

THE EFFECT OF AIRWAY PILLOW USE ON AIRWAY PATENCY IN POST-GENERAL ANESTHESIA PATIENTS AT DR. SOERADJI TIRTONEGORO GENERAL HOSPITAL KLATEN

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Article History

Received : February 2026

Revised :

Published : April 2026

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Keywords

Airway patency, Airway pillow, post general anesthesia

ABSTRACT

Introduction

Patients after general anesthesia are at risk of impaired airway patency due to decreased consciousness and muscle relaxation, which can lead to airway obstruction. Appropriate monitoring and intervention in the PACU are essential to prevent respiratory complications. One non-pharmacological intervention that can be used is an airway pillow, an ergonomic pillow designed to maintain an extended head position, thus helping to maintain an open airway.

Method

This study used a quasi-experimental quantitative design with a pre-test and post-test approach with a control group design. The population in this study was patient post operative with general anesthesia. The study sample consisted of 70 respondents divided into an intervention group and a control group. The sampling technique used consecutive sampling. The intervention group was given an airway pillow, while the control group used a standard IV fluid bag. Airway patency was measured using oxygen saturation (SpO₂) values via a bedside monitor before and after the intervention. Data analysis was performed using the Shapiro-Wilk test, the Wilcoxon Signed-Rank Test, and the Mann-Whitney U test.

Result

The result of statistical test showed that the Wilcoxon signed rank test of airway pillow and IV fluid bag with the airway patency in post general anesthesia patient were obtained with a value of $p=0,000$ ($p<0,05$), the result of Mann Whitney U test for the effectiveness of airway pillow and IV fluid bag on airway patency obtained a value of $p=0,000$ ($p<0,05$).

Conclusion

The use of airway pillows is more effective in helping maintain a airway patency in patients after general anesthesia in the PACU than IV fluid bag. A non-pharmacological method to improve the quality of recovery for patients after anesthesia.

INTRODUCTION

General anesthesia is widely used in surgical procedures worldwide. Although advances in anesthetic management have improved patient safety, postoperative respiratory complications remain a significant concern during recovery. Airway obstruction, hypoventilation, and hypoxemia are among the most frequently encountered complications in the Post-Anesthesia Care Unit (PACU). According to a study by (Xiong, 2024) A total of 5,587 patients experienced hypoxia due to airway patency issues. Airway obstruction occurs due to partial or total obstruction of the upper airway from displacement of tongue and collapse of upper airway structure, which can effectively impede airflow. Optimal airway management is necessary to prevent complications following general anesthesia in the PACU.

Residual anesthetic drugs and anesthetic gases are the primary causes of airway obstruction in post general anesthesia patients in the PACU. This residual anesthesia causes a decrease in muscle tone, which increases the risk of upper airway obstruction due to tongue displacement and collapse of the upper airway structures. (Atanelov *et al.*, 2025). Various factors that can increase the risk of airway compromise include gender, age, ASA physical status, and body mass index (Xiong, 2024).

A non-pharmacological approach that can be taken is to perform a head-tilt maneuver to clear the patient's upper airway obstruction. Head-tilt helps align the upper airway and the larynx (Avva, 2025). Based on the author's observations, head extension is performed using an IV fluid bag to make it easier for the anesthesiologist in the PACU to monitor and manage the airways of multiple patients simultaneously.

Based on the airway management technique using the IV fluid bag, the researchers developed an airway pillow to replace it. The airway pillow measures 50 wide by 15 long by 10 high and is made of polyurethane. A height of 10 cm was chosen to compensate for compression from the patient's body during use, with the goal of achieving a height of 7 cm. According to a study by Vijayakumar (2022), a height of 7 cm is optimal for clearing upper airway obstruction through head extension.

Based on the description of the phenomenon

above, the authors are interested in conducting research on "The Effect of Airway Pillow Use on Airway Patency in Post-General Anesthesia Patients at Dr. Soeradji Tirtonegoro General Hospital Klaten".

METHOD

This study used a quasi-experimental quantitative design with a pre-test and post-test approach with a control group design. Data collection using SpO₂ readings taken with a bedside monitor and a form to record changes in SpO₂ before and after the test in two groups. The use of SpO₂ to determine differences in the effectiveness of the airway pillow and the IV fluid bag.

The independent variable in this study was the airway pillow. The dependent variable was airway patency. This study was conducted at Dr. Soeradji Tirtonegoro Central General Hospital in Klaten, central java, from 9 February to 6 April 2026.

