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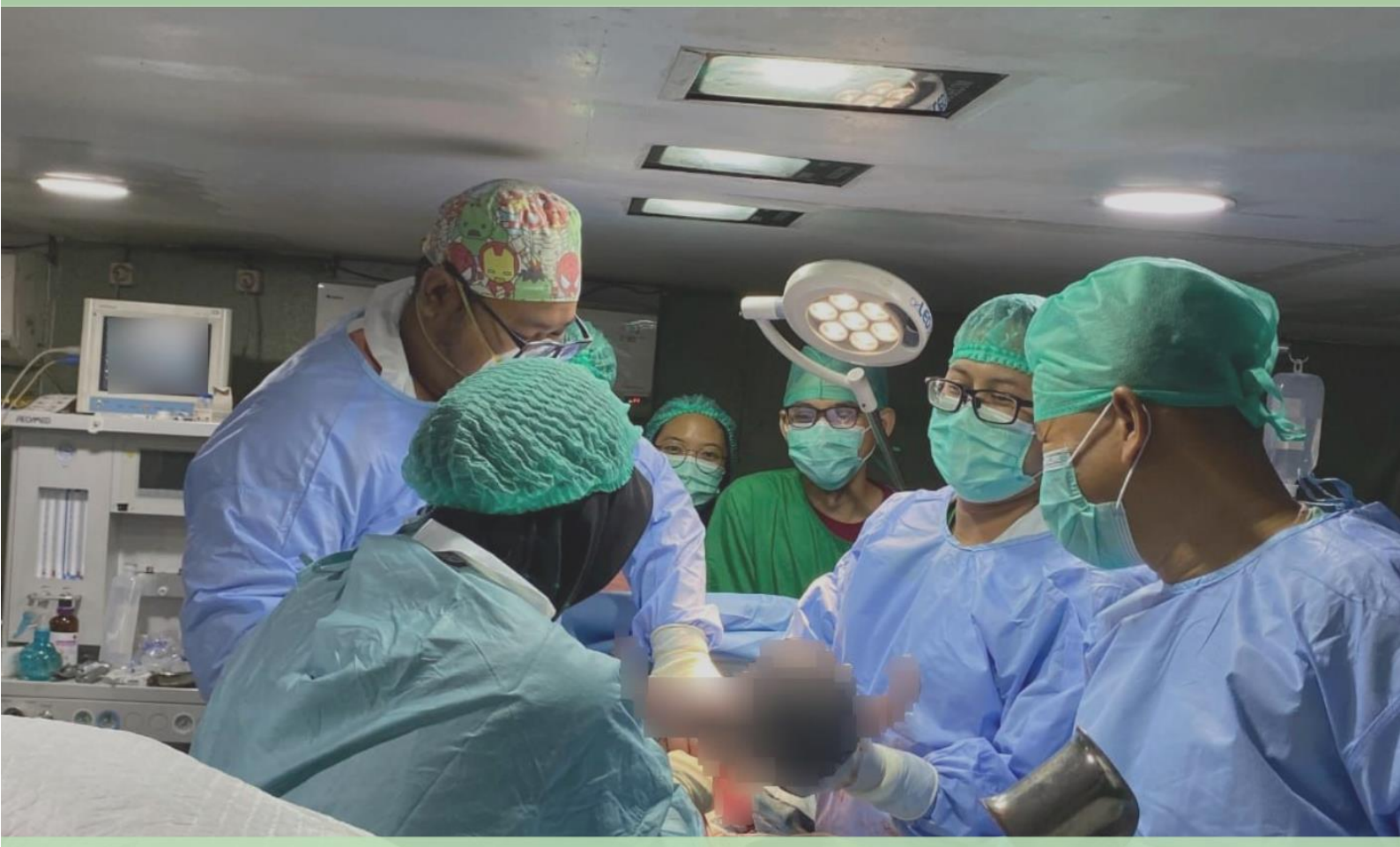

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Office Address
Gedung Anestesi, 2nd Floor, Dr Soetomo General Academic Hospital
Jalan Prof. Dr. Moestopo 6-8 Surabaya
Contact Person: Prihatma Kriswidyatomo (Editor in Chief) – 085646562069
Ghea Kusgandari (Editor Assistant) - 0895340125104

Email
ijar@fk.unair.ac.id | ijar.unair@gmail.com

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Original Article

SEVERE PREECLAMPTIC PATIENTS IN THE RESUSCITATION ROOM OF DR. SOETOMO GENERAL ACADEMIC HOSPITAL SURABAYA: A RETROSPECTIVE STUDY

Neissya Nastiti Firmanto[1a], Maulydia[2], Pungky Mulawardhana[3], Mariza Fitriati[2]

[1] Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

[2] Department of Anesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

[3] Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

[a] Corresponding author: neissya.nastiti.firmanto-2021@fk.unair.ac.id

ABSTRACT

Introduction: Preeclampsia is the leading cause of maternal and fetal death and is an urgent issue in maternal health, especially in developing countries such as Indonesia. Patients with severe preeclampsia who were in critical conditions tend to be admitted to the resuscitation room for assistance from more skilled personnel and more sophisticated technology. **Objective**: This study aims to determine the complications, treatments, and outcomes of severe preeclampsia patients treated in the resuscitation room of Dr. Soetomo General Academic Hospital from January 1st, 2018 to December 31st, 2019. **Materials and Methods**: This was a retrospective, descriptive study that used medical records. Microsoft Excel was used to analyze the data. Eighty-one samples met the inclusion criteria. **Results**: The majority of patients were aged 20-35 years (65.43%) and had completed senior high school (88.89%). Most patients had stage 2 obesity (44.44%) and multigravida (41.97%). A history of preeclampsia and hypertension was not found in the majority of patients. Most patients were diagnosed with late-onset preeclampsia (69.14%) and most were referred from secondary health facilities (96.30%). The most common complication was pulmonary edema (53.09%) and the majority of patients had 2 complications (43.17%), with the most common combination being eclampsia and HELPP syndrome (13.58%). The majority of the patients were intubated (70.37%) and this was done mostly in patients with eclampsia (56.14%). The termination of pregnancy by cesarean section was conducted for the majority of patients (72.84%). There were no cases of maternal death in this study. Most of the babies were born premature (70.11%), with a low birth weight (60%), and asphyxia, as assessed by the first minute APGAR score (72.97%) and fifth minute APGAR score (54.05%). **Conclusion**: The majority of preeclampsia patients with complications in the resuscitation room at Dr. Soetomo's General Academic Hospital Surabaya from January 1st, 2018 to December 31st, 2019 had good maternal outcomes but not fetal outcomes.

Keywords: Complications of Preeclampsia; Intubation; Maternal and Fetal Outcome; Maternal Health; Resuscitation; Severe Preeclampsia.

ABSTRAK

Pendahuluan: Preeklampsia merupakan penyebab terbesar terjadinya kematian ibu hamil dan janin. Hal ini menjadi urgensi pada kesehatan maternal terutama di negara berkembang seperti Indonesia. Pasien dengan preeklampsia berat yang mengalami perburukan kondisi kerap kali harus dirawat di ruang resusitasi untuk mendapatkan bantuan dari tenaga yang lebih ahli dan teknologi yang lebih canggih. **Tujuan**: Penelitian ini bertujuan untuk mengetahui profil dan *outcome* pasien preeklampsia berat beserta komplikasi yang dialami di ruang resusitasi RSUD Dr. Soetomo Surabaya Periode 1 Januari 2018 – 31 Desember 2019. **Metode dan Bahan**: Metode yang digunakan pada penelitian ini adalah deskriptif retrospektif dengan menggunakan rekam medik dan dilakukan analisis menggunakan microsoft excel. Delapan puluh satu pasien memenuhi kriteria inklusi. **Hasil**: Mayoritas pasien berusia 20-35 tahun (65.43%) dengan tingkat pendidikan tamat SMA (88.89%). Sebagian besar pasien mengalami obesitas tingkat 2 (44.44%) dan multigravida (41.97%). Mayoritas pasien tidak memiliki riwayat preeklampsia (96.30%) dan riwayat hipertensi (76.54%). Diagnosis pasien terbanyak adalah *late onset preeclampsia* (69.14%). Mayoritas pasien dirujuk dari fasilitas kesehatan sekunder (96.30%). Komplikasi yang paling banyak terjadi adalah edema paru (53.09%). Kombinasi komplikasi terbanyak berjumlah 2 komplikasi (43.17%) dengan kombinasi terbanyak adalah eklampsia dan sindrom HELLP (13.58%). Mayoritas pasien ditangani dengan melakukan intubasi (70.37%) dan paling sering terjadi pada pasien dengan eclampsia (56.14%). Terminasi kehamilan secara sectio caesarea dilakukan pada mayoritas ibu (72.84%). Tidak ditemukan kasus ibu meninggal pada penelitian ini. Janin yang dilahirkan sebagian besar mengalami prematuritas (70.11%), BBLR (60%), dan asfiksia yang dinilai dari skor APGAR

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menit pertama (72.97%) dan kelima (54.05%). **Kesimpulan**: Mayoritas pasien preeklampsia dengan komplikasi yang masuk dan mendapatkan terapi di ruang resusitasi RSUD Dr. Soetomo Surabaya periode 1 Januari 2018-31 Desember 2019 memiliki *outcome* yang baik pada ibu tetapi outcome yang kurang baik pada janin.

Kata Kunci: Komplikasi Preeklampsia; Resusitasi; Intubasi; *Outcome* Ibu dan Janin; Kesehatan Maternal; Preeklampsia Berat

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INTRODUCTION

Preeclampsia is a hypertensive disorder that can occur in pregnancy and is accompanied by proteinuria at 20 weeks of gestation or more (1). Preeclampsia is considered a burden on maternal health in the world, especially in Indonesia, a low-income country (2). Preeclampsia and eclampsia affect between 3% and 5% of all pregnancies and are responsible for more than 60,000 maternal deaths and 500,000 fetal deaths per year worldwide (3). According to data from the East Java Provincial Health Office, the most common cause of maternal death in East Java is preeclampsia (4). Severe preeclampsia, eclampsia, and HELLP syndrome are common causes of intensive care unit (ICU) admissions among obstetric patients because these conditions are life-threatening and have high maternal and fetal mortality rates (5).

The pathophysiology of preeclampsia is the presence of angiogenic factors that affect the maternal circulation due to placental dysfunction. This can cause endothelial damage that will lead to preeclampsia (6). Several risk factors can increase preeclampsia incidences such as primigravida, primipaternity, the mother being less than 20 years old or more than 35 years old, history of preeclampsia or eclampsia, history of hypertension, history of kidney disease, multiple pregnancies, obesity with BMI above 30, systemic lupus erythematosus, diabetes mellitus types 1 and 2, and obstructive sleep apnea (7)(1).

Preeclampsia can cause some serious maternal and fetal complications. According to research conducted at Dr. Soetomo General Academic Hospital Surabaya, the most common maternal complication found in preeclampsia patients is pulmonary edema. Pulmonary edema occurs due to major proteinuria and systemic inflammation in preeclampsia. This causes albumin levels to decrease and lead to unmaintained oncotic pressure. In addition, preeclampsia can cause eclampsia which is a tonic-clonic seizure that may induce hypoxia, trauma, and aspiration pneumonia. Other maternal complications that can occur are HELLP syndrome, renal impairment, peripartum cardiomyopathy, stroke, myocardial infarction, as well as visual and motor disturbances (7). In addition, fetal complications can also occur, namely prematurity, intrauterine growth restriction, and fetal death (8).

Severe preeclampsia is characterized by the occurrence of several complications. Such cases are advised to undergo delivery after maternal stabilization if the gestational age has reached 34 weeks or more. This is done to reduce the risk of maternal and fetal death (7)

Patients with severe preeclampsia have a dangerous condition that requires serious treatment to stabilize the maternal condition. If the patient's condition cannot be treated at a secondary health facility, the patient will be referred to a tertiary health facility that has better technology and professional personnel such as Dr. Soetomo General Academic Hospital Surabaya. Referral preeclampsia patients are usually brought to the resuscitation

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room for stabilization and are treated with mechanical ventilation or intubation. Therefore, this study was conducted to investigate the demographic characteristics, complications, treatments, and outcomes of the severe preeclampsia patients who were admitted to the resuscitation room of Dr. Soetomo General Academic Hospital Surabaya.

MATERIALS AND METHODS

This is a descriptive, retrospective study that was done by collecting medical records. The data consists of sociodemographic characteristics, complications, treatments, as well as maternal and fetal outcomes from preeclamptic patients who were admitted to the resuscitation room of Dr. Soetomo General Academic Hospital Surabaya from January 1st, 2018 to December 31st, 2019. Eighty-one samples met the inclusion criteria, namely patients with severe preeclampsia who were admitted to the resuscitation room of Dr. Soetomo General Academic Hospital Surabaya from January 1st, 2018 to December 31st, 2019, and had a complete medical record. The total sampling technique was used in this study.

The data were analyzed with Microsoft Excel and presented in a distribution frequency table which then turned into a descriptive form. This study is ethically approved by the committee of ethics from Dr. Soetomo General Academic Hospital Surabaya (0237/LOE/301.4.2/XII/2020).

RESULT AND DISCUSSION

The results of this study showed that as many as 81 samples met the inclusion criteria and 6 patients had multiple pregnancies, therefore the total number of babies born was 87 babies.

Table 1. Patient Characteristics

Characteristics	N (%)
Age (years)	
<20	7 (8.64)
20-35	53 (65.43)
>35	21 (25.93)
Education	
Primary School	6 (7.41)
Junior High School	0 (0.00)
Senior High School	72 (88.89)
Bachelor's Degree	3 (3.70)
Nutritional Status	
Underweight	0 (0.00)
Normal	8 (9.88)
Risk of Obese	10 (12.35)
Obese 1	27 (33.33)
Obese 2	36 (44.44)
Gravida	
Primigravida	37 (45.86)
Multigravida	34 (41.97)
Grand Multigravida	10 (12.35)
History of Preeclampsia	
Yes	3 (3.70)
No	78 (96.30)
History of Hypertension	
Yes	19 (23.46)
No	62 (76.54)
Diagnosis	
Early Onset Preeclampsia	25 (30.86)
Late-Onset Preeclampsia	56 (69.14)
Origin of Referral	
Primary Health Care	3 (3.70)
Secondary Health Care	78 (96.30)

The majority of patients were 20 to 35 years old (65.43%). This finding is similar to a study by Prof. Dr. Kandou Hospital in Manado that showed as many as 63% of patients with severe preeclampsia were aged 20 to 35 years old (6). Conversely, a study from Dr. Zaionel Abidin Hospital Aceh found that patients with ages <20 years and >35 years had 9.444 times higher risk of preeclampsia (9). According to theory, at the age of <20 years, the uterine size is still not normal and not ready to undergo the pregnancy process, while at the age of > 35 years, a degenerative process will occur which causes structural and functional changes in the peripheral blood vessels that play a role in regulating blood pressure (9). This difference suggests that age is not the only risk factor that can induce severe preeclampsia.

As many as 88.89% of patients had graduated from senior high school. However,

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only 3.70% of the patients had a bachelor's degree. According to a previous study, mothers with a lower education level had an 86% higher risk of developing preeclampsia (10). This is because education is one of the factors that influence the mother's knowledge to conduct pregnancy checks to minimize the possibility of pregnancy problems (11).

The majority of patients had level 2 obesity (BMI ≥ 30) at 44.44% of total patients and 33.33% of the sampled patients had level 1 obesity (BMI 25-29.9). This is in line with a previous study in Manado which stated that patients with severe preeclampsia were dominated by patients with a BMI≥30 (1). Obesity can be a risk factor for preeclampsia because it will stimulate inflammation, insulin resistance, dyslipidemia, and oxidative stress. All of these factors will induce the multiplication of ADMA as an endogenous inhibitor of nitric oxide synthase (NOS). Therefore, NOS will decrease, which results in oxidative stress, endothelial dysfunction, and the formation of superoxide anions which will cause preeclampsia (12).

This study showed that the majority of patients had multigravida which was seen in 44 patients (54.32%) including 10 patients (12.35%) with grand multigravida. However, these results contradict a previous study which stated that patients with primigravida had 5.5 times higher risk of developing preeclampsia. This may be due to the unfavorable immune response or the histoincompatibility of the placenta since the antibodies against placental antigens have not been fully formed (13). In addition, in the first pregnancy, the patient is more prone to experiencing stress in pregnancy which triggers an increase in cortisol levels and increase sympathetic activity (9).

A total of 78 patients (96.30%) had no previous history of preeclampsia and 3 patients (3.70%) had a history of preeclampsia. Patients with a history of preeclampsia have a 0.3 times higher risk of developing preeclampsia in their next pregnancy (14). The findings are in line with a previous study conducted at Dr. Soewandhi Hospital Surabaya which stated that there was a relationship between a history of preeclampsia and the incidence of preeclampsia with $p < 0.05$ (15).

Most of the patients (76.54%) had no history of hypertension. This is in line with a study done in Manado which stated that 95% of patients with severe preeclampsia had no history of hypertension (1). In this study, 19 patients (23.46%) had a history of hypertension. According to a previous study in Bantul, there is a relationship between a history of hypertension and the incidence of preeclampsia with a p-value of 0.00. This is because a history of hypertension can cause serious damage to the patient's organ and lead to superimposed preeclampsia or more severe disorders such as proteinuria and edema (16).

This study showed that 56 patients (69.14%) were diagnosed with late-onset preeclampsia or preeclampsia that occurred after 34 weeks of gestation. According to a study conducted in Kenya, eclampsia, low diastolic blood pressure, low hemoglobin, low platelets, and high creatinine levels are more often found in patients with late-onset preeclampsia and can cause more serious complications for the patients (17). A total of 25 patients (30.86%) had a diagnosis of early-onset preeclampsia. According to a previous study, patients with early-onset preeclampsia have worse maternal and fetal outcomes than patients with late-onset preeclampsia (18). In addition, more severe inflammation is seen in early-onset preeclampsia and is characterized by low levels of IL-10. This will cause impaired fetal growth in patients with early-onset preeclampsia (19).

