

ANALYSIS OF COST AND OUTCOME THERAPY OF BLOOD TRANSFUSION ON ANEMIA TREATMENT FOR INPATIENT WITH CHRONIC RENAL FAILURE

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ABSTRACT

Chronic Renal Failure (CRF) is a slow progressive loss of kidney function over a period of several years. One of its complications that determines the patient's quality of life is anemia. Blood transfusion can be used to treat anemia in patient with CRF. The purpose of this study are to measure the average costs per patient, assess the therapy outcomes, and determine the factors that influence the cost of blood transfusion in anemia treatment for patients with CRF in A, B, and C hospitals. This study was a descriptive non-experimental research. Cost analysis was based on the perspective of the hospital. Data were obtained retrospectively from medical records and payment details of inpatient with CRF who experienced anemia in A (tertiary hospital in Yogyakarta province), B (tertiary hospital in Central Java province), and C (private hospital in the province of Yogyakarta) hospitals. Data was analysed by calculating the average costs per patient, while therapy outcome was measured by calculating the percentages of patients who achieved the target of hemoglobin level. Furthermore, the factors that influenced the amount of the total cost were analysed using Oneway ANOVA and Independent T-Test for data with normal distribution and the Kruskal-Wallis and Mann-Whitney for data with non-normal distribution. The results showed that the average costs per patient for anemia treatment in patient with CRF who had blood transfusion therapy were Rp 8,873,243.39±4,417,825.83 in A hospital, Rp 5,249,464.97±4,283,655.41 in B hospital; and Rp 7,961,088.00±6,105,501.80 in C hospital. Most of the patients in A, B, and C hospitals had achieved the target of hemoglobin level (>7g/dL) with the percentages of 95.56%, 68.57% and 87.50% respectively. The factors that mainly influenced the cost of anemia treatment in CRF are length of hospitalization for A hospital, age, gender, payment models, and length of hospitalization for B hospital, whereas age and length of hospitalization for C hospital.

Key words: cost analysis, outcome therapy, blood transfusion, anemia, chronic renal failure

INTRODUCTION

Chronic renal failure (CRF) is one of major health problems in society that requires high expenditure in the health care system. Patients with CFR have high risk of suffering from concomitant diseases (comorbid) such as cardiovascular disease (Carroll, 2006).

National Health and Nutrition Examination reported that the prevalence of CRF increased from 10% to 13% over 10 years between 1994 and 2004 (Abboud and Henric, 2010). CRF incidences increased with average of 8% per year (Novoa *et al.*, 2010). CRF affects

approximately 26 million people in United State (Lankrst and Wish, 2010).

Therapy for CRF requires enormous cost. According to United States Renal Data System explained that in 2010 the total costs for patients with CRF were 3.35 billion dollars in which 8% of the total cost incurred on CRF stages 1-2, 35% occurred in stage 3, and 13% occurred in stage 4-5. Overall expenses of medical care for patients with CRF was around 41 billion dollars, and the cost per person per year estimated around 22,323 dollars for all chronic renal failure (USRDS, 2012).

Anemia is a major complication in renal disease and occurs almost in patient with CRF. Anemia increase the risk of renal impairment, lowering quality of life, and decreasing the risk factor for premature death (Lankrst and Wish, 2010). Anemia is also one of the most conditions that lead to death and disability in the world (Acomb, 2003; Masood and Teehan, 2012). Moreover, it will increase the healthcare cost (Dalton and Schmidt, 2008).

National Health and Nutrition Examination Survey (NHANES) conducted by the National Institutes of Health and the Prevalence of Anemia in Early Renal Insufficiency (PAERI) reported that the incidence of anemia in chronic renal failure approximately <10% in stage 1 and 2, 20-40% at stage 3, 50-60% in stage 4, and >70% at stage 5 (Lankrst and Wish, 2010). The incidence of anemia will increase with the decreasing of glomerulo filtration rate (GFR) (Lankrst and Wish, 2010; Dalton and Schmidt, 2008).

Anemia as a result of kidney disease is treated mainly with erythropoietin (Gombotz, 2012). Although erythropoietin has many advantages but it is an expensive drug. It makes obstacle for patient to get this drug (Mikhail *et al.*, 2012). Blood transfusion is still used as anemia treatment for patient with CRF, despite of having the disadvantages such as the high possibility of reactions due to the transfusion, vulnerable transmission of hepatitis B and C, and potential medical error (Hudson, 2008). On the other hand blood transfusion has several advantages such as rapidly increasing Hb levels to the normal range, increasing blood volume, and improving oxygen delivery to the tissues so it can reduce several symptoms such as fatigue and dizziness (Sharma *et al.*, 2011; Gombotz, 2012).

The purpose of this study were to assess the outcome of therapy and the total cost during blood transfusion therapy, and identify the factors that determine the cost of anemia treatment in patient with CRF.

MATERIAL AND METHODS

Subjects research

Subjects were inpatients with CRF who had anemia in A, B, C hospitals in 2012.

