COST-EFFECTIVENESS ANALYSIS ON THE USE OF PARENTERAL NUTRITION WITH D10-CA GLUCONATE AND D5 1/4NS IN NORMAL-WEIGHT NEONATES WITH RESPIRATORY DISTRESS SYNDROME

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ABSTRACT

Objectives: This retrospective cohort study aimed to compare the cost-effectiveness of using D10-CA Gluconate and D5 1/4NS preparations in normal-weight neonatal patients with Respiratory Distress Syndrome (RDS) in Kambang General Hospital, Jambi, Indonesia.

Methods: The research was conducted from September 2014 to June 2015. The study participants were divided into two groups; D10-CA Gluconate was administered to 40 patients and D5 1/4NS to 43 patients. Effectiveness was assessed based on the changes in the physical examination results, average weight gain (28.48 and 23.49 g/day), blood glucose levels (26.73 and 26.42 mg/dL), respiratory rate (−12.35 breaths/minute and −7.77 breaths/minute), pulse frequency (−10.98 and −8.07 ±), and body temperature (0.013°C and 0.012°C) of the patients in the D10-CA Gluconate and D5 1/4NS groups, respectively.

Results: The average direct medical costs of using D10-CA Gluconate and D5 1/4NS were 458,290 IDR and 408,347 IDR, respectively. The average cost-effectiveness ratio value of total direct medical costs for D10-CA Gluconate preparation was 35,207,467 IDR while that for D5 1/4NS was 33,958,602 IDR. The direct medical costs of the incremental cost-effectiveness ratio mean value of the D5 1/4NS preparation that compared to the D10-CA Gluconate preparation was 10,017,210 IDR.

Conclusions: The parental nutrition preparation of D10-CA Gluconate is more cost-effective than that of D5 1/4NS.

Keywords: D10-CA Gluconate, D5 1/4NS, Effectiveness, Direct medical costs, Incremental cost-effectiveness ratio.

INTRODUCTION

Health is one of the basic human rights. The 1945 Constitution of the Republic of Indonesia assures optimal access to health services for every Indonesian, including those with financial disadvantages. Indonesia is committed to achieving the Millennium Development Goals (MDGs) target from 2000 to 2015. One of the strategically planned programs designed by the Ministry of Health for the period 2010-2014 to achieve the MDGs is the National Health Insurance Program [1]. The health systems have established three goals: Creating fairness in health-care financial management, improving health status, and enhancing the responsiveness of medical services [2]. Under the goal of health-care financial management, it must be assured that the entire health fund is optimally distributed to ensure adequate and optimal health-care services for all citizens. This means that the government must develop an efficient health financing system to fulfill all the health needs of each citizen [2]. Increasing the cost-effectiveness of drugs would improve the efficiency of the national health financing system at the Government level as well as at local levels, such as in hospitals. Pharmacoeconomics is the study of the economic aspect of drugs, including the cost-effectiveness [1]. The results of such pharmacoeconomic studies can be used for determining and developing the most efficient method of using limited health resources.

The Kambang General Hospital is a private hospital located in Jambi City, Jambi Provinces, Indonesia. It is a referral hospital, which accepts and treats neonatal emergency patients referred by other hospitals. This hospital has continuous positive airway pressure facility, which is used for treating neonates in emergencies, especially in the case of respiratory system disorder (RDS). The number of neonatal patients with a diagnosis of RDS is the highest case in the Kambang Hospital. Since 2013, the Kambang Hospital has used parenteral nutrition preparations to treat RDS patients. Two types of preparations are used: D10-CA Gluconate and D5 1/4NS. These two products are the treatments of choice for normal-weight neonatal patients with RDS. D10-CA Gluconate (1000 mL) consists of 100 g Dextrosa and 6-8 mL/kg/weight CaGluconate. On the other hand, 1000 mL of D5 1/4NS consists Na (38.5 mEq), Cl (38.5 mEq), with composition of dextrose 50 g and NaCl 2.25 g (MIMS, 2013). D10-Gluconas increases the blood glucose level rapidly; however, it involves a higher risk of hyperglycemia. It can also lead to hyperemia; therefore, calcium gluconate is administered simultaneously. In contrast, D5 1/4NS increases blood glucose gradually, causing the low risk of hyperglycemia. To the best of our knowledge, no research has been done to assess the cost-effectiveness of these two preparations. In addition, the cost-effectiveness analysis at Kambang Hospital is important due to a large quantity of these preparations. Therefore, we planned this study with the aim of determining the cost-effectiveness of these parenteral nutrition preparations in neonatal patients, the treatment duration, and the direct medical cost involved. We believe that this study will be useful in developing the protocol, establishing the standard treatment cost, and assessing the cost-effectiveness of treatment in Kambang Hospital. This will enable the provision of cost-effective parenteral nutrition for neonatal health services in the JKN era.

