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Influences of Patient Age on Deep Neck Infection: Clinical Etiology and Treatment Outcome

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Abstract

Objectives. To analyze the differences in clinical features, etiology, treatment modalities, and microbiology of the deep neck infections between the elderly and the adults.

Study Design. Cases series.

Setting. Single hospital.

Subjects and Methods. A retrospective review was performed on patients older than 18 years of age with diagnosis of deep neck infection from January 2008 to December 2012. A total of 148 patients were enrolled in this study, including 32 elderly (older than 65 years of age) and 116 adults who aged between 18 and 65. Data collected included age, gender, clinical presentations, etiology, treatment modalities, and microbiology.

Results. Odontogenic and salivary origin were the most common sources of infection for the elderly group, whereas the odontogenic and tonsillar origin were the most common sources of deep neck infections in the adult group. Compared to the adult group, the elderly group had significantly higher ratio with multiple spaces involved (53.1% vs 30.2%, $P = .016$), complication (15.6% vs 4.3%, $P = .024$), and surgical interventions (75.0% vs 38.8%, $P < .001$), in addition to longer hospital stay (11.1 $\pm$ 7.2 days vs 8.2 $\pm$ 4.5 days, $P = .029$).

Conclusion. Compared to the adult group, the elderly patients with deep neck infection had more cases with multiple spaces involvement, complications, surgical interventions, and longer hospital stay. However, the outcome of the elderly group was the same as the adult group. Therefore, the benefits of aggressive management for deep neck infection should not be withheld from patients simply because of the old age.

Keywords

deep neck infection, elderly, complication, surgical intervention

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Introduction

Deep neck infection was first recognized under the names of morbus strangulatorius, cynache, and angina maligna at the time of Hippocrates, Galen, and other authors in the second century AD.[1,2] It is defined as infection in the deep fascia enclosed potential spaces of the neck. The majority of studies have demonstrated that odontogenic infection is the most common etiology in patients with deep neck infection.[3] It is considered potentially life threatening due to complications such as descending necrotizing mediastinitis, septic shock, pleural effusion, pericardial effusion, internal jugular vein thrombosis, cavernous sinus thrombosis, and carotid artery erosion.[4] Therefore, early accurate diagnosis and proper treatments are essential to the management of the patients with deep neck infection.

With the persistent global population aging, it is not surprising that more and more elderly patients with deep neck infection are encountered in clinics. Diagnosis and treatment of deep neck infection in the elderly may be more complex than in the younger patients because of more comorbid conditions. However, the relationship between the old age and deep neck infection was rarely discussed before.

The present study was aimed to analyze the differences in clinical features, etiology, treatment modalities, and microbiology of the infections between the elderly and the adults, with a series of 148 patients treated at a teaching hospital in Taiwan.

Materials and Methods

The medical records of patients older than 18 years of age with diagnosis of deep neck infection between January 2008 and December 2012 were retrospectively reviewed. All patients received a comprehensive diagnostic procedure

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Table 1. Baseline Characteristics of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)	*P* Value
Gender			.055[a]
Male	15 (46.9%)	76 (65.5%)	
Female	17 (53.1%)	40 (34.5%)	
Age in years	73.2 ± 6.0	36.2 ± 13.7	<.001[b]*
Underlying systemic diseases			
Diabetes mellitus	15 (46.9%)	18 (15.5%)	<.001[a]*
Hypertension	19 (59.4%)	9 (7.8%)	<.001[a]*
Hepatitis	1 (3.1%)	3 (2.6%)	.868[a]
Pulmonary tuberculosis	1 (3.1%)	0 (0)	.056[a]
HIV infection	0 (0)	1 (0.9%)	.598[a]

[a]Chi-square test.
[b]Student *t* test.
*$P < .05$.

Table 2. Clinical Symptoms of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)	*P* Value
Neck pain	28 (87.5%)	101 (87.1%)	.949[a]
Sore throat	24 (75.0%)	98 (84.5%)	.212[a]
Odynophagia	23 (71.9%)	60 (51.7%)	.042[a]*
Dysphagia	19 (59.4%)	45 (38.8%)	.037[a]*
Fever	17 (53.1%)	45 (38.8%)	.146[a]
Dyspnea	1 (3.1%)	1 (0.9%)	.326[a]
Duration of symptoms prior to admission in days	5.4 ± 3.1	5.8 ± 3.3	.654[b]

[a]Chi-square test.
[b]Student *t* test.
*$P < .05$.

including medical history taking and physical, laboratory, and computed tomography (CT) examinations. Excluding patients with superficial infections, peritonsillar abscess, infections secondary to traumatic or iatrogenic neck wounds, or without completion of treatment, a total of 148 patients were included in this study.

