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Commentary

Comment on: Global mortality of children after perioperative cardiac arrest: A systematic review, meta-analysis, and meta-regression

The recent article by Abate et al. presented a systematic review of published peer-reviewed literature that reported the mortality of children after a perioperative cardiac arrest [1]. This review is very important considering the high incidence of these events in children, especially in those living in low- and middle-income countries.

However, we highlight several serious concerns regarding the methodology used in the literature. The inclusion and exclusion criteria for these studies should be more precise and the definition of anaesthesia-related cardiac arrest and mortality is insufficient. What types of studies were included in the review? Were studies in which various types of surgery were performed only included or were studies in which a specific type of surgery was performed also included? What was the minimum sample size required for the studies? The incidences of perioperative and anaesthesia-related cardiac arrest and mortality were considered for what length of time? There was no information that the authors used in the Methods section of the study regarding the World Bank Classification by country income level; however, this information was included only in the Results section. These aspects are important to the research findings.

The most serious concerns are related to the process of data extraction from the original articles included in the review, which showed unreliable findings. In Table 1, referring to the distribution of the articles, several inconsistencies, such as references, year of publication, number of cardiac arrests, number of anaesthetic procedures (sample), and ages of paediatric patients were observed. Some examples:

1. Adekola et al. [2] The year of publication is 2016, not 2015; there were 60 perioperative cardiac arrests described in the review, however, this number is the total number of adults and children included in the study. There were 14 perioperative cardiac arrests in children, as described in the article, and the review noted that the children were <18 years of age, while the correct age was ≤18 years.
2. Ahmadi et al. There is no reference of the article. The reference number (28), of this article is the same as that of Ahmed et al. (2009).
3. The articles from Ahmed et al. (2008) [3] (perioperative cardiac arrest in adults and children) and Ahmed et al. (2009) [4] (perioperative cardiac arrest only in children) included the same recruitment period: 1992–2006. Thus, one of these articles must be excluded from the review to avoid repetition of the same children's data.
4. Choi et al. (2014) [5]. The number of perioperative cardiac arrests described in the review was 30, but this number is of adults and children included in the study; the correct number of perioperative cardiac arrests in children is 3, as described in the article. In addition, the authors wrongly included 457,529 as the number of children when this number refers to the total number of patients (adults + children); the correct number of children is 65,443; the children were described as < 18 years of age, when the correct age was <20 years.
5. Ellis et al. (2014) [6]. The number of perioperative cardiac arrests described in the review was 160, but the correct number of cardiac arrests in children was 16, as described in the article. There is no information on the number of children included in this study. However, the authors wrongly included 217,365 as the number of children when this number refers to the total number of patients (adults + children) included in the study; the children were described as < 18 years of age, when the correct age was ≤20 years. So, this article must be excluded from the review and consequently from the forest plot of the rates of perioperative cardiac arrest (Supplemental Figs. 1 and 2), perioperative mortality (Figs. 2 and 3), anaesthesia-related cardiac arrest (Fig. 4) and mortality (Fig. 5), and all the other meta-analyses (Fig. 7).
6. Flick et al. (2007) [7]. The number of cardiac arrests described in the review was 27, but the correct number of cardiac arrests in children was 80, as described in the article.
7. Gerrit et al. (2020). There is no reference of the article from these authors. The reference, number (51), of this article is related to the references in Jansen et al. (2021) (two references: numbers 15 and 51), which was not included in the review, but it must be included because it describes the rates of perioperative and anaesthesia-related cardiac arrest and mortality in children.
8. Gong et al. (2018) [8]. The number of perioperative cardiac arrests described in the review was 104, which included adults + children, but there is no information in the article on the number of perioperative cardiac arrests in children; the children were described was <18 years of age, but there is no information in the article about these data or the number of children included in this study. In addition, the authors wrongly included 125,513 as the number of children when this number refers to the total number of patients (adults + children). Therefore, this article must be excluded from the review and consequently from the meta-analysis of the rates of perioperative cardiac arrest (Supplemental Figs. 1 and 2), perioperative mortality (Figs. 2 and 3), anaesthesia-related cardiac arrest (Fig. 4) and mortality (Fig. 5), and all the other meta-analyses (Fig. 7).
9. Hohn et al. (2019) [9]. The number of cardiac arrests described in the review was 29, but the correct number of cardiac arrests in children was 25, as described in the article.
10. Meyer et al. (2017) [10]. The number of cardiac arrests described in the review was 47. However, the authors of this study

