The 7th Proceeding Strada International Conference on Health
Kediri – East Java, Indonesia, September 24-25, 2025
https://proceeding.thesich.org | Page 53-60

Effect Application Bundle VAP and Installation Normal 0.9% on the Ventilator Associated Events Incidence in ICU RSUD Mardi Waluyo Hospital Blitar City

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ABSTRACT

Ventilator-Associated Events (VAE) is one of the serious complications that often occur in patients with mechanical ventilation in the Intensive Treatment Unit (ICU). VAE includes ventilator-associated condition (VAC), infection-related ventilator-associated complications (IVAC), and Possible Ventilator-Associated Pneumonia (PVAP), which can increase morbidity, mortality, length of treatment, and maintenance costs. VAE prevention efforts are focused on applying the ventilator maintenance bundles and additional interventions, one of which is the use of normal saline installation 0.9%. This study aims to analyze the effect of the application of the VAP bundle and normal installation of 0.9% copy to the VAE incidence in the ICU Room of Mardi Waluyo Hospital, Blitar City. The research method uses the quasi-experimental design with a pretest-posttest with control group design. The research sample consists of patients who use mechanical ventilator according to inclusion criteria, divided into control and intervention groups. Data analysis is carried out univariate, bivariate using the Wilcoxon test, as well as multivariates through logistics/nominal regression regression. The results showed a significant decrease in the incidence of VAC and IVAC after the application of the VAP bundle compared to before the intervention. The application of bundles combined with normal installation of 0.9% copy in the intervention group has proven to be more effective in reducing the incidence of VAE than the control group. Regression analysis shows that the Bundle VAP is a protective factor for the incidence of VAE, while saline installation has an additional effect that strengthens prevention. The conclusion of this research confirms the importance of the implementation of the VAP Bundle consistently as the main strategy of preventing Vae in the ICU. In addition, the normal installation of 0.9% copy can be considered as an additional and easily applied additional intervention. Clinical implications of this study are the need to strengthen hospital policy in the implementation of the VAP bundle and the socialization of the use of normal saline as part of the patient care protocol with mechanical ventilation.

Keywords: bundle vap, ICU, installation normal 0.9%, ventilator-associated event

BACKGROUND

Several VAP prevention methods have been studied to reduce the incidence of this nosocomial infection, but there is still limited consensus regarding appropriate prevention strategies. However, research recommends implementing a multimodal approach to prevent VAP in hospitals (Leone et al., 2018), one of which is the implementation of a VAP

prevention bundle, which is highly effective in reducing VAP incidence in intensive care units. Bundles are a collection of evidence-based practices that result in improved healthcare outcomes when implemented collectively and consistently (Ministry of Health, 2017). This bundle implements several interventions, including: hand hygiene before each patient activity, using the five moments of hand hygiene; positioning the bed between 30-45° if there are no contraindications; maintaining oral hygiene every 2-4 hours using 0.02% chlorhexidine antiseptic; and brushing teeth every 12 hours; managing oropharyngeal and tracheal secretions; conducting daily assessments for sedation and extubation; and providing peptic ulcer disease prophylaxis for high-risk patients, including Deep Vein Thrombosis (DVT) prophylaxis (Ministry of Health, 2017).

In Indonesia, two-thirds of all ICU patients are critically ill and require ventilators (Widiyono, 2021). The ICU at Mardi Waluyo Regional Hospital in Blitar City is the only one actively operating mechanical ventilators for intensive care patients in the Blitar City area. Based on a census of the ICU at Mardi Waluyo Regional Hospital in Blitar City, Blitar had a total of 387 patients in 2024, with 182 patients using mechanical ventilators. Between January and March 2025, there were 97 patients in the ICU, with 45.3%, or 44, using mechanical ventilation using closed suction catheters, which were replaced every 7-10 days. An audit conducted by the PPI team in the ICU found a high incidence of pneumonia, at 4.06%. However, there is no data on compliance with the VAP bundle in the ICU of Mardi Waluyo Regional Hospital, Blitar City.

