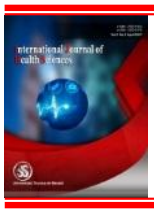

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Characteristics of Referral Neonates in Sanglah Hospital: Reviewed from the S.T.A.B.L.E Program

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Abstract

The purpose of this study was to investigate the number of referral neonates that came with an unstable condition (according to a S.T.A.B.L.E program) and characteristic of unstable conditions of the referred neonates. An observational prospective study was conducted for two years from 1st January 2018 to 31st December 2019 in the Emergency Department of Sanglah Hospital, Bali, Indonesia. Referred neonates were assessed in terms of gender, gestational age, referral characteristic, and condition on arrival at the hospital according to S.T.A.B.L.E criteria. According to S.T.A.B.L.E criteria, 283 neonates (54.8%) came on unstable condition. Prematurity (42.6%) was the main reason for referral, 37.9% of them were very low birth weight. Most of them were referred from Denpasar (33.9%), the equipment of transportation was incubator transport (41.8%). T-piece resuscitator was used in 30.4% of referred neonates. Characteristics of unstable conditions were mostly hypoglycemia (33%) and 36% of unstable neonates had more than one condition of instability. This study revealed 283 neonates were unstable and the main reason of transfer neonates is prematurity. Most of them come with unstable conditions that could lead to higher mortality. This study could be a reference for improvement in the neonatal transportation system in Bali.

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1 Introduction

The infant mortality rate is an indicator of health as well as the accessibility of health services by the people in a developing country such as Indonesia. According to WHO (2003), 8,1 million babies died and almost half of it (3,9 million or 48%) occurred in the neonatal period. Almost two-third (2,8 million) of neonatal mortality occurred in the first week of life (World Health Organization, 2003).

Regionalized systems of perinatal care are recommended to ensure that each neonate is delivered and cared for in a facility most appropriate for the neonate's health care needs, when possible, and to facilitate the achievement of optimal health outcomes (Committee on fetus and newborn, 2018). The principle of neonatal transport includes; adequate preparation and stabilization of the baby to be referred, communication with the receiving facility, and provision of standard care similar to that obtained in a neonatal intensive care unit during transfer.

The S.T.A.B.L.E training (sugar and safe care, temperature, airway, blood pressure, laboratory work, and emotional support) program is carried out on health care experts to find and stabilize sick babies after resuscitation or before the baby is referred (Parekh *et al.,* 2018). In the S.T.A.B.L.E program, a sick baby must avoid unstable conditions such as hypoglycemia, temperature instability (especially hypothermia), breathing disorders (hypoxia), and hypoperfusion (shock), and also equipped with laboratory tests and psychological benefits in the form of counseling and educate parents (Parekh *et al.,* 2018; Karlsen, 2018).

In Indonesia, the network of neonatal transport systems hasn't been organized well as in developed countries. Most infants were referred to as unstable conditions. A study in Wahidin Sudirohusodo Hospital in Makassar (2011) found most of the referred neonates were on unstable conditions (64.7%), which 38.1% of then were hypothermia and the reason of referral mostly due to infection (38.1%) (Alasiry, 2016; Batki *et al.,* 2000).

Sanglah Hospital is a tertiary hospital that receives referral patients from all around Bali as well as Nusa Tenggara. Sanglah Hospital has level III of perinatology care. It means that our NICU has prompt and readily available access to a full range of paediatric medical subspecialists, paediatric surgical specialists, paediatric anaesthesiologists, and paediatric ophthalmologists on-site or at a closely related institution by prearranged consultative agreement (Committee on fetus and newborn, 2018).

There was no study before to evaluate the condition of neonates who were referred to Sanglah Hospital. This study aims to investigate the number of referral neonates who come to Sanglah Hospital and characteristics of unstable conditions of these neonates according to the S.T.A.B.L.E program.