The population was post general anesthesia patients aged 17-55 years old, ASA classification I-II, BMI <18,5-29,9, operation durations 1-3 hours. The sample size calculated using Slovin formula, was 66 respondents. A 10% dropout rate resulted 73 respondents.

RESULT

Tabel 1 Respondents Characteristics based on Gender

Gender	Group				Sig.
	Airway Pillow		IV fluid bag		
	f	%	f	%	
Males	9	25,7	18	51,4	0,375
Females	26	74,3	17	48,6	
Σ	35	100	35	100	

Table 1 presents the distribution of respondents according to sex in both the airway pillow and IV fluid bag groups. In the airway pillow group, the majority of participants were female, accounting for 26 respondents (74.3%), while 9 respondents (25.7%) were male. In the control group, males represented 18 respondents (51.4%) and females represented 17 respondents (48.6%).

Spearman's correlation test showed that gender did not have a significant correlation (0,376) with the study.

Based on study from (Chung, 2021) states that there are physiological differences between men and women. Men generally have greater lung capacity, larger airway diameters, and greater respiratory muscle mass, which, in theory, results in better ventilatory capacity in

men, whereas women have smaller lung volumes and are more sensitive to certain anesthetic depressants. This is likely due to several factors, including head extension caused by the use of an airway pillow and an IV pole. This is consistent with research by Nurdiana (2023) on head position and Avva et al. (2025) on patient positioning.

Tabel 2 Respondents Characteristics based on Age

Age	Group				Sig.
	Airway Pillow		IV fluid bag		
	f	%	f	%	
17-25	1	2,9	2	5,7	0,983
26-35	8	22,9	7	20,0	
36-45	12	34,3	8	22,9	
46-55	14	40,0	18	51,4	
Σ	35	100	35	100	

Table 2 presents the age distribution of respondents in both study groups. In the airway pillow group, the largest proportion of respondents was in the 46–55 years age category, comprising 14 respondents (40.0%), followed by the 36–45 years category with 12 respondents (34.3%). The 26–35 years and 17–25 years age groups accounted for 8 respondents (22.9%) and 1 respondent (2.9%), respectively.

Similarly, in the IV fluid bag group, the majority of respondents were aged 46–55 years, with 18 respondents (51.4%), followed by the 36–45 years category with 8 respondents (22.9%). Respondents aged 26–35 years and 17–25 years accounted for 7 respondents (20.0%) and 2 respondents (5.7%), respectively.

Spearman's correlation test showed that age did not have a significant correlation (0,983) with the study.

Based on study from (Xiong, 2024) states that the physical condition of elderly patients has undergone a process of aging that can impair bodily function and endurance. This condition can lead to damage to cells and body tissues and increases the risk of a decrease in hemoglobin levels, which can affect oxygen levels in the body.

Tabel 3 Respondents Characteristics based on ASA Classification

ASA classification	Group				Sig.
	Airway Pillow		IV fluid bag		
	f	%	f	%	
I	11	31,4	7	20,0	0,100
II	24	68,6	28	80,0	
Σ	35	100	35	100	

Table 3 presents the distribution of respondents according to the American Society of Anesthesiologists (ASA) physical status

classification. In the airway pillow group, most respondents were classified as ASA II, accounting for 24 respondents (68.6%), while 11 respondents (31.4%) were classified as ASA I.

Spearman's correlation test showed that ASA classification did not have a significant correlation (0,100) with the study.

Based on (American Society of Anesthesiologist, 2025) standart indicates the severity of the patient's condition, ranging from ASA I (healthy patients without systemic disease) to ASA VI (brain-dead patients). At ASA II, patients have mild systemic diseases that interfere with the absorption and elimination of anesthetic agents. This can impair the absorption of drugs and inhaled anesthetics and slow the elimination of anesthetics from the body, thereby affecting the respiratory, renal, and other body systems.

Tabel 4 Respondents Characteristics based on BMI

BMI	Group				Sig.
	Airway Pillow		IV fluid bag		
	f	%	f	%	
<18,5	1	2,9	2	2,9	0,159
18,5-22,9	17	48,6	26	74,3	
23,0-24,9	10	28,6	6	17,1	
25,0-29,9	7	20,0	2	5,7	
Σ	35	100	35	100	

Table 4 presents the distribution of respondents according to Body Mass Index (BMI). In the airway pillow group, the largest proportion of respondents had a normal BMI (18.5–22.9 kg/m²), accounting for 17 respondents (48.6%). This was followed by the overweight category (23.0–24.9 kg/m²) with 10 respondents (28.6%), the obesity category (25.0–29.9 kg/m²) with 7 respondents (20.0%), and the underweight category (<18.5 kg/m²) with 1 respondent (2.9%).

