Paediatrica Indonesiana

p-ISSN 0030-9311; e-ISSN 2338-476X; Vol.60, No.5(2020). p.244-52; DOI: 10.14238/pi60.5.2020.244-52

Original Article

Cost analysis of congenital heart disease patients who underwent diagnostic catheterization

Ni Putu Wirantari, Eka Gunawijaya, Ni Putu Veny Kartika Yantie

Abstract

Background Cardiac catheterization has developed into an important technique for diagnosis and management of congenital heart disease (CHD) patients. Catheterization is expensive and almost all patients who undergo the procedure at Sanglah General Hospital are participants of the *Social Insurance Administration Organization* (*Badan Penyelenggara Jaminan Sosial/BPJS*) that uses the *Indonesian Case-Based Groups* (INA-CBGs) payment system.

Objective To determine the characteristics and analyze costs of CHD patients who underwent diagnostic catheterization.

Methods This retrospective study used patient medical record data from March 2009 - July 2018 in Sanglah Hospital, Bali. Data collected included CHD type, age, sex, weight, height, nutritional status, length of procedure, complications, hospital rates, and INA-CBG rates. Data analysis was done with *SPSS software*.

Results Of 219 CHD patients who underwent non-intervention catheterization, most had cyanotic CHD. Catheterization intervention in 2018 showed a discrepancy between the INA-CBG rate and hospital rate. The biggest difference was 107%, in patients who underwent mild heart intervention with class 3 of treatment.

Conclusion Most subjects are diagnosed with cyanotic CHD especially tetralogy of Fallot and most has already received intervention. There are negative differences between the INA-CBG rates and the hospital real rates for catheterization. **[Paediatr Indones. 2020;60:244-52 ; DOI: 10.14238/pi60.5.2020.244-52]**.

Keywords: *heart catheterization; congenital heart disease; INA-CBG; cost analysis; National Health Insurance*

Congenital heart disease (CHD) is a heart disorder that has a significant impact on the morbidity, mortality, and health costs of children. Children with CHD have structural abnormalities in the heart and/or large blood vessels that appear at birth.[1,2] The incidence of CHD is estimated to be 6-8 per 1,000 live births in the general population. CHD events were reported to be 4-10 per 1,000 births in the United States, 6.9 per 1,000 births in Europe, and 9.3 per 1000 births in Asia.[3,4] A study noted that out of 903 catheterizations performed, 51% were diagnostic, 43% were interventions, and 6% were for endomyocardial biopsies.[5]

Cardiac catheterization is an important procedure for diagnosis and management of CHD patients. The role of cardiac catheterization required as a diagnostic tool because of its accuracy and ability to directly assess the cardiac space.[6] Diagnostic catheterization in acyanotic CHD serves to describe the complete anatomy of the heart and assess pulmonary arterial pressure. Catheterization in cyanotic CHD is

From the Deparment of Child Health, Universitas Udayana Medical School/Sanglah General Hospital. Denpasar, Bali, Indonesia.

Corresponding author: Ni Putu Wirantari. Deparment of Child Health, Universitas Udayana Medical School/Sanglah General Hospital. Denpasar, Bali. Email: ariwirantari@yahoo.co.id.

Submitted November 12, 2019. Accepted August 7, 2020.

used to assess pulmonary artery anatomy, pulmonary pressure, and pulmonary aortic collateral vessels.7

The *National Health Insurance* (*Jaminan Kesehatan Nasional/JKN*) was first introduced by the Indonesian government on January 2014. This insurance guarantees health protection by the government for participants who have paid their fees. This program is organized by the *Social Insurance Administration Organization* (*Badan Penyelenggara Jaminan Sosial/BPJS*), which was a change from previous health insurance for government employees namely *Health Insurance (Asuransi Kesehatan/ASKES*).[8] The Presidential Regulation no. 111 (2013) was a revision of Presidential Regulation no. 12 (2013) concerning health insurance, with regards to payments for health services by BPJS using the *Indonesian Case-Based Groups* (INA-CBG) coding and reimbursement system in 2014.[9]

The INA-CBG is a system for determining standard rates used by the hospital as a reference to claim BPJS reimbursements to the government. The INA-CBG rate is the reimbursement rate from BPJS paid to advanced health facilities for service packages based on grouped diagnoses of disease and procedures. The rate is in the form of a package including all components of the hospital rate. Rate data and disease coding refer to the *International Classification of Diseases* (ICD) regulated by the *World Health Organization* (WHO). The ICD 10 includes 14,500 diagnostic codes and the clinical ICD 9 includes 7,500 codes. The INA-CBG rates are subdivided according to 6 types of hospital classes, namely D class hospital, C class hospital, B class hospital, A class hospital, public hospitals, and national referral hospitals. The INA-CBG rate is arranged based on treatment classes, namely, classes 1, 2, and 3.[10,11]

To date, there have been no studies on the cost of catheterization in CHD patients at Sanglah General Hospital, Denpasar. Hence, we aimed to assess the characteristics of such patients and compare the hospital procedure costs to the reimbursement rate from BPJS.