2 Materials and Methods

This is a descriptive observational study. The data were prospectively collected from all neonates who were referred to the emergency department of Sanglah Hospital from January 2018 to December 2019. The Sample was collected using purposive technique sampling. Data was collected in age, sex, gestation, birth weight, body temperature, blood sugar, oxygen saturation, and laboratory file. Inclusions criteria were neonates who were referred to the emergency department of Sanglah Hospital, Denpasar from January 2018 to December 2019. Exclusions criteria were neonates who died on arrival so did not have the probability to do physical and glucose examination. Subjects were divided into neonates with stable and unstable according to the S.T.A.B.L.E program. The sample size was count using single sample proportion formula and got the sample size is 152 samples.

The condition of the neonate when referred is an objective condition for identifying neonatal conditions in the emergency department (Biederman *et al.,* 1999; Peterson *et al.,* 2004). Divided into stable and unstable (according to the S.T.A.B.L.E program). The condition is unstable when neonates suffered from: hypoglycaemia, temperature instability, hypoxia, hypoperfusion, or incomplete laboratory workup. Neonates are categorized as hypoglycaemia when peripheral blood sugar levels are <45 mg/dl (Null *et al.,* 2016). The body temperature <36.5oC means the neonate has hypothermia (Null *et al.,* 2016). Neonates experience hypoxia if oxygen saturation is < 88% while hypoperfusion when capillary refill time is >3 seconds (Alasiry, 2016). Incomplete laboratory workup was there is no standard laboratory data on referral (Complete Blood Count and glucose test).

3 Results and Discussions

The total neonates admitted to the emergency department of Sanglah hospital during the study period were 516 neonates, of which more than half (54.8%) were unstable according to S.T.A.B.L.E program. The main reason for referred was preterm birth (42.6%), 44.3% of referred neonates were VLBW (weight >1000 gram <1500 gram). Most neonates were referred from Denpasar (33.9%). There still 8.5% of neonates were accompanied without health personnel. Respiratory support used was mostly using a nasal cannula (45.4%). Characteristics of referred neonates and equipment used during transport were shown in Table 1 and Table 2. Table 3 showed that according to the S.T.A.B.L.E program, most of the neonates were in hypoglycaemia state (40%).

Table 1
Characteristic of referred neonates

Profile of neonates	Stable (n=233)	Unstable (n=283)	Total (n=516) (%)
Birth weight			
Normal weight	92	50	142 (27.5)
Low birth weight (LBW)	49	76	125 (24.2)
Very low birth weight (VLBW)	74	122	196 (37.9)
Extremely low birth weight (ELBW)	18	35	53 (10.4)
Gestational age			
<28 weeks	18	27	45 (8.7)
28- 32 weeks	71	84	155 (30)
>32-36 weeks	49	71	120 (23.3)
>36 weeks	95	101	196 (38)
Reason for referral			
Preterm/low birth weight	76	144	220 (42.6)
Respiratory distress	50	45	95 (18.4)
Birth asphyxia	31	32	63 (12.2)
Sepsis	44	26	80 (15.5)
Other	22	36	58 (11.5)
Referring district			
Denpasar	51	124	175 (33.9)
Badung	49	27	76 (14.7)
Gianyar	23	33	56 (10.8)
Jembrana	18	22	40 (7.8)
Singaraja	20	10	30 (5.8)
Other	72	67	139 (27)

Table 2
Equipment used during transportation

Equipment used during transport	Stable (n=233)	Unstable (n=283)	Total (n=516) (%)
Equipment of transportation			
Incubator transport	103	113	216 (41.8)
Box	77	99	176 (34)
Kangaroo mother care	68	56	124 (24.2)
Respiratory support			
Without respiratory support	70	39	109 (21.1)
Nasal cannula	34	129	163 (31.5)
Mask	32	55	87 (16.8)
T-piece resuscitator (Mixsafe/neopuff)	97	60	157 (30.4)
Intubated before transferred			
Yes	66	27	93 (18)
No	167	256	423 (82)
IV fluid during transferred			
Yes	212	72	284 (55)
No	21	211	232 (45)
Used monitor saturation			
Yes	88	129	217 (42)
No	145	154	299 (58)

