



Research Article

The Clinical Characteristics of Nosocomial Sinusitis in Patients with Nasogastric Tube: A Single Center Retrospective Study

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Abstract

Background Nosocomial sinusitis is one of the most common nosocomial infections, and has been reported to be associated with fever and other nosocomial infections. In the case of patients with neurological diseases, the incidence and the risk factors of nosocomial sinusitis have not been well studied. **Methods** We conducted a retrospective study including patients with nasogastric tube in the neurology department. The demographic information, the clinical data and the severity evaluation including Glasgow Coma Scale (GCS) score and National Institutes of Health Stroke Scale (NIHSS) score were collected. **Results:** A total of 118 patients were enrolled, and 50 of them were treated in neuro-intensive care unit (NCU). Up to 56.78% of all the patients and 54% of NCU patients have developed nosocomial sinusitis. The length of stay in NCU was significantly correlated with nosocomial sinusitis with the P-value of 0.048. Compared with patients without nosocomial sinusitis, patients with nosocomial sinusitis revealed higher percentage of tracheal intubation, mechanical ventilation and longer ventilation duration, though not significantly. The high incidence time of nosocomial sinusitis after indwelling gastric tube was 1.74-9.88 days. **Conclusion:** Nosocomial sinusitis was highly prevalent in neurological patients with nasogastric tubes. The length of stay in NCU was significantly correlated with nosocomial sinusitis. More research is warranted to elucidate the risk factors for nosocomial sinusitis.

Keywords: Nosocomial sinusitis; Neurological diseases; Nasogastric tube

Introduction

Nosocomial sinusitis, one of the most common nosocomial infections, has been associated with fever and other nosocomial infections, such as meningitis and hospital acquired pneumonia, which may even further lead to severe systemic infection and septic shock [1-3]. The incidence of nosocomial sinusitis varies from 7.7%-43.1% in different studies, depending on the study center, the patient characteristics studied, and especially the major disease that varies widely within each study [3-5]. These results suggested that nosocomial sinusitis occurs frequently and performed different clinical features. In the case of patients with

neurological diseases, as the primary disease site is close to sinuses and the patient's consciousness and breathing are usually affected, the risk of sinusitis may also be greatly affected. Therefore, it is meaningful and necessary to conduct research on nosocomial sinusitis in patients with specific diseases, especially in patients with neurological disorders. In addition, due to the different primary diseases of patients with nosocomial sinusitis and various treatment procedures such as tracheal intubation and gastric tube, the clinical manifestations of nosocomial sinusitis are confusing, and it is difficult to diagnose based on clinical features. Therefore, the diagnosis was mainly based on image scans such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) [6]. Mucosal thickening, opacification, or an air fluid level suggests the diagnosis of nosocomial sinusitis.

Previous studies have revealed several causes that may contribute to nosocomial sinusitis. Although the studies come from different centers and the object observed varies, there are some similar findings among the studies. The following factors may contribute to nosocomial sinusitis: length of hospital stay and ICU stay, use of ventilator, endotracheal intubation, nasogastric tube, tube location, the frequency of tube replacement and comatose or sedated patients [2,7]. And the longer the exposure to the above factors, the higher the risk of nosocomial sinusitis. Previous studies suggested sinusitis was strongly associated with neurological disorders, such as cerebritis and cerebral epidural abscesses [8]. But rare studies have further explored the relationship between nosocomial sinusitis and neurological disorders.

In the present study, we aimed to explore the incidence of nosocomial sinusitis in patients with neurological disease. Besides, we attempted to investigate the influencing factors of nosocomial sinusitis in neurological patients.

Materials and Methods

Study population

We recruited patients admitted to the neurology department of Nanfang Hospital including neuro-intensive care unit (NCU), an academic hospital affiliated to Southern Medical University from 1 July 2018 to 1 March 2021. All the patients involved had gastric tubes. The inclusion criteria were as follows: 1) had at least two times cranial imaging, such as CT or MRI; 2) had a gastric tube placed at least before the last cranial imaging. Patients who had nosocomial sinusitis at the first image were excluded from the study. In this study, nosocomial sinusitis was diagnosed according to imaging study.

Data collection

We reviewed the electronic medical records of all patients, and demographic information was collected, including gender and age. The clinical data including diagnosis, comorbidities, laboratory results, NCU stay, hospital stay, and treatment were collected. Also, the disease severity evaluation scores, such as Glasgow coma scale (GCS) score and National Institutes of Health Stroke Scale (NIHSS) score were also collected. The tracheal intubation, mechanical ventilation time and ventilation time were also collected. The highest value of neutrophil and lymphocytes ratio (NLR) and lowest value of serum phosphorus through hospital stay were included.