Methods

This retrospective study included CHD patients who underwent diagnostic catheterization at Sanglah General Hospital, Bali, from March 2009 - July 2018. We collected data from patient medical records. Patients with incomplete medical records were excluded. The study was approved by the Research Ethics Commission of the Medical School Udayana University/Sanglah General Hospital, Denpasar.

Data from the study included CHD type, age, sex, weight, height, nutritional status, length of procedure, complications, hospital rates, and INA-CBG rates. Operational definitions of variables were as follows:

1. Congenital heart disease (CHD) was a heart disorder present at birth. This CHD was divided into two types, namely, cyanotic and acyanotic heart disease. Cyanotic CHD was characterized by central cyanosis due to the presence of right-to-left shunts, for example, tetralogy of Fallot, transposition of large arteries, or tricuspid atresia. Acyanotic CHD was typified by leakage of the heart septum accompanied by left-to-right shunts, including ventricular septal defect (VSD), atrial septal defect (ASD), or blood vessel openings as in the persistent ductus arteriosus (PDA). In addition, acyanotic CHD was also found in obstruction of the ventricular outlet such as aortic stenosis, pulmonary stenosis, and coarctation of the aorta. Acyanotic CHD was divided into isolated and non-isolated. Isolated was CHD with single abnormality and non-isolated with combination abnormalities.[12]
2. Diagnostic cardiac catheterization was the act of inserting a small tube (catheter) into the arteries and/or veins and tracing it to the heart, other blood vessels and/or other organs that were targeted with the aid of X-rays aimed at diagnostics (seeking interference structure and/or function of the heart blood vessels, other blood vessels, and/or other organs).[13]
3. Age was based on the date of birth taken from subjects' medical records, expressed in years. Age calculation using benchmark of 12 months for one year. If the age calculation was less than 6 months of age, it was rounded down to zero and if more than or equal to 6 months, then it was rounded up to the nearest whole number, and expressed on a numerical scale.
4. Weight was measured using a scale in units of kilograms (kg). Children aged 1 to 24 months were weighed using infant scales, whereas children

over 24 months were weighed with a pediatric standing balance. Body weight was recorded with accuracy to 0.05 kg in infants and 0.5 kg in older children, expressed in kg.

5. Height was measured by scales in centimeters (cm). Measuring the body length of children aged 6 to 12 months was done by two people to ensure that the baby's head touched the head restraint board in the Frankfort (Frankfort horizontal line) flat plane. For children over 12 months, height was measured in a standing position, using a stadiometer. When measuring height, the child stood upright with thighs touching side-by-side, barefooted, and heels, buttocks, and back of the head touching the stadiometer. Height was expressed in cm.
6. Nutritional status was assessed by comparing actual body weight to ideal body weight (based on the 2007 WHO Curve. Patients were classified as obese for >120%, overweight for 110 to 120%, well-nourished for 90 to <110%, undernourished for 70 to <90%, severe malnutrition for <70% according to Waterlow,[14] expressed as a categorical scale.
7. The length of the procedure was the length of time starting from injection of the arteries until the catheter was removed.
8. Complications of catheterization consisted of major and minor complications. Major complications were death, life-threatening hemodynamic decompensation (cardiac arrest or severe hypotension), those that required surgical intervention (tool embolization), or resulted in anatomical lesions, or permanent function events (cerebral infarction, permanent arterial thrombosis, damage to blood vessels, aneurysms). Minor complications consisted of transient events that resolved with or without therapy (e.g., treatable arterial thrombosis and transient arrhythmias).[15,16]
9. Hospital rate was the total cost of hospital care including medicines, medical equipment, paramedics, doctors, wards, laboratory and radiology examinations, and administration fees. The INA-CBG rate was the payment amount by BPJS to advanced health facilities for the service package that was claimed, based on the classification of disease diagnosis and procedures.[8,9] Discrepancy defined as margin between hospital rate with INA CBG rate.
10. The severity of cases in INA-CBG was divided into mild, moderate, and severe. The mild category was used for cases of hospitalization with severity 1 (without complications or comorbidities), moderate for cases of hospitalization with severity 2 (with complications and mild comorbidities), and severe for cases of hospitalization with severity 3 (with complications and severe comorbidities).[9]
11. The INA-CBG rate was arranged based on treatment classes, namely, classes 1, 2, and 3. [10,11]

Data analysis was done with *SPSS software*. Descriptive data were depicted in the form of images, tables, and narratives. Ethical approval was obtained from the Health Research Committee, Sanglah Hospital/Universitas Udayana Medical School.

