Cardiology in the Young

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A survey of current practices in sedation, analgesia, withdrawal, and delirium management in paediatric cardiac ICUs

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Abstract

Objective: To characterise the current approach to sedation, analgesia, iatrogenic withdrawal syndrome and delirium in paediatric cardiac ICUs. *Design:* A convenience sample survey of practitioners at institutions participating in the Pediatric Cardiac Critical Care Consortium conducted from September to December 2020. *Setting:* Paediatric cardiac ICUs. *Measurements and main results:* Survey responses were received from 33 of 42 institutions contacted. Screening for pain and agitation occurs commonly and frequently. A minority of responding centres (39%) have a written analgesia management protocol/guideline. A minority (42%) of centres have a written protocol for sedation. Screening for withdrawal occurs commonly, although triggers for withdrawal screening vary. Only 42% of respondents have written protocols for withdrawal management. Screening for delirium occurs "always" in 46% of responding centres, "sometimes" in 36% of centres and "never" 18%. Nine participating centres (27%) have written protocols for delirium management. *Conclusions:* Our survey identified that most responding paediatric cardiac ICUs lack a standardised approach to the management of analgesia, sedation, iatrogenic withdrawal, and delirium. Screening for pain and agitation occurs regularly, while screening for withdrawal occurs fairly frequently, and screening for delirium is notably less consistent. Only a minority of centres use written protocols or guidelines for the management of these problems. We believe that this represents an opportunity to significantly improve patient care within the paediatric cardiac ICU.

Patients in the paediatric cardiac ICU often experience pain and agitation and may experience adverse complications such as iatrogenic withdrawal syndrome and delirium.[1,2] These experiences can have significant physiologic effects, and management of these problems must take into account the unique cardiovascular risks of each patient.[3] Management of pain and agitation and associated problems have significant effects on a patient's ICU course, for example, on the duration of mechanical ventilation, length of stay in the ICU, and length of stay in the hospital. Adult and paediatric trials suggest that standardisation of analgesia and sedation practice through protocols or practice guidelines may improve these outcomes as well as increase staff satisfaction with sedation and analgesia practice.[4–7] Care bundles focusing on more judicious use of sedatives and analgesics, earlier liberation from mechanical ventilation, and interventions to minimise risk for delirium are recommended for both adult and paediatric ICU patients.[8,9] Similar practices have not yet been evaluated critically in the paediatric cardiac ICU environment.

The Pediatric Cardiac Critical Care Consortium assembled an interprofessional task force to study comfort management in paediatric cardiac ICU patients, defined as screening, diagnosis, and pharmacological and non-pharmacological treatment of pain, agitation, iatrogenic withdrawal syndrome, and delirium. The initial project for the task force was to survey centres within the Pediatric Cardiac Critical Care Consortium registry to learn about current practices for analgesia, sedation, IWS, and delirium in the paediatric cardiac ICU. The information gathered from the survey will be used to guide future quality improvement projects focusing on comfort management in paediatric cardiac patients.

Materials and methods

A web-based survey of cardiac intensive care practitioners in participating Pediatric Cardiac Critical Care Consortium centres was conducted between September 2020 and December 2020. The Pediatric Cardiac Critical Care Consortium is a clinical registry that collects data

on patients with primary cardiac disease admitted to the ICU of participating hospitals to support research and quality improvement initiatives.[10,11] Pediatric Cardiac Critical Care Consortium leadership approved the survey for distribution. The survey was exempt from Indiana University School of Medicine Institutional Review Board review because it did not qualify as human subjects research. Survey topics and questions were developed by content experts in the fields of paediatric critical care medicine, cardiology, nursing, and pharmacy utilising current literature and previous surveys conducted on similar populations.[12–14] The survey was pilot-tested by multiple paediatric intensivists for feedback regarding question clarity and survey user interface. Survey questions were delivered by Research Electronic Data Capture (REDCap©), a secure web application for online surveys and databases.[15]

Survey respondents were a convenience sample of practitioners from participating institutes. The respondent group was established from an email request for participation to all 42 participating institutions. Each participating centre was asked to assemble an interprofessional team with expertise in pain, sedation, withdrawal, and delirium practices and submit only one survey which accurately reflected their practice. Centres were given the option to provide their centre name or remain anonymous.