METHODS

This retrospective cohort study was conducted in the Kambang Hospital in Jambi city in 2015. We used secondary data from the medical records of normal-weight neonatal patients who were administered the parenteral nutrition preparations D10-CA Gluconate and D5 1/4NS in Kambang Hospital. The total sampling technique was used. 371 patients were administered the parenteral nutrition preparations D10-CA Gluconate and D5 1/4NS in Kambang Hospital. The total sampling technique was used. 371 patients...
RESULTS
As shown in the Table 1, the majority of patients treated in the perinatology room at the Kambang Hospital, Jambi comprised neonates aged 1-14 days; 97.5% were under treatment with preparation A (D10-CaGluconate), and 86% with preparation B (D5 1/4NS) with 83.5% patients were treated with both preparation A and B. There were no marked sex differences in the treatment groups. Group A had an equal proportion of boy and girl patients (50%); however, in Group B, the proportion of boys was greater (55.8%) than that of girls (44.2%). Majority of the neonates (55%) in Group A had a gestational age ≥≥36 weeks; 95% were under treatment with parenteral nutrition. In addition, most patients in Group A were born at full gestational age and had a normal birth weight followed by those born at a gestational age of 32-35 months (37.5%), and 28-31 months (7.5%). In Group B, most patients were born ≥≥36 weeks of gestation (83.7%), followed by those born at 32-35 weeks (16.3%). We found that most patients in Group B were also born at full gestational age. None of the patients in Group B was born at 28-31 weeks of gestation.

More patients in Group A had a comorbidity (accompanying disease) (72.5%) than those in Group B (67.4%). All study participants had a normal birth weight (≥2500 g); 45% of Group A and 16.3% of Group B patients were born prematurely but had normal birth weight. One of the factors contributing to this is the food consumed by the mother during pregnancy. The demographic data revealed that in Group A, 67.5% of the parents were private employees, 20% were entrepreneurs, and 12.5% were government employees. By contrast, in Group B, 67.4% parents were private employees, 18.6% were entrepreneurs, and 14% were government employees. The Kambang Hospital is affiliated to several insurance companies; therefore, many of the patients’ parents used company insurance to pay for the treatment.

This study included neonates diagnosed with RDS. According to the Indonesian Doctor Association (Ikatan Dokter Indonesia) (2011) [3], RDS, also known as hyaline membrane disease (HMD), is a respiratory disorder caused by pulmonary immaturity and surfactant deficiency [4]. It usually develops in premature neonates born before 34 weeks of gestation and low birth weight neonates weighing <1500 g. Surfactants are formed at a gestational age of 24-28 weeks; therefore, the incidence of HMD is inversely proportional to the gestational age. The incidence rate of HMD is 60% in neonates born before 30 weeks of gestation, 25% in those born at 30-34 weeks, and 5% in those born at 35-36 weeks. Other predisposing factors are maternal diabetes and cesarean delivery [4].

According to the patients’ clinical weight data, the mean birth weight of the patients in Group A was 2.940±368.504 mg and that of those in Group B was 3.131±348.128 mg. Premature neonates formed the second largest majority in Group A. The average weight gain in neonates was 20-30 g/day after receiving parental nutrition for 1 day. This result was similar to that reported by the Indonesia Pediatric Society (Ikatan Dokter Anak Indonesia) [5]. When the neonates’ condition improves, parental nutrition can be replaced by enteral nutrition (breast milk or formula milk). Prolonged consumption of high concentrations of parenteral nutrition can cause phlebitis.