Results

Of 219 catheterization subjects, 100 subjects had surgery. Of 119 subjects who did not undergo surgery, 2 were treated conservatively, 21 were referred to Harapan Kita Hospital, Jakarta, 6 negotiated about further treatment, 4 refused further treatment, 13 died, and 73 were lost to follow up (**Figure 1**).

The number of subjects who underwent catheterization at Sanglah General Hospital from March 2009 - July 2018 was 219 (**Figure 2**). As shown in **Table 1**, the 0-5 year age group had the most subjects. Males predominated with 53.9%. The most common type of heart disease was cyanotic CHD (51.1%), with several diagnoses including double outlet right ventricle (DORV) (accompanied by atrial septal defect/ASD, tricuspid atresia/TA, transposition of the great arteries/TGA, pulmonary stenosis/PS), pulmonary atresia/PA (accompanied by ASD, TA, ventricular septal defect/VSD), TGA (accompanied by ASD, atrioventricular septal defect/CAVSD, PA, VSD), or tetralogy of Fallot/TF (accompanied by PDA, PA, ASD). Median radiation time was 13.3 minutes in acyanotic patients and 14.3 minutes in cyanotic patients.

Figure 3 shows that ventricular septal defect is the most case (63 cases) from isolated acyanotic CHD category. From non-isolated acyanotic CHD