The survey was written in English and consisted of 61 questions divided into 4 sections: analgesia, sedation, withdrawal, and delirium. Within each section, questions were designed to understand how institutions screened, diagnosed, and treated (pharmacological and non-pharmacological) each of the problems. The questions were closed-ended and multiple choice; several allowed for selection of multiple answers and several included an "other" option for a free-text response.[16] The questionnaire is included as a Supplementary Digital File (Supplementary File S1). Data were summarised using frequency counts and percentages for nominal and ordinal variables. Missing data were excluded from the analysis.

Results

Survey responses were received from 33 out of 42 centres (79%).

Screening and diagnosis

Pain/agitation

All 33 responding centres screen for pain using validated scoring tools, most commonly the Faces, Legs, Arms, Comfort, Consolability (FLACC) scale (used in 93% of centres), Numeric Rating Scale (NRS) (64%), and Wong–Baker FACES pain scale (58%). Pain is assessed every 1–3 hours in the majority of responding centres (63%), every 4–6 hours in 44%, with additional scoring performed during procedures in 22% and as needed in 53%. Respondents were given the opportunity to check more than one assessment frequency.

Thirty-two centres (97%) perform routine sedation/agitation screening. The State Behavioral Scale (SBS) was the most frequently used scale (74%), followed by Richmond Agitation-Sedation Scale (RASS) (22%) and COMFORT-B scale (4%). Sedation and agitation are screened for every 1–3 hours in the majority of centres (59%), followed by every 4–6 hours in 34%. A sedation score goal is discussed on rounds in 85% of participating centres.

Iatrogenic withdrawal syndrome

Centres were asked how frequently they screened for iatrogenic withdrawal in post-operative cardiac surgery patients. Over half (58%) of centres reported screening "always," and 42% of centres reported screening "sometimes." Triggers for withdrawal screening included duration of comfort medications (in 52% of centers), accordance to unit weaning protocol in 30% and at provider discretion in 15%. All centres use the Withdrawal Assessment Tool-1 (WAT-1), a validated paediatric screening tool for opioid and benzodiazepine withdrawal.[17] Withdrawal screening occurred twice daily in 46% of centres, every 4–6 hours in 42% of centres, every 8 hours in 9% of centres, and every 1–3 hours in 3%. A separate question asked about frequency of screening in children diagnosed with iatrogenic withdrawal syndrome. Scoring was reported to occur somewhat more frequently in this scenario: twice daily in 21% of centres, every 8 hours in 6%, every 4–6 hours in 58%, and every 1–3 hours 15%.

Delirium

When asked about frequency of screening for delirium, fewer than half (46%) of the responding centres answered "always," 36% answered "sometimes" and 18% "never" screen for delirium. The most frequently used delirium screening tool was the Cornell Assessment of Pediatric Delirium (CAPD), used by 69% of respondents, followed by the Pediatric Confusion Assessment Method for the Intensive Care Unit (pCAM-ICU) in 9%. Most respondents who routinely screen for delirium do so twice daily (86%). Delirium scores are reported on rounds in 65% of centres that perform delirium screening. The person performing delirium screening was most often the critical care nurse (93%), with additional team members contributing: the critical care attending in 28% centres and critical care nurse practitioner in 24% centres. The majority of respondents reported that parents' observations were incorporated when diagnosing delirium, with 78% of centres reporting incorporating them "sometimes" and 16% "always." Psychiatry consultation occurs "sometimes" in 64% of reporting centres, and "never" in 27%. Neurology is "never" consulted for delirium in 79% of centres, and "sometimes" consulted in 21%.

