Comparing Voice Related Quality of Life scores between fenestrated and speaking valve cannula users

Lisa Apri Yanti*, Veni Rosita Dewi*, Erial Bahar**

*Department of Otorhinolaryngology-Head and Neck Surgery,
Faculty of Medicine, Sriwijaya University/Dr. Muhammad Hoesin General Hospital,
Palembang
**Department of Anatomy, Faculty of Medicine, Sriwijaya University, Palembang

ABSTRACT

Background: Tracheostomy is a procedure that aims to maintain airway so that the air can enter the lungs and bypass the upper airway. Tracheostomy causes physiological changes, especially in terms of communication, which leads to reduced voice-related quality of life (QoL). Fenestrated and speaking valve tracheal cannula can assist patients in generating voice. **Purpose:** To compare the Voice Related Quality of Life (V-RQOL) scores of the fenestrated and speaking valve tracheal cannula users. **Method:** Analytic observational study using a cross-sectional design. Data collection was done through interviews with the V-RQOL questionnaire guide. The study was conducted in September-December 2022 at the Otorhinolaryngology-Head and Neck Surgery Polyclinic of Dr. Mohammad Hoesin Hospital Palembang. Data were analyzed with IBM SPSS 26. **Result:** Forty-two patients were using tracheal cannula: 21 patients with fenestrated cannula, and 21 with speaking valve tracheal cannula. Patients with fenestrated tracheal cannula had lower QoL in the physical, social, and total domains than those in the speaking valve group (poor QoL in the physical domain: 66.67% vs. 9.52%; social domain: 85.71% vs. 57.14%; total domain: 76.19% vs. 4.76%; $p<0.001$). From the multivariate analysis, the tracheal cannula type influenced patient's QoL ($p<0.001$). The probability of patients experiencing poor QoL was 76.2% in fenestrated tracheal cannula samples, while with speaking valve was 4.7%. **Conclusion:** The QoL of patients with a fenestrated type of tracheal cannula was significantly lower than that with speaking valve tracheal cannula users in physical, social, and total domains as measured by the V-RQOL.

Keywords: tracheal cannula, V-RQOL score

ABSTRAK

Latar belakang: Trakeostomi adalah tindakan untuk mempertahankan jalan nafas agar udara dapat masuk ke paru dan memintas jalan nafas bagian atas. Trakeostomi menyebabkan terjadinya perubahan fisiologis terutama dalam hal berkomunikasi, yang menyebabkan berkurangnya kualitas hidup terkait suara. Untuk membantu pasien dalam menghasilkan suara bisa digunakan kanul trakea fenestrated *dan* speaking valve. ***Tujuan:*** *Mengetahui perbandingan skor kualitas hidup sehubungan suara* (V-RQOL) *pada pengguna kanul trakea* fenestrated *dan* speaking valve. ***Metode:*** *Penelitian observasional analitik menggunakan rancangan potong lintang. Pengumpulan data melalui wawancara dengan panduan kuesinoner* V-RQOL. *Penelitian dilakukan September–Desember 2022 di Poliklinik Telinga Hidung Tenggorok-Bedah Kepala Leher, RSUP Dr. Mohammad Hoesin Palembang. Data dianalisis dengan* IBM SPSS 26. ***Hasil:*** *Diperoleh 42 pasien, dengan 21 terpasang kanul trakea tipe* fenestrated, *dan 21 dengan* speaking valve. *Pasien yang terpasang kanul trakea* fenestrated *memiliki kualitas hidup lebih buruk pada domain fisik, sosial dan keseluruhan dibandingkan dengan kelompok* speaking valve *(kualitas hidup buruk pada domain fisik: 66,67% vs. 9,52%; domain sosial: 85,71% vs. 57,14%; domain keseluruhan: 76,19% vs. 4,76%; p<0,001). Dari analisis multivariat didapatkan faktor yang mempengaruhi kualitas hidup pasien* (V-RQOL) *adalah jenis kanul trakea (p<0,001). Probabilitas seseorang yang terpasang kanul trakea* fenestrated *akan mengalami kualitas hidup buruk sebesar 76,2%, sementara pada* speaking valve *4,7%.* ***Kesimpulan:*** *Kualitas hidup pasien dengan kanul*

trakea tipe fenestrated *lebih rendah secara bermakna dibandingkan pengguna kanul trakea* speaking valve, *pada domain fisik, sosial, maupun keseluruhan sebagaimana diukur dengan* V-RQOL. S*eluruh butir pertanyaan dalam kuesioner valid dan reliabel. Oleh karena itu, kuesioner ini dapat digunakan dalam studi selanjutnya untuk skrining pernafasan mulut.*

