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Risk Factors for Postoperative Complications in Patients with Esophageal Cancer Receiving Perioperative Oral Management

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Abstract

Objective: The aim of this study was to determine the factors associated with postoperative complications after surgery for esophageal cancer to promote improvement of perioperative oral management protocols.

Methods: Data were collected from 42 patients who underwent surgery for esophageal cancer under general anesthesia. Oral examination and perioperative oral management were performed in all patients. The incidence of complications and their risk factors were investigated. Classification and regression tree analysis were performed to determine the factors predicting the occurrence of postoperative complications.

Results: Among 42 patients, 16 had postoperative respiratory symptoms, 5 had postoperative pneumonia, and 20 had postoperative fever. The most important risk factor for postoperative respiratory symptoms was the presence of 19.5 or more remaining teeth. Oral care initiation more than 2.5 days after surgery, operation time longer than 6.5 hours, and postoperative fasting period longer than 4.5 days were also risk factors for postoperative respiratory symptoms. A preoperative O'Leary's plaque control record above 40% was the most important risk factor for the occurrence of postoperative pneumonia. Fasting period longer than 8.5 days and the presence of 19.5 or more remaining teeth were also risk factors for postoperative pneumonia. Oral care initiation more than 2.5 days after surgery and fasting period longer than 8.5 days were risk factors for fever.

Conclusion: Starting professional oral care immediately after surgery and establishing effective self-care may be important to prevent postoperative complications in patients with esophageal cancer.

Keywords: Preoperative oral management; Esophageal cancer; Postoperative complications

Introduction

Most esophageal cancer is squamous cell carcinoma (92.9%). Esophageal cancer is usually treated surgically. The incidence of postoperative pneumonia is higher after esophageal cancer surgery than after other cancer surgeries[1,2]. Causes of postoperative pneumonia after esophageal cancer surgery include recurrent laryngeal nerve paralysis resulting from lymphadenectomy, pulmonary atelectasis caused by respiratory tract edema, and ischemia with reduction of expectoration resulting from stethalgia[3,4].

Atelectasis is induced when the functional residual capacity of the lungs is less than the closing capacity. After upper abdominal surgery, the functional residual capacity and vital capacity of the lungs are decreased. The maximum decrease in these capacities is observed on days 1 and 2 after surgery. By postoperative day 5, these capacities recover to preoperative levels[5]. Bacteria propagate in the atelectatic lung, resulting in onset of pneumonia[6]. Therefore, during the early postoperative period, the risk of postoperative pneumonia rises exponentially.

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The presence of pathogenic bacteria in the oral biofilm is another risk factor for postoperative pneumonia[7]. The oral cavity is a major bacterial reservoir. Oral bacteria, including pathogenic bacteria, may move from the oral cavity to the respiratory tract. Attenuation of the cough reflex and ciliary movement resulting from anesthetics and skeletal muscle relaxants during surgery and from opioid pain control postoperatively impairs excretion of respiratory secretions[4].

Treatment of postoperative pneumonia is expensive and requires long hospitalization[8]. Pneumonia prevention is a key factor in the prognosis of esophageal cancer and in health care costs. Recently, prevention of postoperative pneumonia has focused on improving oral hygiene with perioperative and postoperative oral management. Perioperative oral management for patients with cancer was introduced in the Japanese national insurance system in 2012. This oral management targets patients who need surgery under general anesthesia, radiation therapy, or chemotherapy. At our institution, we started oral management for patients undergoing surgery with general anesthesia in 2014. In 2017, we managed about 230 such patients per month.

The program of oral management includes professional tooth cleaning the day before surgery, oral mucosal cleaning on the day of surgery, instructions regarding mouth wash immediately before surgery, and professional oral care after surgery. One of the major aims of oral management is reducing the risk of pneumonia, which could lead to earlier recovery and shorter hospital stays.Shortening the length of hospitalization is important in the Japanese insurance system to reduce medical expenses, which have been increasing because of our aging society. However, the factors associated with postoperative pneumonia remain unknown.

In this study, we analyzed the data of patients who underwent surgery for esophageal cancer at Kyushu University Hospital. The aim of this study was to determine the factors associated with postoperative pneumonia to promote improvement of the oral management system.