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In this study, almost all patients (96.30%) were referrals from secondary health facilities in East Java. This means that the patients in this study have very serious complications that cannot be treated in secondary health facilities. After further review, most of the patients are from Surabaya (29.63%). This supports the results of previous studies which stated that preeclampsia/eclampsia was the biggest cause of maternal death in Surabaya (20). In addition, as many as 18 patients (22.22%) were referred from Madura. A study stated that patients of Madurese ethnicity had a higher severity of preeclampsia than Javanese and Chinese ethnic patients. This is because patients of the Madurese ethnicity have low levels of calcium which can induce preeclampsia (21).

Table 2. Patient Complications

Complications	N (%)
Pulmonary Edema	43 (53.09)
Eclampsia	41 (50.62)
HELLP Syndrome	20 (24.69)
Kidney Disorders	14 (17.28)
Fetal Distress	10 (12.35)
Liver Disorders	6 (7.41)
Oligohydramnion	6 (7.41)
Infections	5 (6.17)
Heart Failure	5 (6.17)
Cardiomyopathy Peripartum	4 (4.94)
Neurologic Deficit	2 (2.47)
Intrauterine Growth Restriction	1 (1.23)

*Each patient could experience more than one complication

The most common complication in this study was pulmonary edema which occurred in 43 patients (53.09%). This supports a previous study that stated that pulmonary edema was the most common complication in preeclampsia patients who were referred to tertiary health facilities (8). Pulmonary edema is characterized by the accumulation of fluid in the interstitial spaces of the lungs and alveoli, thereby inhibiting the diffusion of oxygen and carbon dioxide and causing shortness of breath. Therefore, it is necessary to monitor the patient in the intensive room for hemodynamic monitoring and mechanical ventilation (22). In addition, pulmonary edema can cause complications with HELLP syndrome which occurred in 9 patients (11.11%) According to previous studies, pulmonary edema can increase the incidence of HELLP syndrome where patients can fall into a more serious situation (23).

Eclampsia was the second most common complication occurred in 41 patients (50.62%). Previous research conducted in Sub-Saharan Africa and India stated that of 2,692 women who had eclampsia, 6.9% died and 15.9% of their babies died. These figures indicate the dangers of eclampsia (24).

In this study, HELLP syndrome occurred in 20 patients (24.69%). A study in Zimbabwe stated that the most common complication in preeclampsia patients was HELLP syndrome and all of these cases were treated in the Intensive Care Unit (25). HELLP syndrome is characterized by hemolysis, elevated liver enzymes, and low platelets. Other complications could occur by HELLP syndrome, including pulmonary edema, eclampsia, DIC, ARDS, intracerebral hemorrhage, hematoma, liver rupture, and maternal death (26). The distribution of other complications can be seen in Table 2.

This study also showed that the majority of patients (43.17%) had 2 complications. The number of preeclampsia complications ranges from 1 to 5 complications in each patient. The most common complication combination was eclampsia and HELLP syndrome which was seen in 11 patients (13.58%), followed by the combination of pulmonary edema and HELLP syndrome in 9 patients (11.11%).

Table 3. Patients with Intubation

Intubation	N (%)
Yes	57 (70.17)
No	34 (29.63)

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Management of intubation in the resuscitation room was administered to 57 patients (70.37%). Intubation is performed to secure the airway and prevent the risk of aspiration (27). Intubation was given to the 32 eclamptic patients (56.14%). This is because eclampsia patients tend to experience altered consciousness (28). Moreover, a total of 29 patients (50.88%) with pulmonary edema required intubation. This is necessary since pulmonary edema will cause respiratory failure as a result of ventilation/perfusion mismatch which could lead to a shunt. A shunt is a condition in which the blood in the left ventricle of the heart has not undergone gas exchange and will lead to hypoxemia (29). In addition, as many as 14 patients with HELLP syndrome require intubation. A study states that HELLP syndrome can cause acute respiratory distress syndrome and patients will require breathing assistance (5). Patients with other complications who were intubated are shown in Table 4.

Table 4. Complications in Patients with Intubation Treatment

Complications	N (%)
Eclampsia	32 (56.14)
Pulmonary Edema	29 (50.88)
HELLP Syndrome	14 (24.56)
Kidney Disorders	7 (12.28)
Fetal Distress	7 (12.28)
Liver Disorders	5 (8.77)
Infections	4 (7.02)
Oligohydramnion	4 (7.02)
Heart Failure	3 (5.26)
Neurologic Deficit	2 (3.51)
Cardiomyopathy Peripartum	1 (1.75)

*Each patient could experience more than one complication

In this study, the maternal outcome after being treated in the resuscitation room was a termination of pregnancy which occurred in 65 patients (80.25%). Termination of pregnancy is recommended when the gestational age has reached 37 weeks. However, for patients with severe preeclampsia and who are in an unstable condition, a gestational age of 34 weeks or more is sufficient and recommended for delivery after the stabilization of the mother (30). The most widely used method for termination of pregnancy was a cesarean section, which was performed on 59 patients (72.84%). According to ACOG, the recommended delivery method for people with preeclampsia must be adapted to the conditions of each individual. However, in severe preeclampsia cases, cesarean sections were found in 97% of patients with a gestational age of fewer than 28 weeks and 65% of patients with a gestational age of 28-32 weeks (7). In addition, there is no maternal death in this study, this indicates that the patients received good treatments in the resuscitation room.

Table 5. Maternal Outcomes

Maternal Outcomes	N (%)
Termination of Pregnancy	
Sectio Caesarea	59 (72.84)
Per Vaginam	6 (7.41)
Observation	
Intensive Care Admission	9 (11.11)
Maternity Ward Admission	7 (8.64)
Died	0 (0.00)

In addition, 16 patients (19.75%) did not have their pregnancies terminated either by cesarean section or *pervaginam* after being treated in the resuscitation room. A total of 9 patients (11.11%) required further observation in the intensive care room because of their unstable condition, and 7 patients (8.64%) who had stable conditions were sent to the delivery room for observation and conservative treatment.

This study showed that the fetal outcome of mothers with severe preeclampsia was poor. This can be seen in the majority (70.11%) of babies born prematurely. This is in line with a previous study in New York which states that preeclampsia patients have a 2.69 times higher risk of experiencing premature birth (31). This

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occurs because patients with severe preeclampsia would require a termination of pregnancy which usually occurs before 37 weeks of gestation. In addition, preeclampsia causes endothelial dysfunction that interferes with the delivery of nutrients and oxygen exchange in the fetus which may cause asphyxia, IUGR, and fetal death (32).

Table 6. Fetal Outcomes

Fetal Outcomes	N (%)
Prematurity	
Yes	61 (70.11)
No	26 (29.89)
Birth Weight	
Extremely Low Birth Weight	6 (7.50)
Very Low Birth Weight	7 (8.75)
Low Birth Weight	35 (43.75)
Normal	32 (40.00)
1 Minute APGAR Score	
0-3	39 (52.70)
4-6	15 (20.27)
7-10	20 (27.03)
5 Minute APGAR Score	
0-3	31 (41.89)
4-6	9 (12.16)
7-10	34 (45.95)

In this study, the majority of the babies (60%) were born with below-normal weight, where 35 infants (43.75%) had low birth weight (1500-<2500 grams), 7 infants (8.75%) had very low birth weight (1000-<1500 grams), and 6 babies (7.50%) experienced extreme low birth weight (<1000 grams). A previous study conducted in Palu stated that there was a relationship between preeclampsia and low birth weight with an OR of 2.4. This is because preeclampsia can cause vasoconstriction of uterine blood vessels, resulting in decreased blood flow to the fetus and leading to IUGR and low birth weight (33).

Neonatal asphyxia can be seen through the APGAR scores which were measured in the first and fifth minutes after the birth of the baby. In this study, 54 infants (72.97%) had an APGAR score of below 7 at the first minute and 40 infants (54.05%) had an APGAR score of below 7 at the fifth minute. This is in line with a previous study in Bantul, which stated that there was a relationship between preeclampsia and asphyxia *neonatorum* with a p-value of 0.00. This occurs because of a lack of oxygen and nutrition in the fetus due to vasoconstriction of blood vessels (34). Asphyxia can be associated with premature birth and low birth weight. A study states that premature birth has 12 times higher risk of developing asphyxia *neonatorum*. In addition, a study found that there was a relationship between low birth weight and asphyxia with a p-value of 0.00. This is due to the incomplete development of organs in infants (35). The distribution of fetal outcomes could be seen in table 6.

CONCLUSION

The most common complication of preeclampsia patients in the resuscitation room of Dr. Soetomo General Academic Hospital Surabaya from January 1st, 2018 to December 31st, 2019 was pulmonary edema. Most patients had 2 complications with the most common combination being eclampsia and HELPP syndrome. Intubation was given to the majority of patients and most often in patients with eclampsia. Termination of pregnancy by cesarean section was conducted in the majority of patients. There were no cases of maternal death in this study. However, most of the babies were born premature, had low birth weights, and asphyxia as assessed by the first and fifth-minute APGAR scores.

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Conflict of Interest

The authors stated there is no conflict of interest in this study.

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Authors' Contributors

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Original Article

AIRWAY FOREIGN BODIES IN PATIENTS THAT UNDERWENT BRONCHOSCOPIES WITH GENERAL ANESTHESIA IN DR. SOETOMO GENERAL ACADEMIC HOSPITAL SURABAYA

Annisa Maya Sabrina[1a], Maulydia[2], Rizka Fathoni Perdana[3], Mariza Fitriati[2]

[1] Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

[2] Department of Anesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

[3] Department of Otorhinolaryngology and Head-Neck, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

[a] Corresponding author: annisa.maya.sabrina-2018@fk.unair.ac.id

ABSTRACT

Introduction: Airway foreign body (AFBs) is the most common emergency for ENT-HN (Ear, Nose, Throat-Head Neck) that requires immediate treatment. The gold standard management for AFBs is a bronchoscopy performed under general anesthesia (GA)**. Objective:** This study aims to determine the profile of AFBs patients who underwent bronchoscopies with GA at Dr. Soetomo General Hospital Surabaya from January 2018 – December 2019. **Methods and Materials:** This is a descriptive, retrospective study that uses data from medical records. Microsoft Excel was used to analyze the data. 22 patients met the inclusion criteria. **Results:** The most common ages were 11 to 20-year-olds (73%), 55% were female, and 45% were male. The patients were from outside (73%) and inside (27%) Surabaya. As much as 67% of the sampled patients had coughs and 23% were symptomless. The foreign bodies found were pins (67%), clipboard nails (14%), and nuts (9%). These AFBs were located in the left main bronchus (45%), trachea (32%), and right main bronchus (18%), and in 5% of these cases, the AFBs could not be located. The duration between the event and the bronchoscopy was mostly less than 1 day (54%), 2 days (32%), and 3 days (14%). Most cases (90%) were without AFBs complications, but some had obstruction (5%), and hemoptysis (5%). Most patients also had an uncomplicated bronchoscopy (81%), however, some suffered lesions (14%) and bleeding (5%). A majority of the patients were also ASA I (68%), and the remainder were classified as ASA II (18%), and III (14%). The premedication drugs administered were fentanyl (41%), and a combination of fentanyl and midazolam (41%). Meanwhile, the most frequently maintained anesthetic agent was Isoflurane+O_2 (27%). Most patients also did not have any comorbid factors (85%), but some had anemia (5%), obstruction (5%), as well as obesity followed by sputum retention and hypernatremia (5%). **Conclusion:** Most AFB patients who underwent bronchoscopy under GA were 11-20 years old, female, and had a cough as a clinical symptom. Most AFBs were pins at the left main bronchus. The duration between the incident and the bronchoscopy was less than 1 day. There were also mostly no complications of AFBs and bronchoscopies. The most common physical status in patients was ASA I, with fentanyl only or fentanyl and midazolam as a premedication drug. The most common agent used to maintain the anesthesia was a combination of isoflurane and O_2. Most patients also had no comorbid factors for GA.

Keywords: AFBs; Bronchoscopy; General Anesthesia; Good Health and Well Being; Profile; Sociodemography

ABSTRAK

Pendahuluan: Benda asing saluran napas **(**BASN) merupakan kegawatdaruratan tersering pada THT-KL yang memerlukan penanganan segera. Bronkoskopi adalah *gold standard* untuk tatalaksana BASN yang lebih baik dilakukan dibawah anestesi umum. **Tujuan:** Penelitian ini bertujuan untuk mengetahui profil dan tatalaksana penderita BASN yang menjalani bronkoskopi dengan anestesi umum di RSUD Dr. Soetomo Surabaya Periode Januari 2018 – Desember 2019. **Metode dan Bahan:** Penelitian ini merupakan penelitian deskriptif retrospektif, menggunakan data rekam medis dan dianalisis dengan Microsoft Excel. Didapatkan 22 penderita yang memenuhi kriteria inklusi. **Hasil:** Kelompok usia terbanyak adalah 11-20 tahun (73%),55% perempuan dan 45% laki-laki. Penderita berasal dari luar (73%) dan dalam (27%)

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Surabaya. Batuk ditemukan pada (67%) penderita, sedangkan 23% tanpa gejala. BASN berupa peniti (67%), paku *clipboard* (14%), dan kacang (9%). Lokasi: bronkus utama kiri (45%), trakea (32%), bronkus utama kanan (18%), dan tidak ditemukan (5%). Durasi kejadian sampai bronkoskopi paling banyak <1 hari (54%), 2 hari (32%), dan 3 hari (14%). Terdapat (90%) tanpa komplikasi BASN, namun sebagian mengalami obstruksi (5%), dan hemoptisis (5%). Sebagian besar tanpa komplikasi bronkoskopi (81%), tetapi beberapa mengalami lesi (14%), dan perdarahan (5%). Didapatkan ASA penderita, ASA I (68%), II (18%), dan III (14%). Obat premedikasi yang paling sering digunakan adalah fentanil (41%), dan kombinasi fentanil+midazolam (41%). Obat *maintenance* yang paling sering digunakan adalah Isoflurane+O_2 (27%). Sebagian besar penderita tanpa faktor penyerta (85%), tetapi beberapa mengalami anemia (5%), obstruksi (5%), juga obesitas diikuti dengan retensi sputum dan hipernatremia (5%). **Kesimpulan:** Sebagian besar penderita BASN yang menjalani bronkoskopi di bawah anestesi umum berusia 11-20 tahun, berjenis kelamin perempuan, dengan gejala klinis batuk. Sebagian besar BASN berupa peniti dan lokasinya di bronkus utama kiri. Durasi kejadian sampai bronkoskopi adalah <1 hari. Sebagian besar tidak mengalami komplikasi BASN dan bronkoskopi. Status fisik ASA I adalah yang paling umum, fentanil atau kombinasi fentanil+midazolam sebagai obat premedikasi. Sebagian besar obat *maintenance* adalah kombinasi isofluran dan O_2, dan tidak memiliki faktor komorbiditas untuk anestesi umum.

Kata Kunci: BASN; Bronkoskopi; Anestesi umum; *Good Health and Well* Being; Profil; Sosiodemografi

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INTRODUCTION

Airway foreign bodies (AFBs) or foreign body aspirations, is the entry of objects originating from outside or inside the body into the respiratory tract. AFBs are one of the most common emergencies in the field of ENT-HN that requires immediate treatment (1). Delay in treatment can increase the occurrence of complications and even death. The type of AFBs can vary, and this is influenced by geography, food variations, and the environment. AFBs can be in the form of organic or non-organic materials. A common organic material for AFB is peanuts (2).

AFBs are reported to occur in children worldwide. As high as 80% of cases occur at the age of under 3 years old with a peak at the age of 1-2 years. The incidence is 0.6 cases per 100,000 children and boys have a higher incidence partly due to their more impulsive characteristics (3). The most common location for AFBs is in the right bronchus. The right main bronchus in adults is shorter than the left main bronchus and forms a 25º angle from the median line, while the left main bronchus forms a 45º angle. The right main bronchus almost forms a straight line with the trachea, so foreign objects from outside can easily enter the right bronchus compared to the left (4).

During 2013-2017, there were 92 patients with AFBs at Hasan Sadikin Hospital in Bandung. The AFBs were found in the trachea (18.47%), the right bronchus (51.08%), and the left bronchus (30.43%) (2). Twenty AFBs patients underwent bronchoscopy in 2012-2016 at Dr. Mohammad Hoesin Hospital Palembang. Based on gender, there were 9 male and 11 female patients. The age distribution was 6 months-60 years. The most common age group of AFB patients was children between 6 months to 13 years old, with as many as 18 patients in that age range. Meanwhile, there was also one 43-year-old and one 60-year-old patient too (5).

Diagnosis and therapy are important for preventing mortality and complications in these types of cases. On-time and accurate diagnosis, as well as the safe removal of foreign bodies, are also crucial. The diagnosis is made based on history, physical examination, and radiological examination. Rigid bronchoscopy is the main choice in the management of AFBs (5).

Bronchoscopies can be performed under GA. GA is relatively safer and more convenient than local anesthesia. The bronchoscopy

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procedure causes manipulation of the airway, therefore a safe anesthetic method is needed to maintain good oxygenation and stable hemodynamics with minimal complications (6). Nevertheless, the success of the AFB extraction with GA is strongly influenced by the availability of tools and abilities, as well as the experience of the doctor or operator. To the extent that the availability of tools, abilities, and experience of qualified doctors, can minimize death caused by AFBs under GA. Therefore, this study was conducted to analyze general data on AFB patients, their clinical symptoms, type and location of AFBs, duration between events to bronchoscopy procedure, AFBs and bronchoscopy complications, the patients' ASA physical status, premedication drugs, maintenance drugs, and factors that affect anesthesia (comorbidities). The data obtained from this study can serve as a reference for general anesthesia procedures in AFB bronchoscopy procedures.

