



Survey of pediatric cardiovascular anesthesia in Japan

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Received: 21 April 2023 / Accepted: 26 September 2023 / Published online: 10 October 2023
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To the Editor:

This study aimed to investigate the current standard practices in the management of vasoactive agents, steroid use, and vascular catheter insertion during pediatric cardiovascular surgery in Japan using a questionnaire survey.

In January 2022, we mailed the URL of the questionnaire survey to the hospitals that were certified by the Japanese Society of Cardiovascular Anesthesiologists or pediatric specialty hospitals that potentially performing pediatric cardiovascular surgery and requested their responses via a Google Form. We tabulated the responses and expressed them as number (percentage) or median (interquartile range, range).

Responses were received from 63 of the 90 targeted hospitals (70%) between February 1 and April 30, 2022. Of these, four hospitals were excluded because they did not perform pediatric cardiovascular surgeries. Thus, the data from 59 hospitals were analyzed.

The contents of the questionnaire survey and results are summarized in Online Resource 1. In the responses to the questions about vasoactive agent use, “always (100%),” “usually ($\geq 80\%$),” and “often ($\geq 60\%$)” were combined as “frequent” use. Accordingly, 44 (74.6%), 28 (47.5%), and 7 (11.9%) hospitals “frequently” used dopamine, dobutamine, and adrenaline, respectively. Noradrenaline was “frequently” used by only one hospital (1.7%); however, 18

hospitals (30.5%) used it in “some situations.” Thirty-three (55.9%), 12 (20.3%), three (5.1%), and 30 (50.8%) hospitals “frequently” used milrinone, olprinone, nitroprusside, and nitroglycerin, respectively. The specific situations in which each drug was used are listed in Online Resource 2. In combination, the majority of hospitals (86.4%) most commonly used one or more catecholamines plus PDE III inhibitors, with or without other vasodilators, in all pediatric cardiovascular surgeries. Forty-two hospitals (71.2%) used steroids during cardiovascular surgery involving cardiopulmonary bypass (CPB), whereas 17 (28.8%) did not. The responses to the questions about vascular catheter management are also shown in Online Resource 1. Regarding precautions during ultrasound-guided puncture for arterial line insertion, five hospitals (8.5%) used chlorhexidine or povidone–iodine disinfection, sterile gloves, sterile probe covers, and sterile fenestrated drapes. Among these five hospitals, one also used sterile gowns. None of these precautions were followed in 29 hospitals (49.2%).

Currently, evidence regarding the use of vasoactive agents in pediatric cardiovascular surgery is insufficient [1]. Thus, we assumed that different facilities use various drugs based on their experiences and preferences, and our survey results confirmed this assumption. In Japan, dopamine is the most frequently used catecholamine, and a combination of one or more catecholamines and PDE III inhibitors seems to be preferred. Noradrenaline was not frequently used; however, 18 hospitals (30.5%) used it in the following situations: hypotension with low systemic vascular resistance (SVR), the Glenn operation, and the Fontan operation (Online Resource 2). We found that noradrenaline was also used when needed during pediatric cardiovascular surgeries in Japan, although its use was not as common as that in Germany, where over 90% of hospitals use noradrenaline as the first choice of vasopressor [2]. Eighteen hospitals (30.5%) used vasopressin “in some situations,” which were similar to those in which noradrenaline was used. Vasopressin may increase SVR without increasing pulmonary vascular resistance [3], and its use in single-ventricle circulation when SVR is considered low was also mentioned by some hospitals. Although the

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pediatric heart is vulnerable to afterload, vasopressors, such as noradrenaline and vasopressin, are used when needed in Japan. Adrenaline seems to be used more often than dopamine or dobutamine in Western countries [2, 4, 5], whereas in Japan, adrenaline seems to be an option when dopamine or dobutamine cannot maintain circulation.

Steroids have been used to control the inflammatory response associated with the use of CPB. In children, one systematic review with meta-analysis did not show the efficacy of steroid use during cardiovascular surgery to reduce mortality [6], although the number of included randomized controlled trials and the number of participants were relatively small. Thus, whether steroids improved outcomes remains unknown. More than 70% hospitals in Japan that were surveyed in this study used steroids. A recent large, multicenter randomized controlled trial reported that compared with placebo, 30 mg/kg methylprednisolone for cardiac surgery in infants did not reduce the ranked composite outcome of death within 30 days after surgery, the requirement for heart transplantation, and 13 other complications; moreover, it was associated with increased incidence of hyperglycemia requiring insulin administration [7]. Given the results of this study and the high prevalence of steroid use in Japan, steroid use during pediatric cardiovascular surgery should be reconsidered.

Currently, the guidelines for the prevention of intravascular catheter-related infections recommend the use of a >0.5% chlorhexidine preparation with alcohol before attempting peripheral arterial catheter insertion [8]. Furthermore, these guidelines recommend the use of sterile gloves and sterile fenestrated drapes. Another guideline for ultrasound transducer cleaning and disinfection recommends the use of single-use sterile protective covers for obtaining ultrasound-guided vascular access [9]. According to these guidelines, a bundled approach with “chlorhexidine or povidone–iodine disinfection,” “sterile gloves,” “sterile probe covers,” and “sterile fenestrated drapes” is needed for ultrasound-guided arterial line insertion. However, our study revealed that only 8.5% of hospitals used all four precautions, and 49.2% used none of them. Although the effect of this result on the occurrence of catheter-related bloodstream infections was not investigated in this study, Japanese clinicians should review their practices and attempt to prevent catheter-related bloodstream infections using these guidelines as a reference.

This study has some limitations. First, the questionnaire response rate was 70%; thus, our data may not accurately reflect the conditions across all clinical facilities in Japan. Second, there is no information beyond the responses to the questionnaire survey. Therefore, the infusion rates for each vasoactive agent were not studied. Third, the number of pediatric cardiovascular surgeries performed at each hospital varied widely across the institutions; therefore, the severity of cases may also have varied, and this may have influenced

the choice of vasoactive agents. Fourth, the approximate rate of the use of each vasoactive agent was based on the subjective assessment of the individual who responded to the survey, and not on accurate data. Furthermore, the impact of vasoactive agent use and catheter management on the outcomes was not evaluated.

In conclusion, various vasoactive agents have been used for pediatric cardiovascular surgery in Japan. However, most hospitals use one or more catecholamines and PDE III inhibitors, with or without other vasodilators. The precautions used during ultrasound-guided arterial line insertion were also diverse, and most hospitals did not follow guideline recommendations for precautions against catheter-related bloodstream infections. Nevertheless, there is room for future evaluation of the association among vasoactive agent use, catheter management, and outcomes. This may lead to the standardization of these approaches and thereby improve pediatric patient care.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00540-023-03267-4>.

Acknowledgements The authors would like to thank Editage (<https://www.editage.jp>) for English language editing.

Author contributions All authors contributed to the study conception and design. Data collection and analysis were performed by JT. The first draft of the manuscript was written by JT, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding The work was supported solely by institutional and/or departmental sources.

Declarations

Conflict of interest The authors have no conflicts of interest to disclose.

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