



The Correlation between Sputum Retention and Oxygen Saturation in Nasopharyngeal Cancer Patients with Tracheostomy at The Emergency Department of Dharmais Cancer Hospital in 2022

Repidawati Sinaga¹, Yuni Susilowati², Meynur Rohmah³, Bernardo Oliber A. Arde⁴

^{1,2,3} Nursing Study Program, Yatsi Madani University, Tangerang, Indonesia

⁴ Master of Arts in Nursing Philippines University of Northern Philippines

ARTICLE INFORMATION

Received: March 8, 2023

Revised: August 30, 2023

Available online: November 2023

KEYWORDS

Sputum retention; Oxygen saturation;
Nasopharyngeal cancer; tracheostomy

CORRESPONDENCE

E-mail: repidasinaga@gmail.com

A B S T R A C T

The Global Burden of Cancer Study (Globocan) stated that nasopharyngeal cancer is the fifth most common cancer in Indonesia, with an incidence of 19,943 cases. One of the therapies for patients with nasopharyngeal cancer is a tracheostomy. Post-tracheostomy care is critical because blockage in the cannula due to accumulation of secretions impact decreasing oxygen saturation and result in death. This study analyzes the correlation between sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy at the Emergency Department of Dharmais Cancer Hospital in 2022. It was correlational quantitative research with a cross-sectional approach. The study population was all nasopharyngeal cancer patients with tracheostomy at the Emergency Department, Dharmais Cancer Hospital, from August to November 2022, totaling 65 respondents. There were 65 respondents with a total sampling technique. The data collection used secondary data, namely the level of sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy. Data analysis was univariate analysis and bivariate analysis through chi-square test. The result showed that most respondents experienced poor sputum retention (61.5%) and moderate hypoxemia (63.1%). The chi-square test obtained a $p=0.000$ ($p<0.05$). Thus, there was a correlation between sputum retention and oxygen saturation in respondents. In conclusion, sputum retention correlates with oxygen saturation in nasopharyngeal cancer patients with tracheostomy at the Emergency Department of Dharmais Cancer Hospital. The hospital should continue improving the ability of nurses to manage airway blockage through regular training.

INTRODUCTION

Nasopharyngeal cancer is a malignancy with unique epidemiological characteristics. Its incidence varies according to race and geographical differences (Sudiono and Hassan, 2013). In general, nasopharyngeal cancer is located in the cavity behind the nose and back of the palate of the oral cavity. In the Ear Nose Throat (ENT) Department, nasopharyngeal cancer incidence is the most common or highest malignancy throughout, affecting more men than women, with a ratio of three to one. Some etiological factors are smoking, alcohol, genetics, pollution, combustion fumes, consumption of burned food, food preserved by salting, smoking, or formalin, and Epsteinbar Virus (EBV) or viruses in the nasopharyngeal area (Jia and Qin, 2012).

Global Burden of Cancer Study (Globocan) from the World Health Organization (WHO) estimated the incidence of nasopharyngeal cancer globally was less than 1 per 100,000 annually. The prevalence of nasopharyngeal carcinoma was higher in some regions, such as China, Hong Kong, and Southeast Asia, with a 10-30 times higher incidence compared to other areas. In addition, 81% of new cases occurred in

Asia, and 9% occurred in Africa yearly. While in the UK, the incidence of nasopharyngeal carcinoma tended to be lower, which was 0.25 per 1,000,000 population each year (Chang *et al.*, 2021). According to the Globocan, the incidence of nasopharyngeal cancer is the fifth most common cancer disease in Indonesia (Adham *et al.*, 2012). The first place was breast cancer (65,858), followed by cervical cancer (36,633), lung cancer (34,783), liver cancer (21,392), and nasopharyngeal cancer (19,943) (Andinata *et al.*, 2023). Dharmais Cancer Hospital is a cancer hospital located in DKI Jakarta province. The incidence of nasopharyngeal cancer in 2020 was 189, while it increased to 197 in 2021. It indicated that nasopharyngeal cancer has grown every year (Hospital, 2022).

In patients with nasopharyngeal cancer, there are early and advanced symptoms. Early symptoms usually include ringing and feeling full in the ears and decreased hearing ability. In addition, the patient's nose can be blocked due to chronic colds or mucus mixed with blood (Makkawaru and Yunita, 2019).