The factors included for analysis were age, gender, clinical symptoms, etiology, treatment modalities, and microbiology. Continuous variables were presented as means ± standard deviation and were analyzed with the Student *t* test. Categorical variables were presented as percentages and were analyzed using the chi-square test. A *P* value less than .05 was considered to be statistically significant. All statistical analyses were performed using SPSS version 17.0 for Windows (SPSS, Inc, Chicago, Illinois). The study was approved by the Institutional Review Boards at Kaohsiung Armed Forces General Hospital in Kaohsiung.

Results

Of the 148 patients with diagnosis of deep neck infection, 32 (21.6%) were older than 65 years of age (elderly group) and 116 (78.4%) between 18 and 65 years of age (adult group). The mean ages of the elderly group and adult group were 71.2 ± 6.0 years (range, 65-85) and 36.2 ± 13.7 years (range, 18-61), respectively (**Table 1**). Among the patients, 45 (30.4%) had underlying systemic diseases including diabetes mellitus, hypertension, hepatitis, pulmonary tuberculosis, or HIV infection. The most frequent underlying systemic disease was diabetes mellitus (22.3%). Compared with the adult group, the elderly group had significant higher ratio with underlying systemic diseases of diabetes mellitus (46.9% vs 15.5%, $P < .001$) and hypertension (59.4% vs 7.8%, $P < .001$).

Neck pain and sore throat were the most common presenting symptoms for both the elderly and adult groups (**Table 2**). Compared with the adult group, the elderly group had significantly higher ratio with presenting symptoms of odynophagia (71.9% vs 51.7%, $P = .042$) and dysphagia (59.4% vs 38.8%, $P = .037$). The mean duration of symptoms prior to admission was 5.4 ± 3.1 days (range, 2-14 days) for the elderly group and 5.8 ± 3.3 days (range, 1-28 days) for the adult group with no significant difference between the 2 groups.

Odontogenic infection was the most common cause of deep neck infection both in the elderly group (37.5%) and adult group (33.6%) (**Table 3**). The second most common

Table 3. Etiology of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)
Odontogenic infection	12 (37.5%)	39 (33.6%)
Sialadenitis	6 (18.8%)	18 (15.5%)
Tonsillar infection	5 (15.6%)	32 (27.6%)
Epiglottitis	3 (9.3%)	6 (5.2%)
Foreign body	0 (0)	2 (1.7%)
Infected branchial cleft cyst	0 (0)	1 (0.9%)
Unknown	6 (18.8%)	18 (15.5%)

Table 4. Infected Spaces of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)	*P* Value[a]
Number of spaces			.016*
Single	15 (46.9%)	81 (69.8%)	
Multiple	17 (53.1%)	35 (30.2%)	
Involved spaces			
Parapharyngeal space	25 (78.1%)	91 (78.5%)	
Submandibular space	9 (28.1%)	19 (16.4%)	
Ludwig's angina	6 (18.8%)	13 (11.2%)	
Parotid space	2 (6.3%)	11 (9.5%)	
Masticator space	3 (9.4%)	4 (3.5%)	
Retropharyngeal space	0 (0)	11 (9.5%)	
Anterior cervical space	0 (0)	3 (2.6%)	
Posterior cervical space	1 (3.1%)	5 (4.3%)	

[a]Chi-square test.
*$P < .05$.

Table 5. Comparison of Infected Spaces of the Patients with and Without Systemic Diseases.

	Single Space	Multiple Spaces	*P* Value[a]
Elderly	15	17	.011*
Systemic diseases	8 (53.3%)	14 (82.4%)	
No systemic diseases	7 (46.7%)	3 (17.6%)	
Adult	81	35	.121
Systemic diseases	13 (16.0%)	10 (28.6%)	
No systemic diseases	68 (84.0%)	25 (71.4%)	

[a]Chi-square test.
*$P < .05$.

Table 6. Complications of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)	*P* Value[a]
Complications			.024*
Yes	5 (15.6%)	5 (4.3%)	
No	27 (84.3%)	111 (95.7%)	
Categories			
Upper gastrointestinal bleeding	3 (9.4%)	1 (0.9%)	
Jugular vein thrombosis	1 (3.1%)	2 (1.7%)	
Airway obstruction	1 (3.1%)	1 (0.9%)	
Septic shock	1 (3.1%)	1 (0.9%)	

[a]Chi-square test.
*$P < .05$.

cause of deep neck infection in the elderly group and adult group were sialadenitis (18.8%) and tonsillar infection (27.6%), respectively.