Methods

Subjects

The data of patients who attended a perioperative oral management center at Kyushu University Hospital from July 2015 to March 2016 were collected.The records of all patients who underwent surgery for esophageal cancer under general anesthesia were investigated. A total of 42 patients were included in the analysis. These included 39 men and 3 women, with a mean age of 66.2 ± 9.5 years (range: 44 to 83 years).

Oral management

All patients underwent scaling, root planing, and professional mechanical tooth cleaning on the day before surgery. Tooth brushing instruction, instruction on mucosal cleaning on the morning of surgery, and instruction on mouthwash before surgery were also provided for all patients. After surgery, oral care was performed in accordance with postoperative recovery.

Data

The following data were collected and analyzed.

Background factors: The following background factors were investigated: age, sex, smoking status (current smoker, previous smoker, or nonsmoker), and alcohol intake (regularly, rarely, or never). For alcohol intake, rarely was counted as never.

Esophageal cancer stage and treatments: Esophageal cancer stage was classified as I, II, III, or IV, in accordance with TMN classification (T indicates depth of tumor invasion, M indicates distant metastasis, and N indicates regional lymph node metastasis)[9]. Use of endoscopic surgery, operative time, and fasting period were also considered.

Oral examination and oral management: Oral examination was performed at the first visit and the following items were recorded: O'Leary's plaque control record at the first visit and before surgery, number of remaining teeth, tooth mobility, presence or absence of tooth fixation before surgery, and number of days before initiation of oral care after surgery.

Oral hygiene status was evaluated according to O'Leary's plaque control record. After staining for dental plaque with Mel Sage PC pelletsTM, (SHOFU INC., Kyoto, Japan), the presence of dental plaque on each of four surfaces (mesial, distal, buccal, and lingual or palatal) was recorded for each remaining tooth. The percentage of plaque-positive surfaces was calculated.

Tooth mobility was evaluated with the standard procedure described in periodontology textbooks[10,11]. Assessments were classified as follows: Degree 1, mobility of the tooth crown 0.2–1 mm in the horizontal direction; Degree 2, mobility of the tooth crown exceeding 1 mm in the horizontal direction; and Degree 3, mobility of the tooth crown in the vertical direction.

Disease complications: We defined disease complications as the presence or absence of respiratory symptoms, pneumonia, or fever.

Respiratory symptoms were diagnosed according to the Guideline of Japan Clinical Oncology Group-for-peri- and postoperative complications criteria[12]. The following patients were classified as respiratory-symptom-positive: those diagnosed with atelectasis, those diagnosed with respiratory distress by a physician, and those requiring aspiration of sputum because of difficulty expectorating.

Pneumonia was diagnosed according to the following standard criteria: fever (body temperature ≥37.5°C), high C-reactive protein level, and infiltration shadow on chest computed tomography[13,14]. Postoperative fever was defined as body temperature ≥37.5°C within 3 days after surgery[13]. All the above data were obtained from medical records.

Statistical analysis

Descriptive analysis of the data described above was summarized with means and standard deviations; categorical variables were summarized with frequency tables. To determine the risk factors for postoperative complications, receiver operating characteristic curves were created and cutoff points were set for candidate risk factors. For the purposes of this study, the occurrence of postoperative complications was a serious problem. Therefore, sensitivity was prioritized when setting the cut-off point. Classification and regression tree analysis were performed. The presence or absence of postoperative complications was used

as the objective variable. Analyses were performed with IBM SPSS Statistics Ver. 24.0 (IBM, Tokyo, Japan).

Ethics

The study was conducted in compliance with the principles outlined in the Helsinki Declaration. Informed written consent was obtained from each participant; the protocol was approved by the Institutional Review Board of Kyushu University Hospital (approval number: 29-278).

Results

A descriptive analysis of the factors investigated in this study is shown in Table 1. Most of the patients were men (92.8%); only 3 (7.2%) were women. Thirty-seven patients (88.1%) were current or former smokers. Twenty-nine (69.0%) were regular alcohol drinkers.