One of the therapies for nasopharyngeal cancer is surgical therapy, namely by tracheostomy. Tracheostomy is a surgical procedure by inserting a tube through an opening into the trachea to overcome upper airway obstruction, maintain the airway, or use continuous mechanical ventilation (Rahmi, 2022). According to Novialdi (2019), the benefits of tracheostomy include improving patient comfort, oral hygiene, and communication. In addition, It improves the possibility of oral feeding and easier and safer treatments. Tracheostomy also has the potential to decrease the use of sedation and analgesic drugs to facilitate the weaning process and avoid pneumonia due to mechanical ventilators.

Phlegm/mucus in the throat is usual, but their production sometimes increases. The increased sputum can cause disorders and discomfort in the throat (Widjaja, 2008). According to Law (2003), the clinical signs of sputum retention are rapid respiratory distress and shallow breathing. Kozier explain that excess sputum affects the airway, including airway obstruction, impacting decreasing oxygen saturation characterized by cyanosis (Kozier *et al.*, 2010). Thus, sputum retention leads to hypoxia or hypoxemia, where oxygen saturation is below 95%. The previous research conducted by Septimar (2018) found that the mean oxygen saturation in patients before suction was 95.78%, while after suction was 97.25%, so there was a significant difference in the mean oxygen saturation among critical patients in the ICU before and after suction ($p=0.000$). In addition, a study conducted by Wulan and Huda (2022) found that the mean oxygen saturation before suction was 93.38%, while after suction was 94.19%, with $p=0.009$ ($\alpha=0.05$). It also indicated a significant influence before and after suction on oxygen saturation among hospitalized patients in the Intensive Care Unit, RSUD RAA Soewondo Pati.

An essential first step to managing respiratory failure is alertness to circumstances and situations that can lead to respiratory failure. According to Maisyaroh and Widiyanto (2020), patients with decreased consciousness or artificial airways are at risk of airway obstruction. Suctioning is necessary to clear the

airway, maintain a patent airway, and prevent infection due to sputum accumulation in critically ill patients who experience life-threatening organ failure. A preliminary survey of 5 patients with nasopharyngeal cancer with a tracheostomy who came to the Emergency Department (Emergency Room) of Dharmais Cancer Hospital showed their complaint was shortness of breath. In addition, all of them experienced hypoxia; 2 respondents had mild hypoxia (91-94%), and 3 had moderate hypoxia (85-90%). When suctioning, some sputum could be quickly removed, and some were not. So, giving a nebulizer was critical first to dilute the sputum in the patient's airway. This study analyzes the correlation between sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy at the Emergency Department, Dharmais Cancer Hospital, in 2022.

METHOD

This study was correlational quantitative research with a cross-sectional approach. The study population was all nasopharyngeal cancer patients with tracheostomy at the Emergency Department, Dharmais Cancer Hospital, from August to November 2022, totaling 65 respondents. There were 65 respondents with a total sampling technique. The data collection used secondary data, namely the level of sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy. Data collection was through observation of the Management Information System of Dharmais Hospital. Data analysis was univariate analysis and bivariate analysis through chi-square test. The Ethics Commission of Dharmais Hospital has ethically tested this study. It has been declared to have passed the ethical test with the Ethical Code 054/KEPK/II/2023.

RESULT

Table 1 shows that of the 65 respondents of nasopharyngeal cancer patients with tracheostomy at the Emergency Department, most of them had poor sputum retention (61.5%).

Table 1. Frequency Distribution of Sputum Retention in Nasopharyngeal Cancer Patients with Tracheostomy at the Emergency Department

Sputum Retention	Frequency (f)	Percentage (%)
Good	25	38.5
Poor	40	61.5
Total	65	100

In addition, table 2 declares that of the 65 respondents of nasopharyngeal cancer patients with tracheostomy at the Emergency Department, most have moderate hypoxemia oxygen saturation, as many as 41 respondents (63.1%).