Parapharyngeal space was the most frequent space of infection both in the elderly group (78.1%) and adult group (78.5%) (**Table 4**). The occurrence of multiple infection spaces was significantly higher in the elderly group than that in the adult group (53.1% vs 30.2%, $P = .016$). The elderly group with systemic diseases had significantly higher ratio of multiple spaces involved, suggesting an association between systemic diseases and spaces involved in deep neck infection. On the other hand, no such association was observed in the adult group (**Table 5**).

Of the 148 patients, 10 (6.8%) sustained complications including upper gastrointestinal bleeding, jugular vein thrombosis, airway obstruction, or septic shock (**Table 6**). Besides the 2 patients with airway obstruction who underwent emergent tracheotomy, all other patients with complications received symptomatic medical treatments. The complication rate was significant higher in the elderly group than that in the adult group (15.6% vs 4.3%, $P = .024$).

The results of bacterial cultures were available in 69 patients who underwent drainage (**Table 7**). In the samples derived from the 24 elderly patients, 16 cases (66.7%) yielded cultures and 8 cases (33.3%) yielded no growth. Single organism was isolated from 10 cases, whereas more than 1 organism was isolated from 6 cases. In the samples of 45 adult patients, 31 cases (68.9%) yielded cultures and 14 cases (31.1%) yielded no growth. A single organism was isolated from 21 cases, whereas more than 1 organism was isolated from 10 cases. *Klebsiella pneumoniae* was the most common bacteria characterized both in the elderly group (29.2%) and adult group (24.4%).

Besides sufficient fluid hydration, maintenance of good oral hygiene, and administration of parenteral antibiotics, some patients were treated with surgical incision and drainage because of significant abscess formation, complications, or poor response to other medical treatments. The ratio of patients who received surgical incision and drainage was significantly higher in the elderly group (24/32, 75%) than in the adult group (45/116, 38.8%) with $P < .001$ (**Table 8**). The mean duration of hospital stay for the elderly and the adult group was 11.1 ± 7.2 days (range, 3-34 days) and 8.2 ± 4.5 days (range, 2-34 days),

Table 7. Available Bacterial Cultures of the Patients with Deep Neck Infection.

	Elderly (n = 24)	Adult (n = 45)
Cultures		
Single organism	10 (41.7%)	21 (46.7%)
Multiple organisms	6 (25.0%)	10 (22.2%)
Categories		
Klebsiella pneumoniae	7 (29.2%)	11 (24.4%)
Streptococcus species	4 (16.7%)	9 (20.0%)
Coagulase negative Staphylococci	2 (8.3%)	3 (6.7%)
Pseudomonas aeruginosa	2 (8.3%)	2 (4.4%)
Peptostreptococcus micros	2 (8.3%)	3 (6.7%)
Coagulase staphylococcus	1 (4.2%)	2 (4.4%)
Staphylococcus epidermidis	1 (4.2%)	0 (0)
Methicillin-resistant *Staphylococcus aureus*	1 (4.2%)	1 (2.2%)
Salmonella species	1 (4.2%)	1 (2.2%)
Gemella morbillorum	1 (4.2%)	0 (0)
Citrobacter koseri	0 (0)	2 (4.4%)
Prevotella buccae	0 (0)	2 (4.4%)
Enterobacter cloacae	0 (0)	1 (2.2%)
Propionibacterium acnes	0 (0)	1 (2.2%)
Enterobacter cloacae	0 (0)	1 (2.2%)
Fusobacterium nucleatum	0 (0)	1 (2.2%)
No growth	8 (33.3%)	14 (31.1%)

Table 8. Treatment Modalities and Hospital Stay of the Patients with Deep Neck Infection.

	Elderly (n = 32)	Adult (n = 116)	*P* Value
Treatment			<.001[a]*
Surgical incision and drainage	24 (75.0%)	45 (38.8%)	
Conservative treatment	8 (25.0%)	71 (61.2%)	
Hospital stay in days	11.1 ± 7.2	8.2 ± 4.5	0.029[b]*

[a]Chi-square test.
[b]Student *t* test.
*$P < .05$.

respectively, with significant difference at $P = .029$. No mortality was seen in either group.