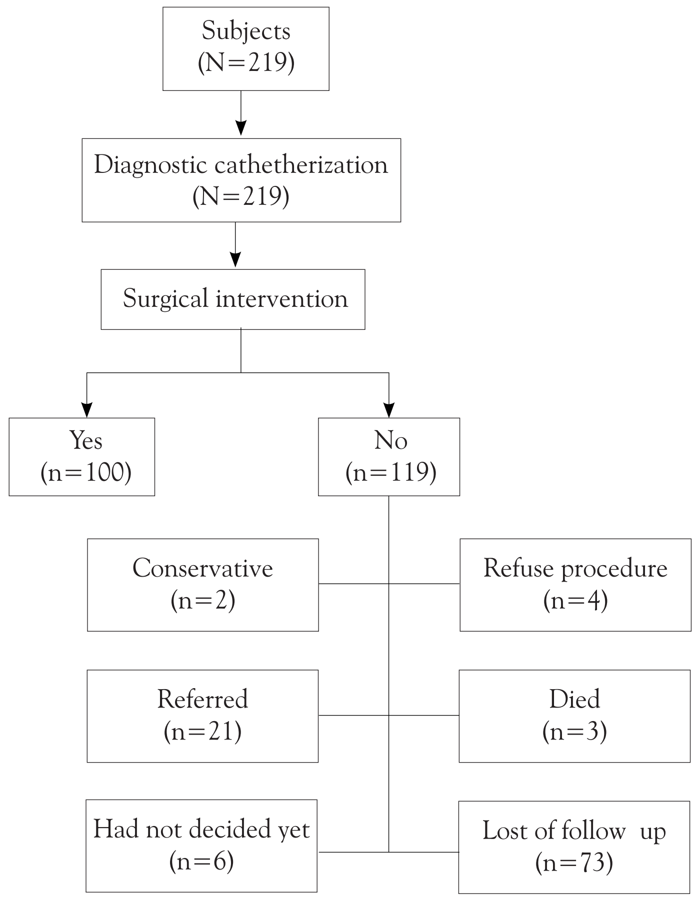

Figure 1. Flow chart of catheterization patients in March 2009 - July 2018

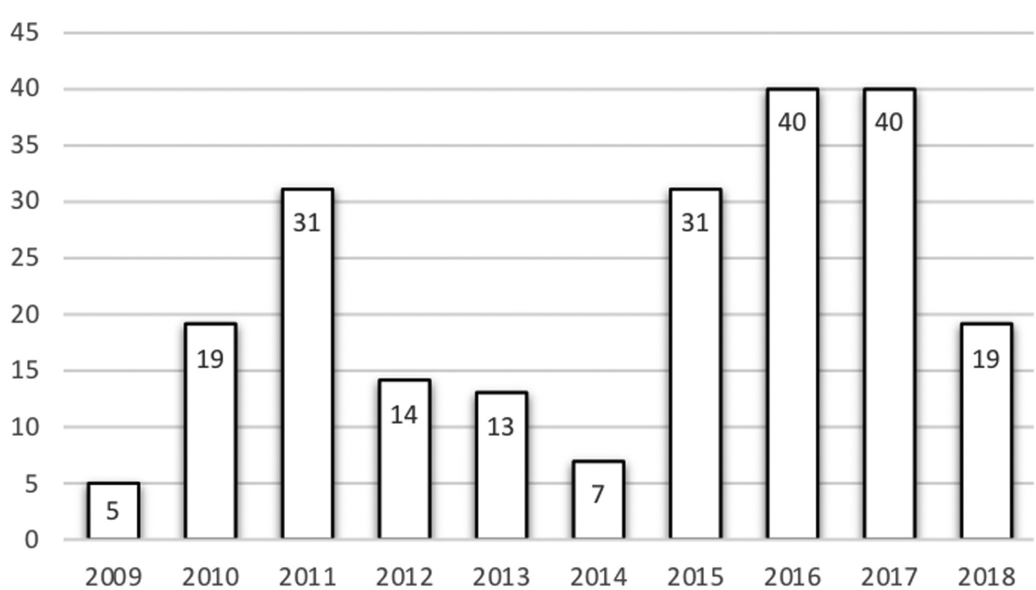

Figure 2. Diagnostic catheterizations at Sanglah Hospital

Table 1. Subjects' characteristics

Characteristics	(N=219)
Age, n (%)	
0-5 years	149 (68)
6-10 years	43 (19.6)
11-18 years	27 (12.3)
Gender, n (%)	
Male	118 (53.9)
Female	101 (46.1)
Median body weight (range), kg	11.0 (2-55)
Mean height (SD), cm	94.9 (27.2)
Nutritional status, n (%)	
Obese	9 (4.1)
Overweight	13 (5.9)
Well-nourished	75 (34.2)
Under-nourished	70 (32.0)
Severe malnutrition	52 (23.7)
Type of CHD, n (%)	
Cyanotic	112 (51.1)
Acyanotic	107 (48.9)
Isolated	90
Non-isolated	17
Type of anesthesia, n (%)	
General	219 (100)
Local	0 (0)
Complications, n (%)	
Major	9 (4.1)
Minor	102 (46.6)
None	108 (49.3)
Median duration of radiation (range), minutes	13.9 (1.8-71.0)
Median duration of procedure (range), minutes	69.0 (15.0-213.0)

category, VSD + PDA are the most cases on this study (8 cases) as showed on **Figure 4**. **Figure 5** shows that ToF + varian are the most cases (61 cases) on cyanotic CHD category.

Table 2 shows the difference between hospital rate and INA CBGs rate for cases in year 2018. The biggest difference was found in mild case with class 3 inpatient room (107%). Among 219 subjects, we randomly choosed 13 subjects from year 2018 database as examples for discrepancy (**Table 2** & **Table 3**). We choosed the year of 2018 as the BPJS database was started on this year. We could not calculated thehospital losses for 9 years (between 2009-2018) since the data was not available.

Discussion

In our study, most subjects were aged 0-5 years. It is slightly different with a study in Sarajevo who observed that the average age of pediatric patients with CHD who underwent cardiac catheterization was 5.9 years. They also noted that more male CHD patients underwent diagnostic catheterization (58.3%).[17] Our subjects were also comprised of more males (118; 53.9%) than females (101; 46.1%).

Our cases had cyanotic CHD (51.1%) with TF as the major diagnosis. A previous study reported that 67% of their subjects had cyanotic CHD during