Management

ICU Liberation protocols

Ninety per cent of responding centres do not have a formal ABCDEF/ICU Liberation protocol.[8] Sixty-seven per cent of centres do not have a protocol for early mobilisation of intubated patients.

Analgesia/sedation protocols

A minority of responding centres (39%) have a written analgesia management protocol/guideline. Among the centres with a written protocol/guideline, 54% described significant non-compliance (defined as following the protocol <=80% of the time). Most centres (73%) use the same protocol for the management of pain in medical and surgical patients. Fourteen centres (42%) have a written sedation management protocol/guideline, and 57% of these respondents describe significant non-compliance. Most responding centres (69%) use the same sedation protocol/guidelines for medical and surgical patients.

Iatrogenic withdrawal syndrome protocols

Fewer than half of the responding centres (14 centres, 42%) have a written guideline for tapering analgesic/sedative medications in patients at risk for iatrogenic withdrawal, and 70% of those respondents who use a guideline report significant non-compliance. Most centres (90%) reported having a clinical pharmacist to aid in the medication management of withdrawal. For pharmacologic

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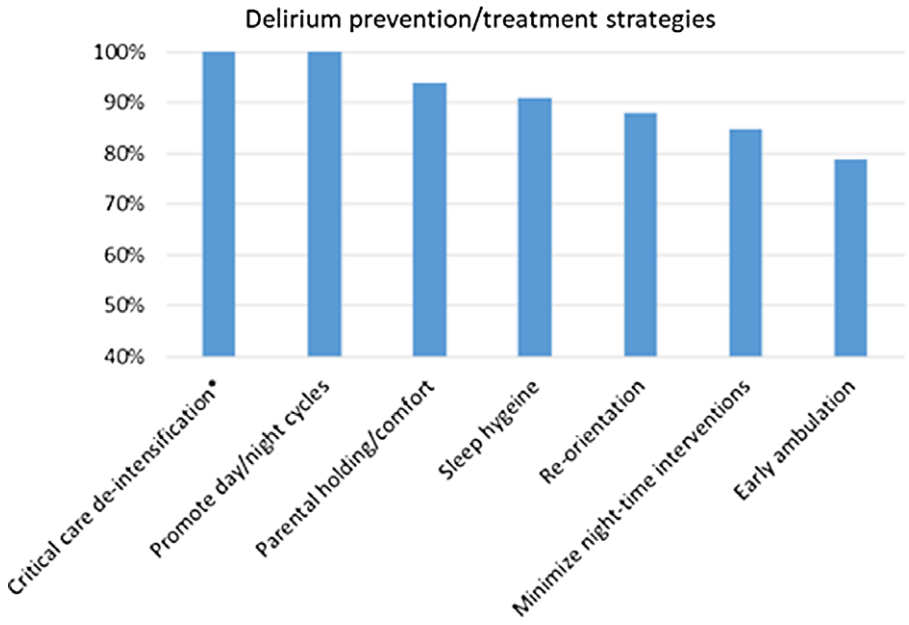

Fig. 1. Delirium prevention treatment strategies.