Table 3
Characteristics of neonates with unstable conditions during admitted in hospital

Characteristics of neonates with unstable conditions during admitted	Cases (n=283) (%)
Hypoglycaemia	93 (33)
Hypothermia	51 (18)
Hypoxia	63 (22)
Hypoperfusion	28 (10)
Incomplete laboratory workup	48 (17)
More than 1 conditions	186 (36)

Discussion

Sanglah Hospital is a tertiary hospital that receives referral patients from Bali and Nusa Tenggara and has a level III perinatology care system. In Bali, there is still no neonatal transportation system as there is in developed countries. It has affected the neonatal conditions on arrival, which most of them were unstable so that it accounts for higher morbidity and mortality. Stabilization during transport is as important as the pre transport stabilization.

The S.T.A.B.L.E training (sugar and safe care, temperature, airway, blood pressure, laboratory work, and emotional support) program is carried out on health care experts to find and stabilize sick babies after resuscitation or before the baby is referred (World Health Organization, 2003). The STABLE program is designed based on the principle of resuscitation priority when facing critical conditions, namely ABC (airway, breathing, and circulation). The STABLE program also strives for the baby to be "warm, pink, and sweet" as soon as possible within 1 hour.

This study found total neonates admitted to the emergency room of Sanglah hospital during the study period were 588 neonates, in which 72 of them were excluded due to incomplete medical records. The total subjects included in the study were 516 neonates of which 54.8% were unstable. There was a male predominance noted in this study (68.3%), which is consistent with the study conducted in India (Ravelli *et al.,* 2011).

According to WHO, Indonesia is in rank ninth as the top 10 countries with the highest rates of preterm birth per 100 live births (Howson *et al.,* 2012). In this study, prematurity was the main reason for referral (42.6%). A study in India also found that prematurity is the main reason for referral in tertiary care (54.63%) followed by sepsis (24.93%) (Ravelli *et al.,* 2011). Among premature neonates, gestational age was mostly in 28-32 weeks (30%). A high incidence of premature neonates may be due to the weakness of antenatal program systems (Ravelli *et al.,* 2011).

Most of the district hospitals in Bali do not have adequate perinatology facilities. On average in each district, there are only 1-2 hospitals that have level-II perinatology care, that provide care for infants born ≥32-week gestation and weighing ≥1500 g who have physiologic immaturity or who are moderately ill with problems that are expected to resolve rapidly (Howson *et al.,* 2012).

Lasswell et al. reviewed 41 studies, which included >113.000 VLBW infants and found that VLBW infants born at non-level III hospitals had a 62% increase in odds of neonatal or predischarge mortality compared with those born at level III hospitals (adjusted odds ratio [aOR], 1.62; 95% confidence interval [CI], 1.44–1.83) (Lasswell *et al.,* 2010). Hence, the risk of death for VLBW infants born in level I or II facilities remained higher than those born within a level III facility.

Bali has wide demography, and lots of peripheral health centers reside in rural areas. In this study, most of the neonates (66.1%) were referred from the peripheral hospital (outside Denpasar). Most neonates were referred from Denpasar (33.9%), followed by Badung (14.7%), and Gianyar (10.8%). Denpasar as the most referral district was due to the densest population of all districts (Badan Pusat Statistik, 2020). There are lots of health care centers in Denpasar but still out of numbers compare to the population. Badung and Gianyar were the same, these two districts have dense population compare to other districts. These two regencies have a distance of approximately 30 kilometers from Sanglah Hospital. Perinatology facilities in these two regencies are more numerous than others but still limited compared to the needs so the referral numbers obtained are still high. The farthest regencies from Denpasar are Singaraja and Jembrana, which is around 50-70 km. Both of these districts only have level 2 perinatology cares with limited capacity.