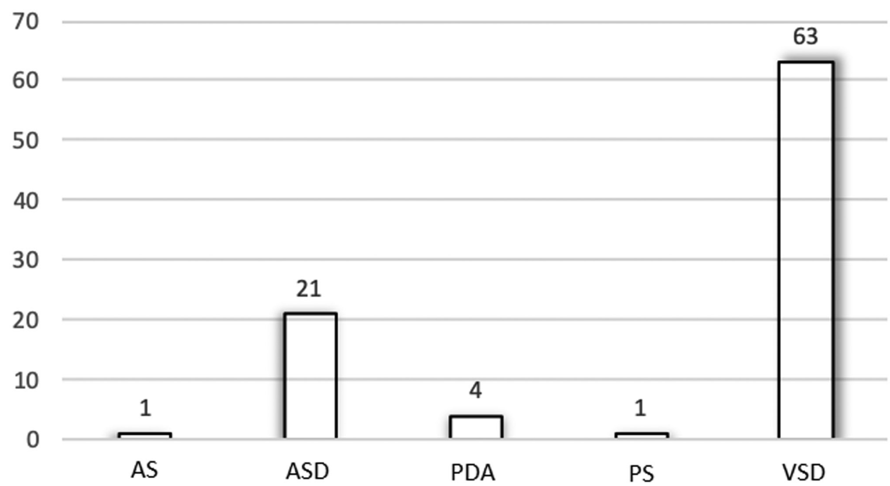

Figure 3. Isolated acyanotic CHD
AS=aortic stenosis, ASD=atrium septal defect, PDA=patent ductus arteriosus, PS=pulmonal stenosis, VSD=ventricle septal defect.

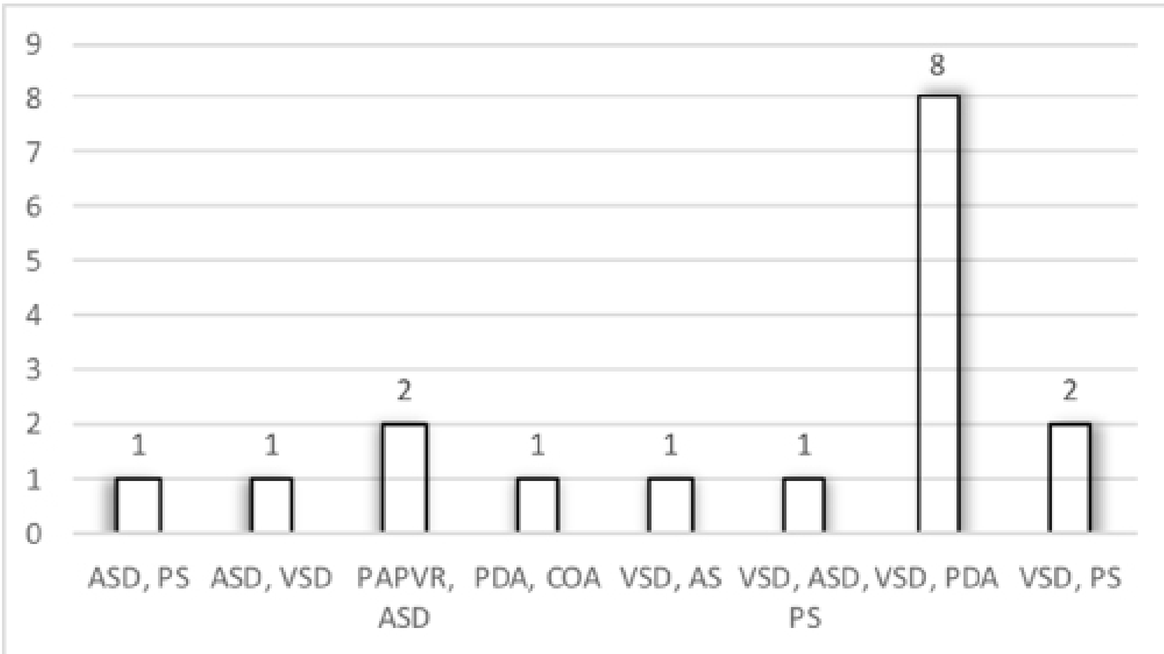

Figure 4. Non-isolated acyanotic CHD
PAPVR=partial anomalous pulmonary venous return, COA=coarctation of the aorta