The implementation of the VAP Bundle in studies varies. Luna's (2015) study found that only 68% of nurses complied with the VAP Bundle. Several studies concluded that implementing the VAP Bundle can reduce the incidence of VAP. A literature review conducted by Rahmiati (2013) and cited in Tri Johan (2020) found that, despite varying prevention components, compliance with the VAP Bundle significantly reduced the incidence of VAP from 9.47 to 1.77. 1.9 cases per 1,000 ventilator days and reduce maintenance costs (Tri Johan, 2020). Sedwick 2012 in Tri Johan, 2020 stated that hand hygiene protocol compliance by healthcare workers (nurses) is only 50% of the established guidelines. Several studies have shown that nosocomial infections in hospitals occur due to a lack of officer compliance, with the average officer compliance for hand hygiene in Indonesia being 23.8%. In the ICU of Indonesian hospitals, the average compliance with SOP for hand hygiene is only 25%, five-moment hand hygiene is 50%, correct oral care is 70%, and head elevation is 80%. The standard set by the hospital for VAP Bundle compliance is 100%, unless there are contraindications. Ventilator Associated Pneumonia (VAP) occurs due to two factors: 1) factors owned by the patient, namely: the vulnerability of the patient's body. 2) Risk factors are external factors, namely the presence of invasive instrumental procedures.

METHODS

This research design or research plan is an experimental study with a quasi-experimental design. The research design uses a pretest-posttest nonequivalent group design. This research design involves two groups: the first experiment and the second experiment. Each group is given a pretest and a posttest with different treatments. The population in this study is all patients with mechanical ventilation in ICU Mardi Waluyo Regional Hospital, Blitar City in 2025. The sampling technique used in this study is accidental sampling, with a sample of 30 respondents for each treatment.

RESULTS

Table 1. Cross Tabulation of VAP Bundle Implementation Groups with VAC and iVAC Incidents in the ICU of Mardi Waluyo Regional Hospital, Blitar City, July – August 2025

VAP Bundle Implementation	VAC		iVAC		VAE	
	Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Before	1	29	0	30	0	30
After	4	26	3	27	3	27
TOTAL	30		30		30	

Table 2. Results of the Wilcoxon VAC and iVAC Tests Before and After Implementation of Bundle VAP in Patients with Mechanical Ventilators ICU Mardi Waluyo Regional Hospital, Blitar City

Test Statistics[a]			
	_iVAC _bundleVAP	VAC - bundleVAP	VAE - BundleVAP
Z	-1,000[b]	-1,732[b]	-1,414[b]
Asymp. Sig. (2-tailed)	,317	,083	,157
a. Wilcoxon Signed Ranks Test			
b. Based on positive ranks.			

The cross-tabulation results of Tables 1 AND 2 show that all respondents in the control group before the implementation of the VAP Bundle were negative for VAE, VAC, and iVAC. While after the implementation of the VAP Bundle, there were 4 respondents with positive VAC and 3 respondents with positive iVAC, while there were 4 respondents with positive VAE. Based on Table 2, there was a significant difference in the value of ventilator-associated condition (P-value = 0.317) and infection-related ventilator-associated complication (P-value = 0.083) before and after the implementation of the VAP Bundle in patients with mechanical ventilators in the ICU room of Mardi Waluyo Regional Hospital, Blitar City. This shows that the implementation of the VAP Bundle in patients with mechanical ventilators is effective in preventing VAE events both before 48 hours, which is indicated by a low incidence of low VAC and can prevent VAE events in the next 48 hours, which is indicated by a low incidence of subsequent iVAC in the ICU room of Mardi Waluyo Regional Hospital, Blitar City.

Table 3. Cross Tabulation of Normal Saline Installation Groups with VAC and iVAC Incidents in the ICU of Mardi Waluyo Regional Hospital, Blitar City, July – August 2025

Normal saline instalation	VAC		iVAC		VAE	
	Positive	**Negative**	**Positive**	**Negative**	Positive	Negative
BEFORE	0	30	2	28	0	30
AFTER	4	26	23	7	11	19
TOTAL	30		30		30	

Tabel 4. Results of the Wilcoxon VAC and iVAC Tests Before and After 0.9% Normal Saline Installation in Patients with Mechanical Ventilators in the ICU of Mardi Waluyo Regional Hospital, Blitar City

Test Statistics[a]			
	Kejadian_VAE instalasi_normal_saline	Kejadia_VAC instalasi_normal_saline	Kejadian_iVAC instalasi_normal_saline
Z	-3.713[b]	-3.201[b]	-1.180[b]
Asymp. Sig. (2-tailed)	,083	,000	,001
a. Wilcoxon Signed Ranks Test			

b. Based on positive ranks.