Table 2. Frequency Distribution of Oxygen Saturation in Nasopharyngeal Cancer Patients with Tracheostomy at the Emergency Department

Oxygen Saturation	Frequency (f)	Percentage (%)
Mild Hypoxemia	24	36.9
Moderate Hypoxemia	41	63.1
Total	65	100

Of the 25 patients with nasopharyngeal cancer with a tracheostomy with good sputum retention, 17 had mild hypoxemia (68%). Meanwhile, of the 40 respondents with poor sputum retention, 33 experienced moderate hypoxemia (82.5%) (Table 3).

Table 3. The Correlation between Sputum Retention and Oxygen Saturation in Nasopharyngeal Cancer Patients with Tracheostomy at the Emergency Department

Sputum Retention	Oxygen Saturation				Total	p	OR and CI
	Mild Hypoxemia		Moderate Hypoxemia				
	f	%	f	%			
Good	17	68.0	8	32.0	25	100	0.000 10.018 (3.106-32.311)
Poor	7	17.5	33	82.5	40	100	
Total	24	36.9	41	63.1	65	100	

The chi-square test obtained a $p=0.000$ ($p<0.05$). Thus, there was a correlation between sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy in the Emergency Department of Dharmais Cancer Hospital. The statistical tests also obtained an Odds Ratio (OR) value of 10.018 and a Confidence Interval (CI) value of 3.106-32.311. Thus, nasopharyngeal cancer patients with a tracheostomy who experienced good sputum retention had a 10.018 times greater chance of experiencing mild hypoxemia than nasopharyngeal cancer patients with a tracheostomy who had poor sputum retention. The lowest chance value was 3.106, and the highest chance value was 32.311 times greater.

DISCUSSION

This study found that of the 65 respondents of nasopharyngeal cancer patients with tracheostomy at the Emergency Department, most of them had poor sputum retention (61.5%). Nasopharyngeal carcinoma is a malignancy in the nasopharyngeal region (above the throat and behind the nose) (Sudiono and Hassan, 2013). Some of the treatments for nasopharyngeal cancer, according to Rowshan and Baur (2010), include surgery through tracheostomy. Sputum (phlegm) is material released from the lungs and trachea through the mouth (Muttaqin, 2008). Good sputum quality was evaluated by observing sputum characteristics (color, viscosity, and amount of sputum). Poor sputum is greenish-yellow or mucopurulent, thick or mucoid, and amounts to 3-5ml (Rab, 2012).

Kozier *et al.* (2010) explain the complications of excess sputum can affect the airway, namely airway obstruction and limited airflow. The classification of sputum and its possible causes, according to Price and Wilson (1978), the yellowish sputum is likely an infectious process. In addition, bleeding sputum or

hemoptysis is often found in Tuberculosis. The color (mucopurulent) is yellow-greenish, indicating that antibiotic treatment can reduce symptoms. Meanwhile, milky white or opaque mucus usually means that antibiotics will not effectively treat symptoms. Yellow-greenish and milky white sputum can be related to bacterial or viral infections, although current research does not support that generalization. Furthermore, white foamy sputum may stem from obstruction or even edema.

Some factors that can trigger increased sputum production, according to Widjaja (2008), are inflammation in the respiratory tract or surrounding areas, throat exposure to infections or allergies to foreign substances, stomach disorders, sinusitis inflammation, and the body's lack of fluids. Muttaqin (2008) explains how to remove sputum retention, including deep breathing, coughing, and suctioning.

The authors found that nasopharyngeal cancer patients with tracheostomy mostly had poor sputum quality or abnormal trachea secretion (color, viscosity, and amount). Most of the sputum was yellow and greenish-yellow. There was also pink, white foamy, and milky white mucus. There was also poor sputum viscosity. In addition, the amount of sputum was between 3 to 5 ml. The results of these observations indicated that the respondents had abnormalities in the respiratory tract, either experiencing inflammation in the respiratory tract, allergies to foreign objects or stomach disorders, and so on. It is crucial to do deep breathing exercises or cough to naturally remove phlegm in the body to clear the airway in patients with good sputum retention. Meanwhile, health workers perform suction for poor sputum retention, which an authorized doctor treats.