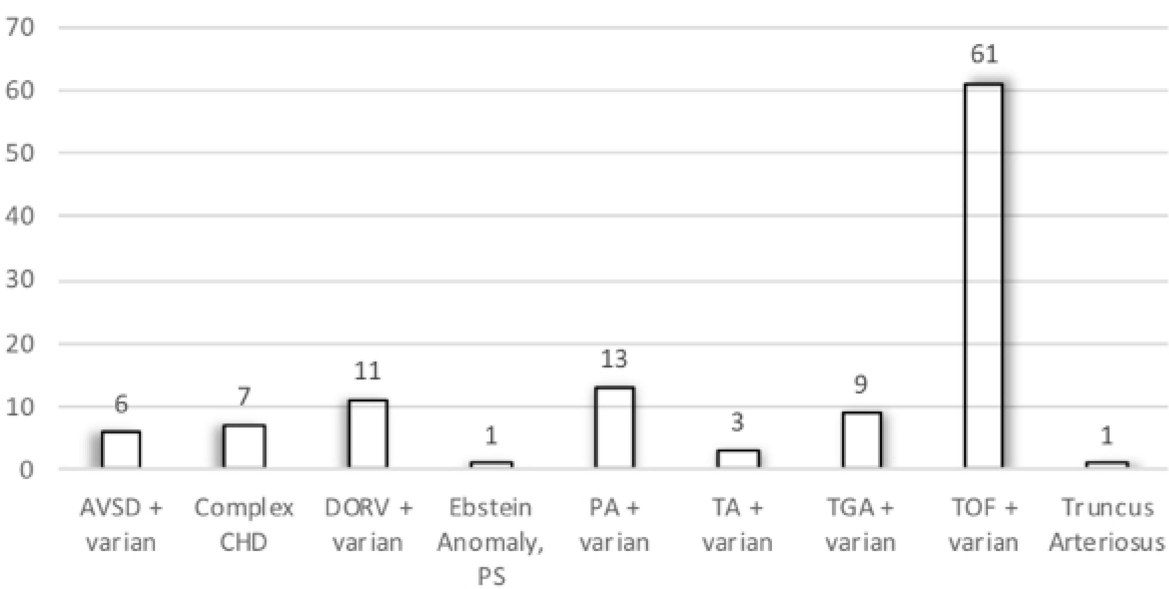

Figure 5. Cyanotic CHD
AVSD=atrioventricular septal defect, complex CHD=complex congenital heart disease, DORV=double outlet right ventricle, PA=pulmonary atresia, TA=tricuspid atresia, TGA=transposition of great arteries, ToF=tetralogy of Fallot

Table 2. Differences in hospital and INA-CBG rates in 2018

Catheterization	Hospital rate	INA-CBG rate	Rate difference	Percentage rate difference
Mild				
Class 3 (n=5)	12,746,163 IDR	6,165,900 IDR	6,580,263 IDR	107%
Class 2 (n=5)	14,976,036 IDR	7,399,000 IDR	7,577,037 IDR	102%
Class 1 (n=2)	14,278,518 IDR	8,632,200 IDR	5,133,184 IDR	59%
Moderate				
Class 3 (n=1)	13,743,684 IDR	8,610,500 IDR	5,133,184 IDR	59%

Table 3. Differences in hospital and INA-CBG rates based on diagnoses in 2018

Diagnosis	Catheterization procedure	Hospital rate	INA-CBG rate	Rate difference	Percentage rate difference
Isolated ASD	Mild				
(n=3)	Class 3	14,163,545 IDR	6,165,900 IDR	7,997,645 IDR	129%
	Class 2	18,608,510 IDR	7,399,000 IDR	11,209,510 IDR	151%
Isolated VSD	Mild				
(n=3)	Class 2	14,060,274 IDR	7,399,000 IDR	6,661,274 IDR	90%
	Class 1	15,008,521 IDR	8,632,200 IDR	6,376,321 IDR	74%
TF	Mild				
(n=2)	Class 3	13,680,993 IDR	6,165,900 IDR	7,515,093 IDR	122%
	Class 2	13,636,886 IDR	7,399,000 IDR	6,237,886 IDR	84%
Isolated AVSD	Mild				
(n=1)	Class 2	14,514,241 IDR	7,399,000 IDR	7,115,241 IDR	96%
DORV + variant	Mild				
(n=1)	Class 3	14,479,043 IDR	6,165,900 IDR	8,313,143 IDR	135%
PA + variant	Mild				
(n=2)	Class 1	13,548,514 IDR	8,632,200 IDR	4,916,314 IDR	57%
	Moderate				
	Class 3	13,743,684 IDR	8,610,500 IDR	5,133,184 IDR	60%
TGA + variant	Mild				
(n=1)	Class 3	7,243,690 IDR	6,165,900 IDR	1,077,790 IDR	175%

diagnostic catheterization with the majority of cyanotic CHD cases were due to TF.[7]

All pediatric CHD patients who underwent cardiac catheterization used general anesthesia. Other literature also stated that most cardiac catheterization procedures are performed under general anesthesia, to reduce or eliminate discomfort and to ensure patient cooperation during the procedure.[18]

The median radiation time in our subjects was 13.9 minutes, ranging from 1.8 to 71 minutes. Similarly, a study showed radiation duration of 5.2-39 minutes. The longest duration of radiation during catheterization was in patients with PA, TF, and PS. Children have higher radio-sensitivity compared to adults, thus, radiation exposure in the first 10 years of life has a risk factor for long-term effects, several times higher compared with that of an adult. The catheterization procedure is carried out with all precautions to minimize the effects of radiation on the operator and patient, so that the fluoroscopy time is kept as low as possible.[19] The median radiation time was 13.3 minutes in acyanotic patients and 14.3 minutes in cyanotic patients. Kumar et al. found that radiation time ranged from 2.4 to 11 minutes in acyanotic patients and 8-28 minutes in cyanotic patients. Catheterization in cyanotic CHD has a longer radiation time because of the need to assess cardiac chamber pressure, pulmonary artery anatomy, and pulmonary aortic collateral vessels.[7]