Table 1: Descriptive statistics of patients in this study

Back ground factor	
Age: Men/Women: Smoking status: Alcohol intake:	66.2 ± 9.5 years (39/3) Non smoker: 5 (11.9%), Previous: 30 (71.4%), Current: 7 (16.7%) Daily: 29(69.0%)
Esophageal cancer	
Stage: Treatment preoperative radiotherapy: Hospitalization days: Operation time: Fasting period:	I: 14 (33.3%), II: 9 (21.4%), III: 18 (42.9%), IV: 1 (2.4%) 8 (19.0%), preoperative chemotherapy: 26(61.9%), Endoscopic surgery: 32(76.2%) 38.05 ± 32.27 days 9.50 ± 2.27 hours 23.88 ± 31.71 days
Oral conditions	
O'Leary's plaque control Initial visit: Before operation: Number of reaming teeth: Tooth mobility(Max): Fixation teeth before operation: Number of days until oral care after operation:	 53.41 ± 30.21 41.78 ± 27.33 21.78 ± 7.42 0:25 (58.5%), 1: 10(23.8%), 2: 7(16.7%) 5 patients (11.9%) 3.90 ± 1.84 days
Incidence of postoperative complications	
	Respiratory symptoms: 16 (38.1%), Pneumonia: 5(11.9%), Fever: 20 (47.6%)

Twenty-six patients (61.9%) received chemotherapy before surgery. Thirty-two patients (76.2%) underwent endoscopic surgery.

The mean value of O'Leary's plaque control record was 43.5%; 17 patients (40.5%) had teeth with mobility above level 1. Five patients (11.9%) had tooth fixation to prevent tooth loss during oral endotracheal tube insertion. The mean number of postoperative days before the start of oral care was 3.9.

Sixteen patients (38.1%) had postoperative respiratory complications, 5 (11.9%) developed pneumonia, and 22 (52.4%) had fever.

The cut-off points of the risk factors for postoperative complications and their sensitivity, specificity, positive predictive value, negative predictive value, and areas under receiver operating characteristics curves are shown in Table 2. According to the areas under the curves of risk factors, operation time and fasting period were important predictors of postoperative respiratory symptoms, preoperative O'Leary's plaque control record was a predictor of postoperative pneumonia, and fasting period and number of remaining teeth were predictors of postoperative fever. Classification and regression tree analysis was performed with these cut-off points to determine the general rules regarding the occurrence of postoperative complications. Among the 16 patients with postoperative respiratory symptoms, 13 had the following characteristics: at least 19.5 remaining teeth, operation time longer than 6.5 hours, fasting period longer than 4.5 days, and oral care initiation more than 2.5 days after surgery (Figure 1). Among the 5 patients with postoperative pneumonia, 4 had the following characteristics: preoperative O'Leary's plaque control record greater than 40%, fasting period longer than 8.5 days, and at least 19.5 remaining teeth (Figure 2). Among the 20 patients with postoperative fever, 18 had the following characteristics: oral care initiation more than 2.5 days after surgery and fasting period longer than 8.5 days (Figure 3).