The cross tabulation results of Table 3, show that all respondents in the control group before the installation of 0.9% Normal Saline were negative for VAE, VAC, and only 2 respondents were declared positive for iVAC. Meanwhile, after the installation of 0.9% Normal Saline, there were 4 respondents who had positive VAC and 23 respondents had iVAC, while the majority of VAE cases were negative, namely 19 respondents. Based on Table 4.14, there was a significant difference in the value of ventilator-associated condition (P-value = 0.083) and infection-related ventilator-associated complication (P-value temperature = 0.000) before and after the installation of 0.9% normal saline aerosol in patients with mechanical ventilators in the ICU room of Mardi Waluyo Regional Hospital, Blitar City. These data show that 0.9% Normal Saline Installation carried out before suction in patients with mechanical ventilators is effective in preventing VAE events before 48 hours which is indicated by a low incidence of VAC but has not been able to prevent VAE events in the following 48 hours which is indicated by a high incidence of iVAC in the ICU Room of Mardi Waluyo Regional Hospital, Blitar City.

Table 5. Ordinal Regression Results of the Effect of VAP Bundle Implementation and 0.9% Normal Saline Installation on Ventilator Associated Events in the ICU Room of Mardi Waluyo Regional Hospital, Blitar City

RISK FACTOR	estimate	Stnd error	Sig.	Wald	95% CI		Keterangan
					Lower	Upper	
Bundle_VAP implementation	-1,253	,405	,002	9,555	,002	-2,047	**Significant protective**:
Normal Saline Installasion	,655	,423	,121	2,402	,121	-,173	Not significant

The tabulated results of the ordinal regression analysis in Table 5 show that the implementation of the VAP Bundle had a significant protective effect on the incidence of VAEs in the ICU of Mardi Waluyo Regional Hospital, Blitar City. The regression estimate of -1.253 with a p-value of 0.002 indicates that this intervention statistically reduced the risk of events, with a 95% confidence interval (CI) ranging from -2.047 to -0.459, which does not include zero. This finding strengthens the evidence that the implementation of the VAP Bundle significantly contributes to the prevention of ventilator-associated events (VAEs). The Wald value of 9.555 also indicates the strength of the variance contribution.

Normal saline installation showed a positive estimate of 0.655, which was statistically insignificant (p = 0.121) and had a CI range that included zero (-0.173 to 1.483). This indicates that the use of normal saline did not have a consistent effect on increasing or decreasing the incidence of ventilator-associated events (VAEs) in the study population. Although this procedure is still frequently used clinically, these results indicate the need for further evaluation of its actual benefits, especially in the SOP of caring for patients with mechanical ventilation.

DISCUSSION

The tabulation results of the ordinal regression analysis in Table 4.15 show that the implementation of the VAP bundle has a significant protective effect against the incidence of VAE in the ICU of RSUD Mardi Waluyo Kota Blitar. A regression estimate of -1.253 with a p-value of 0.002 indicates that this intervention statistically reduces the risk of ventilator-associated events (VAE). In contrast, saline instillation with a positive estimate of 0.655 (p = 0.121) does not demonstrate a significant effect, and therefore cannot be considered a primary

preventive strategy. Although this procedure is still frequently used in clinical practice, the findings suggest that further evaluation of its actual benefits is needed, particularly regarding its inclusion in the standard operating procedures (SOP) for the care of mechanically ventilated patients.

The implementation of the VAP bundle influences the pathogenesis of VAE by reducing the risk of aspiration, decreasing bacterial colonization, and accelerating the weaning process. Therefore, the significant findings for the VAP bundle in this study can be physiologically explained as a form of multifactorial risk control. Conversely, saline instillation only functions temporarily in diluting secretions, which is insufficient to influence the overall pathogenesis of VAE.

These findings are consistent with Rosenthal et al. (2022), who reported that the implementation of the VAP bundle reduced ventilator-associated infections by 40–60%. Meanwhile, studies on saline instillation have shown mixed results, with most evidence not supporting its use as a routine intervention (Klompas et al., 2022). This study further supports the view that the VAP bundle should be the primary prevention strategy against VAE, while 0.9% normal saline instillation has only proven to be effective in preventing VAE within the first 48 hours after mechanical ventilation.