MATERIALS AND METHODS

This is a descriptive retrospective study that uses data from medical records. The data consists of sociodemographic characteristics, clinical symptoms, type of AFBs, location of AFBs, duration of events until bronchoscopy, AFB complications, bronchoscopy complications, ASA physical status, premedication drugs, maintenance drugs, and comorbid factors for GA of AFB patients who underwent bronchoscopies with GA in Dr. Soetomo General Hospital Surabaya from January 2018 to December 2019. A total of 22 samples met the inclusion criteria, namely patients with AFBs who underwent bronchoscopy with GA in Dr. Soetomo General Hospital Surabaya from January 2018 to December 2019 and had a complete medical record. This study used the total sampling method.

The data were analyzed with Microsoft Excel and presented in a distribution frequency table and then turned into a descriptive form. This study was approved by the ethics committee of Dr. Soetomo General Hospital Surabaya (0237/LOE/301.4.2/XII/2020).

RESULTS AND DISCUSSION

This study found 24 patients with AFBs who underwent bronchoscopies under GA, but two of them were excluded because of incomplete data. Thus, a total of 22 patients were included. The majority of patients were in the 11 to 20 years age group (73%), followed by the 0-10 years age group (22%), and the 21-30 years age group (5%). As much as 55% of the patients were female and 45% were male. The patients came from outside (73%) and inside (27%) Surabaya. The patients' sociodemographic distribution is shown in **Table 1.**

Table 1. Sociodemographic of Patients

Sociodemographic	N (%)
Age (years)	
0-10	5 (22)
11-20	16 (73)
21-30	1 (5)
Sex	
Women	12 (55)
Men	10 (45)
Domicile	
Inside Surabaya	6 (27)
Outside Surabaya	16 (73)

The most common clinical symptom was sudden cough (67%), followed by asymptomatic (23%) patients, cough with rhonchi and wheezing (5%), and cough with wheezing (5%). The distribution of clinical symptoms is shown in **Table 2.**

The type of foreign bodies found were mostly non-organic (91%), including pins (67%), clipboard nails (14%), plastic whistles (5%), and magnets (5%). There were also organic foreign bodies (nuts) for 9% of the

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sampled patients. The types of foreign bodies found are shown in **Table 3.**

Table 2. Clinical Symptoms of Patients

Symptoms	N (%)
Sudden Cough	15 (67)
No Symptoms	5 (23)
Cough and Wheezing	1 (5)
Cough, Ronchi, and Wheezing	1 (5)

*Each patient could experience more than one clinical symptom

Table 3. Type of Foreign Bodies

Type		N (%)
Organic	Peanut	2 (9)
Non-Organic	Straight Pins	15 (67)
	Clipboard nails	3 (14)
	Plastic Whistle	1 (5)
	Magnet	1 (5)

The foreign bodies were found in the left main bronchus (45%), trachea (32%), right main bronchus (18%), and some AFBs were not found (5%). The foreign bodies' locations are shown in **Table 4.**

Table 4. Foreign Bodies Location

Location	N (%)
Trachea	7 (32)
Main Bronchus Sinistra	10 (45)
Main Bronchus Dextra	4 (18)
Not Found	1 (5)

For the sampled cases, the duration between the incident to the bronchoscopy was less than one day (54%), two days (32%), and three days (14%). The duration up to Bronchoscopy is shown in **Table 5.**

Table 5. Duration up to Bronchoscopy

Duration (days)	N (%)
<1	12 (54)
2	7 (32)
3	3 (14)

Most patients did not experience AFB complications (90%), but 5% had an obstruction, and 5% had hemoptysis. A majority of the patients also did not experience bronchoscopy complications (81%), but 14% had a lesion, and bleeding (5%). The complications are shown in **Table 6**.

Table 6. Complication

Complication	N (%)
AFBs Complication	
No Complication	20 (90)
Obstruction	1 (5)
Hemoptysis	1 (5)
Bronchoscopy Complication	
No Complication	18 (81)
Lesion	3 (14)
Bleeding	1 (5)

In this study, the highest physical status in patients was ASA I (68%), then ASA II (18%), and ASA III (14%). Most patients also did not have any comorbidities (85%), but 15% had the following comorbidities: anemia (5%), obstruction (5%), and a patient (5%) with obesity, sputum retention, and hypernatremia. The patients' ASA physical status and comorbid factors are shown in **Table 7**.

Table 7. ASA Physical Status and Comorbidities

ASA and Comorbidities		N (%)
ASA		
ASA I		15 (68)
ASA II		4 (18)
ASA III		3 (14)
Comorbid		
No Comorbid Factor		19 (90)
With Comorbid Factor	Anemia	1 (5)
	Obstruction	1 (5)
	Overweight+ Retention Sputum + Hypernatremia	1 (5)

The premedication drugs administered were mostly fentanyl or the combination of fentanyl and midazolam (41%), followed by the combination of midazolam, atropine sulfate, and fentanyl (9%), and the combination of midazolam and atropine sulfate (9%). The most frequently used drugs for anesthesia maintenance were the combination of isoflurane and O_2 (27%), the combination of isoflurane, propofol, and O_2 (23%), the combination of sevoflurane and O_2 (23%), the combination of propofol and O_2 (18%), and the

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combination of propofol, fentanyl, and O_2 (9%). The anesthetic drugs used are shown in **Table 8**.

Table 8. Anesthetic Drug

Drug	N (%)
Premedication	
Fentanyl	9 (41)
Midazolam + Fentanyl	9 (41)
Midazolam + Sulfas Atropine + Fentanyl	2 (9)
Midazolam + Sulfas Atropine	2 (9)
Maintenance	
Isoflurane + O_2	6 (27)
Isoflurane + Propofol + O_2	5 (23)
Sevoflurane + O_2	5 (23)
Propofol + O_2	4 (18)
Propofol + Fentanyl + O_2	2 (9)

In this study, we found that most AFB patients who underwent bronchoscopies under GA were in the 11 to 20 years age group (73%) and most of these patients were female (55%). These results are similar to the research done by Rizk (7) who found that most AFBs occur in patients in the 10 to 20-year-old age group (81%) who were also mostly females (122 patients).

This study also found that most of the patients were from outside the city (73%) (8). A study conducted at the Dr. Mohammad Hosein Hospital Palembang in 2013-2015 also found similar results, where most AFB patients were from outside the city (55.81%) (5).

The type of foreign body found is mostly non-organic in the form of pins in 15 (67%) patients, and the most common location was found in the left main bronchus (45%). This result is also in line with a study conducted by Rizk (7) which showed that most patients with AFB were in the form of pins and the location of these foreign bodies was most often in the left main bronchus.

Moreover, the location of the AFBs found in this study are similar to the research conducted by Bin (9), who determined that most AFBs are located in the left main bronchus (32.3%). Additionally, a study conducted by Rizk (7) linked the findings of non-organic foreign bodies in the form of pins or hairpins being found more often in the left bronchus with the Bernoulli phenomenon.

Next, age is one of the factors that play a role in the entry of foreign bodies into the respiratory tract (10). Rizk (7) found that the subjects included in their study were female and wore the hijab. For women who wear hijabs and use pins, AFBs often occur. This is due to the lack of vigilance when securing the pins to be used, as subjects would hold the pins between their lips or teeth while fixing the hijab so that they could have their hands free to adjust the hijab.

The duration between foreign body aspiration and the bronchoscopy procedure is important because the patient needs to be immediately examined, diagnosed, and treated. The duration between events until bronchoscopy in this study had similar results to the study conducted by Puspa (11) where most patients would have their bronchoscopy done within less than 1 day (55%). Immediacy is very important because delays in foreign body action can cause a fairly large incidence of complications.

Most of our patients did not have any AFB complications. Complications of AFBs are different for each patient because there are predisposing factors for the occurrence of complications, namely the type, depth, and duration of foreign bodies in the body (12).

In our study, most patients did not experience bronchoscopy complications either. This is similar to the study conducted by Grosu (13). Bronchoscopy can cause minor and major complications. The predisposing factors for the occurrence of complications are the type, shape, and duration of foreign bodies in the body (12). Coughing is one of the complications in

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bronchoscopy procedures, which is unpleasant both for the patient and the anesthesiologist. Lidocaine nebulization 2% or lidocaine spray 10% is generally used to help prevent coughs during bronchoscopy procedures (14).

In this research, most patients were in the ASA physical status I (68%). This is similar to the research conducted by Yanmei, which found that most patients with AFB were categorized as ASA I and II (40 patients). ASA physical status classification can be used as a risk consideration for patients related to anesthesia and bronchoscopy procedures (15). Pre-anesthesia evaluation is the first step in a series of anesthetic actions performed on a patient. This evaluation aims to determine the physical status of preoperative patients, analyze the type of surgery, choose the type and technique of anesthesia, predict complications that may occur, and prepare the drugs and anesthesia tools (16). The premedication drugs that are often used in this study are fentanyl and a combination of midazolam and fentanyl (9%). Fentanyl is the most widely used opioid in anesthesia. It has a predictable time-to-peak effect of 3-5 minutes (17). Midazolam is a sedative commonly used before surgery. This drug can reduce anxiety, make the patient feel relaxed, and even give a drowsy effect. Midazolam works by slowing down the work of the brain and nervous system (18).

In this study, the most common drug used to maintain anesthesia is the combination of Isoflurane and O_2 (27%). Isoflurane is a halogenated ether in the form of a colorless, non-explosive liquid, does not contain preservatives, and is insoluble in blood but quite irritating to the respiratory tract. The recovery process is relatively faster than the currently available inhalation anesthetics, but it is still slower than sevoflurane (19).

Most of the patients (85%) had no comorbid factors that could complicate anesthesia procedures. But anemia (5%), obstruction (5%), and obesity followed by sputum retention and hypernatremia (5%) were found in one patient. Preoperative anemia is associated with increased postoperative morbidity and an increased risk of perioperative transfusion. We found 1 (5%) patient with anemia before bronchoscopy under GA. Lin Yulia (20) stated that preoperative anemia occurs 25% to 40% of the time in large observational studies. Airway obstruction is always a concern for the anesthesiologist. Inhalation induction is an option that is often used in patients with respiratory obstruction. Halothane in 100% oxygen is a suitable agent. However, sevoflurane is increasingly being used as an alternative to halothane in these situations. Sevoflurane is moderately effective but achieving a more rapid onset of action is difficult as sufficient depth of anesthesia is needed without an intravenous adjunct. With any form of airway obstruction, absorption of volatile substances is reduced, and it may take up to 15 minutes to achieve sufficient depth of anesthesia (21). In this study, patients with airway obstruction underwent intravenous induction and continued maintenance with sevoflurane.

Obese patients are more difficult to inject anesthetics because they require higher doses of drugs than people with normal weight (22). Approximately 1 in 50 patients develop preoperative hypernatremia which is directly associated with a 40% increased risk of perioperative 30-day mortality. Hypernatremia should not be ignored if a mild increase is associated with a significant increase in perioperative morbidity and mortality regardless of the underlying cause and other comorbidities (23). Patients who experience anesthetic complicating factors in the form of sputum retention would experience clinical symptoms of cough and shortness of breath.

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Cough and shortness of breath can cause sputum retention and lead to bronchospasm. The incidence of bronchospasm can have a fatal impact (24). However, none of the patients in this study experienced bronchospasm.

CONCLUSION

Most AFB patients who underwent bronchoscopies under GA were in the 11 to 20-years age group, female, came from outside Surabaya, had clinical symptoms of sudden cough, and had non-organic AFBs type in the form of a pin that was mostly located in the main left bronchus. The duration of the event until bronchoscopy was <1 day. Our patients did not experience complications for both AFBs and bronchoscopies. ASA I physical status was the most common in our patients. The premedication drugs administered were mostly only fentanyl or the combination of fentanyl and midazolam. The most commonly used maintenance drug for anesthesia is the combination of isoflurane and O_2. Most patients also did not have any comorbidities for GA.

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Conflict of Interest

The authors declared there is no conflict of interest in this study.

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Authors' Contributors

All authors have contributed to all process in this research.

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Original Article

ANEMIA PROFILE IN PEDIATRIC PATIENTS AT THE PEDIATRIC INTENSIVE CARE UNIT (PICU) OF DR. SOETOMO GENERAL ACADEMIC HOSPITAL

Sarah Ayu Larasati[1], Arina Setyaningtyas[2a], Elizeus Hanindito[3], Mia Ratwita Andarsini[2]

[1] Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[2] Department of Pediatrics, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo General Academic Hospital, Surabaya, Indonesia
[3] Department of Anesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga/Dr. Soetomo Academic General Hospital, Surabaya, Indonesia
[a] Corresponding author: arina-s@fk.unair.ac.id

ABSTRACT

Introduction: Anemia often occurs in critically ill children and is associated with increased morbidity and mortality in women and children and impaired cognitive and behavioral development in children. **Objective:** This study aims to understand the profile and characteristics of anemia patients in the critical care population. **Materials and Methods:** This is a retrospective, descriptive study of the patient's medical records. Data were collected by the total sampling technique. **Results:** Among 203 patients, 52% were anemic at admission to the Pediatric Intensive Care Unit (PICU), while 45% were anemic at discharge. Anemia tends to be more common in older age and male individuals with their chief complaints being respiratory symptoms, higher mean Red Cell Distribution Width (RDW) levels, and poorer nutritional status. There were 84 patients (41%) who received Packed Red-Cells (PRC) transfusions, among them there were 54 patients (51%) who were anemic at PICU admission. Of the 84 patients who received PRC transfusions during their PICU stay and 43 patients (47%) were anemic on PICU discharge. **Conclusion:** Anemia is quite common in critically ill children and is dominated by male patients aged under 5 years. Anemia also mostly happens in patients with higher organ dysfunction scores and poorer nutritional status than nonanemic patients. Half of the patients with anemia at the PICU also received PRC blood transfusion.

Keywords: Anemia; Children; Good Health; PICU; Transfusion

ABSTRAK

Pendahuluan: Anemia sering terjadi pada pasien anak sakit kritis dan berhubungan denan peningkatan morbiditas dan mortalitas pada wanita dan anak kecil juga gangguan perkembangan kognitif dan perilaku pada anak. **Tujuan:** Penelitian ini bertujuan untuk mengetahui profil dan karakteristik pada pasien dengan anemia di populasi sakit kritis. **Bahan dan Metode:** Penelitian ini merupakan penelitian deskriptif dengan desain retrospektif pada rekam medis pasien. Data diambil menggunakan tehnik *total sampling*. **Hasil:** Dari 203 pasien, terdapat 52% pasien dengan anemia saat masuk *Pediatric Intensive Care Unit* (PICU) dan 45% pasien dengan anemia saat keluar dari PICU. Anemia lebih banyak terjadi pada pasien dengan usia lebih tua, berjeniskelamin laki-laki, memiliki keluhan utama pada pernapasan, dan memiliki level *Red Cell Distribution Width* (RDW) lebih tinggi serta status nutrisi yang lebih rendah. Terdapat 84 pasien (41%) yang mendapatkan transfusi *Packed Red-Cell*s (PRC), diantaranya terdapat 54 pasien (51%) yang mengalami anemia saat masuk PICU dan 43 pasien (47%) menjadi anemia saat keluar dari PICU. **Kesimpulan:** Anemia cukup umum terjadi pada populasi anak sakit kritis, didominasi anak laki-laki dan usia di bawah 5 tahun. Anemia juga terjadi pada pasien dengan skor disfungsi organ lebih tinggi dan status nutrisi lebih buruk. Sebagian dari pasien anemia di PICU mendapatkan transfusi PRC.

Kata kunci: Anemia; Anak; Kesehatan; PICU; Transfusi

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INTRODUCTION

Anemia often occurs in critically ill children. According to Rawal et al. (2016), anemia is almost unavoidable in critically ill patients in the Intensive Care Unit or ICU (1). Anemia is also associated with increased morbidity and mortality in women and children, poor birth outcomes, decreased productivity in adults and impaired cognitive and behavioral development in children (2). Anemia in critically ill children is a condition that requires attention because it could contribute to poor outcomes and is associated with negative neurological outcomes such as inhibiting the children's mental development (3).

Concerning the distribution of oxygen in the body, patients with very low hemoglobin (Hb) levels may experience hypoxemia, so the distributed oxygen cannot meet the body's metabolic needs (4). If the condition worsens, severe anemia will occur which can be a direct cause of mortality (5). The erythropoietic response to anemia is inhibited by decreased erythropoietin production and spinal cord suppression by various inflammatory cytokines (6). To this day, there is a limited number of studies about the profile and characteristics of anemia in critically ill children. This study aims to investigate the demographic characteristics, clinical characteristics, blood test results, and nutritional status of pediatric patients admitted to the Pediatric Intensive Care Unit of Dr. Soetomo General Academic Hospital Surabaya. The data obtained from this study can serve as a reference for the incidence of anemia in critically ill pediatric patients.

MATERIALS AND METHODS

This is a descriptive, retrospective study of the medical records of critically ill patients with anemia at the PICU of Dr. Soetomo General Academic Hospital between January and December 2019. The variables in this study were demographic data (age and gender), chief complaints, organ dysfunction, Mean Corpuscular Volume (MCV), Red Cell Distribution Width (RDW) values, Pediatric Logistic Organ Dysfunction-2 (PELOD-2) score, nutritional status, and Packed Red Cells (PRC) transfusion. MCV is a value that indicates the size and average volume of red blood cells while RDW is a sum of variations in the size of red blood cells. MCV and RDW values can indicate the morphological category and the etiology of anemia. The PELOD-2 is a score to assess organ dysfunction in critically ill pediatric patients. Whereas PRC transfusions are when red blood cells are administered to patients with certain conditions.

The population in this study included all patients with anemia upon admission and/or discharge at the PICU of Dr. Soetomo General Academic Hospital between January and December 2019. The sample is members of the population that met the inclusion and exclusion criteria. The inclusion criteria are patients with anemia at admission and/or discharge from the PICU. Patients with incomplete medical records were excluded. The total sampling technique was used. Next, the data obtained were processed by editing, coding, entry, and cleaning. The instrument used in this study was the medical records of patients with anemia at the PICU Dr. Soetomo General Academic Hospital between January and December 2019. The data were analyzed descriptively by using SPSS. The data were then grouped based on research variables and presented in a frequency distribution table. This study was approved by the Dr. Soetomo General Academic Hospital Health Research Ethics Committee (0220/LOE/301.4.2/XI/2020).