In addition, this paper revealed that of the 65 respondents of nasopharyngeal cancer patients with tracheostomy at the Emergency Department, most had moderate hypoxemia (63.1%). Tracheostomy is a procedure where a hole is made into the trachea. The term tracheostomy is when an indwelling tube is inserted into the trachea. The decision to perform a tracheostomy can generally be made within seven days of intubation (Smeltzer, 2010).

The previous research by Sari and Ikbal (2019) revealed that the mean oxygen saturation before suction in the control group was 94.77 and 99.48 after suction. In addition, Kitu, Rohana and Widyaningsih (2020) study found that the mean oxygen saturation after the endotracheal tube (ETT) secretion suction increased from 94% to 97.87%.

The author found that most respondents had moderate hypoxia; their oxygen saturation was between 86% and 94%. Thus, the respondent's oxygen saturation was categorized as moderate hypoxia, between 85 to 90%. It indicated that the respondents had an airway disorder, one of which was sputum retention. Thus, suctioning is critical to clear the airway so the oxygen exchange process can run well.

Furthermore, of the 25 respondents in this study with good sputum retention, 17 had mild hypoxemia (68%). Meanwhile, of the 40 respondents with poor sputum retention, 33 experienced moderate

hypoxemia (82.5%). The statistical analysis obtained a $p=0.000$ ($p<0.05$). Thus, there was a correlation between sputum retention and oxygen saturation in nasopharyngeal cancer patients with tracheostomy in the Emergency Department of Dharmais Cancer Hospital. It might be because nasopharyngeal cancer patients had difficulty removing sputum or sputum retention.

Sputum retention is when patients cannot clear secretions from their respiratory tract independently or with assistance. The color, consistency, and volume of sputum can support the diagnosis and management of a patient's clinical condition. Airway obstruction is one of the most common symptoms of excess sputum, causing decreased oxygen saturation (Muttaqin, 2008).

Decreased oxygen saturation due to airway obstruction can decrease diffusion, resulting in hypoxemia. Unwell management of hypoxemia has a high potential to become hypoxia or tissue oxygen insufficiency (inability to carry out its functions adequately) for body metabolism. Further, hypoxia is a cause of injury and cell death. Cells depend on a continuous supply of oxygen. Therefore, without oxygen, cell maintenance and synthesizing activities stop quickly (Price and Wilson, 1978). Without oxygen for a particular time, body cells will experience damage that causes death. The most sensitive organ to a lack of oxygen is the brain. If the brain does not get oxygen for more than 5 minutes, permanent brain cell damage can occur (Kozier *et al.*, 2010).

In previous research conducted by Dengo, Suwondo and Suroto (2018), oxygen saturation due to sputum retention was abnormal (70.0%). In addition, a study by Sari and Ikbali (2019) indicated that the mean oxygen saturation in the control group before the suction was 94.77, while after the suction was 99.48. Thus, there was an influence between suctioning and oxygen saturation with a $p=0.000$.

The oxygen saturation of arterial blood with PaO₂ 100 mmHg is about 97.5%, while that of venous blood with PaO₂ 40 mmHg is about 75%. The affinity of hemoglobin to oxygen can affect oxygen release. When hemoglobin has a greater affinity for oxygen, there is reduced oxygenation to tissues. Conditions such as increased pH, decreased temperature, and decreased carbon dioxide partial pressure will increase hemoglobin's affinity for oxygen and limit oxygen to tissues, and hypoxemia occurs. Thus, hypoxemia can occur due to reduced blood oxygen pressure (PaO₂) (Kozier *et al.*, 2010).

CONCLUSION

In conclusion, sputum retention correlates with oxygen saturation in nasopharyngeal cancer patients with tracheostomy at the Emergency Department of Dharmais Cancer Hospital. The hospital should continue improving the ability of nurses to manage airway blockage through regular training.