This study found that most of the neonates were referred to in condition of premature and transported with limited equipment, which made them prone to serious complications. Improving the survival of these populations can be done by stabilizes them using S.T.A.B.L.E criteria. In this study, there were 36% of neonates referred to a combination of more than one instability conditions. These could be because of the peripheral hospital were referring a neonate without prior stabilization. They might think to save the neonate's life by referring to them as fast as they could.

In this study, we found around 33% of neonates were referred to a hypoglycaemic state. This condition could be related to the gestational age, most of them were premature and low birth weight. Some of these neonates were referred without an intravenous line (45%) or inappropriate fluid, such as normal saline or 5% dextrose. The intravenous line should be inserted in sick neonates due to their fasting. Some problems also could be happened during transportation such as blocking or disruption of intravenous cannulation. Hypoglycemia especially in critically ill neonates can lead to mortality and serious lifelong neuro-developmental sequela (Lasswell *et al.,* 2010).

In this study, 18% of neonates were hypothermia during admission, most of them (85%) were transported using a baby box. There were only 24.2% of neonates referred to kangaroo mother care, as incubator transport is not available in the majority of hospitals. The Kangaroo mother care method is useful to maintain a baby's temperature, reduce hypothermia and hypoglycaemia, especially among preterm babies.

Hypothermia 5 minutes after birth and at NICU admission varied among centers from 13% to 62% and from 25% to 75%, respectively (de Almeida *et al.,* 2014). Hypothermia at 5 minutes after birth and NICU admission was inversely related to gestational age, 35% of neonates with gestational ages of 32 and 33 weeks were hypothermic at 5 minutes, and 40% were hypothermic at NICU admission (de Almeida *et al.,* 2014).

In this study, we found 22% of neonates were hypoxia during admission and only 18% of referred neonates were intubated before transportation. Intubation was mandatory for neonates with respiratory

failure to maintain oxygen saturation of 88-92%. During transportation, 58% were transferred without pulse oximeter. Oxygen saturation monitoring using pulse oximetry is a reliable non-invasive method of monitoring arterial blood oxygenation saturation. Prolong hypoxia can cause poor prognosis to neonates, so pulse oximetry observation is mandatory during transport. Another noteworthy observation in this study was the high proportion of neonates were referred to with high oxygen concentration (100% of fraction oxygen). Over-usage of oxygen treatment may cause lung injury and retinopathy in premature neonates (Anurekha *et al.,* 2018; Gilbert *et al.,* 2000; Dramawan, 2018).

Peripheral skin perfusion is one method to determine whether the circulation is adequate. This study found 11.5% of neonates came with hypoperfusion. Hypoperfusion condition could show whether the baby was shock or hypotensive condition. The neonates in shock have inadequate tissue perfusion and oxygenation. Rapid, effective management of shock is vital to prevent permanent tissue injury, multiple organ failure, and death (Null *et al.,* 2016).

Laboratory analysis wasn't done in 17% of neonates transferred. Incomplete blood tests probably due to the limitation of facilities. A study by Null *et al.* (2016), showed the analyses of blood gases before and after transfers demonstrated significant improvements in blood pH and base deficit (Ravelli *et al.,* 2011).

4 Conclusion

This study demonstrates there were 283 (54.8%) neonates who came with an unstable condition. The main reason of transfer neonates is prematurity and low birth weight. Most of them come with unstable conditions that could lead to higher mortality and morbidity. This study emphasizes the importance of stabilization before and during transportation. The results of this study can be used as a reference for improvement in the neonatal transportation system in Bali.

Limitation of this study

This was an observational study among transferred neonates in our setting. This study was not analyzing the outcome of the neonates so the further prospective study is needed. This study was not observed when the UNSTABLE condition of neonates was happening, it could be happened in the referring hospital or while transport.

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