The IV fluid bag group, the majority of respondents also had a normal BMI, comprising 26 respondents (74.3%). Respondents in the overweight category accounted for 6 respondents (17.1%), while the underweight and obesity categories each consisted of 2 respondents (5.7%).

Spearman's correlation test showed that BMI did not have a significant correlation (0,159) with the study.

Based on study from (Xiong, 2024), A high or low Body Mass Index (BMI) is one of the factors that can increase the risk of airway compromise because it can affect the physiological shape of the neck and the metabolism of anesthetic drugs.

Tabel 5 Respondents Characteristics based on Surgery Duration

Surgery Duration	Group				Sig.
	Airway Pillow		IV fluid bag		
	f	%	f	%	
1 Hour	16	45,7	15	42,9	0,094
2 Hour	14	40,0	12	34,3	
3 Hour	5	14,3	8	22,9	
Σ	35	100	35	100	

Table 5 presents the distribution of respondents according to operation duration. In the airway pillow group, the majority of respondents underwent surgery lasting 1 hour, accounting for 16 respondents (45.7%), followed by 2-hour procedures in 14 respondents (40.0%) and 3-hour procedures in 5 respondents (14.3%).

Similarly, in the IV fluid bag group, most respondents underwent surgery lasting 1 hour, comprising 15 respondents (42.9%). Procedures lasting 2 hours accounted for 12 respondents (34.3%), while 8 respondents (22.9%) underwent surgery lasting 3 hours.

Spearman's correlation test showed that surgery duration did not have a significant correlation (0,094) with the study.

Based on study about duration of surgery is one of the factors that can increase the risk of postoperative airway compromise following general anesthesia, as a longer surgery duration is directly proportional to the amount of anesthetic drugs used. As the amount of anesthetic drugs used increases, so does the time required for their elimination (Bang, 2023).

Tabel 6 The Effect of an Airway Pillow on Airway Patency in Patients After General Anesthesia

Group	SpO ₂ Statistics Test			
	n	Mean	Z	P
Airway Pillow	Positive Rank	33	17,00	-5,060 ,000
	Negative Rank	0	,00	
	Ties	2		
IV Fluid Bag	Positive Rank	21	11,00	-4,196 ,000
	Negative Rank	0	,00	
	Ties	14		

Table 6 presents the results of the Wilcoxon Signed-Rank Test comparing pre- and post-intervention oxygen saturation (SpO₂) within each group.

In the airway pillow group, 33 respondents demonstrated an increase in SpO₂ following the intervention (positive ranks), while no respondents experienced a decrease (negative ranks). Two respondents showed no change in oxygen saturation (ties). The Wilcoxon Signed-

Rank Test revealed a statistically significant improvement in SpO₂ after the intervention ($Z = -5.060, p < 0.001$).

Similarly, in the IV fluid bag group, 21 respondents experienced an increase in SpO₂, no respondents showed a decrease, and 14 respondents had unchanged oxygen saturation values. Statistical analysis also demonstrated a significant improvement in SpO₂ following the intervention ($Z = -4.196, p < 0.001$).

Although both interventions significantly improved airway patency, the airway pillow group exhibited a greater number of positive ranks (33 vs. 21) and substantially fewer ties (2 vs. 14), indicating that improvement in oxygen saturation occurred more consistently among patients receiving the airway pillow.

Tabel 7 The effectiveness of the airway pillow in maintaining airway patency

Group	ΔSpO Statistics Test			
	n	Mean	Z	P
Airway Pillow	35	44,73	-3,923	,000
IV Fluid Bag	35	26,27		

Table 7 presents the comparison of changes in oxygen saturation (ΔSpO₂) between the airway pillow and IV fluid bag groups using the Mann-Whitney U Test.

The airway pillow group achieved a higher mean rank (44.73) compared with the IV fluid bag group (26.27). The Mann-Whitney U Test demonstrated a statistically significant difference in ΔSpO₂ between the two groups ($Z = -3.923, p < 0.001$).

These findings indicate that patients receiving the airway pillow experienced significantly greater improvements in oxygen saturation than those receiving the conventional IV fluid bag positioning. Therefore, the airway pillow was more effective in maintaining airway patency during the early postoperative recovery period.