REFERENCES

- Adham, M. *et al.* (2012) ‘Nasopharyngeal carcinoma in Indonesia: epidemiology, incidence, signs, and symptoms at presentation’, *Chinese journal of cancer*, 31(4), p. 185.
- Andinata, B. *et al.* (2023) ‘A Comparison of Cancer Incidences Between Dharmais Cancer Hospital and Globocan 2020: A Descriptive Study of Top 10 Cancer Incidences’, *Indonesian Journal of Cancer*, 17(2), pp. 119–122.
- Chang, E.T. *et al.* (2021) ‘The evolving epidemiology of nasopharyngeal carcinoma’, *Cancer Epidemiology, Biomarkers & Prevention*, 30(6), pp. 1035–1047.
- Dengo, M.R., Suwondo, A. and Suroto, S. (2018) ‘Hubungan paparan co terhadap saturasi oksigen dan kelelahan kerja pada petugas parkir’.
- Hospital, D.C. (2022) *Profile of Dharmais Cancer Hospital in 2022*.
- Jia, W.-H. and Qin, H.-D. (2012) ‘Non-viral environmental risk factors for nasopharyngeal carcinoma: a systematic review’, in *Seminars in cancer biology*. Elsevier, pp. 117–126.
- Kitu, N.B., Rohana, N. and Widyaningsih, T.S.T.S. (2020) ‘Pengaruh tindakan penghisapan lendir endotrakeal tube (ett) terhadap kadar saturasi oksigen pada pasien yang dirawat di ruang icu’, *Jurnal Ners Widya Husada*, 6(2), pp. 57–64.
- Kozier, B. *et al.* (2010) ‘Buku ajar fundamental keperawatan: konsep, proses, dan praktik’, *jakarta: EGC* [Preprint].
- Law, C. (2003) ‘Recognition, prevention and management of sputum retention.’, *Nursing Times*, 99(23), pp. 49–51.
- Maisyaroh, A. and Widiyanto, E.P. (2020) ‘Buku ajar keperawatan gawat darurat, manajemen bencana, dan keperawatan kritis’. Bondowoso: KHD Production, 2020.
- Makkawaru, A.I. and Yunita, E. (2019) ‘TB Miliary Disease On Nasofaring Carsinoma Case’, *Jurnal Medical Profession (Medpro)*, 1(1), pp. 1–6.
- Muttaqin, A. (2008) *Buku Ajar Asuhan Keperawatan Dgn Gangguan Sistem Pernapasan*. Penerbit Salemba.
- Novialdi, S.A. (2019) ‘Trakeostomi dan Krikotirotomi’.
- Price, S.A. and Wilson, L.M. (1978) *Pathophysiology: clinical concepts of disease processes*. McGraw-Hill.
- Rab, T. (2012) ‘Ilmu Penyakit Paru-paru’, *Jakarta: CV Trans Info Media* [Preprint].
- Rahmi, U. and Kep, M. (2022) *Dokumentasi keperawatan*. Bumi Medika.
- Rowshan, H.H. and Baur, D.A. (2010) ‘Surgical tracheotomy’, *Atlas of the Oral and Maxillofacial Surgery Clinics of North America*, 18(1), pp. 39–50.
- Sari, R.P. and Ikbal, R.N. (2019) ‘Pengaruh Tindakan Suction Terhadap Perubahan Saturasi Oksigen Pada Pasien Penurunan Kesadaran Diruangan ICU Rumah Sakit Islam Siti Rahmah Padang Tahun 2019’, *Prosiding SainsTeKes*, 1, pp. 50–57.
- Septimar, Z.M. (2018) ‘Pengaruh Tindakan Penghisapan Lendir (Suction) terhadap Perubahan Kadar Saturasi Oksigen pada Pasien kritis di ICU’, *Jurnal Ilmu Kesehatan Masyarakat*, 7(01), pp. 10–14.
- Smeltzer, S. (2010) *Buku Ajar Keperawatan Medikal Bedah*. Jakarta: EGC.

- Sudiono, J. and Hassan, I. (2013) 'DNA Epstein-Barr virus (EBV) sebagai biomaker diagnosis karsinoma nasofaring', *Dental Journal (Majalah Kedokteran Gigi)*, 46(3), pp. 140–147.
- Widjaja, M.C. (2008) *Mencegah & Mengatasi Alergi & Asma pada Balita*. Kawan Pustaka.
- Wulan, E.S. and Huda, N.N. (2022) 'Pengaruh Tindakan Suction Terhadap Saturasi Oksigen Pada Pasien Yang di Rawat di Ruang ICU RSUD RAA Soewondo Pati', *Jurnal Profesi Keperawatan (JPK)*, 9(1), pp. 22–33.