Clinical parameters, including weight, blood glucose level, respiratory rate, pulse frequency, and body temperature of the neonates in both groups were assessed to compare the effectiveness of both the

Table 1: Basic characteristic of participants according to the treatment groups

| Parameters total (%) | Preparation A n=40 (%) | Preparation B n=43 (%) | p     |
|----------------------|------------------------|------------------------|-------|
| Patient’s age (days) |                        |                        |       |
| 1-14                 | 39 (97.5)              | 38 (88.4)              | 0.109a|
| 15-30                | 1 (2.5)                | 5 (11.6)               |       |
| Pregnancy age (gestation) (weeks) | | | |
| 20-31                | 3 (7.5)                | 0 (0)                  | 0.010b|
| 32-35                | 15 (37.5)              | 7 (16.3)               |       |
| ≥≥36                 | 22 (55)                | 36 (83.7)              |       |
| Sex                  |                        |                        |       |
| Male                 | 20 (50)                | 24 (55.8)              | 0.596b|
| Female               | 20 (50)                | 19 (44.2)              |       |
| Comorbid             |                        |                        |       |
| Hyperbilirubinemia/icterus/jaundice | 2 (5) | 5 (11.6) | 0.534a|
| Neonatal infection/sepsis | 9 (22.5) | 8 (18.6) |         |
| Others               | 29 (72.5)              | 29 (69.8)              |       |
| Social economic      |                        |                        |       |
| Government employees | 5 (12.5)               | 6 (14)                 | 0.973a|
| Non-government employees (private employees) | 27 (67.5) | 29 (67.4) |       |
| Entrepreneur (farmer, other) | 8 (20) | 8 (18.6) |         |
| Insurance             |                        |                        |       |
| BPP                  | 18 (45)                | 17 (39.5)              | 0.418b|
| Company               | 1 (2.5)                | 4 (9.3)                |       |
| General               | 21 (52.5)              | 22 (51.2)              |       |

*aAnalysis by Chi-square, banalysis by Fisher’s exact test

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Table 2: Parameters of cost-effectiveness in each treatment group

| Parameter                  | Effectiveness (total [%]) | p     |
|----------------------------|---------------------------|-------|
|                           | Preparation A (n=40)      |       |
| Weight (g)                |                           |       |
| Increasing weight gain    | 28.48±3.464               |       |
| Blood glucose level (mg/dL)|                           |       |
| Increasing blood glucose level | 26.72±7.841               |       |
| Respiratory rate (breaths/minute) | 34 (85)                   |       |
| Not returning to normal   | 6 (15)                    |       |
| Pulse (x/minute)          |                           |       |
| Returning to normal       | 34 (85)                   |       |
| Not returning to normal   | 6 (15)                    |       |
| Temperature (°C)          |                           |       |
| Returning to normal       | 25 (62.5)                 |       |
| Not returning to normal   | 15 (37.5)                 |       |
| Preparation B (n=43)      |                           |       |
| Increasing weight gain    | 23.49±4.3                 | 0.000a|
| Blood glucose level (mg/dL)|                           |       |
| Increasing blood glucose level | 26.64±10.147              | 0.879b|
| Respiratory rate (breaths/minute) | 33 (76.7)                 |       |
| Not returning to normal   | 10 (23.3)                 |       |
| Pulse (x/minute)          |                           |       |
| Returning to normal       | 34 (79.1)                 | 0.341a|
| Not returning to normal   | 9 (20.9)                  | 0.483a|
| Temperature (°C)          |                           |       |
| Returning to normal       | 30 (69.8)                 | 0.484a|
| Not returning to normal   | 13 (30.2)                 |       |

*aAnalysis by t-test; banalysis by Mann–Whitney; canalysis by Chi-square

The mean increase in the weight of the neonates in Group A was 28.48±3.464 g/day and that in those belonging to Group B was 23.49±4.3 g/day. The mean blood glucose level in patients of Group A was 26.72±7.841 mg/dL and that of those in Group B was 26.42±10.147 mg/dL. The respiratory rate and pulse frequency returned to normal in 85% patients of Group A and in 76.7% and 79.1% patients in Group B, respectively. Finally, the body temperature of 62.5% and 69.8% patients in Groups A and B, respectively, returned to normal.

Based on the data regarding clinical parameters of both the groups, the effectiveness percentage for Group A was larger than that for Group B, although Group B had a higher sample size than Group A (n=43 [52%] vs. n=40 neonates [48%]). RDS patients experience hypoglycemia; therefore, when the condition is left untreated, it could cause brain destruction and death. The mean weight of the neonates was ±2500 g and 50% of them were born at full gestational age. This could be attributable to immature or improper functioning of their body organs, increasing the risk of hypoglycemia and other infections.