Our subjects median duration of the diagnostic heart catheterization procedure was 69 minutes. The longest duration was 213 minutes in VSD cases with ST depression during the intervention. Similarly, a previous study reported an average length of cardiac catheterization to be 118 (SD 40.2) minutes.[20] The duration of the procedure depends on the type and complexity of the abnormality, the anesthetic procedure, the experience and skill of the operator and assisting staff.

We found major complications in 4.1% of our subjects, minor complications in 46.6%, and no complications in 49.3%. In contrast, a study noted that 17% of cases had complications during catheterization. The most common complication in this study was limited bleeding at the location of insertion of catheterization access.[20]

Diagnostic catheterization from January to July 2018 consisted of mild and moderate catheterization. Table 2 shows that INA-CBG rates were lower than hospital costs in all categories of action. A previous study also showed that insurance rates were lower than hospital rates for certain diseases.[21] The BPJS officials reported that at the start of the INA-CBG package implementation, around 94 hospitals had a surplus from using INA-CBG reimbursements compared to previously; this applied to hospitals in and outside Jakarta, such as *Rumah Sakit Islam* in Jemursari, Surabaya, East Java.[9] Low INA-CBG reimbursement rates compared to hospital rate result in hospital losses, whereas INA-CBG rate higher than hospital rates benefit the hospital.

The biggest difference in rates was found in mild intervention with class 3 of treatment (107%). Factors that cause differences between hospital and INA-CBG package rates include administrative fees, accommodation, doctor's actions, nursing, pharmacy, and laboratory examinations. Hospital rate are calculated from details of the type of service, with rates determined by local regulations. Hospital rate calculations are generally based on a retrospective rate calculation, which means the rates are billed after the service is done. Such calculations do not encourage efficiency. The INA-CBG rate is determined based on prospective calculations, so it is important to establish standard disease management procedures with clinical pathways. These procedures can help the hospital team to perform optimal, efficient, and effective services in the JKN era.[11]

The INA-CBG rates are calculated based on the diagnostic code and procedure code entered into the CBG's standard code set by the central government. While hospital rates depend on patient length of stay, the INA-CBG rate is not affected because its reimbursement rate is adjusted according to only the diagnostic and procedural codes. In our study, the average length of stay was 2.1 days. The accuracy of the diagnosis and coding procedures affects the accuracy of INA-CBG rates. Coding accuracy is compared to diagnoses stated in the patient summary and audited by the BPJS verifier.[11]

Based on the results of this study, we expect that hospitals will be more selective in carrying out future catheterization measures. Other modalities that are less expensive and easier in the diagnosis of CHD should be considered as alternatives to catheterization. Other tools that can be used repeatedly and reduction of consumable items during catheterization would be preferred.

The limitations of this study were not analyzing the hospital and INA-CBG rate components. This study relatively had small number of subjects and more studies with a large number of subjects are needed to be more representative. We also did not assess the types of laboratory examinations or imaging, information on the suitability of diagnoses or coder understanding in coding appropriate diagnoses or procedures with patient records.

In conclusion, the majority of subjects have cyanotic CHD compared to acyanotic CHD, with TF as the most common diagnosis. All patients undergo catheterization using general anesthesia. Most of the catheterizations are uncomplicated. Most of the subjects have surgery at Sanglah General Hospital. There is a discrepancy between hospital rate and INA-CBG rates in diagnostic catheterization.

Conflict of Interest

None declared.

Funding Acknowledgment

The authors received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Ismail MT, Hidayati F, Krisdinarti L, Noormanto, Nugroho S, Wahab AS. Epidemiology profile of congenital heart disease in a national referral hospital. Acta Cardiologia Indones. 2015;1:66-71. DOI: https://doi.org/10.22146/aci.17811.
2. Allen HD, Shaddy RE, Penny AJ, Feltes TF, Cetta F. Development of the heart. In: Sizarov A, Baldwin HS,

