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CASE SERIES PEDIATRIC ANESTHESIA

Preanesthesia carbohydrate loading in pediatric patients with acyanotic congenital heart disease: a case series

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ABSTRACT

Children with acyanotic congenital heart disease need cardiac catheterization for various indications, ranging from diagnostic procedures to innovative interventional therapy. Although preanesthesia fasting is widely accepted to minimize the risk of regurgitation and aspiration during induction, studies have shown that fasting also has a negative impact. Some studies have reported the incidence of anxiety in pediatric patients in the operating room to be 75.44% and 34–56% of it was caused by hunger.

We report 4 of our patients, who were allowed maltodextrin drinks as much as 5–10 ml/kg 2 h before anesthesia and the patient's anxiety level, vital signs, blood sugar before and during the procedure, and the incidence of complications were observed. The results showed a low level of anxiety, with good vital signs, and normal blood sugar. Carbohydrate drinks given up to 2 h before the procedure to the patients reduced hunger and thirst so that they were more comfortable, had reduced anxiety and stable blood sugar levels during the procedure. No complications were found due to the administration of carbohydrate drinks; therefore, routine administration of carbohydrate drinks can be considered in pediatric patients with acyanotic congenital heart disease who will undergo cardiac catheterization.

Key words: Pediatric; Congenital heart disease; Carbohydrate loading; Anxiety

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1. INTRODUCTION

Congenital heart disease (CHD) has become one of the emerging global problems in child health, being reported as the underlying cause of 19.8% deaths in 2017. Low and lower-middle income countries have the highest share of these cases.[1] In order to improve the survival rate, children with CHD such as acyanotic type need to undergo catheterization either for diagnostic or interventional therapies.[2,3] Careful and thorough planning is required right from the preanesthetic stage to achieve favorable outcomes, and to reduce complications and morbidity.[4] Prolonged preanesthetic fasting is stressful and uncomfortable to the children. Although preanesthetic fasting is widely practiced to minimize the risk of aspiration and regurgitation during induction, many studies show that fasting causes restlessness, is stressful, increases insulin resistance, with risk of its associated complications, higher morbidity and mortality, and prolonged hospital stay.[2–5] Pediatric patients have an anxiety level in the operating room up to 75.44%, in which 34–56% are made up of hunger.[6,7] The incidence of hypoglycemia in pediatric surgery in the operating room is about 3.5%, and has many causative factors, the most important being the duration of preanesthetic fasting.[8,9]

Table 1: Patients demographic data

Description	Case 1	Case 2	Case 3	Case 4
Age (y)	3	2	1	1
Gender	Female	Male	Female	Female
Weight (kg)	14	8.5	10	6.1
Height (cm)	99	75	79	62

Table 2: Diagnosis and procedure

Description	Case 1	Case 2	Case 3	Case 4
Diagnosis	PDA	PDA	VSD	PDA
Action	TCC of PDA	TCC of PDA	TCC of VSD	TCC of PDA
Procedure duration (min)	60	90	100	90
Anesthesia duration (min)	90	120	120	120
Procedure results	Installed, device in situ	Installed, device in situ	Installed, device in situ	Failed, scheduled for surgery
Amount of CHO consumed (ml)	70	90 (5 h pre-anesthesia)	40	50

PDA = patent ductus arteriosus; VSD = ventricular septal defect; TCC = transcatheter closure; CHO = carbohydrate drink

Table 3: Comparative observed data before and after procedure

Parameters	Description	Case 1	Case 2	Case 3	Case 4
Blood pressure (mmHg)	Pre-procedure	94/53	97/43	104/69	107/64
	Post-procedure	97/62	97/44	107/70	103/75
Heart rate (bpm)	Pre-procedure	99	100	122	105
	Post-procedure	90	103	128	108
Blood glucose level (mg/dL)	Pre-procedure	97	102	103	102
	Intra-procedure	83	227	87	76
mYPAS-SF	Pre-procedure	39.5	43.75	33.25	39.5
FLACC score	Pre-procedure	0	0	0	0
	Post Procedure	3	4	3	2

BPM = beats per minute; mYPAS-SF = modified Yale preoperative anxiety scale-short form; FLACC = face, legs, activity, cry and consolability

Several studies have shown that preanesthetic use of clear carbohydrate drinks (CaD) is safe when administered up to 2 h before surgery, and may be beneficial because it increases patient comfort before surgery by reducing thirst, hunger and anxiety, and can also reduce postoperative nausea and vomiting, postoperative pain and inflammatory response due tosurgery.[10–12] There is no consensus on the carbohydrate dose, but many studies have used a 12% maltodextrin solution.[10] Although several studies have shown the benefits of giving CaD to children before surgery, there has been no report of the administration of CaD in pediatric patients with CHD, undergoing cardiac catheterization in Indonesia. This series of four case reports attempts to examine the implementation of CaD for pediatric cardiac patients undergoing cardiac catheterization by assessing the patient's behavior or anxiety level, vital signs, blood sugar before and during the procedure, and the incidence of complications. It may stimulate researchers to conduct randomized, controlled trials to establish the risks and the benefits of preanesthetic use of clear carbohydrate drinks in assorted cohorts of children and even of adults.

2. CASE STUDY

Four cases with CHD, who received CaD, are presented. All patients were fasted according to the American Heart

Association (AHA) guidelines and received clear fluid using 12.5% maltodextrin solution ad libitum for up to 1 hour prior to catheterization. The usage of maltodextrin is usually for adult patients in our institution. However, a mother of a child patient complained about previous fasting experience, so we decided to use maltodextrin for this patient. When the patient was in front of the catheterization room, the Modified Yale Preoperative Anxiety Scale-Short Form (mYPAS-SF) score was assessed, and then premedication was performed with midazolam 0.05–0.08 mg/kg and ketamine 0.5–1 mg/kg. Once sedated, the patients were separated from their parents. Anesthesia was induced with 2% sevoflurane inhalation, fentanyl 2 µg/kg and atracurium 0.5 mg/kg. After two min, appropriate-size endotracheal tube was passed and fixed.