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described perioperative mortality (n = 47), rather than perioperative cardiac arrest. In addition, the authors of the review erroneously included the perioperative mortality data in the forest plot of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).

11. Morray et al. (2000) [11]. The authors of the review erroneously noted that there were 289 children, while the correct number of children was 1,089,200, as described in the article. In addition, the authors of the review did not include the relevant data to calculate the global incidence of perioperative cardiac arrest in the meta-analysis (Supplemental Figs. 1 and 2). On the other hand, the authors of the review showed lower values (26.00 per 1000 anaesthetics - Fig. 4) than the values of anaesthesia-related mortality (134.96 per 1000 anaesthetics -Fig. 5) in the forest plot of the rates of anaesthesia-related cardiac arrest. In the article, Morray et al. described 150 anaesthesia-related cardiac arrests and 39 anaesthesia-related deaths in 1,089,200 anaesthesia patients in the intraoperative and post-anaesthesia care units. Therefore, the rate of anaesthesia-related cardiac arrest is higher than the rate of anaesthesia-related mortality.
12. Newton et al. (2020) [12]. There were 185 cardiac arrests that were described. However, the authors of this study described perioperative mortality (n = 185), rather than perioperative cardiac arrest. Again, the authors of the review erroneously included the perioperative mortality data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).
13. Newland et al. (2002) [13]. There were 144 cardiac arrests that were described in the review, but this number reflects the total number of adults and children included in the study, therefore, the correct number of perioperative cardiac arrests in children is 22, as described in the original study; the children were described as < 18 years of age, when the correct age was ≤20 years. In addition, the authors of the review wrongly noted that there were 72,959 children, when this number, according to the article, refers to the total number of patients (adults + children); the correct number of children is 16,051.
14. Bunchungmongkol et al. (2009) [14] is correct, not Nutchanart et al., as referenced by the authors. The number of cardiac arrests described was 150, but the correct number of cardiac arrests in children was 50, as described in the article.
15. Peiffer et al. [15]. The accurate year of publication is 2020, not 2018. There were 8 cardiac arrests that were described. However, the authors of this study described perioperative mortality (n = 8), rather than perioperative cardiac arrest. Again, the authors of the review erroneously included the perioperative mortality data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).
16. Skellett et al. (2020) [16]. The number of perioperative cardiac arrests described was 1580. Therefore, this number refers to in-hospital cardiac arrests in surgical and clinical patients. Thus, this article must be excluded from the review. Therefore, the authors of the review erroneously included the in-hospital cardiac arrest data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).
17. Sprung et al. (2003) [17]. The number of cardiac arrests described in the review was 223, but this number refers to the total number of adults and children included in the study, while the correct number of perioperative cardiac arrests in children is 8; there is also no information on the total number of children included in this study. Additionally, the authors wrongly included 518,294 as the number of children when this number refers to the total number of patients (adults + children). Therefore, this article must be excluded from the review and, consequently, from the meta-analysis of the rates of perioperative cardiac arrest (Supplemental Figs. 1 and 2) and perioperative mortality (Figs. 2 and 3)
18. Talabi et al. (2018) [18]. The number of cardiac arrests described was 64. However, the authors of this study described perioperative mortality (n = 64), rather than perioperative cardiac arrest. Again, the authors of the review erroneously included perioperative mortality data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).
19. Tarekegn et al. (2021) [19]. There were 5 cardiac arrests that were described in the review. However, the authors of this study described perioperative mortality (n = 5), rather than perioperative cardiac arrest. Again, the authors of the review erroneously included perioperative mortality data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2).
20. Torborg et al. [20]. The year of publication for this article is 2019, not 2018. There were 12 cardiac arrests that were described in the review. However, the authors of this study described perioperative mortality (n = 22), rather than perioperative cardiac arrest. Again, the authors of the review erroneously included perioperative mortality data in the meta-analysis of the perioperative cardiac arrest rates (Supplemental Figs. 1 and 2). On the other hand, the authors of the review did not include the perioperative mortality data found in the article in the meta-analysis (Figs. 2 and 3).

