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ORIGINAL RESEARCH AMBULATORY ANESTHESIA

The correlation of risk factors with mortality of geriatric patients in non-operating room anesthesia services

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ABSTRACT

Background & objective: One of the most frequently performed anesthesia services is Non-Operating Room Anesthesia (NORA). In geriatric patients, there are several risk factors which are directly or indirectly related to post-NORA mortality. We aimed to find out the relationship between pre-NORA risk factors and the mortality of geriatric patients receiving NORA services.

Methods: This observational analytical study used the convenient sampling method in seventy patients undergoing NORA. Data collected included pre-NORA risk factors; e.g., age, gender, Body Mass Index (BMI), quality of life, and cognitive function. Mortality within 30 days post-NORA was noted. The data was analyzed using an independent t-test and Spearman correlation with α= 5% and a confidence interval (CI) of 95%.

Results: We included 70 patients as the subject of the study, with a mortality rate of 8.6%. There was a significant difference between BMI (P = 0.034), quality of life (P = 0.001), and cognitive function (P = 0.004) in patients who died with those who remained alive. There were correlations between cognitive function (P = 0.001, R= 0.379) and quality of life (P = 0.009, R= 0.309) with 30 days post-NORA mortality.

Conclusion: There is a positive correlation between the risk factors of cognitive function and quality of life pre-NORA of geriatric patients with 30-day mortality post-NORA. Careful selection and maximum optimization of the geriatric patients selected for non-operating room anesthesia may reduce post-operative mortality.

Abbreviations: MMSE - Mini-Mental State Examination; NORA - Non-Operating Room Anesthesia; ROC - Receiver Operating Characteristic curve; WHOQOL -World Health Organization Quality of Life criteria;

Keywords: Cognitive function, Geriatrics, Mortality, Non-operating room anesthesia, Quality of life,

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1. INTRODUCTION

In the coming days, the growing elderly population will bring about a mix of positive and negative impact on the healthcare systems. As most of the geriatric patients face multiple health issues, the repercussions would be negative, leading to increased burden on the medical care facilities, reduced incomes, a lack of social support, and an inhospitable environment.[1] On a global scale, there is a discernible trend indicating a persistent rise in the aging demographics. World Health Organization (WHO)

has predicted that by 2050, the massive increase of population aged 60 years will double or triple the current numbers.[2] During the period from 2004 to 2015, life expectancy in Indonesia exhibited an upward trajectory, advancing from 68.6 years to 70.8 years. Projections for the period spanning 2030 to 2035 anticipate a further increase, reaching 72.2 years.[3]

Contemporary advancements in anesthesia and surgical interventions across numerous nations have resulted in an expanded array of medical treatment alternatives for elderly patients.[4] However, the advancement of these additional options presents some challenges for both patients and the healthcare providers. Aging, as an inexorable and cumulative process, encompasses a spectrum of biological, anatomical, physiological, and functional changes manifesting over time.[5] It represents an irreversible phenomenon marked by degenerative alterations in organ and tissue structure and function.[6] Consequently, these multifaceted factors underline the increasing dependence of geriatric patients on enhanced healthcare services, particularly in the realms of surgeries and secure anesthesia.[7]

Non-Operating Room Anesthesia (NORA) refers to a sedative and anesthetic procedure conducted by an anesthesiologist outside the conventional operating room setting.[8] The principal challenges inherent in NORA encompass considerations related to the patient, the nature of the procedure, and the environmental factors.[9] An anesthesiologist undertaking NORA must possess a comprehensive understanding of the specific procedure, including its intricacies, patient positioning, spatial requirements, and duration. This knowledge is imperative for ensuring the safety and efficacy of anesthesia administration in non-traditional medical settings.

Several independent risk factors are associated with NORA.[9] Aging significantly influences pharmacological responses, necessitating careful consideration of dose reduction and titration.[10] Extant research suggests that factors such as age, gender, comorbidities, hospital history, daily activity levels, and diminished cognitive function contribute to increased mortality risks among geriatric populations.[11] These variables amplify the morbidity and mortality associated with perioperative care, both within and beyond the operating room. There have been very limited studies regarding the incidence of mortality related to geriatric risk factors in NORA services.

Consequently, the primary objective of this study was to explore the correlation between risk factors and mortality among geriatric patients in our country.

2. METHODOLOGY

This research was approved by the ethics committee of Dr. Saiful Anwar Malang General Hospital (No. 400/025/K.3/302/2021). The study population was all geriatric patients, who underwent NORA during study period. In this study, NORA was performed related to diagnostic procedures. The inclusion criteria were patients aged 60 y or above, undergoing anesthesia for diagnostic purposes outside the operating room and agreeing to participate in this study. The exclusion criterion was the patients who could not be followed up 30 days after NORA.