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RESULTS AND DISCUSSION

The total population of pediatric patients at PICU in 2019 was 318 patients, among them only 203 were eligible for further analysis in this study. Anemic patients were determined according to the criteria set by the WHO based on age and gender. Data on hemoglobin levels were taken when the patient was admitted and discharged from the PICU. A total of 106 patients (52%) had anemia at admission to the PICU and 91 (45%) patients had anemia at discharge from the PICU. The distribution of anemic patients' demographic characteristics at PICU admission and discharge was dominated by the age group 6-59 months and male patients. The demographic characteristics data are presented in Table 1.

Table 1. Demographic Characteristics of Anemic Patients

Characteristics	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
Age (months)		
1-5	15 (14)	11 (12)
6-59	45 (42)	34 (37)
60-143	24 (23)	21 (23)
144-179	12 (11)	14 (15)
≥180	10 (9)	11 (12)
Gender		
Male	65 (61)	49 (54)
Female	41 (39)	42 (46)

In critical patients, the diagnosis is not confined to only one organ system. Critically ill pediatric patients generally have more than 1 organ system dysfunction. In this study, most of the patients with anemia both at admission and discharge from the PICU had dysfunctions in two organ systems. The most frequent chief complaints were respiratory complaints. The clinical characteristics data are presented in Table 2.

Table 2. Clinical Characteristics of Anemic Patients

Characteristics	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
Organ/Multiorgan Disfunction		
1 organ	30 (28)	23 (25)
2 organs	48 (45)	42 (46)
3 organs	24 (23)	19 (21)
4 organs	3 (3)	6 (7)
5 organs	1 (1)	1 (1)
Chief Complaint at Admission		
1. Respiratory Symptoms	27 (25)	25 (27)
2. Decreased of Consciousness	10 (9)	6 (7)
3. Seizure	19 (18)	6 (7)
4. Anemia Symptoms	18 (17)	18 (20)
5. Digestive Symptoms	20 (19)	18 (20)
6. Fever	6 (6)	13 (14)
7. Others	6 (6)	5 (5)

In patients with anemia at the PICU, the distribution of MCV values in anemic patients showed that most were within normal limits (62.3%). Conversely, most of the patients with anemia had an increased RDW value. An increased RDW value indicates heterogeneity of erythrocytes. The erythrocytes index data are presented in Table 3.

Table 3. Erythrocytes index of Anemic Patients

Value	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
MCV		
Normal	66 (62)	60 (66)
Increased	25 (24)	19 (21)
Decreased	15 (14)	12 (13)
RDW		
Normal	28 (26)	33 (36)
Increased	78 (74)	58 (64)

In this study, it was found that most patients with anemia had PELOD-2 scores between 1-10. Patients with anemia at the PICU had a higher mean PELOD-2 score than nonanemic patients. The PELOD-2 score data are presented in Table 4.

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Table 4. PELOD-2 Scores of Anemic Patients

Characteristics	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
At Admission		
0	16 (15)	17 (19)
0-11	89 (84)	73 (80)
≥11	1 (1)	1 (1)
At Discharge		
0	27 (25)	25 (27)
0-11	77 (73)	65 (71)
≥11	2 (2)	1 (1)

Anthropometric data were also taken when the patients were admitted to the PICU. The anthropometric data were then calculated to obtain the Z-Score value and used to categorize the patients based on nutritional status. This study used body mass index for age Z-Score (BMIz). It was also found that patients with anemia at admission to the PICU had poorer nutritional status than nonanemic patients. The nutritional status data are presented in Table 5.

Table 5. Nutritional Status of Anemic Patients

Nutritional Status	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
Normal	45 (42)	42 (46)
Obese	5 (5)	3 (3)
Overweight	4 (4)	2 (2)
Risk of Overweight	11 (10)	10 (11)
Wasted	16 (15)	17 (19)
Severely Wasted	25 (24)	17 (19)

Among 106 patients with anemia at PICU admission, 54 patients (51%) received PRC transfusions during their stay in the PICU. Of all PICU patients, 84 patients received blood transfusions during their PICU stay and as many as 43 of them (47%) became anemic at PICU discharge. The PRC transfusion data are presented in Table 6.

Anemia is determined by the levels of hemoglobin and hematocrit in the blood, which are obtained from the results of a complete blood count. The complete blood count technique used in this study is an automated hematology analyzer and has been proven to provide accurate and reliable results (7). This study found that half of the PICU population had anemia at PICU admission and discharge. However, a previous study by Ngo et al (2013) found a low prevalence of anemia at PICU, which are contrary to our results (6). Nevertheless, some studies had similar results to our findings. Maji et al. (2021) found that 64.8% of patients had anemia on discharge from the PICU while Demaret et al. (2017) found that 57.4% of their patients were anemic on discharge from the PICU (3,8). Overall, existing research has indicated the high incidence of anemia in the critically ill pediatric patient population.

Table 6. PRC Transfusion of Anemic Patients

PRC Transfusion	Anemic at PICU Admission N (%)	Anemic at PICU Discharge N (%)
Receiving	54 (51)	43 (47)
Not Receiving	52 (49)	48 (53)

Anemia that occurs in the critically ill pediatric population is complex and multifactorial (9). In critically ill patients, procedures that allow the occurrence of anemia are performed, such as phlebotomy for laboratory examination. Critically ill patients could also have falling hemoglobin levels, such as decreased erythrocyte production caused by EPO deficiency due to the body's inflammatory response. Inflammation inhibits the release of proinflammatory cytokines such as TNF- and interleukins that cause the EPO response (10). In this study, the hemoglobin levels of the sampled patients improved during their stay at the PICU. Therefore, the possibility of disrupted EPO response was minor. Several other mechanisms can also cause anemia in critically ill patients, such as increased erythrocyte destruction, bleeding, hemodilution, and nutritional deficiency.

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Demographic data showed that most patients with anemia in the PICU were in the 6-59 months age group. Similar results were also found in the studies conducted by Demaret et al. (2017) and Maji et al. (2021) (3,8). Anemia is common in under-five patients possibly due to maternal care regarding breastfeeding and the lack of provision of complementary foods, but this was not investigated further in this study. Children under the age of 2 years also experience a phase of rapid growth. To assist this growth phase, higher reserves of iron, folic acid, and vitamin B12 are needed (11). In children under the age of 1 month, decreased hemoglobin level is the result of the replacement of erythrocytes produced before birth (12). These reasons may cause the prevalence of anemia in the age group under 5 years.

Anemia is commonly found in male patients. Based on previous studies, male infants have more infections than female infants, which causes male infants to have a higher risk for iron deficiency and lead to anemia (12). Other studies also found that anemic PICU patients were dominated by male patients (3,8). We found that most patients with anemia have two organ systems dysfunctions. The chief complaint experienced by most patients with anemia is respiratory symptoms. These symptoms include shortness of breath, cough, and airway obstruction. Joo et al. (2016) found similar results where patients aged 6-23 months had iron deficiency anemia in their pediatric department (13). Anemic patients can experience respiratory problems because hemoglobin plays a role in distributing oxygen. Therefore, anemic patients with low hemoglobin will experience hypoxemia and shortness of breath (4). Symptoms of anemia such as pallor of the skin, conjunctiva, and weakness are present in the majority of patients with anemia although they are not the chief complaints.

Complete blood count (CBC) tests are needed in patients with anemia. Other than determining the hemoglobin level, which is a marker of anemia, other indicator values can be used to classify anemia, such as MCV and RDW values. MCV levels can be used to classify anemia into normocytic, microcytic, and macrocytic anemia. Most of the anemic patients in this study had normal MCV values. RDW or Red-Cell Distribution Width are levels that can be used to assess the homogeneity of erythrocyte form. An elevated RDW (more than 20%) also indicates iron deficiency (14). For anemic patients in the PICU, most of the RDW values increased (73.6%). This indicates the possibility that the anemia experienced by most PICU patients was caused by iron deficiency.

This study also found that anemic patients had a higher PELOD-2 score than patients without anemia, although the difference was only slight. Research by Demaret et al. (2017) and Ngo et al. (2013) also found similar results (3,6). The PELOD-2 scores taken at the PICU admission of anemic patients were higher than the scores taken at the PICU discharge. This indicates an improvement in the organ dysfunction experienced by patients with anemia. Nutritional status is also closely related to critically ill pediatric patients and anemia. In this study, wasted and severely wasted patients based on BMIz were more prevalent in patients with anemia than in patients without anemia. This is similar to the studies conducted by Yang et al. (2012) and Ruhman et al. (2020) (15,16). Nutritional deficiency is one of the etiologies of anemia in critical populations. Therefore, greater attention should be paid to critically ill pediatric patients with anemia and poor nutritional status.

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Erythrocyte transfusion is one of the treatments for anemic patients in the critically ill population. Theoretically, the purpose of erythrocyte transfusion is to restore the body's oxygen-carrying capacity to provide an adequate response to the body's physiological needs (10). Based on the WHO and IDAI, anemic patients with very low hemoglobin levels or severe anemia (hemoglobin < 5 g/dL) need to receive blood transfusions in the form of packed red cells or frozen red blood cells/erythrocytes (17). PRC transfusions are administered in an emergency and are used to increase the patient's hemoglobin levels. The provision of PRC transfusions can have different hemoglobin threshold values depending on the other pathologies suffered by the patient (18). However, in this study, no further investigation was done.

Next, in this study, 84 patients (41%) of PICU patients received PRC transfusions. Of the 84 patients, 54 patients (51%) were anemic when they entered the PICU and 43 of them experienced anemia when they left the PICU with a percentage of 47%. Ngo et al. (2013) in their study showed a lower percentage of 18.8% while Demaret et al. found that 25.1% of their patients who were anemic on discharge from the PICU received PRC transfusions during their stay in the PICU (3,6).

CONCLUSION

The prevalence of anemia is quite frequent in PICU patients at Dr. Soetomo General Academic Hospital in 2019. Anemia mostly occurs in patients of the male sex, under 5 years of age, and have respiratory systems as their chief complaints. Patients with anemia also had higher organ dysfunction scores and poorer nutritional status than patients without anemia. Half of the patients with anemia in the PICU of Dr. Soetomo Academic General Hospital in 2019 received a PRC blood transfusion. Further prospective studies about the profile and characteristics of patients with anemia in the PICU are warranted to obtain more accurate data.

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Conflict of Interest
The authors declared there is no conflict of interest in this study.

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Original Article

LOW-DOSE KETAMINE AS POSTOPERATIVE ANALGESIA IN CESAREAN SECTIONS IN REMOTE AREAS WITH LIMITED MEDICAL SUPPLIES

Yoppie Prim Avidar[1,2], Agustina Salinding[1,3], Hamzah[1a], Akhyar Nur Uhud[1], Maulydia[1]

[1] Department of Anesthesiology and Reanimation, Faculty of Medicine, Dr. Soetomo General Hospital, Universitas Airlangga, Surabaya, Indonesia
[2] Primasatya Husada Citra Hospital, Surabaya, Indonesia
[3] Siloam Hospital, Surabaya, Indonesia
[a] Corresponding author: hamzah@fk.unair.ac.id

ABSTRACT

Introduction: Cesarean section is the most common surgical procedure performed in the world and its postoperative pain is still a major issue in several countries. In a low-resource setting, this management poses a challenge for anesthesiologists. Ketamine is the most used anesthetic drug in the world due to its easy access and proven benefits. **Objective**: This research aims to analyze the effectiveness of low-dose ketamine as postoperative analgesia in cesarean sections conducted in areas with limited medical supplies. **Materials and Methods**: A Randomized Controlled Trial (RCT) was done from August 2020 to January 2021 with consenting pregnant patients who had undergone cesarean section. The sampled population was randomized to receive either ketamine intravenously or a placebo before the Subarachnoid Block (SAB). Low dose ketamine was divided into three groups 0.15 mg/kg, 0.25 mg/kg, and 0.5 mg/kg. The outcome was divided into primary outcome (pain score after 1-hour post-operation, 2 hours post-operation, 24 hours post-operation, and 48 hours post-operation) and secondary outcome (Apgar Score in the first minute and 5 minutes, hypotension after SAB, sedative effect during operation, postoperative nausea vomiting, time to receive opioid postoperative as rescue analgesia and total opioid uses). **Results and Discussion**: This study screened 105 patients and recruited 90 patients that were randomized into two groups consisting of 45 patients that received either low-dose ketamine or a placebo. The groups administered ketamine showed a lower pain score in 1 hour (p-value = 0.0037) and 2 hours post-operation (p-value = 0.0037). They also showed that it could prolong the administration of fentanyl (p-value = 0.0003) and lower total fentanyl used (p-value = 0.0008). The groups administered ketamine showed that there was a sedation effect (p-value = 0.0001) that depended on the dosage used. **Conclusion**: Intravenous ketamine with low doses can reduce pain scores at 1 hour to 2 hours post-operation and shows the need to reduce opioid requirements.

Keywords: Analgesia; Caesarean Section; Ketamine Low dose; Maternal Health; Postoperative Pain; Subarachnoid Block

ABSTRAK

Pendahuluan: *Sectio Caesaria* (SC) merupakan operasi yang sering dilakukan di dunia dan nyeri pascaoperasi masih menjadi masalah di beberapa negara. Manajemen nyeri pascaoperasi di rumah sakit dengan sumber terbatas merupakan tantangan yang tersendiri untuk dokter anestesi yang bekerja di tempat tersebut. Ketamin merupakan obat anestesi yang sering dipakai yang mudah didapat serta terbukti memiliki keuntungan. **Tujuan:** Tujuan dari penelitian ini adalah untuk menganalisis keefektifan dari penggunaan Ketamin dosis rendah sebagai analgesik pascaoperasi pada opersi SC dengan kondisi persediaan alat dan bahan medis yang terbatas. **Bahan dan Metode:** Penelitian ini merupakan *Randomized Controlled Trial* (RCT) yang dilakukan selama agustus 2020 hingga januari 2021, dilakukan pada ibu hamil yang akan dilakukan SC yang secara acak dibagi mendapatkan perlakuan pemberian ketamin intravena atau placebo sebelum dilakukan *Sub-Arachnoid Block* (SAB). Pembagian dosis rendah ketamin dibagi menjadi dosis 0,15mg/kg, 0,25mg/kg dan 0,5 mg/kg. Outcome penelitian ini dibagi menjadi keluaran primer (skor nyeri setelah 1 jam pascaoperasi, 2 jam pascaoperasi, 24 jam pasca operasi dan 48 pascaoperasi) dan keluaran sekunder (APGAR pada menit pertama dan 5 menit,

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hipotensi setelah SAB,efek sedasi selama operasi, kejadian mual-muntah setelah operasi,waktu menerima opioid sebagai analgesi pascaoperasi dan total opioid selama perawatan). **Hasil dan Pembahasan:** Studi ini memeriksa 105 pasien dan mendapatkan 90 pasien sebagai subjek penelitian yang dibagi secara random menjadi dua kelompok dengan 45 pasien pada masing masing kelompok. Kelompok ketamine menunjukkan skor nyeri yang lebih rendah pada 1 jam (nilai p 0,037) dan 2 jam pascaoperasi (nilai p 0,037), waktu yang lebih lama untuk pemberian fentanyl pertama pascaoperasi (nilai p 0,003) serta total penggunaan fentanyl (nilai p 0,008). Kelompok ketamin juga menunjukkan adanya efek sedasi selama operasi (nilai p 0,001) dan tergantung pada dosis yang digunakan. **Kesimpulan:** Ketamin intravena dengan dosis rendah dapat menurunkan skor nyeri pada 1 jam hingga 2 jam pascaoperasi serta kebutuhan menurunkan kebutuhan opioid.

Kata kunci: Analgetik; *Sectio Caesaria*; Ketamine Dosis Rendah; Kesehatan Ibu; Nyeri Pasca Operasi; *Subarachnoid Block*

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INTRODUCTION

Cesarean section is one of the most frequently performed operations in the world, more than 1 million cesarean sections are performed in America in one year. The prevalence in different countries varies with a ratio of about 10 to 30% in one year (1). Postpartum pain after cesarean section is often unreported, causing it to be negligible. However, postpartum pain is a serious issue because it can impact the mother and the baby if not handled properly. Postoperative pain will create stress for the mother, so the interaction between the baby and the mother will be delayed, hindering the healing of the mother and causing postpartum depression (2).

A study reported that pain after a cesarean section was ranked ninth on the first day after surgery and had a mean NRS of 6 (IQR 4.5–8.0) which corresponds to trauma/orthopedic patients. Moreover, pain during mobilization has the highest intensity compared to other gynecological operations (3).

Postoperative pain management of cesarean sections can be done by providing multimodal analgesics. Administration of NSAIDs in combination with Paracetamol is the recommended combination by ERAS, but in some patients, this combination is insufficient. Interventions at the time of surgery such as long-term opioids (morphine) in intrathecal and Transverse Abdominis Plane (TAP) blocks can provide good analgesics. However, these techniques are difficult to conduct in places with limited resources. Another thing that needs to be considered is the mother's need to breastfeed, so drugs and techniques need to be safe for breastfeeding mothers (4,5).

In a developing country such as Indonesia where the conditions of numerous regions have limited or lack resources, postoperative pain management is a challenge. The difficulties that may arise are lack of awareness from patients (causing them to rarely report their pain to health workers), low nurse-patient ratio (causing difficulties to assess pain and monitor side effects of interventions performed by anesthesiologists), and the limited availability of drugs and supporting equipment (6). Therefore, the administration of drugs or interventions to reduce pain in patients after cesarean sections requires a safe and effective method.

The management of post-operative pain is ideally done by providing multi-modal therapy. However, as there are difficulties in procuring medical and pharmaceutical supplies in distant and remote areas, other alternatives must be considered.

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Ketamine is an antagonist of the N-Methyl-D-Aspartate (NMDA) receptor which is often used as an anesthetic agent. NMDA receptor antagonists can provide an analgesic effect by desensitizing NMDA receptors, therefore inhibiting pain transmission in the central nervous system (7). Greater attention should be paid to this drug because it has been proven to be effective in relieving pain and is relatively available in remote areas (8).