After the procedure was completed, extubation was performed and the analgesic inj. paracetamol 10 mg/kg was administered. The patient was immediately transferred to the PACU. There were no anesthetic complications in all patients. The observed data are further described in Tables 1 to 3. Patients' demographic data is given in Table 1. Data regarding diagnosis and the intervention done is given in Table 2, and comparative observed data before and after procedure is presented as Table 3.

3. DISCUSSION

Until now, studies on the effects of fasting and giving CaD in pediatric patients with CHD have not been widely carried out; none in Indonesia. The population of children with CHD mostly requires intervention in the form of catheterization and/or surgery.[2,3] Fasting and the administration of CaD have so far been of great concern, especially in the enhanced recovery after surgery (ERAS) protocol, with the aim of optimizing the post-surgery recovery process.[4,13,14]

Generally, fasting is performed on patients who will receive general anesthesia in an effort to minimize the risk of aspiration and regurgitation during induction.[2,5] The fasting guidelines used for pediatric patients undergoing elective procedures are fasting for 6 h for solid foods or formula milk, 4 h for breast milk and 1–2 h for clear fluids.[4,15–17] However, several studies have shown a negative impact of preanesthesia fasting. Pediatric patients who undergo fasting often feel hungry and thirsty, making them feel uncomfortable and restless.[6–8] Prolonged fasting can also cause hypoglycemia and cause the body to undergo a catabolic process during the procedure, leading to increased insulin resistance, which carries a greater risk of complications, especially post-operative infection.[9,10,18,20] CaD were given to the patients in the hope that it would make them less hungry, thirsty, and cause the body to undergo anabolic process, thus reducing the detrimental effect of fasting. A meta-analysis by Kotfis et al. showed that preoperative CaD are safe, simple, harmless and might even be beneficial postoperatively.[21] Maltodextrin is a polysaccharide that is used as a food ingredient. It is produced from grain starch by partial hydrolysis and is easily digestible, being absorbed as rapidly as glucose and may be either moderately sweet or almost flavorless.

There are no guidelines on the dosage of CaD recommended before the procedure, but Tudor-Drobjevski et al. used a dose of 5 ml/kg.[18] Given that there are no guidelines, clear fluid drinks are administered ad libitum to patients. In patients weighing more than 10 kg, the drink consumption is close to 5 ml/kg, but for those weighing less than 10 kg, it is close to 10 ml/kg. The difference can be due to an inappropriate taste or to the patient's thirst. Patients received CaD up to 1–2 h before anesthesia, but some patients consumed within 2–5 h before anesthesia, and refused to drink again, which is thought to be associated with the taste.[10–14,17] Behavior and anxiety before anesthesia were observed using the FLACC scale and mYPAS-SF.[22] The mYPAS-SF assessment was done when the patients were in the pre-anesthesia room before premedication was administered. From the mYPAS-SF assessment, the patient's level of anxiety tends to be low with all scores below 50 on a scale of 23.3–100.[21] The FLACC scale is also used to assess patient discomfort because it is more manageable and easier to interpret. Based on the observations using the FLACC scale, the patient seemed relaxed. From both types of assessment, patients who were given CaD seemed calm and the level of anxiety tended to be low, this was in agreement to the study by Frykholm et al. where the patient's anxiety/discomfort may be caused by thirst and hunger.[5,7,8] In general there was no case with abnormal blood sugar levels, but in the second patient there was a slight increase compared to pre-anesthesia levels. This may not be a special thing, but it can also be a sign of catabolism, given the consumption of maltodextrin 5 h before the procedure. The patient was asleep, so he did not drink until the time of the procedure.

Prolonged fasting before the procedure causes oxidative stress in the patient, which may lead to intraoperative or postoperative hypoglycemia which leads to insulin resistance; therefore, CaD should be given up to 2 h before the procedure.[5,19,20] We monitored vital signs before, during, and after the procedure, all of which were within normal limits. Discomfort or pain was seen in the patients after the procedure, although it cannot be explained with certainty, it may be related to thirst, hunger, pain in the puncture area, or because of the patient's feet requiring immobilization for 6 h after the procedure. No complications due to the administration of

CaD were found in the four cases, and all the patients were discharged one day after the procedure in stable condition.

In these four cases, we observed no negative impact of CaD administration to pediatric patients with acyanotic CHD to undergo cardiac catheterization, the FLACC scale score was good, and the level of anxiety tends to be low based on mYPAS-SF. Routine administration of CaD can be considered. We recommend further studies with a large sample size and more complete examination to better understand the impact of giving CaD on the population of children with CHD.

4. CONCLUSION

Pediatric patients with CHD who are fasted for catheterization tend to be restless and appear uncomfortable just before anesthesia which may be due to hunger and thirst. Carbohydrate drinks given up to 2 h before the procedure seem to help reduce hunger and thirst in the pediatric patients so that they are more comfortable, have less anxiety and their blood sugar level is stabilized during the procedure. Further studies are needed to better understanding of the impact of carbohydrate loading on pediatric patients with CHD who undergo general anesthesia.

5. Conflict of interest

The authors have no conflicts of interest to declare.

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7. Authors' contributions

AK: Conceptualization, case analysis, draft preparation, literature research, manuscript editing
JH: Case analysis, supervision, reviewing, manuscript editing

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