Srivastava D, Moorman AFM, editors. Moss and Adams heart disease in infants, children, and adolescents. 9th ed. Baltimore: Williams & Wilkins; 2016. p.657-64.
3. Yun SW. Congenital heart disease in the newborn requiring early intervention. Korean J Pediatr. 2011;54:183-91. DOI: 10.3345/kjp.2011.54.5.183
4. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Borden WB, *et al.* Heart disease and stroke statistics 2013 update: a report from the American Heart Association. Circulation. 2013;127:e6-e245. DOI: 10.1161/CIR.0b013e31828124ad.
5. Phillips BL, Cabalka AK, Hagler D, Bailey KR, Cetta F. Procedural complications during congenital cardiac catheterization. Congenit Heart Dis. 2010;5:118-23.
6. Moustafa GA, Kolokythas A, Cahritakis K, Avgerinos DV. Diagnostic cardiac catheterization in the pediatric population. Curr Cardiol Rev. 2016;12:155-62. DOI: 10.1111/j.1747-0803.2010. 00385.x.
7. Kumar P, Joshi VS, Madhu PV. Diagnostic pediatric cardiac catheterization: experience of a tertiary care pediatric cardiac centre. Med J Armed Forces India. 2014;70:10-6. DOI: 10.1016/j.mjafi.2013.01.002.
8. Aulia S, Supriadi, Sari DK, Mutiha A. Cost recovery rate program jaminan kesehatan nasional BPJS kesehatan. Akuntabilitas. 2015;8:111-20. DOI: 10.154 08/akt.v8i2.2767
9. BPJS Kesehatan. Info BPJS kesehatan [cited 2019 May 17]. Available from: http://www.bpjs-kesehatan.go.id.
10. Wijayanti AI, Sugiarsi S. Analisis perbedaan tarif riil dengan tarif paket INA-CBG pada pembayaran klaim Jamkesmas pasien rawat inap di RSUD Kabupaten Sukoharjo. JMIKI. 2013;1:1-10. DOI : 10.33560/.v1i1.56
11. Komaryani K. Kebijakan penentuan besaran biaya CBG. Tim teknis INA-CBG's Kementerian Kesehatan RI. Accessed: 2019 May 17. Available from: http://www.inahea.org.
12. Djer MM, Madiyono B. Tata laksana penyakit jantung bawaan. Sari Pediatri. 2000;2:155-62. DOI: http://dx.doi.org/10.14238/sp2.3.2000.155-62.
13. Perhimpunan Dokter Spesialis Kardiovaskular Indonesia. Pedoman Laboratorium Kateterisasi Jantung dan Pembuluh Darah. Jakarta: PERKI; 2018. p. 1-53.
14. Ikatan Dokter Anak Indonesia (IDAI). Rekomendasi ikatan dokter anak Indonesia: asuhan nutrisi pediatrik (pediatric nutrition care). Jakarta: Ikatan Dokter Anak Indonesia; 2011
15. Mehta R, Lee KJ, Cahturvedi R, Benson L. Complications of pediatric cardiac catheterization: a review in the current era. Catheter Cardiovasc Interv. 2008;72:278-85. DOI: 10.1002/ccd.21580.
16. Vitiello R, McCrindle BW, Nykanen D, Freedom RM, Benson LN. Complications associated with pediatric cardiac catheterization. J Am Coll Cardiol. 1998;32:1433-40. DOI: 10.1016/s0735-1097(98)00396-9.
17. McPhee SJ, Papadakis MA. Heart disease. In: Basgore TM, Granger CB, Jackson KP, Patel MR, editors. Current medical diagnosis & treatment. 56th ed. New York City: McGraw-Hill; 2017. p. 322-438.
18. Mullins CE. Cardiac catheterization in congenital heart disease: pediatric and adult. Massachusetts: Blackwell Futura; 2006. p. 25-73.
19. Papadopoulou D, Yakoumais E, Sandilos P, Thanopoulos V, Makri T, Gialousis G, *et al.* Entrance radiation doses during paediatric cardiac catheterisations performed for diagnosis or the treatment of congenital heart disease. Radiat Prot Dosimetry. 2005;117:236-40. DOI: 10.1093/rpd/nci755. Epub 2006 Feb 3.
20. Phillips BL, Cabalka AK, Hagler DJ, Bailey KR, Cetta F. Procedural complications during congenital cardiac catheterization. Congenit Heart Dis. 2010;5:118-23. DOI: 10.1111/j.1747-0803.2010.00385.x.
21. Yuniarti E, Amalia, Handayani TM. Analisis biaya terapi penyakit diabetes melitus pasien Jaminan Keshatan Nasional di RS PKU Muhammadiyah Yogyakarta - perbandingan terhadap tarif INA CBGs. JKKI. 2015;4:43-56. DOI: 10.22146/jkki.v4i3.36108.