Furthermore, ketamine is also able to inhibit the tolerance of opioids hence reducing the need for it. A meta-analysis from Cochrane showed that the administration of ketamine at subanesthetic doses reduced pain intensity and the need for opioids and produced minimal side effects (9). Ketamine is also safe for the fetus as well as for nursing mothers because although it can cross the placenta, its administration of less than 1 mg/kg will not cause fetal depression. Moreover, although the level of ketamine in breast milk has never been measured, some data has shown that it has not caused any effects on the baby or the lactation process (10,11).

Ketamine at subanesthetic doses has shown varying analgesic effects in several studies. It is believed to have a preemptive analgesic effect so that it can provide long-term analgesic effects (7–9,12). In another study, the preemptive analgesic effect of ketamine was not proven (5,13,14). A meta-analysis study also stated that the administration of preoperative ketamine could reduce morphine consumption and prolong postoperative analgesic requirements. This study also mentioned that there is a difference in pain scores at 1 to 12 hours postoperatively, but this is not statistically significant (15).

Furthermore, a study stated that the effectiveness of ketamine as preemptive analgesia depends on the intensity of the noxious stimulus, the dose of ketamine used, and the additional drug administered (16). The doses of ketamine used in several studies were 0.15 mg/kg (12,15), 0.25 mg/kg (5,8,9,15), and 0.5 mg/kg (13,15,16). These three doses have been proven to be safe for pregnant women and have not shown any significant side effects on the fetus (5,8,12,16).

In conclusion, previous studies have shown an analgesic effect in postoperative cesarean sections, but different anesthetic techniques and doses of ketamine give varying results (5,8,12,16). This study conducted an RCT to demonstrate the postoperative analgesic effect of low-dose intravenous ketamine in patients undergoing cesarean sections with Sub-Arachnoid Blocks (SAB). The hypothesis is that there was a difference in the postoperative analgesic effect of low-dose intravenous ketamine versus the placebo based on data from previous studies.

MATERIALS AND METHODS

This study implemented an RCT and was conducted from August 2020 to January 2021 at the Kuala Pembuang Hospital, Seruyan - Central Kalimantan. Patients undergoing Cesarean Section with SAB would be included as subjects if they agreed to participate by signing the informed consent form. The inclusion criteria in this study were patients with the American Society of Anesthesiology (ASA) Scores I and II. The exclusion criteria are patients with a history of hypertension, patients with preeclampsia - eclampsia, patients with a history of hypersensitivity to ketamine, psychological disorders, and patients with a history of SAB procedure and are at risk for General Anesthesia (GA). This study used a total sampling technique on patients who underwent SC from August 2020 to January 2021. The Simple Random

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Sampling technique was conducted by the pharmacist who prepared the drug. The patients were divided into two groups (the ketamine group and the control group), and the ketamine group was further divided into three sub-groups (0.15 mg/kg; 0.25 mg/kg; 0.5 mg/kg).

This was a double-blind study as all of the subjects and data takers do not know the type of drug administered. Only the anesthesiologist was aware of the type of drug being administered. This was done for the safety of the patient and due to the limited manpower. The blind process was conducted on the anesthetic records during surgery.

Research Procedure

The patients arrived in the operating room and were measured for their hemodynamics (Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), and pulse rate) using a non-invasive monitor before they were given the intervention (the administration of low-dose intravenous ketamine).

Five minutes later, the patients were re-evaluated, and if there were no disturbances, the patient was positioned for left lateral decubitus for SAB. The SAB drug given was hyperbaric bupivacaine 5% 12.5 mg with adrenaline 1:200,000. The block level targeted was sensory T6. If the target level has been reached, the patient would be disinfected in preparation for the cesarean section.

The patients were then given dexamethasone 10 mg intravenously and ketorolac 30 mg intravenously before the incision. Hypotension in this study was a decrease in MAP of more than 20% basal MAP. This was then treated with ephedrine 5-10 mg intravenously according to the anesthesiologist performing the SAB. Sedation during surgery in this study was measured using the Ramsey Sedation Score (RSS) with patients deemed sedated when an RSS score of 2 or more was recorded during anesthesia. Five minutes before the end of the operation the patients were given pethidine 1 mg/kg intravenously. Post-operation, the patients were brought to the Recovery Room (RR) for monitoring and evaluation. In the RR, if the patient was experiencing nausea/vomiting after surgery, 8 mg of ondansetron and 50 mg of ranitidine were administered intravenously.

This study used the Wong-Baker Face Scale (WBFS) as the pain score, with the diagnosis of postoperative pain determined by WBFS > 2. Postoperative pain was treated with fentanyl (rescue analgesia) 0.5-2 mcg/kg. Patients would also be returned to the ward with a Bromage score of IV and an Alderette score of > 9.

In the ward, if the patient experienced pain (WBFS > 2), the nurse would report to the anesthesiologist on duty and the patient would be treated using a fentanyl bolus or with a syringe pump. The data taken in this study were divided into two, namely primary results (consisting of WBFS 1 hour, 2 hours, 24 hours, and 48 hours post-operation) and secondary results (consisting of APGAR scores at 1 minute and 5 minutes). Hypotension after SAB, sedation during surgery, postoperative nausea/vomiting, the timing of the first postoperative rescue analgesia (fentanyl), and total rescue analgesia (fentanyl) administered during treatment) were entered in the Data Collection Sheet (LPD).

Statistical Analysis

The statistical analysis in this study was done using SPSS 23. The data in this study were age (years), body weight (kg), ASA Score, SBP (mmHg), DBP (mmHg), MAP (mmHg),

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pulse (times/minute), the urgency of the surgery, as well as primary and secondary results. This study used the Kolmogorov-Smirnov test to determine the distribution of the data. If the data distribution was normal, a parametric test would be used (Pearson, univariate one-way ANOVA, univariate two-way ANOVA) and if the data distribution was not normal, a non-parametric test would be used (Spearman, x2, Mann-Whitney test, x2 with K sample).

RESULT AND DISCUSSION

This study screened 105 patients, but 15 patients met the exclusion criteria, hence 90 patients were eligible as this study's subjects. The subjects were divided into 2 groups, the control group and the ketamine group. Demographic data can be seen in table 1.

The primary outcome of this study showed there was a significant difference between WBFS 1-hour post-operation and WBFS 2 hours post-operation in the control group and the ketamine group. The mean one-hour postoperative WBFS was 0.44 ± 1.25 vs 0.98 ± 1.72 and 2-hour postoperative WBFS was 0.24 ± 0.82 vs 0.91 ± 1.57 with the ketamine group results being lower compared to the control group. The WBFS 24 hours post-operation and WBFS 48 hours post-operation between the ketamine and control groups showed a difference, but it was not statistically significant (the p-value of WBFS 24 hours post-operation was 0.299 and the p-value of WBFS 48 hours post-operation was 0.097). The complete data can be seen in table 2.

The secondary outcome of this study was that there was a significant difference in the incidence of sedation during surgery, time of first fentanyl administration, and total fentanyl administered. Fentanyl as the first rescue analgesia in the ketamine group was administered on average 52 minutes (±10.61) post-operation with an average total administration of fentanyl being 3.33 mcg (±22.36), while the control group was administered fentanyl on average at 44 minutes (±17.66) post-operation with a total mean of 38.33 mcg of fentanyl (±90.07). The post-spinal hypotensive effect in the control group was higher than in the ketamine group (20% vs 11%), but this was not statistically significant. Sedation was also common in 22% of patients given ketamine.

Table 1. Demographic Data

Variables	Ketamine Group Mean ± SD / N (%)	Control Group Mean ± SD / N (%)	p-Values
Age (years)	27 (±5.51)	27 (±6.31)	0.986*
Weight (kg)	60 (±10.14)	64 (±12.75)	0.080*
ASA Score			
I	32 (71 %)	29 (64%)	0.504**
II	13 (29%)	16 (36%)	
Preop SBP (mmHg)	108 (±10.95)	109 (±12.45)	0.948**
Preop DBP (mmHg)	63 (±8.31)	65 (±8.11)	0.485**
Preop MAP (mmHg)	80 (±7.77)	78 (±8.33)	0.168**
Preop Pulse (times/minutes)	72 (±8.57)	71 (±8.78)	0.699*
Surgery Urgency			
Elective	14 (31%)	10 (22%)	0.238***
Emergency	31 (69%)	35 (78%)	

* *Chi-square* (X^2) ** *Mann-Whitney Test*

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Table 2. Primary Outcomes

Variables	Ketamine Group Mean ± SD	Control Group Mean ± SD	p-Values
1-hour postoperative WBFS	**0.44 (±1.25)**	**0.98 (±1.72)**	**0.037***
2-hour postoperative WBFS	**0.24 (±0.82)**	**0.91 (±1.57)**	**0.037***
24-hour postoperative WBFS	0.24 (±0.74)	0.76 (±1.74)	0.299*
48-hour postoperative WBFS	0.07 (±0.25)	0.24 (±0.57)	0.097*

* *Mann-Whitney Test*

Table 3. Secondary Outcomes

Variables	Ketamine Group (n:45)	Control Group (n:45)	p-Values
Hypotension after SAB	5 (11%)	9 (20%)	0.245*
Sedation during surgery	**10 (22%)**	**0**	**0.001***
1-minute Apgar score	7 (± 0.89)	7 (±1.47)	0.929**
5 minutes Apgar score	9 (±1.48)	9 (±1.48)	0.732**
Postoperative nausea/vomiting	6 (13%)	6 (13%)	1.000*
Timing of the first postoperative fentanyl (minutes)	**52 (±10.61)**	**44 (±17.66)**	**0.003****
Total fentanyl administered (mcg)	**3.33 (±22.36)**	**38.33 (±90.07)**	**0.008****

* Chi-square (X2) **Mann-Whitney Test

This study demonstrated that administering low-dose intravenous ketamine before SAB in cesarean sections can provide postoperative analgesia. This can be seen from the lower WBFS levels at 1 hour and 2 hours post-operation. The results in our study are in line with other studies (12,17) which found that the patients that were administered ketamine experienced a lower pain scale at 60 to 150 minutes after a cesarean section.

Ketamine can provide postoperative analgesia effects through several mechanisms, such as through the effect of preemptive analgesia due to its effect on central sensitization. The operation will cause tissue damage that will form a central pain pathway sensitization by releasing glutamate which causes a higher pain sensation due to the activation of NMDA receptors in the postsynaptic spinal cord (7,15,17).

Our study found a significant difference in early postoperative WBFS (ketamine group 0-1 vs control group 0-3) with a p-value of less than 0.05. This may be because ketamine can also reduce the occurrence of hypersensitization. After all, NMDA receptors are also found in pre-synaptic pain pathways in the dorsal horn (17). This study also showed a decrease in pain scale at 24 hours and 48 hours post-operation (WBFS range 0 - 1) with the use of ketamine, but there was no difference between the ketamine group and the control group (with a p-value of more than 0.05). This was also shown in several studies where the administration of low doses of ketamine (0.5-1.0 mg/kg) did not show a significant difference on the postoperative pain scale (0 to 24 hours) (13,14,16).

The preemptive effect of ketamine is influenced by the intensity of the pain stimulus produced (type of surgery) and the use of other drugs (16).

Our study also found that administering ketamine prolonged the patients' need to be administered rescue analgesia (fentanyl) than the control group (52[41-63] vs 44[27-62]) with a p-value of less than 0.05 (p-value 0.008). Similar results were found in several studies,

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where administration of low doses of ketamine was able to prolong the administration of additional postoperative analgesics (both cesarean or not cesarean) (5,7,8,12,15,17).

Several studies have also shown that the administration of low-dose ketamine in cesarean sections can delay the administration of the first additional analgesia to more than 2 hours (190 – 210 minutes) (5,7,12,17). In our study, the first rescue analgesia (fentanyl) was administered in approximately 52 minutes (41 – 63) with a p-value of less than 0.05 (p-value 0.003). The longer delay of rescue analgesia is due to the preemptive analgesic effect of ketamine. However, good perioperative pain management can suppress the activation of NMDA receptors so the administration of ketamine in these cases is insignificant. This was evidenced in a study of low-dose ketamine administration in patients undergoing cesarean section under general anesthesia, where the use of ketamine did not significantly reduce pain scale, and the consumption of morphine did not differ from 2 to 24 hours postoperatively (16).

Postoperative pain management in post-cesarean section patients has its challenges because improper pain management will cause morbidity for the patients and their babies. Inadequate pain management, especially during the first 24 hours will interfere with the bonding process between the baby and the mother. The use of analgesics also has to be done cautiously due to the patient's breastfeeding needs after giving birth (6,18). Thus, the administration of NSAIDs is the main choice for the management of postoperative cesarean section pain, but NSAIDs alone cannot treat moderate to severe pain. Opioids are still often the main choice in the management of acute pain, but their use in postoperative cesarean section (in breastfeeding) should be limited to 2 to 3 days, and the drugs selected should also not harm the fetus (16,19).

Our study chose fentanyl as rescue analgesia due to its minimal excretion into breast milk, therefore it is safer to use in postoperative cesarean section mothers who are planning to breastfeed (20). This study also showed a significant difference in the total consumption of fentanyl in patients who received ketamine. This is similar to other studies that showed how low-dose intravenous ketamine can reduce fentanyl consumption (21). Similar results were also seen in another study with other classes of opioids such as meperidine (8). In addition, the use of other classes of analgesics such as diclofenac was also lower (about 30-40%) 24 hours after cesarean section. This is because ketamine has several analgesic mechanisms that can trigger this phenomenon.

Ketamine is known to act on several receptor systems (such as opioidergic and cholinergic systems) and activate the supraspinal monoaminergic descending inhibitory pathway, resulting in anti-nociceptive effects (12). The use of low-dose ketamine in this study did not show a significant difference in the incidence of postoperative nausea and vomiting as 13% of patients in each group experienced nausea and vomiting. Several other studies also showed that there was no significant difference in the incidence of postoperative nausea and vomiting in the use of low-dose ketamine in patients who underwent cesarean section under anesthesia SAB (5,12,17). The analgesic effect of ketamine can also be triggered by the pre-synaptic and post-synaptic blockade of NMDA receptors causing a decrease in efferent transmission, thus reducing the "wind-up" and central sensitization phenomenon (17).

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Table 4. Comparison of Ketamine Doses to The Primary and Secondary Outcome

Variables	0.15mg/kg	0.25mg/kg	0.5mg/kg	p-value
1-hour postoperative WBFS	1.30 (±2.05)	0.87 (±1.55)	0.73 (±1.58)	0.617*
2-hour postoperative WBFS	0.40 (±1.29)	0.20 (±0.41)	0,27 (±0.45)	0.799*
24-hour postoperative WBFS	0.47 (±1.06)	0.27 (±0.70)	0	0.230*
48-hour postoperative WBFS	0.13 (±0.35)	0.07 (±0.25)	0	0.359*
Post SAB Hypotension	3 (20%)	1 (6%)	1 (6%)	0.254**
Nausea and Vomiting	2 (13%)	2 (13%)	2 (13%)	1.000**
1-minute Apgar Score	8 (±0.67)	7 (±1.04)	8 (±0.88)	0.238*
5 minutes Apgar Score	9 (±0.64)	9 (±1.22)	9 (±0.86)	0.500*
Sedation Effect	**0**	**2 (7%)**	**8 (53%)**	**0.000****
First Fentanyl Administration (minutes)	4 (±15.49)	0	0	0.376*
Total fentanyl use (mcg)	10.00 (±38.73)	0.00	0.00	0.376*

The secondary effect that was seen to be significantly different in this study was the presence of a sedative effect on the use of ketamine. The incidence of sedation during the administration of ketamine in this study was 22%. Ketamine can provide an analgesic effect at plasma concentrations of 100-160 ng/ml and will last about 1 to 2 hours. The ED50 for the narcotic effect of ketamine is at a dose of 0.4-0.7 mg/kg (22). This also occurred in another study where the administration of 30 mg of ketamine in patients who underwent cesarean sections under SAB caused hallucinations during surgery (8).

The sedative effect of ketamine use is believed to affect the dose of ketamine used. In another study using lower doses of ketamine (0.15 mg/kg), there was no hallucinatory effect but 10% of patients experienced sedation (but it was not statistically significant) (17). Another study using a ketamine dose of 0.25mg/kg also showed the same result where during the initial 30 minutes of surgery the patient was sedated with RSS (23).

The use of low-dose ketamine in this study did not show a significant difference in the incidence of postoperative nausea and vomiting. In this study, 13% of patients in each group experienced nausea and vomiting. Several other studies also showed that there was no significant difference in the incidence of postoperative nausea and vomiting in the use of low-dose ketamine in patients who underwent cesarean section under SAB (5,12,17).

This study also used ketamine at three different doses, in accordance with several other studies (0.15 mg/kg (12,17); 0.25 mg/kg (5); 0.5 mg/kg (21)). A comparison of the primary and secondary outcomes can be seen in Table 4. This study showed no significant difference in WBFS on 1 hour, 2 hours, 24 hours, and 48 hours post-operation. Much like the incidence of postoperative nausea and vomiting and post-SAB hypotension, there was no statistically significant difference. However, the incidence of post-SAB hypotension with a dose of ≥ 0.25 mg/kg was lower (6% vs 20%).

A significant difference was found in the sedative effect during surgery, the administration of ketamine at 0.5 mg/kg gave a higher possibility of a sedative effect than a dose of 0.25 mg/kg (53% vs 7%) and there was no sedation effect at a dose of 0.15 mg/kg. Furthermore, this study found that no rescue analgesia (fentanyl) was administered to patients who were given a ketamine dose of

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0.25 mg/kg, but based on our statistical analysis there was no significant difference between the firsttime fentanyl was given and the total administration of fentanyl at the three other doses.