In addition, considering that the authors conducted a global review of perioperative cardiac arrests (Table 1), they did not include relevant and important articles found in the PubMed/Medline databases; examples include: Haché et al. [21]; Jansen et al. [22]; Kawashima et al. [23]; Morita et al. [24]; Strøm et al. [25]; and Strøm et al. [26].

Regarding data on perioperative mortality, anaesthesia-related cardiac arrest and anaesthesia-related mortality, the authors of the review did not show, in tables, the corresponding values of these factors found in the included studies of the review, which did not result in an adequate evaluation.

Again, the authors of the review did not include relevant articles found in the PubMed/Medline databases in the forest plot of the perioperative mortality rates (Figs. 2 and 3 are the same); examples include Boonmak et al. [27], Habre et al. [28], Haché et al. [21], Jansen et al. [22], Kawashima et al. [23], Morita et al. [24], Strøm al. [25], and Strøm et al. [26].

Relevant articles found in the PubMed/Medline databases were also not included in the anaesthesia-related cardiac arrest rates forest plot (Fig. 4); examples among several articles include: Biboulet et al. [29], Braz et al. [30], de Graaff et al. [31], Gonzalez et al. [32], Haché et al. [29], Jansen et al. [30], Kawashima et al. [23], Lee et al. [33], Morita et al. [24], Murat et al. [34], Sanabria-Carretero et al. [35], and Zoumenou et al. [36].

Again, relevant articles found in the PubMed/Medline databases were also not included in the anaesthesia-related mortality rates forest plot (Fig. 5); examples among several articles include: Biboulet et al. [29], de Graaff et al. [31], Gonzalez et al. [32], Haché et al. [29], Jansen et al. [30], Kawashima et al. [23], Lee et al. [33], Morita et al. [24], Murat et al. [34], Sanabria-Carretero et al. [35], and Zoumenou et al. [36].

Considering the major concerns described, all the results of this research, in relation to the incidences reported in the study's outcomes are invalid and cause the authors to question the results regarding the higher rates of anaesthesia-related cardiac arrest (27.68 per 1000 anaesthetics, Page 7; 29.94 per 1000 anaesthetics, Fig. 4) when compared to the global rates of perioperative cardiac arrest (2.54 per 1000 anaesthetics, Page 6; Supplemental Fig. 1), and the higher rates of anaesthesia-related mortality (95.31 per 1000 anaesthetics; Fig. 5) when compared to the global rates of perioperative mortality (41.18 per 1000 anaesthetics; Fig. 2 = Fig. 3).

In addition, we were surprised to observe that in Fig. 7, the title/

legend describes a completely different subject unrelated to this review, such as the following: "Forest plot for factor analysis for acute myocardial injury among patients with COVID-19".

Out of respect for the scientific community, we write this letter of caution to the editor regarding the responsibility and role of the authors, reviewers, and the editorial board in relation to the quality of the articles published by this journal. Considering that a systematic review has the highest level of scientific evidence, erroneous data and reports have repercussions that are extremely relevant to the scientific community and, therefore, must be addressed with the highest level of care in extracting data and presenting the findings.

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The following information is required for submission. Please note that failure to respond to these questions/statements will mean your submission will be returned. If you have nothing to declare in any of these categories then this should be stated.

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Please state any sources of funding for your research

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Consent

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