Correspondence address: Lisa Apri Yanti. Department of Otolaryngology-Head and Neck Surgery, Faculty of Medicine, Sriwijaya University/Dr. Muhammad Hoesin General Hospital, Jl. Jendral Sudirman, Sekip Jaya, Kecamatan Kemuning, Palembang, South Sumatera 30126, Indonesia. Phone: 0711-354088 ext 521. Email: lisa.abda@yahoo.com

INTRODUCTION

Tracheostomy, one of the oldest surgical techniques in the history of head and neck surgery, involves incising or perforating the trachea to create an opening in the anterior wall of the trachea, to maintain an airway for air to enter the lungs and bypass the upper airway.[1–3]

There are various physiological changes after tracheostomy in individuals who utilize a tracheal cannula, one of which is communication issue. Communication issues are the most commonly complained by patients with a tracheal cannula, which might hinder their quality of life (QoL).[3] This finding was investigated in a study by Kumar et al.[4] in India who discovered a decline in the average score in all four quality of life domains (physical, psychological, social, and environmental) assessed with the World Health Organization Quality of Life – Biomedical Research Education Facility (WHOQOL-BREF). Furthermore, Vinciya et al.[5] used the Voice Related Quality of Life (V-RQOL) instrument to assess the voice-related quality of life in 58 ICU patients with and without a speaking valve. They discovered improved QoL compared to the control group. The validated V-RQOL instrument had been used in several studies to assess the voice- related QoL in adult patients with a tracheal cannula, and researchers could use this instrument as a guide to assess the V-RQOL in tracheal cannula users.[4–6]

A fenestrated tracheal cannula, or tracheal cannula equipped with a speaking valve, could aid the patient in generating sound. Both cannulas may well assist patients in creating sound. Nonetheless, not all patients could utilize tracheal cannulas with speaking valves. A speaking valve is believed to increase the patient's ability to communicate, and restore confidence in the absence of the tracheal cannula's sensation of disability.[7–9] This study aimed to compare the V-RQOL scores of tracheal cannulas with fenestrated and speaking valves users.

METHOD

This observational and analytical study used a cross-sectional design to compare V-RQOL scores among users of the fenestrated and speaking valve tracheal cannula at Dr. Mohammad Hoesin Palembang Hospital from September to December 2022. All individuals over 18 years old who utilized a fenestrated or a speaking valve tracheal cannula, and were willing to participate in the trial were included in the study's sample. Patients who were not fully conscious, uncooperative, or did not understand when asked to communicate or participate in a direct interview, were not included in this study. The samples were acquired through sequential sampling with a sample size at least 18 subjects. The study participants provided sociodemographic data. The researcher conducted direct interviews with the V-RQOL questionnaire guide at the

Otorhinolaryngology-Head and Neck Surgery Polyclinic of Dr. Mohammad Hoesin Hospital Palembang.

The analysis included univariate, bivariate, and multivariate analysis. Univariate analysis was performed to determine the frequency distribution data revealing the characteristics of the study sample in the dependent variable (QoL) and independent variable (type of tracheal cannula). Meanwhile, bivariate analysis aimed to compare the use of a fenestrated and speaking valve tracheal cannula with voice-related quality of life using the V-RQOL score, using the independent T-test if the data were normally distributed, or the alternative Mann-Whitney test if the data were not normally distributed. The Chi-Square or non-parametric Fisher exact test was used to examine the relationship between using a fenestrated and speaking valve tracheal cannula on QoL, which was classified as poor, good, or very good. Finally, a multivariate analysis was performed to discover the relevant elements in determining the V-RQOL in patients with tracheal cannulas. All data were analyzed using IBM SPSS 26.0 software.

RESULT

There were 42 patients who used tracheal cannulas, 21 of whom used fenestrated and 21 of whom used speaking valve tracheal cannulas. The fenestrated group had a mean age of 50.14 years, while the speaking valve group had a mean age of 49.57 years. The study samples in the fenestrated group were mostly male, 45-59 years old, and tracheostomy was performed with an indication of intubation difficulty. Most of the study samples in the speaking valve group were >60 years old, female, and tracheostomy was performed due to difficult or prolonged intubation. Meanwhile, the overwhelming proportions of both groups were found to be identical in terms of occupation (non-voice user), nutritional state (good), depressive status (mild), and comorbidity level (moderate risk). Table 1.