Ketamine at low doses (less than 1 mg/kg) can provide analgesic effects and is often used in the management of acute and chronic pain (24). Moreover, different doses of ketamine in cesarean sections are safe for infants with different analgesic efficacy (5,12,16,17,21). Effects other than analgesia can also be found with higher ketamine doses. Ketamine 0.5-1 mg/kg is often used for diagnostic sedation in children or adults. This study found that the use of 0.5 mg/kg caused sedation in 53% of patients whereas a dose of 0.25 mg/kg provided sedation in 7% of patients. An article review stated that a plasma concentration of 70 ng/ml ketamine can alter memory and a dose of 200ng/ml can cause an anesthetic effect (22).

This study showed that there was no significant difference in the postoperative pain scale with the use of three different doses of ketamine. The analgesic efficacy of ketamine can also be affected by additional drugs given during surgery. This study used dexamethasone and an NSAID (ketorolac) before incision as preemptive analgesia, which may influence the outcome of the postoperative pain scale. A study of the preemptive analgesic effect of ketorolac in ankle fracture surgery showed that administering ketorolac before a tourniquet could reduce postoperative pain (25). Dexamethasone can also reduce the intensity of postoperative cholecystectomy pain as well as the consumption of meperidine (23).

CONCLUSION

Administration of low-dose ketamine in patients undergoing cesarean section with SAB can provide a better analgesic effect 1 to 2 hours post-operation and delay the postoperative administration of fentanyl and total fentanyl use. Additionally, administration of 0.25 mg/kg can provide the same analgesic effect as a higher dose (0.5 mg/kg) with a lower sedative effect.

Limitations

Observation bias is the main limitation of this study as the non-blind test on the anesthetic operator may confuse the results of this study and the reasons for not selecting single blinding have been described previously. Thus, a more objective examination of the analgesic efficacy of low-dose ketamine in cesarean sections under SAB is needed.

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Conflict of Interest

No conflict of interest in this study.

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Authors' Contributors

All authors have contributed to all process in this research.

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Original Article

ANESTHESIA AND ANALGESIA MANAGEMENT PROFILE FOR AIRWAY SURGERIES AT DR. SOETOMO GENERAL ACADEMIC HOSPITAL SURABAYA

Agustina Salinding[1,3a], Widiartha Wahyudi[1], Arya Pradipta[2]

[1] Department of Anesthesiology and Reanimation, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[2] Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[3] Siloam Hospital, Surabaya, Indonesia
[a] Corresponding author: tiensanest@gmail.com

ABSTRACT

Introduction: Ear, Nose, and Throat (ENT) surgeries are commonly performed and very often require the surgeon and anesthesiologist to share the same workspace. Over the years, ENT surgery techniques have evolved from conventional methods to computer-assisted intraoperative navigation. In contrast to the past, a minimally invasive approach to paranasal sinus and petrous bone surgery is now preferred. Bleeding, postoperative nausea, and vomiting are complications often encountered in ENT surgery. In addition, pain management during surgery and patient comfort after a surgical procedure is a challenge for anesthesiologists. Therefore, the choice of anesthetic drugs is important. **Objective:** This study aims to determine the action profile, anesthetic management, and pain management in ENT surgery at Dr. Soetomo General Academic Hospital Surabaya. **Materials and Methods:** This is a retrospective descriptive study. A total of 177 patients underwent airway surgery. Data were obtained from the Medical Records of the Integrated Surgery Center of Dr. Soetomo General Academic Hospital recorded from January to December 2021. **Results and Discussion:** Most of the patients were in the age group of 45 - 65 years (40.1%) and a majority were men (65.5%). Most patients who were ≥ 20 years old had a normal nutritional status (54.2%). The most frequent diagnosis was laryngeal cancer (23%), with micro laryngeal surgery being the most frequently performed (35.8%). Most surgeries also needed less than 60 minutes followed by 60 to 119 minutes (27.1%). The most frequently used induction agents were a combination of propofol, fentanyl, and rocuronium (39.5%), with isoflurane as the most frequent inhalation agent (91.3%). Metamizole (70.1%) was the most postoperative analgesic. **Conclusion:** In general, intravenous agents were used for anesthesia induction. A combination of different induction agents brings synergistic benefits.

Keywords: Airway; Analgesic; Anesthesia; ENT Surgery; Good Health

ABSTRAK

Pendahuluan: Pembedahan telinga, hidung, dan tenggorokan (THT) merupakan salah satu tindakan pembedahan yang paling seringkali dilakukan dan seringkali mengharuskan ahli bedah dan tim anestesi berbagi area kerja yang sama. Teknik pembedahan THT sekarang telah banyak berkembang mulai dari teknik konvensional hingga penggunaan bantuan komputer dalam pelaksanaan operasi. Berbeda dengan masa lalu, saat ini tindakan invasif minimal pada operasi sinus paranasal dan tulang petrosa lebih disukai. Adanya perdarahan serta terjadinya mual muntah pasca operasi adalah komplikasi yang sering terjadi pada operasi THT. Karena itu, sangatlah diperlukan pemilihan obat anestesi yang tepat. Sebagai tambahan, tata laksana nyeri selama operasi dan kenyamanan pasien setelah operasi adalah tantangan bagi ahli anetsi. **Tujuan:** Penelitian ini bertujuan untuk mengetahui Profil Tindakan, manajemen anestesi dan manajemen nyeri pada Operasti THT di RSUD Dr. Soetomo Surabaya. **Bahan dan Metode:** Penelitian ini merupakan penelitian deskriptif retrospektif. Sejumlah 177 pasien menjalani operasi jalan nafas. Data diperoleh dari rekam medis pada pembedahan pusat terpadu RSUD Dr. Soetomo, diambil bulan Januari – Desember 2021 dan dianalisis dengan aplikasi SPSS. **Hasil dan Pembahasan:** Jumlah pasien terbanyak berasal dari kelompok umur 45 – 65 tahun (40,1%). Penderita laki – laki lebih banyak dibandingkan penderita wanita (65,5%). Kebanyakan pasien berusa lebih dari 20 tahun berada dalam status nutrisi normal (54,2%). Diagnosa terbanyak adalah kanker laring (23%), dengan tindakan pembedahan paling banyak pembedahan bedah mikro laring (BLM) (35,8%). Sebagian besar pembedahan membutuhkan waktu kurang dari 60 menit

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dan diantara 60 – 119 menit (27,1%). Obat induksi terbanyak adalah kombinasi dari propofol, fenatnil, dan rokuronium (39,5%), dan obat inhalasi terbanyak adalah isofluran (91,3%). Analgetik pasca operasi paling banyak menggunakan metamizol (70,1%). **Kesimpulan:** Induksi anestesi umumnya secara intravena. Adanya kombinasi obat induksi memberikan keuntungan secara sinergis.

Kata Kunci: Jalan Napas; Analgesik; Anestesi; Operasi THT; Kesehatan

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INTRODUCTION

A total of 210 patients underwent rhinoplasty between June 2017 and December 2017 at the Konyang University Hospital, Daejon, Korea (1). Meanwhile, at the Santo Spirito Hospital, Casale Monferrato, Italy, 1321 patients underwent ENT surgery between January 2002 and December 2004. In addition, 1133 (85.7%) of them underwent airway surgery (2).

Ear, Nose, and Throat (ENT) surgery is the most common surgery performed and very often requires the surgeon and anesthesiologist to share the same workspace (3). There is a wide variety of existing ENT cases in various parts of the world with varying incidences.

ENT surgery techniques have evolved from conventional methods to computer-assisted intraoperative navigation. In conventional surgeries, the surgeon must apply his anatomical knowledge and experience to map the patient during surgery. Therefore, the radiological image must remain in the sight of the surgeon to help them determine the exact location of the surgical instrument. This is done through distorted endoscopic images, with the possibility of bleeding and other significant changes in the patient's anatomy during the surgery. In contrast to the past, a minimally invasive approach to the paranasal sinus and petrous bone surgery is now preferred due to the length of stay and patient compliance (4).

Bleeding is a significant complication of ENT surgery, especially in oral and nasal interventions. Tonsillectomies in particular have the potential for life-threatening bleeding. Bleeding during ENT surgery can interfere with the operative field of view and the airway, increase technical difficulties, as well as increase the operating time (5). In addition, Postoperative Nausea Vomiting (PONV) occurs in 70% of patients who underwent ENT surgery (6). PONV can cause psychological effects, airway obstruction, prolongation of hospitalization, and increased costs (6,7). Therefore, choosing the right anesthetic drug is important.

Ear-nose-throat (ENT) and head and neck surgical procedures are unique because the anesthesiologist and operator share an airway. Anesthesia management in the patient is centered on the airway. Good cooperation and communication between the operator and the anesthesiologist are also important for achieving patient safety and recovery. In addition, pain management during surgery and patient comfort after a surgical procedure is a challenge for anesthesiologists.

This study aims to determine the action profile, anesthetic management, and pain management during ENT surgeries at Dr. Soetomo General Academic Hospital, Surabaya.

MATERIALS AND METHODS

This is a retrospective descriptive study. All patients who underwent airway surgery were included. Data on age, gender, nutritional

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status, disease, treatment, analgesic, and anesthetic agents were collected.

Patient data were taken from the Medical Records of the Integrated Surgery Center of Dr. Soetomo General Academic Hospital, Surabaya recorded from January to December 2021. The data were then processed descriptively using the SPSS application to obtain the frequency and percentage of the data.

RESULTS AND DISCUSSION

Patients' Basic Characteristics

A total of 177 patients underwent airway surgery. There were more male patients (65.5%) than female patients. A majority of the patients were within the 45-65 years (40.1%) age group. Most patients' nutritional status was also within normal limits for ≥ 20 years

Table 1. Patients' Characteristics

Characteristics	N (%)
Gender	
Man	116 (65.5)
Woman	61 (34.5)
Age Group	
0 – 5 years	2 (1.1)
6 – 19 years	25 (14.1)
20 – 44 years	63 (35.6)
45 – 65 years	71 (40.1)
>65 years	16 (9.1)
Nutritional Status by Age Group	
0 – 5 years	
Severe thinness (<-3SD)	0 (0)
Thinness (-2SD - -3SD)	0 (0)
Normal (+2SD - -2SD)	0 (0)
Overweight (>+2SD - +3SD)	1(0.6)
Obesity (>+3SD)	1(0.6)
6 – 19 years	
Severe thinness (<-3SD)	1 (0.6)
Thinness (-2SD - -3SD)	5 (2.8)
Normal (+2SD - -2SD)	22 (12.4)
Overweight (>+2SD - +3SD)	3 (1.7)
Obesity (>+3SD)	3 (1.7)
≥ 20 years	
Underweight (<18.5)	2 (1.1)
Normal (18.5 – 24.9)	96 (54.2)
Overweight (25 – 29.9)	31 (17.5)
Obesity Class I (30 – 34.9)	10 (5.7)
Obesity Class II (35 – 39.9)	2 (1.1)
Obesity Class III (≥ 40)	0 (0)

Diagnosis

The most common diagnosis found in patients with airway procedures was laryngeal cancer (23%).

Table 2. The Most Common Patient Diagnosis

Diagnosis	N	%
Juvenile Nasopharyngeal Angiofibroma	8	4.5
Laryngeal Cancer	41	23
Sinonasal Cancer	12	6.7
Midline paralysis + post tracheotomy	8	4.5
SSR without polyps + deviated septum	10	5.6
Oropharyngeal tumor + impending UAO	9	5

Surgery

The most frequent procedure was micro-laryngeal surgery (24%), followed by Functional Endoscopic Sinus Surgery (FESS) at 17.0%.

Table 3. The Most Frequent Surgeries

Surgeries	N	%
Micro Laryngeal	42	24
Extirpation	9	5
FESS	30	17
MM – RL	10	5.6
Total Laryngectomy	15	8.5

Operation Duration

The duration of most airway operations is under 60 minutes and between 60 to 119 minutes (27.1%).

Table 4. Duration of Operations

Operation Duration	N (%)
<60 minutes	48 (27.1)
69 – 119 minutes	48 (27.1)
120 – 179 minutes	40 (22.6)
180 – 239 minutes	23 (13.0)
>240 minutes	18 (10.2)

Induction and Inhalation Agent

The most frequently used induction agent was a combination of propofol, fentanyl, and rocuronium (39.6%), followed by a combination of propofol, fentanyl, and

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atracurium (37.8%). The most used inhalation agent was isoflurane (96%).

Table 5. Induction and Inhalation Agent

Agent	N (%)
Induction	
Propofol	1 (0.6)
Fentanyl	2 (1)
Ketamine	0 (0)
Propofol and Fentanyl	30 (17)
Propofol and Ketamine	1 (0.6)
Propofol, Fentanyl and Rocuronium	70 (39.6)
Propofol, Fentanyl and Atracurium	67 (37.8)
Propofol, Fentanyl, and Lidocaine	4 (2.2)
Propofol, Fentanyl, and Pethidine	1 (0.6)
Propofol, Fentanyl, and Morphine	1 (0.6)
Propofol, Fentanyl and Ketamine	0 (0)
Inhalation	
Isoflurane	170 (96)
Sevoflurane	7 (4)

Postoperative Analgesic Use

Metamizole injection was the most frequently used analgesic option (70.1%), followed by a combination of paracetamol and ketorolac.

Table 6. Analgesia Postoperative

Analgesic	N (%)
Paracetamol	15 (8.5)
Metamizole	124 (70.1)
Ketorolac	11 (6.3)
Paracetamol dan Ketorolac	4 (2.2)
Paracetamol dan Metamizole	15 (8.5)
Paracetamol dan Fentanyl	1 (0.6)
Metamizole dan Ketorolac	3 (1.6)
Metamizole dan Tramadol	3 (1.6)
Ketorolac dan Tramadol	1 (0.6)

This study found that most patients belonged to the age group between 45-65 years, and the majority were men. This result is similar to Nocini et al., 2020 who found that the incidence of laryngeal carcinoma increased steadily after the age of 35 years (8). The incidence of laryngeal carcinoma peaks after 65 years but then decreases gradually. Men are also more likely to develop laryngeal carcinoma as it is associated with smoking and alcohol consumption (8,9). This study showed that most patients had normal nutritional status. This result is similar to te Riele et al., 2018 who found that most patients with laryngeal squamous cell carcinoma had a normal nutritional status even after weight loss (10).

Laryngeal carcinoma was the most frequent diagnosis in our study. This result is in line with a previous study that described laryngeal tumors as the most common laryngeal cancer (11). In our study, we explained that micro-laryngeal surgery is a common procedure. Micro laryngeal surgery is a minimally invasive procedure often performed in head and neck surgeries for the diagnosis and therapy of pathological conditions of the larynx (12,13). Micro laryngeal surgery is usually safe. However, as with other operations, micro laryngeal surgery has the following risks: tongue damage, tooth damage, lip damage, and temporary hypoglossal nerve paralysis due to laryngoscope compression. Moreover, tracheostomy devices must be available in the operating room during the surgery (13).

Anesthesia induction can generally use inhalation or intravenous agents. Intravenous agents are the most commonly used induction agents. Propofol, etomidate, and ketamine are the most commonly used intravenous agents (14). While opioids can also be used for induction, they are more often used for other purposes. Inhalation agents are also commonly used for induction in children (15).

Each anesthetic agent has its advantages and disadvantages, and none is superior to the other (16). Propofol is highly lipid-soluble, has

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a fast induction time, and short duration due to rapid redistribution (14). However, propofol is very painful when injected (14), causes dose-dependent respiratory depression and hypotension, and has poor analgesic properties (17). Ketamine has sedative and analgesic properties due to its favorable hemodynamic profile (17,18). It also protects airway reflexes and spontaneous breathing (17). Although it is classified as an induction agent, it does not achieve anesthesia in the arm-brain circulation (14).

Etomidate, as a sedative and hypnotic drug, has a good hemodynamic profile but is associated with suppressing adrenocortical function (14,19). Opioids with high doses can also be used for sedation, but this is associated with chest wall stiffness (20). Inhaled anesthetics can be used as induction agents, but their effectiveness is strongly influenced by cardiac output, alveolar ventilation, inspired volatile agent concentrations, and gas partition coefficient (14).

Most common anesthetics use a combination of different drugs that work synergistically with one another. Recent anesthetic strategies have prioritized the use of these synergistic drugs to reduce the dose and dose-dependent side effects of single substances (21). Previous studies have also shown that using a mixture of “Ketofol” as an induction agent provides hemodynamic stability and BIS assessment between propofol and ketamine (17). Likewise, the combination of propofol and fentanyl shows a better sedative effect, reduces the incidence of respiratory depression, and provides hemodynamic stability (22). Furthermore, according to research conducted by Azeem et al., 2020 the combination of ketamine and propofol is better in maintaining hemodynamic stability than fentanyl and propofol (23). Meanwhile, the vital capacity induction technique with sevoflurane provides the same intubation and induction conditions as the standard intravenous induction technique with propofol, fentanyl, and rocuronium. However, it provides a longer induction time (18).

Propofol and volatile anesthetic agents are an important part of modern general anesthesia and provide many benefits in clinical anesthetic practice and perioperative medicine (24). The use of inhalation agents to maintain general anesthesia was chosen in this study. The researchers found different results in previous studies. Several studies have shown that TIVA reduces PONV, the emergence of agitation, and blood loss while having high surgeon satisfaction compared to volatile anesthetic agents to maintain general anesthesia (25,26). However, volatile anesthetics still have the advantage that tracheal extubation and respiratory recovery are significantly faster (25). The use of low-flow anesthetics has many advantages in reducing atmospheric pollution, cost effects, and efficient maintenance of airway temperature and humidity (27). Several studies have also shown that the hemodynamic instability between the two techniques is not much different (25,26).

General anesthetic techniques are used in a wide variety of surgeries. General anesthesia has obvious advantages, such as an immovable surgical field to perform a more precise surgical operation, effective respiratory tract protection, adequate analgesia, and ventilation (28). However, one of the effects of isoflurane and sevoflurane, a commonly used inhalation anesthetic, is bleeding. Researchers have differences of opinion regarding the use of isoflurane with sevoflurane. Isoflurane provides a better surgical outlook than sevoflurane in adenotonsillectomy surgery due to the lower amount of bleeding in isoflurane

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(29). Whereas sevoflurane has an inhibitory effect on coagulation and platelet aggregation (30). In addition, in previous studies, platelet aggregation induced by ADP, epinephrine, arachidonic acid, prostaglandin G2, and thromboxane A2 receptor agonists were suppressed by sevoflurane (31). However, isoflurane does not inhibit the platelet aggregation induced by ADP (32). Research conducted by Özkiris et al., 2013 concluded that sevoflurane reduces the amount of intraoperative bleeding in nasal septal surgery, this is because isoflurane can increase the perfusion of the nasal mucous membrane and surgical bleeding (28).