This study was approved by the Ethics Committee of Nanfang Hospital, Southern Medical University. Informed consent was waived by the review board because this study was observational and retrospective, and all data were fully de-identified.

Statistical analysis

Data analyses was performed via IBM SPSS Statistics 22.0. Categorical variables in patient information were expressed as percentages and compared by two-sided chi-square test. Continuous

variables were represented by means and tested for statistical differences by independent samples t-test. The significance level for all analyses was set at $P < 0.05$.

Results

Clinical characteristics

A total of 575 patients were screened by the electrical medical record. Patients who did not have two image scans ($n=280$), had nosocomial sinusitis on the first image ($n=154$) and had a gastric tube after the last cranial imaging ($n=23$) were excluded. Finally, 118 patients were enrolled in the study (Figure 1). Of the 118 patients, 67(56.78%) patients diagnosed with nosocomial sinusitis. Up to 54.0% (27/50) patients in NCU (50 patients were admitted to NCU) developed nosocomial sinusitis. The mean age of the patients was 63.68 years. Among them, 80 were male (67.8%) and 32.2% were female. The clinical diagnosis spectrum of the patients included 79 cases of cerebral infarction (66.9%), 21 cases of cerebral hemorrhage (17.8%), 7 cases of intracranial infection (5.9%), other diseases (such as peripheral neuropathy, Parkinson's disease, etc.) 11 cases (9.3%) of undefined diagnosis).

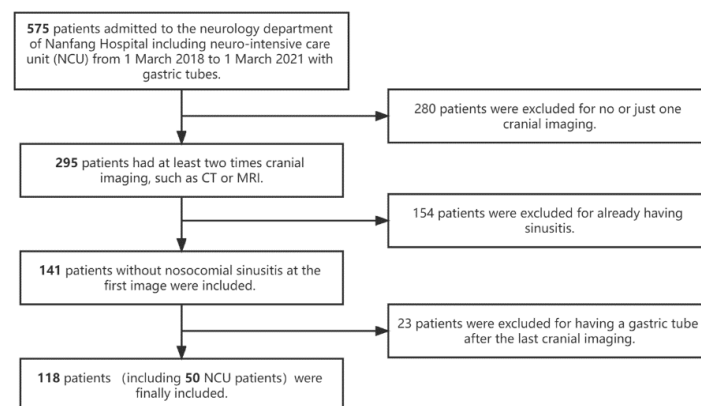


Figure 1: Clinical characteristics.

Risk factors for nosocomial sinusitis

The risk factors for nosocomial sinusitis were illustrated in Table1. Patients with nosocomial sinusitis had significantly higher NCU stay than patients without nosocomial sinusitis ($P=0.048$). Nosocomial sinusitis patients revealed higher percentage of tracheal intubation, mechanical ventilation and longer mechanical ventilation time though not significantly ($P= 0.054, 0.071, 0.094$ respectively). Other factors, such as gender, clinical diagnosis, vascular intervention, intracranial surgery, use of antibiotics, GCS score and NIHSS score revealed no significant difference between patients with and without nosocomial sinusitis. The lowest value of serum phosphorus and the highest value of NLR during the hospitalization were also evaluated and no significant difference was observed.

Risk factors	With nosocomial sinusitis n=67	Without nosocomial sinusitis n=51	P value
Sociodemography			
Male (n, %)	47(70.1)	33(64.7)	0.531
Age (years)	62.60±15.56	64.76±14.51	0.442
Main diagnosis			
Stroke	54(80.6)	46(90.1)	0.317
Intracranial infection	4(6.0)	3(5.9)	
Others	9(13.4)	2(3.9)	
Hospitalization and Treatment			
Hospital stay	19.79±17.80	18.15±13.15	0.551
NCU stay	13.74±16.56	6.70±6.06	0.048
GCS score	12.90±2.98	12.51±2.64	0.466
NIHSS score	10.10±7.24	10.95±5.96	0.547
Use of antibiotics	10(14.9)	8(15.7)	0.776
Intracranial surgery	6(9.0)	5(9.8)	0.875
intravascular intervention	8(14.8)	8(17.4)	0.726
Tracheal intubation(*)	10(37.0)	3(13.0)	0.054
Mechanical ventilation(*)	9(33.3)	3(13.0)	0.094
Ventilation duration	16.65±8.88	6.51±6.33	0.071
The highest value of NLR	9.64±9.49	9.25±8.36	0.819
The lowest value of serum phosphorus	0.91±0.24	0.85±0.21	0.232

((a) NIHSS score was calculated only in stroke patients; (b) NCU stay was studied only in NCU patients; (c) Ventilation duration was studied only in patients with tracheal intubation; (d) Factors with “*” were studied among NCU patients. (e) NCU: Neuro-intensive Care Unit. GCS score: Glasgow Coma Scale. NIHSS score: National Institute of Health stroke scale. NLR: Neutrophil and Lymphocytes Ratio.