Tabel 1. Characteristics of fenestrated and speaking valve tracheal cannula users

Variable	Fenestrated			Speaking valve		
	N	%	$\bar{x}\pm SD$	N	%	$\bar{x}\pm SD$
Age			50.14 ±14.02			49.57±18.21
18–25 years	1	2.4		3	7.1	
26–44 years	6	14.3		6	14.3	
45–59 years	9	21.4		3	7.1	
>60 years	5	11.9		9	21.4	
Gender						
Male	12	28.6		6	14.3	
Female	9	21.4		15	35.7	
Occupation						
Voice user	0	0		1	2.4	
Non voice user	21	50		20	47.6	
Nutritional status						
Underweight	6	14.3		3	7.1	
Overweight	14	33.3		15	35.7	
Normoweight	1	2.4		3	7.1	

Tracheostomy indication

Upper airway obstruction	3	7.1	4	9.5
Difficult intubation	17	40.5	8	19.0
Prolonged intubation	1	2.4	8	19.0
Others	0	0	1	2.4
Tracheal cannula care				
Complete care	21	50	21	50
Incomplete care	0	0	0	0
No performed care	0	0	0	0
Psychological factor				
Mild depression	11	26.2	13	31.0
Moderate depression	10	23.8	8	19.0
Severe depression	0	0	0	0
Comorbidity				
Low risk	3	7.1	8	19
Moderate risk	14	33.3	13	31
High risk	4	9.5	0	0

Patients with fenestrated cannula had lower QoL scores across all categories (physical functioning, social- emotional, and overall) than those with speaking valve cannula (p<0.001). According to V-RQOL, patients with fenestrated tracheal cannulas had low QoL in the domains of physical functioning (66.67%), social-emotional (85.71%), and total (76.19%). Furthermore, the bivariate analysis revealed an association between tracheal cannula use and low QoL in the physical functioning, social-emotional, and total domains (p<0.001). Table 2.

Tabel 2. Relationship of V-RQOL scores of physical functioning, social-emotional, and total function domains with the use of fenestrated and speaking valve tracheal cannula

V-RQOL scores	Tracheal cannula		P value	OR (CI 95%)
	Fenestrated (n=21)	*Speaking valve* (n=21)		
Physical functioning domain	45.90 (33.30-70.90)	70.90 (45-95.8)	<0.001[a]	
Poor	14 (66.67%)	2 (9.52%)	<0.001[b]	19 (1.23-4.66)
Good + Very good	7 (33.33%)	19 (90.48%)		
Social-emotional domain	37.50 (31.25-68.75)	71,43 ± 15,23	<0.001[a]	
Poor	18 (85.71%)	12 (57.14%)	<0.001[b]	57 (2.14-5.95)
Good + Very good	3 (14.29%)	9 (42.86%)		
Total domain	37.50 (20-70)	55.06 ± 20.85	<0.001[a]	
Poor	16 (76.19%)	1 (4.76%)	<0.001[b]	64 (1.91-6.40)

| *Good + Very good* | 5 (23.81%) | 20 (95.24%) |

Table 3 showed the binary logistic regression calculations performed by entering total patient quality of life (V-RQOL) data as the dependent variable and independent variables, namely fenestrated and speaking valve tracheal cannula, and confounding variables, namely age, gender, tracheostomy indication, tracheal cannula maintenance, occupation, psychological factors, and comorbidities related to patients' characteristic patterns (as covariates). According to the multivariate study, the modelling could predict 61.6% of patient's QoL predictors. The final model's research findings revealed that the category of tracheal cannula type used was the critical component that substantially influenced patients' quality of life (VRQOL) (p<0.001).

Tabel 3. Multivariate analysis of factors affecting the QoL of patients with tracheal cannula

	Variable	B	S.E.	Wald	Df	Sig.
Step 8[a]	Cannula type (*fenestrated*)	-4.159	1.146	13.178		**<0.001**
	Constanta	2.996	1.025	8.547		0.003

The mathematical formulation for assessing the QoL of patients with tracheal cannulas were established based on the multivariate analysis of this study.

Using the regression equation and probability formula, the probability of patient using a fenestrated tracheal cannula was 76.2% chance of experiencing poor QoL. Meanwhile, only 4.7% of speaking valve canal users had a negative QoL.

DISCUSSION

This cross-sectional analytical observational study compared two groups to determine the relationship between QoL in patients using a tracheal cannula, measured by Voice Related Quality of Life (V-RQOL). The mean age of the sample in this study was 50.14 years in the fenestrated group, and 49.57 years in the speaking valve group, which was consistent with prior research by Gupta et al.,[10] who found that the majority of patients receiving tracheostomy were between the ages of 41 and 60. Furthermore, the fenestrated group's study sample was predominantly male, whereas the speaking valve group's study population was mostly female. Their study found that men had more tracheostomies than women, with a male-to-female ratio of 2.7:1.61, likely because of men's higher activity levels and the increased prevalence of malignancies in men induced by smoking and alcohol intake. Another study by Pandian et al.[11] found no gender differences among speaking valve tracheostomy users.