The management of postoperative pain management in this study mostly used NSAIDs alone. Metamizole is the most frequently used NSAID. In our study, the most common procedures were minor procedures that did not damage a lot of tissue (i.e., 35.8% were micro-laryngeal surgery, followed by 15% were Functional Endoscopic Sinus Surgery (FESS)). Most studies showed that postoperative pain after a FESS is generally mild to moderate (33–35). A study conducted by Bianchini et al. (2016) also showed that minor surgeries (i.e., tracheotomies) require sufficient NSAIDs as effective pain medication (36).

The use of metamizole as a basic drug after tonsillectomy surgery showed lower maximal pain, lower use of additional opioids, and lower need for increased analgesic treatment (37). Likewise, in septorhinoplasty surgeries, metamizole consumption was significantly decreased for three postoperative days compared to ibuprofen (38). Unfortunately, metamizole is associated with agranulocytosis (39,40). However, agranulocytosis caused by metamizole is rare (40).

The use of opioids should be reduced to avoid the potential dangers of excessive narcotic drugs (41). NSAIDs are safe analgesics, provide adequate pain control during septoplasty/rhinoplasty, are inexpensive, and reduce postoperative rescue analgesia (opioids) (42). Several guidelines recommend postoperative multimodal analgesia and strongly recommend postoperative non-opioid analgesia unless contraindicated (43,44).

Furthermore, the use of NSAIDs is not indicated in coagulopathy, renal failure, or the risk of bleeding (36). Research by Nguyen et al. (2019) described no significant bleeding events following the perioperative administration of NSAIDs and supported their use as an effective non-opioid alternative (42).

CONCLUSION

General anesthetic techniques are often used for airway surgeries. The induction technique generally uses intravenous agents. Each intravenous agent has its advantages and disadvantages. A combination of different induction agents provides synergistic benefits by reducing the dose-dependent side effects of a single intravenous agent. In this study, isoflurane was the most common agent used. Isoflurane provides a better surgical field for airway surgery and reduces postoperative complications. This advantage is obtained because the amount of bleeding is lower with isoflurane. Metamizole is the most commonly used analgesic agent. In addition, the use of NSAIDs can reduce opioid use and reduce the harmful effects of opioids. Most airway surgeries in this study took less than 60 minutes. The most common diagnosis was laryngeal carcinoma, with micro-laryngeal surgeries being the most common surgical procedure.

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Case Report

ANESTHETIC MANAGEMENT OF A PATIENT WITH HENOCH-SCHONLEIN PURPURA FOR CESAREAN SECTION

Indriyani Wijaya[1a]

[1] Anesthesiology and Intensive Care Department, Faculty of Medicine, Public Health and Nursing Gadjah Mada University/ Dr. Sardjito Hospital Yogyakarta

[a] Corresponding author: indriyani.wijaya@mail.ugm.ac.id

ABSTRACT

Introduction: Henoch-Schonlein Purpura or Immunoglobulin-A vasculitis is a systemic vasculitis caused by immune complexes that attack small blood vessels. The classic symptoms of Henoch-Schonlein Purpura include erythema purpura, arthralgia, gastrointestinal complaints, and renal involvement. Some cases show that pregnancy itself could be the trigger for its recurrence and lead to early delivery. **Case report :** A 33-year-old patient, G2P1A0 and 35 weeks and 4 days pregnant complained of diarrhea 8 days before hospital admission (8-15 times per day). The patient was diagnosed with Henoch-Schonlein Purpura 3 years ago. Upon monitoring in the ward, the fetus was found to be in a compromised condition and an emergency cesarean section was needed. The patient was assessed as having an ASA II physical status and was anesthetized with regional anesthesia epidural in the sitting position, with a median approach, puncture at L3-L4 level, and with 12 ml of Bupivacaine 0.5% isobaric. Postoperative care was continued in the ward. **Discussion**: As long as there are no contraindications, a neuraxial block could be performed on parturient patients with Henoch-Schonlein Purpura who would undergo a cesarean section. Neuraxial block, namely epidural block, has the added advantage of being a postoperative analgesic and helps to avoid the use of Non-Steroidal Anti Inflammatory Drugs (NSAIDs) in Henoch-Schonlein Purpura patients who often have renal complications. **Conclusion:** Caesarean Section with Henoch-Schonlein Purpura disease has been reported with Epidural Block Anesthesia without complications.

Keywords: Cesarean Section; Epidural; Henoch-Schonlein Purpura; Multigravida; Maternal Health

ABSTRAK

Pendahuluan: Henoch-Schonlein Purpura atau Vaskulitis Imunoglobulin-A merupakan vaskulitis sistemik, yang disebabkan kompleks imun yang menyerang pembuluh – pembuluh darah kecil. Gejala klasik Henoch-Schonlein Purpura antara lain (1) eritema purpura (2) artralgia (3) keluhan gastrointestinal (4) keterlibatan ginjal. Beberapa kasus menunjukkan kehamilan sendiri dapat menjadi pencetus kekambuhan dan menyebabkan persalinan yang lebih awal. **Laporan Kasus:** Dilaporkan pasien 33 tahun dengan G2P1A0 hamil 35 minggu 4 hari mengeluhkan diare sejak 8 hari sebelum masuk rumah sakit, frekuensi 8 – 15 kali per hari. Pasien terdiagnosis Henoch-Schonlein Purpura sejak 3 tahun yang lalu. Pada pemantauan di bangsal ditemukan janin dalam kondisi fetal compromised dan diputuskan untuk dilakukan seksio sesarea emergensi. Pasien dinilai sebagai status fisik ASA II, pembiusan dengan regional anestesi epidural, sitting position, median approach, puncture setinggi L3-L4, agen Bupivacaine 0.5% isobarik 12 ml. Paska operasi perawatan dilanjutkan di bangsal. **Pembahasan** : Selama tidak ada kontraindikasi, blok neuraksial dapat dilakukan pada ibu hamil dengan Henoch-Schonlein Purpura yang akan menjalani seksio sesarea. Blok neuraksial, yaitu blok epidural, mempunyai keuntungan tambahan yaitu dapat menjadi analgesi paska operasi untuk menghindari penggunaan Obat Antiinflamasi Non Steroid (OAINS) pada pasien Henoch-Schonlein Purpura yang sering mempunyai komplikasi ginjal. **Kesimpulan :** Telah dilaporkan Seksio Sesarea pada penyakit Henoch-Schonlein Purpura dengan Anestesi Blok Epidural tanpa penyulit.

Kata kunci : Seksio Sesarea; Epidural; Henoch-Schonlein Purpura; Multigravida; Kesehatan Ibu

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INTRODUCTION

Henoch-Schonlein Purpura or Immunoglobulin-A vasculitis is a systemic vasculitis, caused by immune complexes that attack small blood vessels. Henoch-Schonlein Purpura is generally found in pediatric patients with an age range of 4-7 years old and with incidences of 3-26 cases per 100,000 children per year. In adults, this disease is less common with only around 0.1 – 1.8 cases per 100,000 individuals per year with a male to female ratio of 1.5 (1).

Clinical Diagnosis and Manifestation

The classic symptoms of Henoch-Schonlein Purpura include (1) erythema purpura (without thrombocytopenia); (2) joints pain (polyarthralgia of the knee, ankle, hand, and wrist joints); (3) gastrointestinal complaints (nausea, vomiting, abdominal pain, acute enteritis, hematemesis, melena, complications of intestinal ischemia, perforation, and intussusception); (4) renal involvement (in 30 - 50% of patients it is characterized by asymptomatic hematuria, proteinuria, acute renal failure, progressive glomerulonephritis, and chronic renal failure) (2,3,4).

Purpura symptoms often appear after upper respiratory tract infections (caused by Streptococcus) in certain seasons (spring, autumn, and winter) (2). The standard diagnosis for Henoch-Schonlein Purpura is based on the clinical findings and criteria issued by EULAR/PRINTO/PRES (European League Against Rheumatism/Paediatric Rheumatology International Trials Organization/Paediatric Rheumatology European Society) in 2010. In pediatric patients, these diagnostic criteria have a sensitivity of up to 100% and specificity of up to 87%, while in adult patients the sensitivity is up to 99.2% and specificity is up to 86% (5).

Table 1. Henoch-Schonlein Purpura Diagnosis Criteria by EULAR/PRINTO/PRES (5)

Criteria	Description
Criteria that must be met	Purpura, especially in the lower extremities
1 of 4 criteria at minimum	1. Diffuse abdominal pain with acute onset 2. Histopathology shows leukocytoclastic vasculitis or proliferative glomerulonephritis, with predominant IgA deposits. 3. Arthritis or arthralgia with acute onset 4. Renal involvement in the form of proteinuria or hematuria

Therapy

Therapy for Henoch-Schonlein Purpura in adults is still a matter of debate. Mild arthralgia and purpura are treated with analgesia and rest. Non-steroidal anti-inflammatory drugs (NSAIDs) are avoided due to the risk of gastrointestinal bleeding and renal effects (9). Corticosteroids are indicated in patients with IgA nephritis. Immunosuppressant agents (such as azathioprine or mycophenolate) may also be given as a corticosteroid adjuvant or as a second-line drug. Whereas angiotensin II receptor antagonists are administered to prevent secondary glomerular injury (10). Henoch-Schonlein Purpura Therapies are summarized in Table 2.

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Table 2. Henoch-Schonlein Purpura Therapy (10)

	First Line	Second Line	Third Line
With mild grade nephritis • Normal GFR • Mild-moderate Proteinuria	Oral Corticosteroids Adjuvant: • Immunosuppressant agents • Angiotensin II receptor antagonist	Immunosuppressant agents Adjuvant: • Angiotensin II receptor antagonist	
With moderate grade nephritis • <50% decrease in renal biopsy and decrease in GFR or • Persistent Proteinuria	Intravenous or Oral Corticosteroids Adjuvant: • Immunosuppressant agents • Angiotensin II receptor antagonist	Immunosuppressant agents Adjuvant: • Angiotensin II receptor antagonist	
With severe grade nephritis • > 50% decrease in renal biopsy and GFR decrease or • Persistent Proteinuria	Intravenous cyclophosphamide Adjuvant: • Intravenous Corticosteroids • Angiotensin II receptor antagonist	Immunosuppressant agents Adjuvant: • Oral Corticosteroids • Angiotensin II receptor antagonist	Renal Transplantation
Persistent Proteinuria	Intravenous or Oral Corticosteroids Adjuvant: Angiotensin II receptor antagonist		

Prognosis

Henoch-Schonlein Purpura which appears during childhood is relatively mild and may be self-limiting, while those that appear in adulthood are often found along with persistent kidney disorders, which cause a worse prognosis (8). Poor prognosis related to renal issues may include proteinuria >1 g/dL, macroscopic hematuria, hypertension, decreased Glomerular Filtration Rate (GFR) < 30 ml/min, and age-related decline (11).

CASE REPORT

The patient was a 33-year-old woman, gravid 2 parity 1 abortion 0, with a gestational age of 35 weeks and 4 days and was admitted to the hospital with complaints of diarrhea for the past 8 days before hospital admission and a frequency of 8-15 times per day with no mucus and blood. The patient had felt a tightness since the previous day, but it was still seldom and had a short duration. There was no blood, mucus, or fluid seen from the birth canal and there was active fetal movement. At the time, there was also no blurred vision or epigastric pain.

The patient has been diagnosed with Henoch-Schonlein Purpura (HSP) for the past 3 years. Confirmation of the diagnosis of Henoch-Schonlein Purpura was done through kidney biopsy with the following results: diffused segmental glomerulosclerosis with increased mesangial cells, which was an IgA nephropathy. Since being diagnosed with HSP (before pregnancy), the patient had received routine therapy with Sodium Mycophenolate (Myfortic ®) which was changed to Acetylsalicylic Acid (Minisapi ®), Azathioprine (Imuran®), and Methylprednisolone (dose of 4 mg/day; then increased to 16 mg/day due to flares). During pregnancy, Methylprednisolone was continued and other therapies were discontinued. Before the complaints, the patient routinely performed pregnancy care at the midwife, internal medicine, and gynecology polyclinics. The patient went once in the first and second trimesters, and twice in the third trimester.

The laboratory examination found the patient's hemoglobin levels of 10.0 g/dL, hematocrit of 31.4 g/dL, platelets of 370 x

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10^3/µL, leukocytes of 9.81 x 10^3/µL, albumin of 2.62 g/dL, SGOT of 24 U/L, SGPT of 11 U/L, PT of 14.6/14.8 sec, APTT of 34.2/29.7 sec, INR of 1.13, GDS of 91 mg/dL, BUN of 27 mg/dL, creatinine of 1.9 mg/dL, sodium levels of 135 mmol/L, potassium of 4.51 mmol/L, chloride of 113 mmol/L, and LDH of 332 U/L. The urinalysis examination found proteinuria +2, bilirubin +1, and blood +2. In the electrocardiographic examination, a sinus rhythm was found with a pulse rate of 78 beats/minute. In the ultrasound examination, a single fetus with a head presentation was found, with a positive Fetal Heart Rate (FHR), placenta in the right lateral body, sufficient amniotic fluid, EFW of 2.370 grams, renal dextra of 7.10 x 4.2 cm, and renal left of 8.35 x 4.35 cm. In the fetus' NST (Nonstress Test) examination, its FHR was 135 times/minute, variability > 5, acceleration positive, no deceleration, positive movement, uterus contraction of 1 time/10 seconds/210 mVu.

During monitoring in the ward, it was found that the mother's blood pressure was 155/90 mmHg, pulse rate was 73 times/minute, respiration rate was 20 times/minute, temperature was 36.7 ^{o}C, and the tightness became constant. The fetus' NST (Nonstress Test) showed FHR 142 beats/minute, uterus contraction was 5 times / 10 minutes / 30 – 35 times/ 210 mVu, variability >5, and acceleration (-), deceleration (-), motion (-) was in the 1st category fetal condition. The vaginal examination found a slightly soft cervix, 30% effaced, no opening, head down in S3, mucus-blood (+), amniotic fluid (-), and a Bishop score of 2. Based on the patient's current condition, obstetricians diagnosed fetal compromise and decided to terminate the pregnancy by conducting an emergency cesarean section. From the examination data, the patient was assessed to have an ASA 2 physical status with an epidural regional anesthetic plan. The preparations conducted included obtaining informed consent from the patient, fasting, installing an intravenous line, and providing 1 unit of Packed Red Cell (PRC) transfusion.

The patient was admitted to the reception area with an intravenous line installed with a transfusion set, an 18G abbocath, and an infusion of 0.9% NaCl at a rate of 40 drops/minute which was administered until the patient entered the operating theater. The patient entered the operating theater and her blood pressure was monitored along with an ECG and pulse oximetry. The monitor stated that the patient's blood pressure was 116/75 mmHg, pulse rate was 123 beats/minute, respiration rate was 23 breaths/minute, and peripheral oxygen saturation was 97% with an oxygen supplementation of 2 liters/minute through the nasal cannula. Anesthesia was done with epidural anesthesia, sitting position, median approach, puncture level at L3-L4, LOR saline (+), Tuohy needle no. 18G, and Bupivacaine agent 0.5% isobaric 12 ml. The patient was in a supine position and the pinprick reached as high as VTh 6. The surgery lasted for 1.5 hours and bleeding of 500 ml occurred. During surgery, the patient's systolic blood pressure was 103 – 151 mmHg, diastolic blood pressure was 71 – 127 mmHg, pulse rate was 100 – 129 beats/minute, respiration rate was 21 – 27 times/minute, and peripheral oxygen saturation was 97 – 100% with an oxygen supplementation of 2 liters/minute through the nasal cannula. Oxytocin 10 IU drip was given in 100 ml of 0.9% NaCl immediately after the delivery of the fetus. Before the surgery was completed, paracetamol 1 gram iv and ondansetron 4 mg iv were administered. Postoperatively, the patient was observed for 1 hour in the recovery room and the treatment

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was continued in the ward with intermittent epidural analgesia.

DISCUSSION

Henoch-Schonlein Purpura occurs due to abnormalities in Human Leukocyte Antigen Class II (HLA II). HLA class II gene polymorphisms modulate vascular homeostasis, i.e. nitric oxide production, activation of the renin-angiotensin system and endothelial cell/adhesive molecules, T cell-associated neoangiogenesis, and production of proinflammatory cytokines, or homocysteine metabolism. This modulation of vascular homeostasis is assumed to be implicated as a predisposition and is also associated with HSP severity. The pathophysiology of adult-onset HSP is slightly different from that of children. At the onset of HSP, the appearance of HSP is related to the increased levels of C-reactive protein and higher levels of IgA (12).

Publication on the effect of Henoch-Schonlein Purpura during pregnancy is still limited. There are no specific clinical manifestations of Henoch-Schonlein Purpura in pregnant women and thus cause difficulties when the patient does not have skin manifestations. However, it must be distinguished from other disorders that cause hypertension and proteinuria, such as preeclampsia and HELLP syndrome (Haemolysis, Elevated Liver Enzymes, and Low Platelet Counts). Hypertension and proteinuria are the signs of severe renal complications. Renal biopsy with immunofluorescence technique which shows mesangial IgA deposits is the best way to differentiate it (8). In this patient, a renal biopsy was performed when the patient was first diagnosed. Abdominal pain must also be distinguished from other conditions which have similar symptoms, for example, labor contractions, obstetric emergencies, or acute abdomen (13). In this patient, no skin manifestations were found.