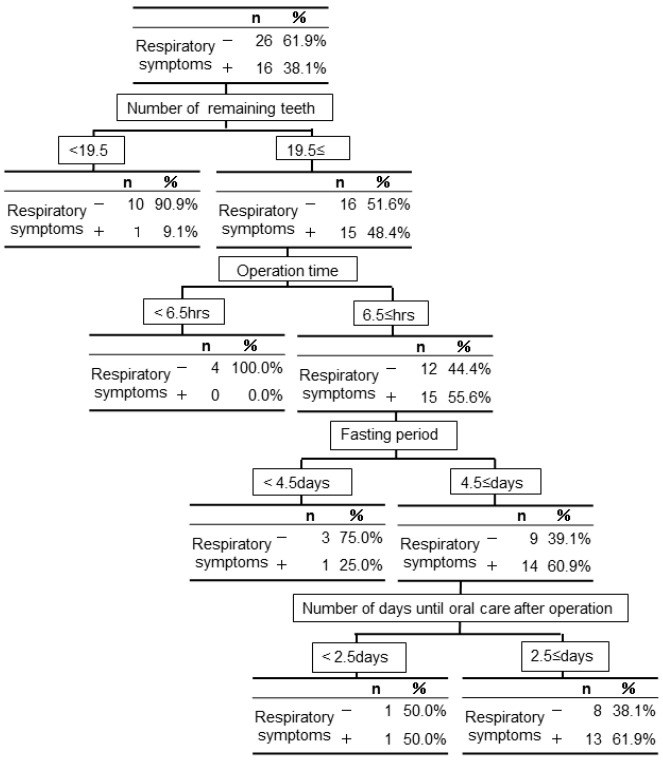

Figure 1: Decision tree for the occurrence of postoperative respiratory symptoms. Decision tree using cut-off point shown in Table 2 (A) for the occurrence of postoperative respiratory complications. Factors higher on the tree were more influential than lower factors for postoperative respiratory symptoms. Important factors for the occurrence of postoperative respiratory symptoms were the presence of 19.5 or more remaining teeth and initiation of oral care more than 2.5 days postoperatively. Operation time and postoperative fasting period were also important risk factors for postoperative respiratory symptoms, indicating that the degree of surgical stress influenced the development of postoperative respiratory complications.

Table 2: Cut-off points and predictive values of risk factors for occurrence of postoperative complications in patients with esophageal cancer

(A) Postoperative respiratory complications

	Cut-off point	Sensitivity	Specificity	Positive Predictive value	Negative predictive value	Likelihood ratio	AUR
Operation time	6.5 hours	1	0.231	0.444	1	1.3	0.63
Fasting period	4.5 days	0.938	0.192	0.417	0.833	1.161	0.718
Length of hospital stay	11.0days	1	0.077	0.4	1	1.083	0.676
O'Leary's plaque control record							
At initial visit	5.00%	0.7	0.318	0.318	0.7	1.026	0.546
Before operation	7.00%	0.385	0.565	0.333	0.619	0.885	0.352
Number of remaining teeth	19.5	0.938	0.385	0.484	0.909	1.525	0.588
Number of days until oral care after operation	2.5 days	0.923	0.25	0.5	0.8	1.231	0.417

(B) Postoperative pneumonia

	Cut-off point	Sensitivity	Specificity	Positive Predictive value	Negative predictive value	Likelihood ratio	AUR
Operation time	9.5hours	1	0.162	0.139	1	1.193	0.5
Fasting period	8.5 days	1	0.162	0.139	1	1.193	0.426
Length of hospital stay	16.0days	1	0.054	0.125	1	1.057	0.352
O'Leary's plaque control record							
At initial visit	32.00%	1	0.345	0.136	1	1.527	0.565
Before operation	40.00%	1	0.656	0.267	1	2.907	0.769
Number of remaining teeth	19.5	0.8	0.27	0.129	0.909	1.096	0.491
Number of days until oral care after operation	2.5 days	1	0.192	0.125	1	1.238	0.444

(C) Postoperative pyrexia

	Cut-off point	Sensitivity	Specificity	Positive Predictive value	Negative predictive value	Likelihood ratio	AUR
Operation time	5.0 hours	0.86	0.15	0.53	0.5	1.012	0.614
Fasting period	8.5 days	0.73	0.35	0.55	0.54	1.123	0.818
Length of hospital stay	19.5 days	1	0.091	0.5	1	1.1	0.845
O'Leary's plaque control record							
At initial visit	11.00%	0.692	0.316	0.409	0.6	1.012	0.6
Before operation	7.00%	0.444	0.611	0.533	0.524	1.141	0.509
Number of remaining teeth	6	0.85	0.364	0.548	0.727	1.336	0.659
Number of days until oral care after operation	2.5 days	0.933	0.286	0.583	0.8	1.307	0.577

Cut-off points determined with ROC curves for the occurrence of postoperative complications. Sensitivity was prioritized in determining cut-off points.