The data were assessed for normality; however, the data did not follow a normal distribution, except for the effectivity score of the increase in blood glucose level which appears to follow a normal distribution. The effectivity score of the increase in blood glucose level was studied using parametric t-test methods. The Mann–Whitney U-test was used to study the effectivity score of the increase in the neonates’ weight, respiratory rate, pulse frequency, and body temperature as these data were not normally distributed. Based on the results of the Mann–Whitney test, there was a significant difference between the effectivity score of the increase in neonates’ weight (20-30 g/day) (with p<0.05). Fisher’s test also showed a statistically significant correlation between gestational age and type of parenteral nutrition preparation with pregnancy age score (p<0.01).

The direct medical cost data were also assessed for normal distribution; these data were normally distributed. Parametric tests were then used to study variables such as the pre- and post-treatment weight; the pre- and post-treatment pulse frequency; and direct medical cost components, including the costs for laboratory examination, doctor visit, room, and total direct medical cost. Parametric t-test showed that although there were differences in the average costs of some components, there were no significant differences in the laboratory examination cost (p=0.474), doctor visit cost (p=0.648), room cost (p=0.629), and total direct medical cost (p=0.980) of the two groups.

Table 3: Parameters of the direct medical cost of participants based on treatment groups

| Direct medical cost types                   | Total cost (mean±SD) |
|---------------------------------------------|----------------------|
|                                             | Preparation A (n=40) | Preparation B (n=43) |
| Direct medical cost                         | 458,290±23,828 IDR   | 408,347±19,728 IDR   |
| Laboratory examination cost                | 125,000 IDR          | 125,000 IDR          |
| Doctor visit cost                          | 98,375±17,773 IDR    | 87,558±14,284 IDR    |
| Disposable material cost                   | 30,000 IDR           | 30,000 IDR           |
| Room cost                                  | 107,375±11,435 IDR   | 101,744±10,112 IDR   |
| Parenteral nutrition cost                  | 97,540±3,109 IDR     | 64,044±1893 IDR      |

The Mann–Whitney statistical test was employed to compare the difference in the costs of both the parenteral nutrition preparations. There were statistically significant differences between the costs of the two treatments (p=0.000). It can be concluded that there were significant differences in the gestational age, effectivity score of weight gain in infants, and parenteral nutrition costs between the two groups of parenteral nutrition preparations.

Based on direct medical cost data, the mean direct medical cost in Group A was higher (458,290±23,828 IDR) than that in Group B (408,347±19,728 IDR). This could be attributable to the parenteral nutrition preparations, which have a higher distribution and provision cost than conventional nutrition. Total direct medical cost for both preparations includes the cost of making the parenteral nutrition preparations, laboratory examination cost, disposable material cost, doctor visit cost, and room cost for the period 2013-2014. Parenteral

parenteral nutrition preparations. All of these are vital parameters that must be examined during a physical examination.
nutrition cost was adjusted as per an annual inflation rate of 6%. Other costs were not adjusted for inflation (Table 3).

Table 4 proves that parenteral nutrition involves a higher cost than conventional nutrition. Parenteral nutrition components are more complex than conventional nutrition components; therefore, they incur a higher cost for both, provision and distribution.

Sensitivity analysis showed that there was no difference with the base case. Preparation A (D10-GaGlucanate) was part of the first quadrant, which had higher cost and higher effectivity. Meanwhile, preparation B (DS 1/ANS) was part of the third quadrant, which had lower cost with lower effectivity (Fig. 1). Sensitivity analysis with respect to effectivity change of preparation A and preparation B are shown in Table 5. Preparation A was the first choice because its effectivity level was greater than that of preparation B. However, preparation B could be a treatment alternative for RDS. Preparation A was more cost effective than preparation B, with or without the 50% simulation of the increase and decrease in the effectivity costs of up to 3,359,194 IDR (decrease of 50%) and 10,077,582 IDR (increase of 50%) (Table 6). Table 7 shows the sensitivity analysis cost compared to the change in the direct medical cost, with or without the 1.5% simulation. Preparation A was also more cost-effective in terms of the daily direct medical costs, with or without the 1.5% simulation of decrease of 9,866,951 IDR and increase of 10,167,468 IDR (Table 8). Total average cost-effectiveness ratio (ACER) score of the direct medical cost in each patient with preparation A from all effectivity was 6,791,720 IDR/effectivity. Meanwhile, in preparation B, the total cost was 23,789,458 IDR/effectivity. Therefore, the mean incremental cost-effectiveness ratio (ICER) direct medical cost of preparation B, compared to that of preparation A was 10,017,210 IDR. The ACER score of parenteral nutrition in each patient of Groups A and B from all effectivity was 1,498,674 IDR/effectivity and 1,065,194 IDR/effectivity, respectively. Therefore, the mean ICER parenteral nutrition cost of preparation B compared to that of preparation A was 6,718,388 IDR. Table 9 shows the threshold analysis to the change of ICER score with the score of 3 × gross domestic product (GDP) is US$10,425.9.