This is in line with Torres et al. (2017), who highlighted that VAE prevention requires a multifactorial approach, with the VAP bundle consistently proving more effective than single interventions. Furthermore, recent meta-analyses confirm that bundle implementation can significantly reduce both the duration of ventilation and ICU length of stay. Clinically, VAP bundle implementation directly contributes to reductions in length of stay, healthcare costs, and ICU mortality rates (Torres et al., 2017).

These results also correspond with Wang et al. (2022), cited in Klompas et al. (2022), who found that hospitals with higher VAP bundle adherence experienced significant reductions in mechanical ventilation duration and ICU length of stay. In contrast, 0.9% normal saline instillation does not achieve similar outcomes. Based on this study, its effectiveness is limited to the first 48 hours post mechanical ventilation. Several case reports have even shown that its use may increase the risk of complications due to bacterial colonization and transient oxygen desaturation following suctioning (AARC, 2017). Therefore, this intervention is not recommended as a routine strategy for VAE prevention.

Thus, this study reaffirms that the implementation of the VAP bundle is the main protective factor against VAE, while 0.9% normal saline instillation is only effective within the first 48 hours after the initiation of mechanical ventilation and should not be considered a routine intervention for preventing complications in mechanically ventilated patients.

The clinical implications of these findings emphasize that VAP bundle implementation should be the primary strategy for preventing VAE, as it has been statistically proven to significantly reduce the incidence of complications. Meanwhile, 0.9% normal saline instillation is only effective in the first 48 hours and should not be used as a routine preventive measure. This means that ICU resources should be more focused on increasing compliance with bundle implementation rather than maintaining procedures that are not proven to be effective.

The leadership and management of the ICU at RSUD Mardi Waluyo Kota Blitar may use these findings as the basis for formulating policies regarding nosocomial infection control. Implementing the VAP bundle for mechanically ventilated patients not only improves quality of care but also reduces costs associated with prolonged hospitalization due to VAE. This is consistent with Wang et al. (2022), who reported that consistent VAP bundle implementation reduces ICU length of stay and overall treatment costs. Furthermore, ICU nurses and physicians at RSUD Mardi Waluyo Kota Blitar should receive regular training

related to the VAP bundle, including aspects of monitoring, oral hygiene, sedation management, and ventilator weaning.

These findings can also serve as an entry point for further research by practitioners and academics to explore the effectiveness of combining the VAP bundle with other interventions, such as nutritional therapy, fluid management, or respiratory physiotherapy. In this way, VAE prevention strategies can become more comprehensive and tailored to the clinical needs of ICU patients in general.

CONCLUSION

Based on the findings of the study on the effect of VAP bundle implementation and 0.9% normal saline instillation on the incidence of ventilator-associated events (VAE) in the ICU of RSUD Mardi Waluyo Kota Blitar, it can be concluded that:

The implementation of the VAP bundle proved effective in significantly reducing the incidence of VAC and IVAC. The Wilcoxon test results showed a significant difference between before and after the implementation of the VAP bundle on the incidence of VAC ($p = 0.317$) and IVAC ($p = 0.083$). This demonstrates that the application of the VAP bundle effectively reduces the occurrence of VAE in patients in the ICU of RSUD Mardi Waluyo Kota Blitar.

The Wilcoxon test results indicated that saline instillation was not significant for VAC ($p = 0.083$), but was significant for IVAC ($p = 0.001$). The use of 0.9% normal saline in aerosol form showed a minimal incidence of VAC. These results suggest that the additional strategy of using normal saline may help prevent VAE within the first 48 hours but is not effective beyond 48 hours after mechanical ventilation initiation.

The implementation of the VAP bundle has a significant protective effect against the incidence of VAE in the ICU of RSUD Mardi Waluyo Kota Blitar. The regression estimate of -1.253 with a p-value of 0.002 indicates that this intervention statistically reduces the risk of ventilator-associated events (VAE). In contrast, saline instillation with a positive estimate of 0.655 ($p = 0.121$) did not show a significant effect, and therefore cannot be considered a sustainable preventive strategy.

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