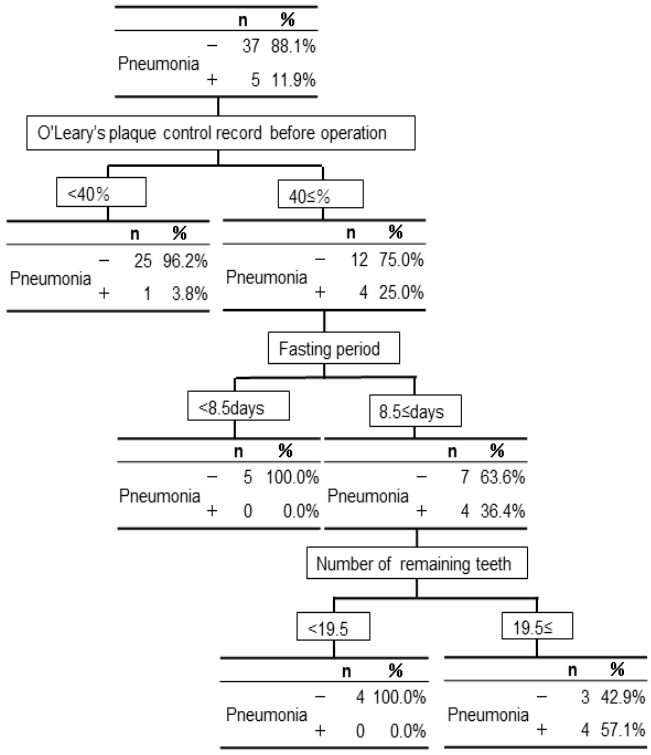

Figure 2: Decision tree for the occurrence of postoperative pneumonia. The most important factor predicting the occurrence of postoperative pneumonia was having a preoperative O'Leary's plaque control record above 40%. This findingsuggests that preoperative oral hygiene is a factor in the development of postoperative pneumonia. Fasting period longer than 8.5 days and the presence of 19.5 or more remaining teeth were also important factors in the development of pneumonia and respiratory symptoms.

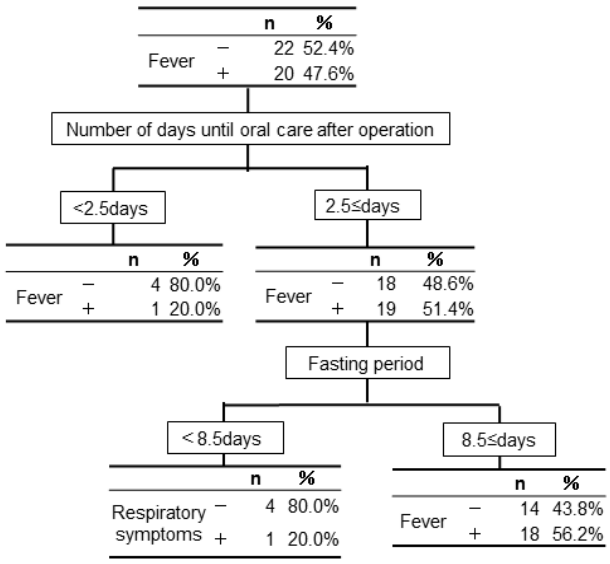

Figure 3: Decision tree for the occurrence of postoperative fever. Initiation of oral care more than 2.5 days after surgery was the most important risk factor for the occurrence of postoperative fever. Immediate professional oral care may be important for the prevention of postoperative fever.

Discussion

In this study, we developed general rules to predict which patients will develop postoperative complications. According to the 2002 survey of the Japan Esophageal Society, esophageal cancer is more common in men than women, with a male-to-female ratio of 6:1. Patients tend to develop esophageal cancer in their 60s and 70s, with 68.0% of cases occurring in this age range[15]. The average age of patients in this study was 66.2 ± 9.5 years, which agrees with previous results. The male-to-female ratio in this study was 13 to 1, which is extremely high.

Smoking and alcohol use are risk factors for esophageal cancer; their interaction increases the risk[16-19]. In this study, 11.9% of patients were nonsmokers and 69% had daily alcohol consumption. This rate of daily drinking is higher than the age-matched alcohol consumption rate of 21.2% in the 2005 National Health and Nutrition Survey in Japan.