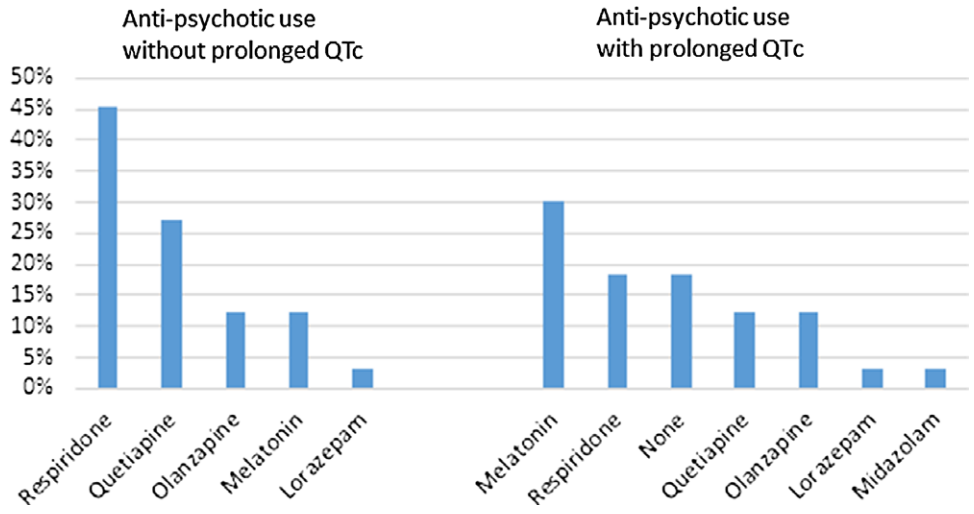

Fig. 2. Medication use to treat pediatric delirium. Bars denote percentage of responding centres that use each medication.

treatment of opioid withdrawal, 60% of centres use methadone as the first-line medication, 36% use morphine, and 3% use clonidine. For patients with a prolonged QT interval, first-line medications shift to morphine (63%), followed by methadone (25%) and clonidine (13%). For benzodiazepine withdrawal, first-line therapy includes lorazepam (82%), followed by diazepam (18%). Alpha-agonist withdrawal is treated first-line with clonidine (94%), with the remaining centres using dexmedetomidine (6%).

Delirium

Centres utilise a variety of pharmacologic and non-pharmacologic approaches to prevent or treat delirium (Fig 1). Nine participating centres (27%) have written, standardised protocols for delirium management. When acute delirium is treated with medication, the most common drugs used are risperidone (used in 45% of centres) and quetiapine (used in 27%). Figure 2 lists additional medications used for acute management of delirium. Many centres report using non-pharmacologic interventions focusing on sleep promotion and/or prevention of acquired circadian rhythm disturbance (Fig 3). Melatonin was the most prescribed sleep aid. Most centres open shades/blinds to let in natural light (42% of centres do this "always" and 58% do this "sometimes"). Only three centres (9%) have a written protocol for light exposure to help with promote a normal day–night cycle. Just over 60% of centres use a daily schedule to optimise the ratio of clinical to non-clinical care time. All centres allow 24-hour parental presence.

The survey also explored practitioners' impressions of delirium and their unit's approach to delirium education. Within the year prior to the survey, 19 centres (58%) provided delirium screening/management education to the nursing staff and 16 centres (48%) provided delirium screening and management education to the medical staff. Every centre responded "yes" to the question "Do you believe there are long-term consequences associated with pediatric delirium?" Most centres (76–81%) answered "unknown/not measured" when asked about the prevalence of delirium subtypes (hyperactive, hypoactive, and mixed) in their units. Finally, few centres have specific follow-up services for children who demonstrated delirium during their hospitalisation. Specifically, only 27% of responding institutions have specific neurodevelopmental or behavioural health outpatient capabilities

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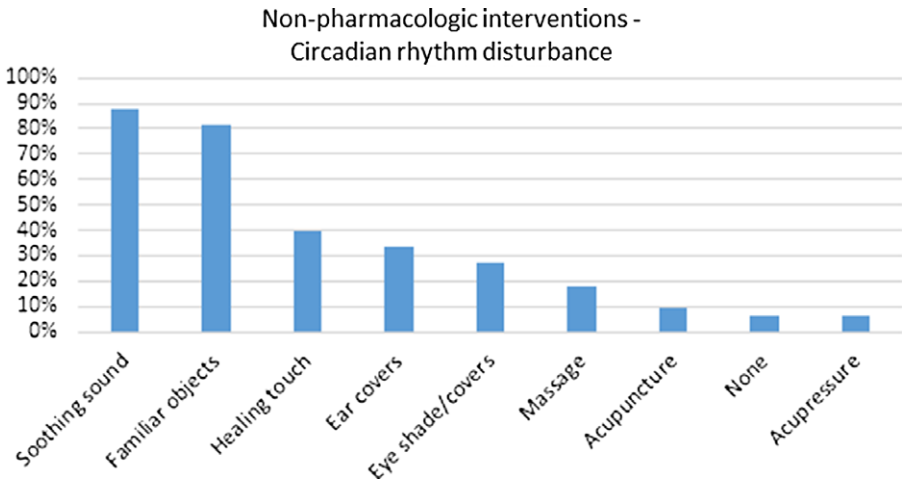