**DISCUSSION**

Neonatal patients diagnosed with RDS tend to have a low blood sugar level or hypoglycemia. Thus, blood glucose levels must be closely monitored. Hypoglycemia occurs if the blood glucose level falls below 40 mg% (serum or plasma glucose >10-15%). This is probably caused by a defect in the glucose production, glucose overconsumption, or both. Low birth weight neonates; premature neonates; neonates with asphyxia or macrosomia; and neonates with signs of hypoglycemia must be examined in cases of hypoglycemia, especially if the oral nutrition consumption of the mother during pregnancy was poor. The normal blood glucose level of neonates is 50-80 mg/dL. Delayed treatment may cause permanent brain damage, especially in low-weight and premature neonates. Chronic or recurring hypoglycemia can also affect

| Table 4: Parameters of the direct medical cost of participants based on treatment groups |
|---------------------------------------------------------------|
| Costs | Preparation A (n=40) | Preparation B (n=43) |
| Parenteral nutrition cost | 3,901,600 IDR | 2,753,900 IDR |
| Lowest | 92,850 IDR | 62,300 IDR |
| Highest | 99,550 IDR | 66,050 IDR |
| Laboratory examination cost | 5,000,000 IDR | 5,375,000 IDR |
| Lowest | 1,200,000 IDR | 1,290,000 IDR |
| Highest | 5,000,000 IDR | 1,200,000 IDR |
| Disposable material cost | 3,955,000 IDR | 3,765,000 IDR |
| Lowest | 70,000 IDR | 70,000 IDR |
| Highest | 150,000 IDR | 150,000 IDR |
| Perinatology room cost | 4,295,000 IDR | 4,375,000 IDR |
| Lowest | 100,000 IDR | 70,000 IDR |
| Highest | 125,000 IDR | 125,000 IDR |
| Total cost of all samples | 18,331,600 IDR | 17,558,900 IDR |
| Mean total cost for each patient | 458,290 IDR | 408,347 IDR |

| Table 5: Sensitivity analysis with respect to effectivity change |
|---------------------------------------------------------------|
| Effectivity | −50% | +50% |
| Weight (g) | Preparation A | 14.240 IDR | 42.720 IDR |
| Preparation B | 11.745 IDR | 35.235 IDR |
| Blood glucose level (mg/dL) | Preparation A | 13.365 IDR | 40.095 IDR |
| Preparation B | 13.21 IDR | 39.630 IDR |
| Respiratory rate (breaths/minute) | Preparation A | −6.175 IDR | −18.525 IDR |
| Preparation B | −3.885 IDR | −11.655 IDR |
| Pulse frequency (*/minute) | Preparation A | −5.490 IDR | −16.470 IDR |
| Preparation B | −4.035 IDR | −12.105 IDR |
| Temperature (°C) | Preparation A | 0.0065 IDR | 0.0195 IDR |
| Preparation B | 0.0060 IDR | 0.0180 IDR |

**Table 6: Sensitivity analysis compared to the change in the ICER score effectivity**

| ICER | −50% | +50% |
|------|------|------|
| Weight (g) | Preparation B  A | 3.356 IDR | 10.069 IDR |
| Blood glucose level (mg/dL) | Preparation B  A | 54.026 IDR | 162.077 IDR |
| Respiratory rate (breaths/minute) | Preparation B  A | −3.657 IDR | −10.970 IDR |
| Pulse frequency (*/minute) | Preparation B  A | −5.755 IDR | −17.266 IDR |
| Temperature (°C) | Preparation B  A | 16,748,000 IDR | 50,244,000 IDR |
| ICER preparation B  A | 16,795,970 IDR | 50,387,910 IDR |
| Mean ICER | 3,359,194 IDR | 10,077,582 IDR |