Professional oral care intervention effectively reduces the incidence of postoperative pneumonia in patients with esophageal cancer[20,21]. In this study, oral care initiation more than 2.5 days after surgery and preoperative O'Leary's plaque control record above 40% were important risk factors for the occurrence of postoperative complications. These findings suggest that maintaining oral hygiene is important to prevent complications after surgery for esophageal cancer. As shown in Figure 2, a preoperative O'Leary's plaque control record above 40% was the most important risk factor for the development of postoperative pneumonia. We instructed esophageal cancer patients in daily oral hygiene self-care at their first visit; however, patients with poor oral hygiene often developed pneumonia. This finding suggests that patients who could not adequately master oral hygiene self-care developed postoperative pneumonia.

Having 19.5 or more remaining teeth was an important risk factor for the occurrence of postoperative respiratory symptoms (Figure 1). Among the 5 patients with postoperative pneumonia, 4 had 19.5 or more teeth, suggesting that dental plaque could be one cause of postoperative respiratory complications. In other words, intraoral bacterial counts are higher in patients with many remaining teeth, possibly resulting in pneumonia. However, the number of remaining teeth depends on the patient's oral hygiene over time. Poor oral hygiene results in many missing teeth. Therefore, more research is needed to evaluate the relationship between the number of remaining teeth and postoperative complications.

As shown in Figure 3, oral care initiated more than 2.5 days after surgery was the most important risk factor for the occurrence of postoperative fever. As shown in Figure 1, among 16 patients who developed postoperative respiratory symptoms, 13 initiated oral care more than 2.5 days after surgery. These results indicate the importance of professional oral care immediately after surgery, even when intensive infection controls are administered.

Operation time longer than 6.5 hours was a risk factor for the development of postoperative respiratory symptoms. Fasting period longer than 8.5 days was a risk factor for the development of postoperative pneumonia and postoperative fever. Fasting period longer than 4.5 days was also a risk factor for the development of postoperative respiratory symptoms. Prolonged operation time and fasting period indicate considerable system-

ic damage. It is natural that these factors would be risk factors for postoperative complications. Early resumption of ingestion maintains intestinal tract function in the perioperative and postoperative period and is recommended to prevent infectious disease, improve nutritional status, and promote wound healing[22].

Incomplete suturing in esophageal cancer surgery results in a prolonged fasting period. Prolonged fasting may impair oral function and swallowing, leading to insufficient oral self-cleaning function and inadequate oral hygiene. As a result, postoperative complications may occur.

Peri- and postoperative oral management have become popular in Japan. However, postoperative respiratory complications still occur. Our results indicate that oral hygiene self-care and its instruction may be important factors for the prevention of postoperative respiratory complications in patients with esophageal cancer.

Conclusion

Starting professional oral care immediately after surgery and establishing effective self-care may be important for the prevention of postoperative complications in patients with esophageal cancer.