The examination of V-RQOL scores revealed a significant disparity in patients' QoL using a fenestrated and speaking valve tracheal cannula in this study. Patients who used a fenestrated tracheal cannula had a lower QoL than those who used a speaking valve regarding physical functioning, social-emotional well-being, and overall quality of life (p<0.001). Using multivariate analysis and including independent variables and confounding variables related to patient characteristic patterns (as covariates), the main factor that significantly affected patients' V-RQOL was the category of tracheal cannula type used (p<0.001).

Gul et al.[12] discovered that tracheostomy impacted basic human needs (as articulated in Maslow's hierarchy of needs) and QoL to varying degrees in a study of 70 individuals with a tracheostomy. In addition, patients encountered changes in physical appearance due to body conditions, psychological issues, and various additional ailments. The level of QoL was found to be considerably poorer in the group of patients who had lived with a tracheostomy for 3 months to 1 year, compared to those who had lived with a tracheostomy for 6-9 years, in the domain of the physical function and role limits due to physical difficulties.[12]

Tracheostomy could impair physical activity, limit neck mobility, promote dysphagia, and lead to communication problems. A tracheal cannula immediately implemented following a tracheostomy, prevents air from passing through the larynx and vocal cords, and preventing the individual from producing sounds. The diameter, length, type of tracheal cannula, and parameters such as mechanical breathing time in patients with a tracheal cannula can all impact patient's capacity to regain speech. As a result, procedures for restoring speech vary greatly, including the type of tracheal cannula used.[6,13]

The fenestrated tracheal cannula not only assesses the patient's capacity to breathe normally through the oral/nasal route (preparing the patient for decannulation), but also lets air to travel through the vocal cords, allowing phonation to occur. According to Pandian et al.[11] study, fenestrated tracheal cannulas were infrequently utilized and were often reserved for certain situations. Malposition could irritate the tracheal mucosa, leading to the production of granulation tissue, tracheal stenosis, and tracheomalacia. Furthermore, when it comes to voice, a fenestrated tracheal cannula that is too close to the tracheal posterior wall may produce partial or complete obstruction, resulting in lower voice quality. As a result, the

appropriate position in the airway should be examined on a frequent basis.[11,14]

During inhalation, the tracheal speaking valve opens, allowing external airflow to enter the airway through the valve opening. When the patient exhales, the valve closes, and the air is expelled through the upper airway from the tracheal cannula and tracheal space. According to the speaking valve's operating concept, the patient's breathing process remains unchanged. Still, on exhale, air no longer goes via the tracheal cannula but through the space between the trachea and the upper airway. The air then flows through the vocal cords and out of the nose and mouth, restoring airflow to the upper airway, improving throat sensation, re-establishing the glottic closure reflex and cough reflex, restoring intra-pharyngeal pressure, lowering the risk of aspiration and leakage, and allowing the patient to regain swallowing, vocalization, and speech functions.[15]

Voice-related quality of life (V-RQOL) is a 10-item assessment designed, and validated for individuals with voice abnormalities to assess the social-emotional and physical-functional elements of voice difficulties. Pandian et al.[5] examined patients' V-RQOL before and after a one-way speaking valve cannula intervention. As a result, there was a significant difference in scores before and after intervention in each group (p=0.001), though more significant changes were found in the intervention group, where significant improvements were found after treatment on questions about repetition scores (p=0.001), and friendliness (p=0.04) through multivariate analysis. Furthermore, even though some participants in the control group employed other channels of communication, changes in the emotional component of V-RQOL from pre- to post- treatment were considerably better in the intervention group. The language and educational status of the study sample bring forth limitations in this study. So, when the interview was conducted, the interviewer

had to explain in clear words and easily understood by the research sample. There were even several times when the interview was conducted, the interviewer had to use the local language so that the research sample understood and comprehended what was being asked, and a comfortable interview room be facilitated. The study's strength was examining the QoL in tracheostomy patients with fenestrated cannula, which had not been done priorly. Furthermore, gathering primary data directly from patients had enabled more thorough review with samples based on appropriate standards.

In conclusion, the QoL of patients with fenestrated tracheal cannula, as measured by V-RQOL, was significantly lower than those with speaking valve tracheal cannula in the physical functioning, social-emotional, and total domains.

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