The variables evaluated in this study were age, gender, quality of life (QOL), cognitive function before NORA and 30 days mortality after NORA. Cognitive functions were calculated using Mini-Mental State Examination (MMSE) scores. Cognitive functions recorded included aspects of orientation in time and place, attention, recall, language, repetition, and the ability to follow complex instructions.

Categories of cognitive impairment using the MMSE score:

27-30 = normal cognitive function
21-26 = mild cognitive impairment
11-20 = moderate cognitive impairment
0-10 = severe cognitive impairment

The QOL was calculated using the World Health Organization Quality of Life (WHOQOL) criteria by measuring 4 aspects: physical, psychological, social, and environmental.

The data is displayed as mean, standard deviation, maximum and minimum values. ROC analysis was performed to find out the cutoff point of WHOQOL. Pre-post MMSE and QOL scores were analyzed using paired t-tests. The correlation between the pre-NORA factors and 30-day mortality post-NORA was analyzed using Spearman's correlation test to determine the relationship between geriatric factors and mortality. Statistical analysis was done using SPSS (IBM Statistic, USA) with $\alpha = 5\%$ and confidence interval 95%.

3. RESULTS

This study was conducted on 70 geriatric patients who underwent NORA. The characteristics of the subjects of the study can be seen in Table 1. In terms of age distribution, the majority of patients undergoing NORA services in Indonesia fell within the age range of 60-69 years, comprising 72.9% of the sample. Patients aged 70-79 y constituted 21.4%, and those aged 80 y and above comprised 5.7% of the total sample, with four individuals in this age bracket. In the context of gender

Table 1: Demographic characteristic of the sample (N=70)

Demographic characteristic	N (%) or Mean ± SD
Age	67.17 ± 7.17
○ 60-69 y	51(72.9)
○ 70-79 y	15 (21.4)
○ ≥ 80 y	4 (5.7)
Gender	
○ Female	29 (41.4)
○ Male	41 (58.6)
Weight (kg)	57.91 ± 10.74
Height (cm)	160.53 ± 6.63
Body mass index (kg/m^2)	22.73 ± 4.57
30-days mortality	
○ Died	6 (8.6)
○ Survived	64 (91.4)

distribution among the 70 sampled individuals receiving NORA services, 58.6% were male, while 41.4% were

female. The mortality data obtained from the 30-day observation period for the 70 geriatric patients subjected to NORA treatment in Indonesia revealed that 8.6% of these patients succumbed to mortality, whereas the remaining 91.4% survived the specified timeframe.

The cognitive function, as assessed by the Mini-Mental State Examination (MMSE), demonstrated an average pre-NORA score of 24.51, ranging from 11 to 30.

Following NORA intervention, the post-action MMSE data exhibited an average score of 22.96, with scores ranging from 0 (for deceased patients) to 30. In terms of

the WHOQOL scores, the pre-NORA assessments yielded an average of 57.86, ranging from 26 to 88. Subsequent to NORA procedures, the post-NORA WHOQOL scores averaged 54.50, with a range extending from 0 (for deceased patients) to 88. Regarding the temporal aspect of patient outcomes, the data on the number of days until patient mortality revealed that, of the six patients who die, the average duration until death was 13.17 days post-NORA, with the range spanning from day 8 to day 20.

In the context of cognitive function, there is a significant difference in MMSE cognitive function pre- and post-NORA (P = 0.000). Categorized by Mini-Mental State Examination (MMSE), the pre-NORA analysis revealed that 18.6% of patients exhibited moderate cognitive impairment, 30.0% displayed mild cognitive impairments, and the remaining 51.4% demonstrated normal cognitive function. Subsequent to NORA, the MMSE categorization indicated that 1.4% of patients experienced severe cognitive impairment, 12.9% displayed moderate cognitive impairment, 31.4% exhibited mild cognitive impairment, and 45.7% maintained normal cognitive function. Additionally, 8.6% of patients were recorded with an MMSE score of zero, indicating mortality (Table 2).