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References

1. Tachimori, Y., Watanabe, H., Kato, H. Aspiration Pneumonia after Esophagectomy. (1990)The J Soc gastroenterological Surg 23(5): 1029-1035.
Pubmed | Crossref | Others
2. Whooley, B.P., Law, S., Murthy, S.C., et al. Analysis of reduced death and complication rates after esophageal resection. (2001) Ann Surg 233(3): 338–344.
Pubmed | Crossref | Others
3. Kunisaki, C., Yamaoka, H., Takahashi, M., et al. Risk factors of postoperative pulmonary complications after surgery for esophageal cancer using univariate and stepwise logistic regression analyses. (1997) J Jpn Soc Clin Surg 58(11): 2493–2498.
Pubmed | Crossref | Others
4. Sugimachi, K., Ueo, H., Natsuda, Y., et al. Cough dynamics in esophageal cancer: prevention of postoperative pulmonary complications. (1982) Br J Surg 69(12): 734–736.
Pubmed | Crossref | Others
5. Meyers, J.R., Lembeck, L., O'Kane, H. et al. Changes in functional residual capacity of the lung after operation. (1975) Arch Surg 110(5): 576–583.
Pubmed | Crossref | Others
6. van Kaam, A.H., Lachmann, R.A., Herting, E., et al. Reducing atelectasis attenuates bacterial growth and translocation in experimental pneumonia. (2004) Am J Respir Crit Care Med 169(9): 1046-1053.
Pubmed | Crossref | Others
7. Akutsu, Y., Matsubara, H., Okazumi, S., et al. Impact of preoperative dental plaque culture for predicting postoperative pneumonia in esophageal cancer patients. (2009) Dig Surg 25(2): 93-97.
Pubmed | Crossref | Others
8. Dimick, J.B., Chen, S.L., Taheri, P.A., et al. Hospital costs associated with surgical complications: a report from the private-sector national surgical quality improvement program. (2004) J Am Coll Surg 199(4): 531–537.
Pubmed | Crossref | Others
9. Japan Esophageal Society: Japanese Classification of Esophageal Cancer, 11th Edition: part I. (2017) Esophagus 14(1):1-36.
Pubmed | Crossref | Others
10. Miller, S.C. Textbook of Periodontia, 3rd ed. (1950) Philadelphia: The Blakeston Corporation: 291.
Pubmed | Crossref | Others
11. The National Dental Advisory Committee in partnership with NHS Education for Scotland. Prevention and Treatment of Periodontal Diseases in Primary Care-Dental Clinical Guidance Dundee (2014) Scottish Dental Clinical Effectiveness Programme 116.
Pubmed | Crossref | Others
12. Katayama, H., Kuroiwa, Y., Nakamura, K., et al. Extended Clavien –Dindo classification of surgical complications:Japan Clinical Oncology Group postoperative complications criteria. (2016) Surg Today 46(6): 668-685.
Pubmed | Crossref | Others
13. Committee for the Japanese Respiratory Society Guidelines in Management of Respiratory. Severity rating of hospital-acquired pneumonia and classification. (2004) Respirology 9 (Suppl 1): S13–S15.
Pubmed | Crossref | Others
14. Sekizawa, K., Ujiie, Y., Itabashi, S., et al. Lack of cough reflex in aspiration pneumonia. (1990) Lancet 335 (8699): 1228-1229.
Pubmed | Crossref | Others
15. Ozawa, S., Tachimori, Y., Baba, H., et al. Comprehensive registry of esophageal cancer in Japan, 2002. (2010) Esophagus 7(1): 7–22.
Pubmed | Crossref | Others
16. Steevens, J., Schouten, L.J., Goldbohm, R.A., et al. Alcohol consumption, cigarette smoking and risk of subtypes of oesophageal and gastric cancer: a prospective cohort study. (2010) Gut 59(1): 39-48.
Pubmed | Crossref | Others
17. Sakata, K., Hoshiyama, Y., Morioka, S., et al. Smoking, alcohol drinking and esophageal cancer: findings from the JACC Study. (2005) J Epidemiol. (Suppl 2) 15: S212–S219.
Pubmed | Crossref | Others
18. Ishiguro S, Sasazuki S, Inoue M., et al. Effect of alcohol consumption, cigarette smoking and flushing response on esophageal cancer risk: a population-based cohort study (JPHC study). (2009) Cancer Lett 275(2): 240–246.
Pubmed | Crossref | Others
19. Secretan, B., Straif, K., Baan, R., et al. A review of human carcinogens-Part E: tobacco, areca nut, alcohol, coal smoke,

and salted fish. (2009) Lancet Oncol 10(11): 1033-1034.
Pubmed | Crossref | Others

20. Soutome, S., Yanamoto, S., Funahara, M., et al. Preventive Effect on Post-Operative Pneumonia of Oral Health Care among Patients Who Undergo Esophageal Resection: A Multi-Center Retrospective Study. (2016) Surg Infect 17(4): 479-84.
Pubmed | Crossref | Others
21. Sato Y, Motoyama S, Takano H, et al. Esophageal cancer patients have a high incidence of severe periodontitis and preoperative dental care reduces the likelihood of severe pneumonia after esophagectomy. (2016) Dig Surg 33(6): 495–502.
Pubmed | Crossref | Others
22. Fukuzawa J, Terashima H, Ohkohchi N. Early postoperative oral feeding accelerates upper gastrointestinal anastomotic healing in the rat model. (2007) World J Surg 31(1): 1234-1239.
Pubmed | Crossref | Others