Fig. 3. Non-pharmacologic interventions.

for longer-term treatment of adverse consequences associated with delirium.

Discussion

Sedation and analgesia in the paediatric cardiac ICU are areas needing critical study and practice improvement. The trend in general critical care medicine is towards minimising exposure to sedative and analgesic medications, earlier extubation, recognition and prevention of delirium, and optimisation of the ICU environment to minimise the risk of morbidities associated with critical illness. Patients in the paediatric cardiac ICU are similarly at risk for these morbidities, yet very little about sedation and analgesia has been studied in this specific environment. This survey provides descriptive information about current comfort management practices in paediatric cardiac ICUs.

Survey responses suggest that screening for pain and agitation happens consistently and frequently, findings that are consistent with the results of a recent international survey of paediatric ICUs.[18] Centres use a variety of validated scoring tools for pain, which presumably reflects the use of age-appropriate tools for patients of different chronological or developmental age. Management of pain and agitation, however, seems less consistent. The majority of centres lack standardised protocols for the management of pain and agitation, and those centres that do use protocols report notable rates of non-compliance. The factors contributing to non-compliance with existing protocols were not investigated by this survey. It would be useful to study this in more depth in order to better understand how to design protocols that are both effective and consistently adopted by practitioners.

Clinical studies of analgesia or sedation protocols suggest potential benefits. In adult ICU patients, implementation of protocols has been associated with shorter duration of mechanical ventilation and shorter ICU stays.[5–7] Focusing on paediatrics, a large, multicentre trial of a nurse-driven sedation protocol in mechanically ventilated paediatric ICU patients failed to show a decrease in duration of mechanical ventilation, but use of the protocol was associated with shorter duration of opioid exposure, exposure to fewer drug classes and more time "awake and comfortable" in protocol-care patients.[19] A similar approach was trialed in a paediatric cardiac ICU and was associated with decreased opioid and benzodiazepine use without concomitant increase in other sedative drugs.[20] A trial in two neonatal ICUs found that the use of an analgesia and sedation protocol, including a standardised scoring tool, significantly increased staff satisfaction for both physicians and nurses (defined as staff feeling that pain and sedation management was "good or very good").[4] Implementation of the protocol was associated with higher cumulative exposure to opioids, although with the majority of scoring assessments (65%) indicating that analgesia and sedation were at goal. Sources of staff dissatisfaction prior to the intervention included inadequate and untimely treatment of pain and sedation, and also the lack of a standard assessment method and lack of a treatment protocol. This highlights what may be an under-emphasised area of potential benefit – we would argue that inconsistency or frequent changes in management, for example when medical team members switch, can be disruptive and potentially have negative impacts on patient care. Protocols have the potential to mitigate such variation, improve communication among team members, and improve teamwork.

Switching focus to iatrogenic withdrawal, all responding centres screen for withdrawal either "always" or "sometimes." This may be entirely appropriate, in that not all paediatric cardiac ICU patients will be at significant risk for withdrawal. Uniform screening in all patients may be an inefficient use of resources, and it may be better to try to identify those patients at higher risk for withdrawal. An alternative possibility is that screening "sometimes" may imply that some patients who should be screened are being missed; this survey does not provide granular enough information to understand how accurately practitioners are identifying at-risk patients, and this may be an area for future study. Responding centres use duration of exposure to medications as the most common trigger for screening, which is one of the most common risk factors identified in clinical studies of iatrogenic withdrawal.[21] However, this is only used in 52% of responding centres; overall there seems to be a significant degree of variability in screening triggers.