DISCUSSION

Gender

The results of this study showed that women constituted the majority in the airway pillow group, while men constituted the majority in the IV fluid bag group. Correlation tests indicated that gender did not significantly affect airway patency.

These findings are inconsistent with the theory proposed by (Chung, 2021), which states that there are physiological differences

between men and women. Men generally have larger lung capacity, larger airway diameter, and higher respiratory muscle mass; theoretically, these factors result in better ventilation in men, whereas women have smaller lung volume and are more sensitive to certain anesthetic depressants.

This inconsistent is likely due to several factors, including head extension caused by the use of an airway pillow and an IV fluid bag. This action helps relieve airway obstruction caused by the tongue blocking the upper airway. This is consistent with studies by (Nurdiana, 2023) and (Avva., 2025).

Age

The results of the analysis of the age characteristics of the sample showed that early-stage older adults were present in both groups. Based on the analysis of the correlation between age and airway patency, it was found that age was not significantly associated with airway patency.

. The results of this study do not align with the theory that age is a key factor influencing the effectiveness of airway patency in patients following general anesthesia, particularly in elderly patients. This theory, based on a study by Xiong (2024), states that the physical condition of elderly patients has undergone an aging process that can impair bodily function and endurance. This condition can trigger damage to cells and body tissues and increases the risk of decreased hemoglobin levels, which can affect oxygen levels in the body.

Additionally, a study conducted by (Andualem, 2022) states that individuals aged 45 and older experience a decrease in lung elasticity and an increase in the rate of alveolar collapse, leading to postoperative hypoxia. Although age can physiologically affect respiratory function following general anesthesia, this effect is mitigated by other factors such as the use of an airway pillow and the administration of supplemental oxygen in the PACU, as indicated by research conducted by (Nurdiana, 2023) and (Avva, 2025).

ASA Classification

The majority of respondents in both groups were classified as ASA II based on their ASA physical status. The results of the correlation test indicated that ASA physical status was not significantly associated with airway patency in this study.

This finding is inconsistent with the theory

that ASA physical status indicates the degree of a patient's physical condition based on the standards of the American Society of Anesthesiologists, where ASA physical status reflects the severity of a patient's condition, ranging from ASA I (healthy patients without systemic disease) to ASA VI (brain-dead patients). Patients with an ASA physical status of II have mild systemic diseases that interfere with the absorption and elimination of anesthetic agents. This can impair the absorption of anesthetic drugs and inhaled anesthetics and slow the elimination of anesthetics from the body, thereby disrupting the respiratory, renal, and other body systems (American Society of Anesthesiologists, 2025).

In the context of airway patency, this affects the time the body requires to eliminate anesthetic drugs and neuromuscular blocking agents used during anesthesia, potentially causing the patient's upper airway to become obstructed by the tongue. This aligns with the statement by (Xiong, 2024).

The influence of ASA physical status becomes less significant because there are other, stronger factors affecting SpO₂, such as: residual effects of anesthesia, the use of an airway pillow, and the administration of supplemental oxygen (Vijayakumar, 2022).

BMI

The results of the data analysis based on respondents' BMI characteristics showed that the majority had a normal body weight. The results of the correlation test indicated that there was no significant association with airway patency.

These findings do not align with the theory that high and low Body Mass Index (BMI) are factors that can increase the risk of airway obstruction because they can affect the physiological shape of the neck and the metabolic mechanisms of anesthetic drugs (Xiong, 2024) and (Bang, 2023).

Furthermore, the effect of BMI on airway patency during the post-general anesthesia phase is not dominant because there are other, stronger factors, such as the use of an airway pillow and the administration of supplemental oxygen (Vijayakumar, 2022).

Surgery Duration

The results of the data analysis based on the characteristics of the respondents regarding surgery duration showed that the majority in both groups were respondents who had

undergone surgery lasting 1 hour.

The results of the correlation test indicated that there was no significant association with airway patency. This finding contradicts the theory that surgery duration is a factor that can increase the risk of postoperative airway obstruction following general anesthesia, as longer surgery duration is directly proportional to greater use of anesthetic agents. As the amount of anesthetic used increases, the time required for its elimination also increases (Bang, 2023) and (American Society of Anesthesiologists, 2025).

Other factors that have a more dominant influence on airway patency in the PACU than IMT include the use of an airway pillow for head extension and the administration of supplemental oxygen (Nurdiana, 2023) and (Avva, 2025).