The evaluation of the QOL in geriatric patients undergoing NORA is determined through the utilization of the WHOQOL score. The establishment of the WHOQOL score's cut-off point involves the application

Table 2: Comparison of cognitive function pre and post NORA baes on MMSE score (N=70)

MMSE Cognitive function	pre-NORA	post-NORA	P-value
Score 0 (deceased)	0 (0.0)	6 (8.6)	
Severe cognitional impairment	0 (0.0)	1 (1.4)	
Moderate cognitional impairment	13 (18.6)	9 (12.9)	0.000
Mild cognitive impairment	21 (30.0)	22 (31.4)	
Normal cognitive function	36 (51.4)	32 (45.7)	
Data presented as n (%); P < 0.05 considered as significant			

Table 3: Comparative Quality of life before and after NORA

Quality of life	pre-NORA	post-NORA	P-value
Skor 0 (Die)	0 (0.0)	6 (8.6)	0.001
Less (< 50.5)	25 (35.7)	20 (28.6)	
Good (> 50.5)	45 (64.3)	44 (62.9)	
Data presented as n (%); P < 0.05 considered as significant			

Table 3: Comparative Quality of life before and after NORA

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Good (> 50.5)	45 (64.3)	44 (62.9)	

Data presented as n (%); P < 0.05 considered as significant

Table 4: Comparison of pre-NORA factor between survive and un-survive

Parameter	Not survived (n = 6)	Survived (n = 64)	P-value
Age (y)	69.33 ± 6.83	66.97 ± 6.86	0.422 t
Weight (kg)	53.83 ± 6.18	58.30 ± 11.03	0.334 t
Height (cm)	164.33 ± 4.80	160.17 ± 6.70	0.143 t
BMI (kg/m^2)	19.67 ± 2.42	23.02 ± 4.63	0.034 M*
Pre-NORA MMSE	14.50 ± 6.25	25.45 ± 4.66	0.001M*
Pre-NORA WHOQOL	39.73 ± 12.65	59.55 ± 15.77	0.004t*

*Data presented as mean ± SD; t = tested using independent t-test; M = tested using Mann whitney; *indicate a significant result*

of the Receiver Operating Characteristic (ROC) curve. The identified cut-off value for WHOQOL is 50.5, indicative of great diagnostic accuracy (AUC > 0.8).

There was a significant difference in the WHOQOL score pre- and post-NORA (P = 0.001). Based on the cut-off point from the analysis of ROC (Table 3), there are 35.7% of patients have a low quality of living (with WHOQOL score < 50.5), and 64.3% of other patients have a well-developed life quality (who have WHOQOL score > 50.5). There are 28.6% of patients with a low QOL (with WHOQOL scores < 50.5) post-NORA, and the other 62.9% have a good QOL and with WHOQOL scores > 50.5%.

Analysis of risk factors for mortality in geriatric patients undergoing NORA showed varied results. There was no statistical difference between the age, weight, and height of NORA patients who survived and did not survive (P > 0.05). MMSE scores showed a significant difference between the average MMSE score before NORA in survivors and non-survivors (P = 0.001). The above Table shows that the average patient who died had a pre-NORA score of 14.50, which tends to be lower than the non-NORA pre-MMSE scoring of 25.45. The comparison of WHOQOL pre-NORA scores also shows significant differences between the pre-NORA average WHOQOL score of patients who survived and did not survive (P = 0.004). So, statistically, there's a significant difference between both groups (Table 4).

After a significant difference was found, a correlation test was conducted to assess the relationship between risk factors and mortality of patients undergoing NORA. Based on the tests in Table 5 the correlation of MMSE pre-NORA scores with patient mortality showed a correlation coefficient value of 0.379 with a significance value (P = 0.001), so that it could be concluded that there is a meaningful relationship (correlation) between MMSE score before NORA and the patient mortality. There was also a positive correlation of WHOQOL with mortality (P = 0.009) with r = 0.309 (Table 5).

Table 5: Correlation between pre-NORA factor with 30-days mortality post-NORA

Parameter	Correlation coefficient (R)	P-value
Age	-0.137	0.260
Gender	-0.050	0.679
Pre-NORA MMSE score	0.379	0.001*
Pre-NORA WHOQOL score	0.309	0.009*