Steroid administration, especially prednisone, had been shown to relieve arthralgia and gastrointestinal complaints within 4 weeks, as well as accelerate nephritis resolution, although it has not been shown to prevent nephritis. Prednisone was preferred because only a small amount crossed the placenta, thereby minimizing the effect on the fetus (8,13). The use of steroids, apart from therapy for Henoch-Schonlein Purpura, was also expected to accelerate fetal lung maturity considering that the gestational age was still 35 weeks and 4 days. In this patient, methylprednisolone was administered at a dose of 4 mg/day and then increased to 16 mg/day. Steroids had been taken since the first diagnosis.

The long-term use of steroids/ glucocorticoids (methylprednisolone) in pregnant women instigated the question: what are the effects on the mother and fetus? Normally, the placenta would produce corticosteroid 11-beta-dehydrogenase isozyme 2 (via HSD11B2 gene expression) which limits the glucocorticoid transfer from mother to fetus by oxidizing cortisol into inactive metabolites. Before birth, fetal cortisol production would increase and corticosteroid 11-beta-dehydrogenase isozyme 2 would decrease and trigger organ maturation. An example would be the production of surfactants for the fetus' lung maturation to support life at birth. Exogenous exposure would increase the level of glucocorticoids in the fetus. Existing studies show that high levels of cortisol are thought to cause sequelae, including preterm birth, attention deficit and hyperactivity disorder, and decreased brain cortex thickness in the Magnetic Resonance Imaging (MRI) of

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children aged 6-10 years. No evidence specifically mentions how many doses and duration of exposure could cause these sequelae. Preclinical data in experimental animals showed that a dose of 0.125 mg/kg intramuscularly is a safe limit which still shows the benefits of improving lung maturation and gas exchange compared to the negative effects that may occur (14).

In the mother, long-term use of steroids increases the risk of peripartum infection, gestational hypertension, and preeclampsia (15). In addition, during labor, hemodynamic instability may occur. This is because long-term steroid use suppresses the Hypothalamic-Pituitary-Adrenal (HPA) axis, which results in decreased levels of Adrenocorticotropic Hormone (ACTH) and Corticotrophin-Releasing Hormone (CRH) which leads to decreased cortisol production. This process is known as secondary adrenal insufficiency. Low cortisol levels may also predispose the patient to vasodilation and hypotension, in other words the patient becomes at risk for an adrenal crisis during periods of stress because the ability to enhance the cortisol response is attenuated. The clinical symptoms that would appear are severe and persistent hypotension which is less responsive to fluids and vasopressor therapy. The perioperative adrenal crisis could also be life-threatening and requires prompt recognition and treatment with stress doses of steroids and supportive care with fluids and vasopressors (16). In this case, these effects were not detected. During surgery, the patient's hemodynamics were stable and no adrenal crisis was found.

Furthermore, there has been no report yet for the recommendation of the use of immunosuppressant agents (Azathioprine, Cyclophosphamide) in pregnant women. Plasmapheresis has been reported to be used in cases of progressive renal complications, although its efficacy has not been proven (6).

Anesthesia for a parturient with Henoch-Schonlein Purpura was adjusted to the clinical conditions at that time. If there are no contraindications, regional anesthesia is still the first choice. Regional anesthesia requires normal coagulation function and platelet count, as was found in this patient. In addition, there were no skin abnormalities or lesions in the puncture area. Another consideration is that the mother was not in a state of hypovolemia due to diarrhea she experienced when she was first admitted to the hospital. The epidural block was also chosen with consideration of the fetus being in a fetal compromised condition so that there was still sufficient time to await the onset of the block. Furthermore, the insertion of an epidural catheter could also be used to avoid the use of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) as postoperative analgesia in patients with renal complications.

The consideration for the babies born to mothers with Henoch-Schonlein Purpura focused on the problems that would occur to the mothers. Several cases have shown that pregnancy alone could trigger the recurrence of Henoch-Schonlein Purpura and lead to early delivery. Complications in the fetus are caused by problems that occur in the mother rather than as a direct effect on the fetus. This is because IgA cannot cross the placenta so it could not cause vasculitis in the fetus (8). Nevertheless, placenta and amniotic fluid monitoring are still recommended from 24 weeks of age as the placenta is a blood vessel network that grows during pregnancy (6). For the babies born to mothers with Henoch-Schonlein Purpura, the care is adjusted according to the problems found. In this case, the following problems were found: the baby was born preterm with a low birth weight (2,200 g) and an Apgar score

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of 6/8. The treatment was continued by the pediatrics department and in the nursery, the baby was cared for together with the mother.

CONCLUSION

As long as contradiction is not detected, pregnant women with Henoch-Schonlein Purpura without coagulopathy, thrombocytopenia, severe hypovolemia, or skin type abnormalities in the puncture area, who would need to undergo cesarean section could be anesthetized with a neuraxial block. In this case, the neuraxial block chosen was the epidural block as it has the additional advantage of being a postoperative analgesic and helps to avoid the use of NSAIDs in Henoch-Schonlein Purpura patients who often have renal complications.

Abbreviations

HSP: Henoch-Schonlein Purpura; EULAR/PRINTO/PRES: European League Against Rheumatism/Paediatric Rheumatology International Trials Organization/Paediatric Rheumatology European Society; NSAIDs: non-steroidal anti-inflammatory drugs

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Ethics Approval and Consent to Participate

Not applicable.

Consent for Publication

Written informed consent forms were obtained from the patients for the publication of this case report and accompanying images.

Conflict of Interests

The author declares that they have no conflict of interests.

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Case Report

EARLY TRACHEOSTOMY IN PROLONGED MECHANICAL VENTILATION DUE TO SEVERE HEAD INJURY TO PREVENT VENTILATOR-ASSOCIATED PNEUMONIA (VAP)

Pratama Ananda[1a], **Sony** [1]

[1] Department of Anesthesiology and Intensive Care, Faculty of Medicine Riau University, Arifin Achmad Hospital, Pekanbaru, Riau, Indonesia

[a] Corresponding author: pratama.anestesi@gmail.com

ABSTRACT

Introduction: Early tracheostomy needs to be considered if a ventilator is expected to be used for an extended period of time. Early tracheostomy is recommended since it improves the respiratory function, reduces the risk of ventilator-associated pneumonia (VAP), improves patients' comfort level, cleanses secretions in the throat, reduces laryngeal ulceration, improves mobilization and speech efforts, and allows treatment outside the intensive care unit (ICU). **Case Report**: Four cases of severe head injury with early tracheostomy, which illustrate the prevention of VAP, were reported. In these four cases, early tracheostomy was performed (≤ 4 days) considering the initial critical GCS, the location of the lesion, and that mechanical ventilation was expected to be used for an extended period of time. During treatment, no VAP signs were detected, evidenced by Clinicial Pulmonary Infection Score (CPIS), rontgen thorax and sputum culture examinations. Based on a meta-analysis study, early tracheostomy reduces mortality due to VAP by up to 50% and reduces the length of stay in ICU compared to delayed/late tracheostomy (> 10 days) or prolonged intubation (> 14 days). **Conclusion:** In the study cases, early tracheostomy (<4 days) was found to be associated with reduced ventilation time and shortened ICU and hospital stays without an increased risk of VAP. VAP prevention efforts are carried out by applying early tracheostomy and VAP bundle as well. Early tracheostomy offers more benefits than prolonged intubation or delayed/late tracheostomy.

Keywords: Early Tracheostomy; Prolonged Mechanical Ventilation; Severe Head Injury; Ventilator-Associated Pneumonia (VAP)

ABSTRAK

Pendahuluan: Trakeostomi dini perlu dipertimbangkan jika penggunaan ventilator diperkirakan akan digunakan untuk waktu yang lama. Trakeostomi dini direkomendasikan karena dapat meningkatkan fungsi pernapasan, mengurangi Pneumonia terkait Ventilator (VAP), meningkatkan kenyamanan pasien, membersihkan sekresi di tenggorokan, mengurangi ulserasi laring, meningkatkan upaya mobilisasi dan bicara, dan memungkinkan perawatan di luar Unit Perawatan Intensif (ICU). **Laporan Kasus:** Kami melaporkan empat kasus cedera kepala berat dengan trakeostomi dini yang dapat menggambarkan pencegahan VAP. Pada empat kasus tersebut, trakeostomi dini dilakukan (≤ 4 hari) dengan pertimbangan GCS awal, lokasi lesi, dan penggunaan ventilasi mekanik yang diperkirakan untuk jangka waktu yang lama. Selama perawatan tidak ada tanda-tanda VAP yang terjadi dibuktikan dengan *Clinicial Pulmonary Infection Score (CPIS),* pemeriksaan rontgen thorax dan kultur sputum. Berdasarkan studi meta-analisis didapatkan bahwa trakeostomi dini (≤ 4 hari) dapat mengurangi angka kematian akibat VAP hingga 50% dan mengurangi lamanya perawatan di ICU, dibandingkan dengan trakeostomi lama (> 10 hari) atau intubasi yang lama (> 14 hari). **Kesimpulan:** Pada kasus serial ini ditemukan bahwa trakeostomi dini (<4 hari) berkaitan dengan pengurangan waktu menggunakan Ventilator serta perawatan ICU dan RS tanpa disertai peningkatan resiko VAP. Upaya pencegahan VAP dapat dilakukan dengan menerapkan Bundle VAP dan Trakeostomi dini. Trakeostomi dini memberikan manfaat lebih banyak daripada intubasi berkepanjangan atau trakeostomi lama.

Kata kunci: Trakeostomi dini; Ventilasi Mekanik lama; Cedera Kepala Berat; *Ventilator Associated Pneumonia* (VAP)

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INTRODUCTION

Tracheostomy is a surgical measure to open the anterior wall of the trachea to allow mechanical ventilation through a tracheostomy tube. Tracheostomy is one of the most common procedures performed in intensive care unit (ICU) (1). Early tracheostomy (< 4 days) is considered if a ventilator is expected to be used for an extended period of time (more than 14 days). It is also recommended since it improves the respiration function, reduces the risk of nosocomial infection (ventilator-associated pneumonia/VAP), encourages quicker weaning from mechanical ventilation, increases patients' comfort, safety, and ability to communicate, cleans secretions in the throat, reduces laryngeal ulceration, increases mobilization and talking effort, as well as allows treatment outside the ICU (2-4). Hence, patients may expect shorter ICU stays, shorter days of mechanical ventilation, and shorter length of stay (LOS) in hospital. This case study aims to describe the advantages of early tracheostomy in several cases of severe head injury with prolonged mechanical ventilation.

CASE REPORTS

A. Child D, 13 years old, did not wear helmet, the injury mechanism was unknown. In resuscitation room, vital signs were recorded as follows: blood pressure was at 112/54 mmHg, pulse rate was at 113x/minute, respiratory rate was at 12x/minute, temperature was at 38.7^{o} C. GCS of E1M3V1, bilateral isochoral pupils and a light reflex were detected. Head CT-scan without contrast showed contusion in the left frontal, bleeding in the intraventricular (IVH) and subarachnoid (SAH), and sinistra media fossa cranii base fracture. Non-operative management was decided. The patient was subsequently moved to ICU in an intubated state. Pressure control mode ventilator was installed and mannitol and anticonvulsants were administered.

B. Mr. S, male, 45 years old, found lying on the side of the road, wearing helmet. The injury mechanism was unknown. In resuscitation room, vital signs were recorded as follows: blood pressure was at 110/75 mmHg, pulse rate was at 120x/minute, respiratory rate was at 13x/minute, temperature was at 36.5^{o} C. GCS of E1M2V1, anisocoria pupils 2/5 mm, and a slow light reflex were detected. Head CT-scan without contrast showed bleeding in the intracerebral (ICH) dextra and sinistra basal ganglia region, as well as intraventricular (IVH). Neurosurgery decided a conservative therapy. The patient was subsequently intubated and connected to the ventilator and moved to the ICU.

C. Mrs. N, female, 55 years old, hit by a car, wearing helmet. In resuscitation room, vital signs were recorded as follows: blood pressure was at 147/88 mmHg, pulse rate was at 95x/minute, respiratory rate was at 14x/minute, temperature was at 36.5^{o} C. GCS of E1M1V4, isochoral pupils 3/3 mm, and a slow light reflex were detected. Head CT-scan without contrast showed ICH of dextra temporal front region. Neurosurgery decided to perform dextra ICH evacuation craniotomy. After operation, patient was observed in the ICU.

D. Mr. M, male, 42 years old, motorcycle-motorcycle collision, with a history of vomiting (+). In resuscitation room, vital signs were recorded as follows: blood pressure was at 100/80 mmHg, pulse rate was at 90x/minute, respiratory rate was at 20x/minute, temperature was at 36.5^{o} C. GCS of E1M1V3, isochoral pupils 3/3

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mm, and a light reflex were detected. Head CT-scan without contrast showed frontal thin EDH (D), occipital parieto impression fracture (D) as well as cerebral edema (D). Neurosurgery decided to perform EDH evacuation craniotomy, reconstruction and ICP monitor. After operation, patient was observed in the ICU.

Management

On the 3rd day of treatment of patient Child D, early tracheostomy was performed since a long-term ventilator use (more than 14 days) was expected. On the 5th day of treatment, a repeat head CT was performed and indicated infarction at the sinistra temporal base. After 7 days of broad-spectrum antibiotic use, no bacteria growth was found in culture results of blood, urine and sputum. Thorax photo was also obtained to ensure that there was no infection and weaning from ventilator was able to be performed on the 9th day. On the 10th day, patient was moved to generic ward with GCS of E3M6Vx. Patient was discharged on the 30th day of treatment with GCS of E4M6V4.

On the 4th day of treatment of patient Mr. S, early tracheostomy was performed since there was no significant increase in consciousness and a ventilator would be used in a long period of time. Subsequently, a repeat head CT was performed on the 5th day and no additional bleeding occurred. However, the edema around the bleeding increased. No bacteria growth was found in the culture results of blood, urine and sputum and no infection signs were detected from thorax photo. Hence, the use of broad-spectrum antibiotic was continued until the 7th day (based on the recommendation of pneumonia management by ATS and IDSA). Weaning from ventilator was performed on the 16th day and patient was later moved to generic ward with GCS of E3M5Vx. Patient was discharged on the 33rd day of treatment with GCS of E4M6V2.

Dextra ICH evacuation craniotomy was decided to be performed on patient Mrs. N, immediately followed by early tracheostomy considering patient's critical initial GCS. It was expected that the improvement of GCS would take time and ICU treatment as well as long-term mechanical ventilation were required. After two days of treatment in ICU, the weaning from ventilator was performed. On the 4th day, the patient was able to be moved to HCU with GCS of E2M4Vx. Rontgen thorax and culture were obtained and no infection signs were detected. The culture results of blood and sputum indicated that there was no bacteria growth found during treatment. Patient was discharged on the 49th day of treatment with GCS of E4M6Vx.

On the 3rd day of treatment of patient Mr. M, early tracheostomy was performed, during which there was no increase in consciousness and a lot of sputum production was detected. After the tracheostomy, the weaning from ventilator was able to be performed on the 5th day of treatment. Patient was subsequently moved to HCU with GCS of E2M2Vx. A broad-spectrum antibiotic was continued after the treatment. The culture results of blood and sputum indicated that no bacteria found and the laboratory result as well as thorax photo suggested that antibiotic use could be stopped. Patient was discharged on the 54th day of treatment with GCS of E4M6Vx.

DISCUSSION

Based on observation of the above cases, several potential advantages of tracheostomy over endotracheal intubation were proposed. It improves the respiration function, reduces the risk of nosocomial infection (ventilator-associated pneumonia/VAP), enables more rapid weaning from mechanical ventilation,

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increases patients' comfort and safety, encourages patients' ability to communicate, cleans secretions in the throat, reduces laryngeal ulceration, increases mobilization and talking effort, as well as allows treatment outside the ICU. Based on the meta-analysis study results, early tracheostomy (<4 days) reduces mortality rate due to VAP up to 50% and shortens the treatment duration in ICU and hospital (length of stay/LOS) compared to late tracheostomy (>10 days) or prolonged intubation (>14 days) (2-4). Early tracheostomy is performed in critical III patients who are expected to use long-term mechanical ventilation or prolonged mechanical ventilation (more than 10-14 days) (1, 5, 6, 7). Patients are categorized in prolonged mechanical ventilation if the use of mechanical ventilation in the ICU is >5 days (8). Early tracheostomy offers numerous advantages compared to late tracheostomy or prolonged intubation, such as reduction in VAP, shortened duration of ventilator use and duration of ICU treatment. VAP is one of the leading causes of nosocomial death (9). VAP Bundle is performed on ICU patients using ventilators, and it is scientifically proven that VAP Bundle reduces the incidence rate of VAP by 25%. Early tracheostomy is performed on patients who are expected to be on a ventilator for an extended period of time, and one of the advantages is that it reduces the incidence of VAP. The VAP prevention efforts can be carried out by implementing VAP Bundle as follows:

1. Elevation head of bed is set at 30-45^{o}
2. Oral care with chlorhexidin is administered every 4-6 hours
3. Sedation vacation is carried out daily, allowing patients to wake up once every 24 hours
4. Readiness assessment of mechanical weaning from ventilation is carried out daily
5. Stress ulcer prophylaxis is administered in the first 24 hours of the use of mechanical ventilation
6. Deep vein thrombosis (DVT) prophylaxis is administered in the first 24 hours of the use of mechanical ventilation (10-12)

CONCLUSION

In this case study, early tracheostomy (<4 days) was found to be associated with reduced ventilation time as well as shortened ICU and hospital stays without an increased risk of VAP. Early tracheostomy offers advantages compared to prolonged intubation or late tracheostomy, namely reduction of VAP incidence rate, improvement of patients' comfort, more effective airway suctioning, decreased airway resistance, enhanced patient mobility, reduction of ventilator use duration, reduction of length of stay (LOS) in the ICU as well as reduction in hospital costs. Future studies with more cases to analyse are needed to draw definitive conclusions regarding early tracheostomy.

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Conflict of Interest
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- Amini S, Najafi MN, Karrari SP, Mashhadi ME, Mirzaei S, Tashnizi MA, et al. Risk factors and outcome of acute kidney injury after isolated cabg surgery: A prospective cohort study. Brazilian J Cardiovasc Surg. 2019; 34(1): 70–5.

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