Inclusion criterias were patients who was diagnosed with CRF and anemia, got a blood transfusion therapy, had complete medical records, and available payment data. Exclusion criteria was patient who died while undergoing treatment at the hospital. There were 45 cases in hospital A (tertiary hospital in the province of Yogyakarta), and 70 cases at Hospital B (tertiary hospital in Central Java province) and 40 cases in the hospital C (private hospitals in the province of Yogyakarta), that met the inclusion and exclusion criteria.

Research data

Data obtained from medical records included age, gender, treatment class, payment models, length of stay, stage of CRF, and hemoglobin level. Data for patient care costs was taken from the financial department. Cost analysis was based on the perspective of the hospital. Data were obtained retrospectively from medical records and payment details of inpatient with CRF who experienced anemia.

Outcome of blood transfusion therapy were calculated based on the percentages of patients who achieved the target of hemoglobin levels after receiving blood transfusion or hemoglobin levels when patients discharged from hospital. Targeted therapy in blood transfusion if the achievement of Hb ≥ 7 . Hb level of data obtained from the medical records of patients.

Analysis of research findings

Patients were classified by age, gender, treatment class, payment models, long hospitalization, stage of CRF, and Hb levels when patients entered hospital before treatment. Outcome analysis of blood transfusion therapy was calculated based on the percentage of patients who achieved Hb >7g/dL when patients discharged from hospital. After that, the average of total cost for inpatient treatment and the factors that influence the amount of the total cost were analysed using One -way ANOVA and Independent T -Test for data with normal distribution and the Kruskal-Wallis and Mann-Whitney for data with non-normal distribution.

RESULTS AND DISCUSSIONS

Patient characteristics

Male patients were higher than females with the percentage of 53.33%, 58.82%, and 62.50% in A, B, and C hospitals respectively. The incidence of anemia in CRF is more common in men than women, because the kidney damage occurs more quickly in men than in women (McFarlane *et al.*, 2008). Other cross-sectional study from the National Health and Nutrition Examination Survey explain that the prevalence of chronic renal failure in males is higher than females so the risk of anemia also be more common in males.

The majority of patients both in A, B, and C hospitals were hospitalized in the third class with the percentages of 77.15%, 73.34%, and 65.00% respectively. According to the payment models, most of patients in A and B hospitals were financed by health insurance for the poor (JAMKESMAS) with the same percentages of 40.00% (18 and 28 patients respectively), while in C hospital the majority of patients paid with their own money with the percentages of 35.00% (14 patients). Based on the length of hospitalization, the majority of patients were hospitalized in the range of 6-10 days with with the percentages of 55.56% (25 days), 44.29% (31 days), and 45.00% (18 days) in A, B, and C hospitals respectively.

The majority of patients were diagnosed CRF at stage 5 with the percentages of 95.56% (43 cases) in A hospital, 94.28% (66 cases) in the B hospital, and 92.50% (37 cases) in C hospital. This is accordance with a study from the National Health and Nutrition Examination Survey (NHANES) by the National Institutes of Health and Prevalence of Anemia in Early Renal Insufficiency (PAERI) showed that the incidence of anemia was less than 10% in stage I of CRF and II, 20-40% in stage III, 50-60% in stage IV, and more than 70% in stage V (Lankrst and Wish, 2010), so there were an increase in the incidence of anemia with increasing the stage of CRF both in all three hospitals.

The majority of patients with anemia in chronic renal failure admitted to hospital with Hb<7g/dL i.e. in the A hospital with 24 cases (53.33%), B hospital with 44 cases (62.86%), and C hospital with 19 cases (47.50%).

Blood transfusion therapy outcome

Outcome of blood transfusion therapy were calculated based on the percentages of patients who achieved the target of hemoglobin levels after receiving blood transfusion or hemoglobin levels when patients discharged from hospital. Therapy outcome is determined to control the patient's hemoglobin levels within the normal range in order to prevent the complications that can be caused by anemia. The target of blood transfusion is to achieve hemoglobin levels at 7-9 g/dL (not the same as the hemoglobin target in ESA therapy) (PERNEFRI, 2012). The number of patients who had achieved the target of hemoglobin level at each hospital is showed in table I.

According to table I, the majority of patients in the Hospital A, Hospital B, and Hospital C had achieved the target of hemoglobin levels (>7g/dL) with the percentages of 95.56%, 68.57% and 87.50% respectively. In addition, treatment outcome was also analysed in the increase of hemoglobin levels after patients received blood transfusions. Table II explained that in all hospitals most of patients experienced an increase in hemoglobin levels after receiving blood transfusion. However, in some cases both of A and C hospital there were a decrease in hemoglobin levels due to the fact that CRF is a progressive kidney disease in which the anemic condition will get worse with worsening of kidney disease, so the decline of hemoglobin levels could be occurred even after receiving blood transfusion treatment.

Cost analysis

This study looked at a total cost of treatment of patients, its components, and how big the components that contribute to the magnitude of the total cost. These costs are calculated by looking at the average cost to be incurred by each patient admissions each component described. Analysis was performed on blood transfusion costs, examinations, hospital services, the anemia drug drugs for other diseases, medical devices, drug charges anemia, dialysis, surgery, and non-medical costs.