P < 0.05 considered as significant

4. DISCUSSION

NORA is a sedative procedure performed by an anesthesiologist

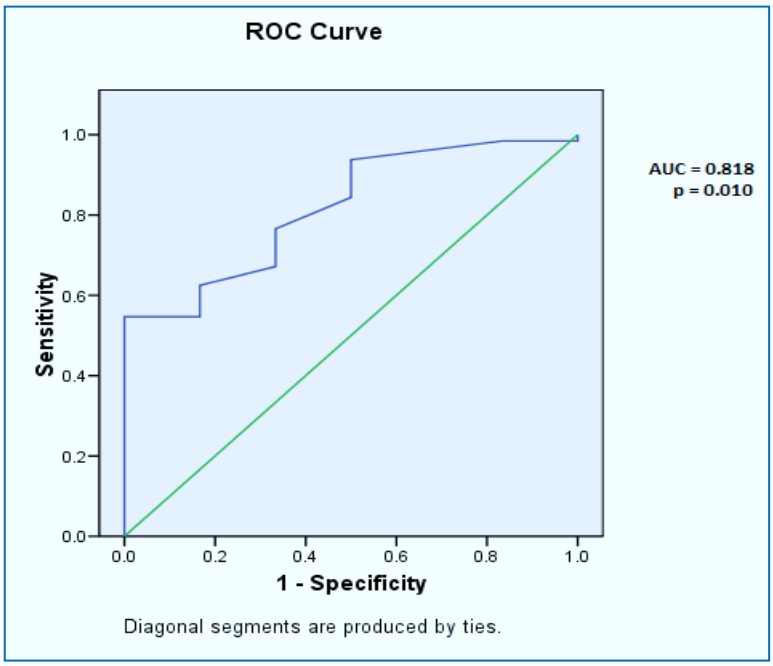

Figure 1: ROC curve of WHOQOL

outside the operating room.[8] NORA in geriatric patients has several advantages because it is minimally invasive and has faster recovery.[12] However, the anesthetic action performed on geriatric patients is of great concern because of the presence of physiological and anatomical changes with age, that have clinical implications, thereby increasing the risk of morbidity and mortality. Age, BMI, gender, cognitive function and QOL are among the risk factors for mortality in geriatric patients.[11] This study aimed to find out the relationship between risk factors and the mortality of geriatric patients subjected to NORA.

Of the 70 patients, 8.6% died, with an average death after the 13th post-op day, and 92.4% survived. According to previous research, Kim (2020) stated that NORA in geriatric patients tends to be safer due to more tolerable and faster recovery as well as minimal invasive measures.[12] From the results of the study, there was no significant difference in age, weight and height between the survivors and non- survivors patients 30 days post-NORA. We found significant differences in BMI, pre-MMSE score, and pre-WHOQOL score between survivors and not survive patients on 30 days post-NORA.

In this study, no significant relationship was found between gender and patient mortality. It is consistent with research by Crimmins et al (2019) which states that the rate of mortality by gender depends on the epidemiological social and customary behavior of each region.[13] Therefore, gender is not a definite factor to determine the mortality. Although there were no significant differences in this study the mortality rate in men (66.7%) was higher than in women (33.3%). Some causes of higher mortality in men were due to factors, including women being more sensitive to healthcare, women having protective hormones during childbearing and women habitat more likely to be at home, thus minimizing the risk of workspace, traffic accidents, murder, and stress caused by socio-economic changes.[14]

Based on cognitive function, the average pre-NORA MMSE of patients who died were lower than survivors. The lower MMSE score resemble the low cognitive function. According to research by Kvitting et al.[15] and Woodford et al.,[16] MMSE scores will decrease following aging. Interestingly, in this study we also found a significant correlation between MMSE score and mortality (P = 0.001). Research by Gillum et al. found that low cognitive function was linked to increased mortality in geriatric patients. [17] In other words, the low MMSE score (where cognitive dysfunction will become more severe), has higher risk of mortality. It is also mentioned that the risk of mortality is increased in patients with severe cognitive impairment.[18] In this study, five patients with moderate cognitive impairment died and one patient died with normal cognitive function. This study has raised a concern about high mortality in patients with moderate cognitive function. The other factor may influence the outcome of patients. In this study, NORA was done for diagnostic purpose. Therefore, the underlying disease and comorbidity might influence the mortality of the patients.[19]

From the ROC curve analysis, the cut-off point of WHOQOL is 50.5. Study by Li et al. (2022) used the same method to determine the patient's QOL based on physical health, physiology, social relationships and environment.[20] From the cut-off point we obtain the patients' average score of 57.86 ± 16.43. The majority of patients (64.3%) had good QOL and 35.7% patients had a lower QOL. Of the 6 patients who died, the mean WHOQOL score was 39.73 ± 12.65 and in the survivors the mean WHOQOL was 59.55 ± 15.77.

The findings of our investigation align with established theoretical frameworks, indicating that a lower WHOQOL score, indicative of diminished life quality, is associated with higher mortality risk in patients.[21] In this study, there was a correlation between pre-NORA WHOQOL score and 30 days mortality post NORA, even though the correlation is classify as a low correlation.

5. LIMITATIONS

Our study did not delve into the analysis of underlying diseases and comorbidities. Subsequent research endeavors should include a meticulous examination of the interplay between these factors and mortality outcomes, thereby enriching our understanding of the complex dynamics at play in this context.

6. CONCLUSION

There is a correlation between cognitive function and the quality-of-life during pre-anesthesia period in geriatric patients with 30 days mortality after intervention. Both of these factors can be used in determining the most preferable line of action in anesthetic services particularly in non-operating room anesthesia.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Acknowledgement

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9. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

10. Authors' contribution

All authors took part in the concept, the conduct of the study, literature search and preparartion of the manuscript.

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