ICER: Incremental cost-effectiveness ratio

| Table 7: Sensitivity analysis cost compared to the change in the direct medical cost |
|---------------------------------------------------------------|
| Treatment groups | −1.5% | +1.5% |
| Preparation A | 451,146 IDR | 465,164 IDR |
| Preparation B | 402,222 IDR | 414,472 IDR |

| Table 8: Sensitivity analysis of the direct medical cost compared to the change in the ICER score of the direct medical cost |
|---------------------------------------------------------------|
| ICER | −1.5% | +1.5% |
| Preparation B  A | 9,866,951 IDR | 10,167,468 IDR |

ICER: Incremental cost-effectiveness ratio

| Table 9: Threshold analysis to the change of the ICER score |
|---------------------------------------------------------------|
| ICER (effectivity) | Treatment groups | Direct medical cost |
|---------------------------------------------------------------|
| Preparation B  A | Weight | 10,009 IDR | <US$10,425.9/year |
| Blood glucose level | 161,107 IDR | <US$10,425.9/year |
| Respiratory rate | 10,905 IDR | <US$10,425.9/year |
| Pulse frequency | 17,163 IDR | <US$10,425.9/year |
| Temperature | 49,943,000 IDR | <US$10,425.9/year |
| Threshold 3 × GDP | US$10,425.9 | ICER: Incremental cost-effectiveness ratio |

Table 6 proves that parenteral nutrition involves a higher cost than conventional nutrition. Parenteral nutrition components are more complex than conventional nutrition components; therefore, they incur a higher cost for both, provision and distribution.
RDS has signs or symptoms as parameters for the diagnosis which must be treated. Respiratory rate is one of the main parameters in the diagnosis of RDS. Patients who experience difficulty in breathing or cannot breathe must be treated immediately, otherwise it may lead to death. The second parameter is pulse frequency. RDS patients tend to experience tachycardia. When such a patient is not treated immediately, it could cause heart failure. The third parameter is body temperature. RDS patients have a high risk of hypothermia; thus, lighting with ultraviolet light or other warming methods must be done for treatment. All these conditions (apnea, tachycardia, and hypothermia) must be treated immediately to avoid permanent damage to the brain, paralysis, and death. Intensive care is crucial. The previous study showed that RDS occurs in 78% of neonates weighing 501-1500 g, with 71% cases reported in neonates weighing 501-750 g, 54% in neonates weighing 751-1000 g, 36% in those weighing 1001-1250 g, and 26% in those weighing 1250-1500 g [8-11]. A study conducted by Gunn et al. suggested that infants with respiratory distress who weigh <1500 g may receive the greater benefit from total parenteral nutrition [12].

According to the previous studies [13], the values of the cost incurred in health programs must be adjusted each year, by 3.5% in England and 4% in France. Both countries need sensitivity analysis using alternative discounted medical cost (1.5% in England; 3% and 6% in France). In France, after 30 years, the discounted medical cost should be progressively decreased by 2%. The National Institute for Clinical Excellence (NICE) has set the lowest price or discounting for each therapy with long-term medical benefit at 1.5%. Therefore, simulation of the increase and decrease in the cost by 50% is used for effectivity. In this study, the author used the adjustment score suggested by NICE (1.5%). Indonesia, as a developing country, does not have its own established sensitivity score cost. Previous studies have recommended simulation scores of 5%, 15%, and 20% for the simulation of the increased and decreased costs.

As per our knowledge, no previous study has conducted a cost-effectiveness analysis between parenteral D10-CaGluconate and conventional D5 1/4NS nutrition preparations. If there were two or more medical interventions with the same purpose but different levels of effectiveness, cost-effectiveness would be the deciding factor for selecting the method. Based on threshold analysis, we can conclude that the cost incurred for RDS patients was relatively under the GDP. In other words, it was still suitable with medication rationality. This retrospective cohort research used 83 samples, including 40 D10-CaGluconate samples and 43 D5 1/4NS samples. The following secondary data used in this research were obtained from the patients’ medical records: Neonates weight, blood glucose level, respiratory rate, pulse frequency, body temperature, and medical cost. It was found that the patients’ diseases were not homogenous and had severe variations; in addition, there were some non-specific diagnoses. The significance of the statistical test was low due to its weak power. Advanced studies need to be conducted to evaluate the effect of bias factors on the effectiveness of the preparation.

CONCLUSION

The D10-CaGluconate preparation was more cost-effective than the D5 1/4NS preparation. However, the D5 1/4NS preparation could serve as an alternative treatment for RDS in normal-weight neonatal patients. To conclude, further studies on parenteral nutrition that involve more complex parenteral preparations need to be conducted to determine the actual effectiveness of a parenteral nutrition preparation.

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