Screening for withdrawal is with the WAT-1 scale in all centres. Interestingly, while the developers of the WAT-1 recommend twice daily screening,[17] half of respondents screened more frequently than this. It may be that the optimal frequency of screening varies depending on the medications being used, frequency of changes, and other patient factors, especially since withdrawal has time- and dose-dependent characteristics.[21–25] Most surveyed centres do not treat withdrawal with weaning protocols, despite literature suggesting this practice reduces

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duration of opioid treatment as well as total opioid amount.[26,27] This represents another area of potential practice improvement.

Delirium has become a major focus in critical care relatively recently, and likely reflecting this, our survey suggests that delirium management is the most inconsistent. Delirium is common in the paediatric cardiac ICU, occurring in at least 40% of children in the first 30 post-operative days after bypass surgery.[1,28,29] However, this survey suggests that the majority of responding Pediatric Cardiac Critical Care Consortium centres lack a regular approach to delirium screening. Respondents report that the overall prevalence of delirium and the prevalence of specific subtypes of delirium are largely unknown. The majority of personnel who would screen for delirium are critical care staff who likely have less delirium education and experience than psychiatry or psychology colleagues. These findings are in line with previously published reports of delirium management in paediatric cardiac ICUs.[12,29] Frequent screening for delirium has been promoted since 2014.[1,28–30] Over 8 years later, a significant proportion of centres do not have a mechanism in place for standardised screening.

Similarly, few centres reported having a standardised protocol for prevention or treatment of delirium, which is a potential target for practice improvement efforts.[31] Interestingly, even though delirium screening and protocol use are infrequent, most centres do employ interventions that may prevent or mitigate delirium, including maintaining a normal day–night circadian rhythm, exposure to sunlight, and promoting normal sleep habits. The survey responses also suggested that while few centres have early mobility protocols, most report using mobility when asked about specific measures to prevent or treat delirium. This survey did not provide granular enough data to explain these apparent discrepancies – it may be that that centres employ some of the practices that are believed to be beneficial for delirium outside of formal protocols.

When delirium is treated with medications, the most common first-line drugs are risperidone and quetiapine. The survey did not investigate how often centres treat delirium with medication versus non-pharmacologic interventions. This would be an additional area for future study to better understand current practice, especially in the light of recent guidelines recommending first-line use of non-pharmacologic measures to prevent or mitigate delirium.[9] Overall, there is relatively little information about the efficacy and optimal use of medications for delirium in children, and meta-analyses evaluating antipsychotic medication use in adult delirium have found mixed results with respect to outcomes.[32,33] Further study is needed to better understand the efficacy and safety of these medications in the paediatric cardiac ICU population.

Limitations to this report include but are not limited to the retrospective nature of the survey. We received a 79% response rate, which may increase the risk of selection bias. Centres that have teams focused on analgesia, sedation, withdrawal, and delirium may have been more represented in the responses than those without such teams. The survey included a relatively small number of centres, which may limit the ability to generalise the results.

Conclusion

We identified a number of areas for further study and potential improvement in comfort management in the paediatric cardiac ICU. Few paediatric cardiac ICUs use protocols for the management of pain, agitation, or withdrawal. While the clinical significance of delirium seems to be widely appreciated; in practice, the diagnosis and treatment of delirium is inconsistent. Much more needs to be understood about how to treat and ideally prevent delirium in paediatric ICU patients. We suggest that standardisation of care in these areas could improve patient outcomes. Initial efforts should include better screening and diagnosis, better understanding of predisposing or exacerbating factors, and critical evaluation of treatment options.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/S1047951122004115.

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Conflicts of interest. None. Ethical standards: Not applicable.

Ethical standards. Not applicable.

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