Table I. Patients who achieved targeted therapy.

Categori Hb	Hospital C		Hospital A		Hospital B	
	n=40	%	n=45	%	n=70	%
≤7 g/dL (not achieved the target)	-	-	1	2.22	14	20.00
>7 g/dL (achieved the target)	35	87.50	43	95.56	48	68.57
Not Available	5	12.50	1	2.22	8	11.43
Total	40	100.00	45	100.00	70	100.00

Table II. Patients who experiencing increase in hemoglobin levels.

Categori Hb	Hospital C		Hospital A		Hospital B	
	n=40	%	n=45	%	n=70	%
Increase	29	72.50	35	77.78	61	87.14
Fixed	-	-	1	2.22	-	-
Decrease	3	7.50	8	17.78	-	-
Not Available	8	20.00	1	2.22	9	12.86
Total	40	100.00	45	100.00	70	100.00

Table III. Cost components of anemia treatment in inpatients with CRF who received blood transfusion in A, B and C Hospitals in 2012.

Cost Components	Hospital B		Hospital C		Hospital A	
	Average Cost per Patient±SD (million Rp)	%	Average Cost per Patient±SD (million Rp)	%	Average Cost per Patient±SD (million Rp)	%
Transfusion	0.659±0.452	12.53	0.815±0,011	10.24	0.837±0.395	9.44
Examinations	1.406±0.863	26.78	0.713±0.727	8.96	2.461±1.235	27.77
Anemia drugs	0.006±0.005	0.11	0.022±0.021	0.28	0.010±0.005	0.11
Medical services	0.422±0.355	8.04	0.407±0.408	5.11	0.867±0.545	9.78
Other disease drugs	0.902±1.776	17.19	1.337±2.611	16.80	1.366±1.568	15.41
Administration	0.016±0.039	0.31	0.078±0.024	0.98	0.015±0.007	0.17
Surgery	-	-	3.382±1.650	42.49	2.858±1.935	32.25
Hemodialysis	0.965±1.111	18.38	1.394±0.737	17.51	1.715±0.825	19.35
Services	0.217±0.352	4.14	0.188±0.210	2.36	0.468±0.467	5.28
Hospitalizations	0.448±0.351	8.54	0.990±0.923	12.44	1.026±1.163	11.58
Medical devices	0.511±0.625	9.73	0.198±0.299	2.49	0.444±0.318	5.01
The others	0.049±0.018	0.94	0.010±0	0.19	0.033±0.015	0.37
Average total cost per patient	5.249±4.283		7.961±6.105		8.873±4.417	

Cost analysis was conducted to determine which component is the largest allocation for the anemia treatment in the hospital, the percentages of blood transfusion cost compared to total cost, and the average of total costs per patient in A, B, and C hospitals.

According to the table III, the average of total costs per patient for treating anemia in CFR were Rp 5,249±4,283million, Rp 7,961±6,105 million, and Rp 8,873±4,417

million in B, C, and A hospitals respectively. The highest budget allocation in the B hospital was examination fees (26.78%), while in the C and A hospitals the highest proportion were the cost of operating with 42.49% and 32.25% respectively. Examination fee in hospital C and A of 8.96% and 27.77%. The examination fees included USG, laboratory test, radiology and EKG. Cost of blood transfusions allocated 12.53% in the B hospital, 10.24% in C hospital,

and 9.44% in A hospital. Other costs that require a large allocation in all three hospitals were hemodialysis and drugs for other diseases. Costs of other diseases had high contribution since the majority of patients had comorbid diseases and complications.

Factors that influence the total costs for treating

Analysis of factors that influence the total cost of treating were analysed using One-way ANOVA and Independent T-test for data with normal distribution and the Kruskal-Wallis and Mann-Whitney for data with non-normal distribution. If significant value (p) is less than 0.05, the factors influence the total cost of treating significantly. The results showed that A hospital is affected by the length of stay (LOS) with $p=0.000$; the hospital B is influenced by age ($p=0.040$), gender ($p=0.035$), the payment models ($p=0.001$), and LOS ($p=0.000$); and C hospital is influenced by age ($p=0.001$) and LOS ($p=0.000$). It can be interpreted that if there is an increase in the length of hospitalization, the total cost will increase significantly.

CONCLUSION

In conclusion, the average costs per patient for anemia treatment in patients with CRF using blood transfusion therapy were Rp 8,873,243.39 \pm 4,417,825.83 in A Hospital, Rp 5,249,464.97 \pm 4,283,655.41 in B Hospital, and Rp 7,961,088,00 \pm 6,105,501.80 in C Hospital. The majority of patients in A, B, and C hospitals had achieved the target of hemoglobin levels ($>7\text{g/dL}$) with the percentages of 95.56%, 68.57% and 87.50% respectively. The factors that mainly influenced the cost of anemia treatment in CRF are length of hospitalization for A hospital, age, gender, payment models, and length of hospitalization for B hospital, whereas age and length of hospitalization for C hospital.

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