Effect of Airway Pillow and IV Fluid Bag on Airway Patency

Based on the analysis of positive ranks, negative ranks, and ties, it is clear that the airway pillow group had better results than the IV bag group. This suggests that both interventions can affect oxygen saturation. The effects of the interventions in the airway pillow group and the IV bag group indicate that both have a significant effect on airway patency ($p < 0.05$). However, the Z-score in the airway pillow group indicates that the airway pillow provided to patients after general anesthesia had a greater positive effect than the infusion flabot. This finding is consistent with the study by Vijayakumar (2022), which noted that the use of an airway pillow helps patients extend their heads to open the upper airway and relieve obstruction.

Another factor influencing the increase in oxygen saturation, aside from the use of an airway pillow and an IV fluid bag, is gender: men generally have greater lung capacity, larger airway diameters, and higher minute ventilation than women. In women, the hormone progesterone can increase respiratory drive, while estrogen increases vascular sensitivity and ventilation (Bang, 2023). Furthermore, in elderly patients, the initial response to supplemental oxygen is quite good, and the increase in oxygen levels is rapidly compensated for in the blood (Bang, 2023) and (Andualem, 2022). Furthermore, regarding ASA physical status, patients with ASA I and ASA II physical status have adequate lung and heart function, so their oxygen reserve remains

good (Bang, 2023). Next, regarding BMI: patients with normal weight to mild obesity have lung volumes still within physiological limits, good lung compliance, and no significant decrease in functional residual capacity (Bang, 2023) and (Andualem, 2022). Regarding the duration of surgery, in procedures lasting 1 hour, short-acting intravenous anesthetic agents are used, so the effects of the medication are brief and do not persist; the use of inhaled anesthetics is minimal, keeping oxygen saturation stable (Bang, 2023) and (Xiong, 2024).

Other findings supporting this conclusion include studies by (Vijayakumar, 2022) and (Hasanin, 2020), which show that interventions using pillows can improve head and neck positioning, thereby aligning the airway. This position helps open the upper airway, reduces the risk of obstruction, and increases airflow to the lungs. Consequently, gas exchange becomes more optimal, as indicated by higher SpO₂ levels.

The effectiveness of the airway pillow in maintaining airway patency

The data used to analyze the effectiveness of the airway pillow in maintaining airway patency were the changes in oxygen saturation (Δ SpO₂) between the airway pillow group and the IV fluid bag group. The results of the Mann-Whitney U test showed that there was a statistically significant difference between the two groups. Both groups exhibited a significant difference in oxygen saturation (Δ SpO₂) ($P < 0.05$). Looking further at the mean rank values, the airway pillow group had higher results than the infusion flabot group, with the airway pillow group showing a greater increase in SpO₂.

These findings indicate that the use of an airway pillow is more effective in managing airway patency compared to the IV fluid bag group; these results are consistent with studies conducted by (Vijayakumar, 2022) and (Hasanin, 2020). The greater improvement observed in the airway pillow group suggests that this intervention can aid in the recovery process of patients following general anesthesia in the PACU.

Physiologically, both the airway pillow and the IV fluid bag can maintain the head in an extended position. However, the airway pillow consistently maintains this position even when patients experience agitation during the recovery process following general anesthesia

in the PACU. This theory is consistent with the study by (Liu, 2021). Head extension allows for alignment between the oral cavity, pharynx, and larynx, thereby reducing the likelihood of airway obstruction. Maintaining this position results in more optimal airway patency, more effective alveolar ventilation, and increased oxygen exchange. This can be seen from the increase in the ΔSpO_2 value. These findings are consistent with research conducted by (Avva, 2025).

CONCLUSION

Based on the results of the study entitled "The Effect of Airway Pillow Use on Airway Patency in Post-General Anesthesia Patients at Dr. Soeradji Tirtonegoro General Hospital Klaten" shows that 1. Based on the data obtained, the majority of respondents in both the airway pillow group and the IV flabot group were in the early elderly age range (46–55 years); the airway pillow group consisted of males and the IV flabot group consisted of females; all had an ASA II physical status, a normal body mass index, and a surgery duration of 1 hour.

In both groups, there was a significant effect on airway patency. However, there was a major difference in the effect: the airway pillow group had a stronger effect on airway patency than the IV flabot group.

The use of an airway pillow was more effective in maintaining airway patency during IV therapy in patients recovering from general anesthesia than the use of an IV flabot at Dr. Soeradji Tirtonegoro General Hospital in Klaten.

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