *CRP* C-reactive protein, *BMI* body mass index

regardless of intervention, so postural maneuvers and food modification [6] become necessary. Timely nutrition management and compensatory maneuvers based on patient condition may extend oral feeding ability.

The present study showed that oral self-care was more difficult when the DTD period was shorter. Oral self-care was inadequate in roughly half of the long group patients, but this had increased to more than three quarters in the short group. Among this group, insufficient oral self-care was significantly increased along with the appearance of dry mouth and bleeding spots. This suggests that an incapability of oral self-care is a primary indicator for oral care intervention by care givers.

This study has several limitations. Since it was retrospective in design and used clinical oral assessment sheets, intra- and inter-observer reliability could not be verified. However, as most assessment items were binomial, we believe that reliability was relatively high as compared with ordinal or numerical scoring systems. Second, we evaluated dryness of the mouth by observation and not by patient-reported outcome. Ideally, xerostomia should be detected by an observer and confirmed by a validation questionnaire that describes the symptom from the patient's perspective [4]. Third, oral assessment was basically performed by visual observation of the mucosa without any fungal, bacterial, or viral cultures. In future prospective studies, more precise oral assessment will be needed to evaluate changes in oral symptoms in terminally ill patients.

In conclusion, adverse oral symptoms may not be clearly evident in palliate care patients having a long DTD period. However, these symptoms gradually appear with disease progression. To prevent the deterioration of oral condition and eating abilities, continuous assessment of key clinical signs, such as inadequate oral self-care, dry mouth, and bleeding spots, and prompt intervention are necessary. As this preliminary study was conducted at only one cross-sectional data time point during admission into the palliative care unit, further study is needed to characterize the timing of changes in oral symptoms and accompanying declines in ADL and QOL in terminal patients.

Conflict of interest This study was partially supported by a Longevity Sciences grant (25-7) from the National Center for Geriatrics and Gerontology and the 8020 Research Grant for fiscal 2014 from the 8020 Promotion Foundation (14-2-06), Japan.

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