Discussion

Deep neck infection is one of the most commonly treated conditions by otolaryngologists. It may appear in all ages. If not treated adequately and early, deep neck infection still gives rise to serious complications despite of the progress in antibiotics and improvement of oral hygiene. Since the overall population ages gradually, deep neck infection in the elderly is more prevalent and becomes a challenge for the physician. In the present study, we reported that about one-fifth (32/148, 21.6%) of the patients diagnosed with deep neck infection were elderly. This result was close to the occurrence rate of deep neck infection in the elderly of 23.3% reported in a previous study.[5]

The present study demonstrated that the mean duration of symptoms prior to admission in the elderly group was close to that in the adult group. Marioni et al[6] reported neck pain and odynophagia were the main presenting symptoms; however, the current study found that neck pain and sore throat were the most common presenting symptoms in both groups. Moreover, we found that the elderly group had higher occurrence of odynophagia and dysphagia.

In accordance with previous studies, we identified that odontogenic infection was the most common infectious source of deep neck infection.[4-7] This is likely related to poor oral hygiene caused by irregular tooth brushing, lack of knowledge about oral hygiene due to indifference to dental health, and delayed treatment because of higher cost of dental care.[8,9] The tonsillar and salivary gland infection were the second most common infectious source for the adult and elderly group, respectively. It may be explained by the higher prevalence of xerostomia with increases in age,[10] and consequently the elderly become more susceptible to salivary gland infection.

The most common space of infection in our series was parapharyngeal space, which was different from submandibular space that was reported as the leading involved space in previous studies.[7,11] Although nearly 65% of the patients had single space involvement of deep neck infection in the current study, we found the elderly group tended to have multiple infection spaces than the adult group. Marioni et al[5] reported the underlying systemic diseases and complications were higher in the elderly in Italy. The current study showed the systemic diseases were observed to be associated with multiple infection spaces involved in the elderly group. This may be due to the declined immunity and consequent susceptibility to infection related to aging and associated systemic diseases.[12,13] In this hospital-based study, the complication rate of 6.8% (10/148) was comparable with 4.5% to 33.7%,[4,7,14] the complication rate that was reported in the literature.

From the cases that yielded positive bacterial culture in the current series, the most common microorganism identified was a Gram-negative bacterium, *Klebsiella pneumoniae*, in both elderly and adult groups. However, this finding was different from the previous studies that reported the most common cause of deep neck infection was *Streptococcus* species.[7,15]

The principal treatment of deep neck infection includes keeping airway patent, empiric broad-spectrum antibiotics before the definite results of cultures available, and drainage if abscess formation occurs or there is poor response to medical treatment.[13] In terms of deep neck infection drainage, needle aspiration, incision, and drainage were the treatment strategies. Although needle aspiration in selective patients with deep neck infection was reported in the

literature, it was not feasible for drainage of enormous abscesses or impending complication.[9,16] Surgical incision and drainage has become the mainstream approach if abscess formation occurs or poor response to medical treatment is observed. In the current study, 69 patients (46.6%) with drainage treatment all went through surgical incision and drainage. Furthermore, surgical incision and drainage was performed more frequently in the elderly group than in the adult group. The elderly group also stayed longer in hospital compared to the adult group. It may be due to more occurrences of multiple infection spaces and complications in the elderly group.

Our treatment strategy was the same for both the elderly and adult groups. It was based on patient clinical condition and radiological findings. All patients were initially treated with a regimen consisting of sufficient fluid hydration and administration of parenteral antibiotics. If obvious abscess was observed from CT or poor response to medical treatment was observed within 48 hours, surgical incision and drainage was performed. Though we did observe a large number of underlying systemic diseases, multiple spaces involvement, and complications in the elderly, no significant difference in treatment outcomes was observed between the elderly and the adult group in our study.

Conclusion

Otolaryngologists are facing an inevitable increasing number of elderly patients with deep neck infection. Many constitutional and immune changes associated with aging are liable to increase severity of deep neck infection in the elderly. Although whether to perform surgical incision and drainage for elderly patients should be particularly considered, the elderly should be given the same chance of treatment for deep neck infection that is given to younger patients. This study indicated that although the elderly group with deep neck infection had more underlying systemic diseases, multiple spaces involvement, complications, and longer hospital stay than the adult group, this group also had a higher ratio with surgical interventions. The present study revealed that aging does not appear to be an unfavorable prognostic factor in deep neck infection. Since the elderly group had the same outcome as the adult group, necessary aggressive medical treatment with surgical incision and drainage is crucial to assure a better outcome for elderly patients.

Author Contributions

Tzu-Hang Chi, study design (retrospective medical charts review), data collection (medical charts were reviewed in detail and recorded with Microsoft Office EXCEL 2003), and draft the manuscript; **Yuan-Heng Tsao**, manuscript review and final approval; **Chien-Han Yuan**, data analysis (interpretation using SPSS) and manuscript review.

Disclosures

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