Table 1: The risk factors for nosocomial sinusitis.

Incidence interval of nosocomial sinusitis

Incidence interval of nosocomial sinusitis was shown in Figure 2. We set the time of intubation to the last imaging study suggesting no sinusitis as the beginning, while the time from indwelling gastric tube to the first imaging examination suggesting sinusitis as the end. The average time of the first point was 1.74 days, while the average time of the end was 9.88 days. We supposed that the high incidence time of nosocomial sinusitis after indwelling gastric tube was 1.74-9.88 days.

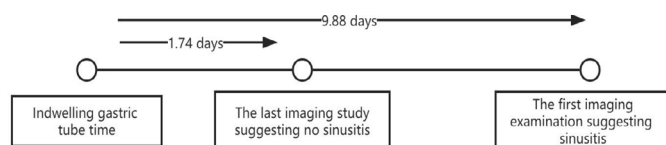


Figure 2: Incidence interval of nosocomial sinusitis.

Discussion

Our study revealed a high incidence of nosocomial sinusitis in patients with gastric tubes. As high as 56.78% of all patients and 54.0% of NCU patients were diagnosed with nosocomial sinusitis. The incidence of nosocomial sinusitis varies widely across different studies. Some are partly similar as our results [4,9], while others have a lower incidence than ours [1]. We considered that the difference in incidence was due to different subjects. The patients in our study were at high risk for nosocomial sinusitis. Although some studies have also reported a high incidence of patients with gastric tube, it is hard to say whether it is due to gastric tube or any other factor. Thus, it is necessary to study patients without gastric tubes.

As for risk factors for nosocomial sinusitis in patients with gastric tube, we found that NCU stay time was a risk factor. Besides, tracheal intubation, ventilation duration and mechanical ventilation might be also risk factors, though not significant. The correlation between nosocomial sinusitis and NCU stay has been reported in many literatures [1-5]. Our findings are consistent with those previous researches. Previous studies have also demonstrated the relationship between tracheal intubation, ventilation duration, mechanical ventilation and nosocomial sinusitis. In this study, the percentage of tracheal intubation, ventilation duration and mechanical ventilation were higher though not significantly in patients with nosocomial sinusitis, which was consistent with previous studies. The difference in the study was not significant, and the result might be due to limited sample size. In the future, more research was required to elucidate the risk factors for nosocomial sinusitis.

In our study, the highest value of NLR and the lowest value of serum phosphorus showed revealed no significant difference between patients with and without nosocomial sinusitis. NLR has been reported as an important marker in many diseases such

as tumor, autoimmune disease, infection and even nosocomial infection [10-13]. But the relationship between NLR and nosocomial sinusitis remains unclear. Serum phosphorus is closely associated with refeeding syndrome, a kind of clinical symptom and metabolic abnormality in malnourished patients undergoing refeeding [14]. Such syndrome has been reported to occur widely in patients with nutritional risk and in severe conditions, and has become an independent risk factor for nosocomial infection and even mortality [15]. However, in this study, serum phosphorus was not a risk factor for nosocomial sinusitis, which might be due to limited sample size.

In this study, the estimated time of nosocomial sinusitis was between 1.74-9.88 days. The results should be interpreted with caution because this is a retrospective study and the timing of image scanning was determined according to the clinical needs of the patients.

This study has some limitations as a retrospective, single-center and small sample study. However, this is a study that specifically focused on risk factors for nosocomial sinusitis in patients with neurological disorders and we found NCU stay was an important risk factor for nosocomial sinusitis. The high incidence interval of the sinusitis is 1.74-9.88 days after indwelling gastric tube.

Conclusion

Nosocomial sinusitis is highly prevalent in patients with neurological diseases with nasogastric tubes. Neurologists should be aware of nosocomial sinusitis and pay attention to the management of patients with nasogastric tubes. A large study is warranted to explore the risk factors for nosocomial sinusitis and to find the preventive measures.

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Authors' Contributions

QC and XZ contributed to study conception and design. ZL and DW participated in data analysis and drafted the manuscript. All authors made substantial contributions to the study, and read and approved the final version of the manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Nanfang Hospital, Southern Medical University.

Consent for publication

Written informed consent was waived because all the information was de-identified.

Competing interests

The authors declare no competing or financial interests.

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