

Tan YS,¹ Brincat E,² Perry N,² Donnelly P,²

1. Medical student, University of Glasgow, Glasgow, United Kingdom

2. Paediatric Intensive Care Unit, Royal Hospital for Children, Glasgow, United Kingdom

Introduction and aims

The PICU at the Royal Hospital for Children Glasgow (RHCG) has defined:

- Cardiac arrest: an episode “requiring CPR ± adrenaline ± supplementary resuscitation drugs/measures”.
- Peri-arrest: an episode in which there is “profound cardiovascular decompensation but because of resuscitative measures, i.e. rapid fluid bolus and 1:100,000 adrenaline, prevented a loss of cardiac output and requirement for CPR”.

In this audit, we explored the incidence and outcomes of, as well as the relationship between, cardiac arrests and peri-arrests in children in the PICU over the last 5 years.

Methods

- This was a single centre retrospective audit encompassing patients over 5 years (from 10/09/2018 to 15/05/2022).
- Patients with an event were initially identified from our daily PICU dashboard and then manually verified through a search of the patient’s records.
- We analysed the incidence of peri-arrests and cardiac arrests, the duration between first and second events, and outcomes after the said events, which were whether the patient survived, was put on extracorporeal membrane oxygenation (ECMO), or unfortunately died (all within 30 days of the event).

Results

- The combined incidence of peri-arrests and cardiac arrests was 4.45% (n=134).
- 26.4% (n=28) proceeded to have a second event.
- Patients were more likely to suffer from another cardiac arrest if their first episode was also a cardiac arrest.
- The median duration between any two events was 3 days.
- Single event mortality was higher in patients who had a cardiac arrest (31.5%) compared to those who had a peri-arrest (11.5%).
- In patients who had two events, mortality was higher in those with two peri-arrest episodes (57.1%).
- Patients who had a cardiac arrest were more likely to be put on ECMO, but they also had higher mortality rates.

Discussion

Recognising the potential for second events to occur and the general timeframe between events can provide insight into possible interventions. The use of warning tools, team huddles, and bedside signs have been shown to significantly reduce incidence of CPR and associated mortality. events.

There are several limitations in this study.

- Some events reported on the dashboard did not meet the criteria for peri-arrests or cardiac arrests.
- It was difficult to determine the exact timing of some events.

The audit poses new questions as well, in particular, how long after the primary event should the second event be considered as related, and whether the same interventions can be applied to both peri-arrests and cardiac arrests.

Conclusion

In summary, we report a significant increase in mortality after a second event, which emphasises the importance of prevention. We plan to use this data to implement a quality improvement process aiming to improve situation awareness.

| Incidence of peri-arrests and arrests in the PICU over the last 5 years | | | | |
|---|------------|------------|-----------|------------|
| | Dashboard | 1st event | 2nd event | Total |
| Peri-arrests | 86 | 52 | 15 | 67 |
| Cardiac arrests | 82 | 54 | 13 | 67 |
| Total | 168 | 106 | 28 | 134 |
| Total number of patients in the PICU | 2223 | | | |
| Total number of admissions to the PICU | 3008 | | | |

| Number that progress to 2nd event | | | | |
|-----------------------------------|-------------|-------|----------------|-------|
| | 2nd event | | | |
| 1st event | Peri arrest | | Cardiac arrest | |
| Peri-arrest (n=52) | 7 | 13.5% | 3 | 5.8% |
| Cardiac arrest (n=54) | 8 | 14.8% | 10 | 18.5% |

| Duration between 1st and 2nd event (mean & median) (days) | | | | | | |
|---|-------------|--------|----------------|---------|-------------|---------|
| 1st event | 2nd event | | | | | |
| | Peri-arrest | | Cardiac arrest | | Either | |
| Peri-arrest | 4.248028571 | 3.3889 | 29.4201 | 12.7083 | 11.79965 | 4.3507 |
| Cardiac arrest | 10.64193 | 2.3559 | 35.1118103 | 1.8906 | 24.23630794 | 2.18055 |
| Either | | | | | 19.79464439 | 3.22395 |

| Outcomes after 1st events | | | | | |
|---------------------------|------------|-----------|--------------|-----------|--------------|
| 1st event | n | Outcome | | | |
| | | Death | | Survived | |
| Peri-arrest | 52 | 6 | 11.5% | 46 | 88.5% |
| Cardiac arrest | 54 | 17 | 31.5% | 37 | 68.5% |
| Total | 106 | 23 | 21.7% | 83 | 78.3% |

| ECMO outcomes after 1st events | | | | | | | |
|--------------------------------|------------|-----------|--------------|----------------|------------|---------------|------------|
| 1st event | n | Outcome | | | | | |
| | | ECMO | | ECMO Mortality | | ECMO Survived | |
| Peri-arrest | 52 | 9 | 17.3% | 4 | 44.4% | 5 | 55.6% |
| Cardiac arrest | 54 | 16 | 29.6% | 9 | 56.3% | 7 | 43.8% |
| Total | 106 | 25 | 23.6% | 13 | 52% | 12 | 48% |

| Outcomes in patients with 2 events | | | | | | |
|------------------------------------|----------------|-----------|-----------|--------------|-----------|--------------|
| Event | | n | Outcome | | | |
| 1st event | 2nd event | | Death | | Survived | |
| Peri-arrest | Peri-arrest | 7 | 4 | 57.1% | 3 | 42.9% |
| Peri-arrest | Cardiac arrest | 3 | 0 | 0.0% | 3 | 100.0% |
| Cardiac arrest | Peri-arrest | 8 | 2 | 25.0% | 6 | 75.0% |
| Cardiac arrest | Cardiac arrest | 10 | 5 | 50.0% | 5 | 50.0% |
| Total | | 28 | 11 | 39.3% | 17 | 60.7% |

| ECMO outcomes in patients with 2 events | | | | | | | |
|---|----------------|-----------|----------|-------------|----------------|-------------|---------------|
| Event | | n | Outcome | | | | |
| 1st event | 2nd event | | ECMO | | ECMO Mortality | | ECMO Survived |
| Peri-arrest | Peri-arrest | 7 | 0 | 0% | 0 | 0% | 0 |
| Peri-arrest | Cardiac arrest | 3 | 0 | 0% | 0 | 0% | 0 |
| Cardiac arrest | Peri-arrest | 8 | 0 | 0% | 0 | 0% | 0 |
| Cardiac arrest | Cardiac arrest | 10 | 2 | 20% | 2 | 100% | 0 |
| Total | | 28 | 2 | 7.1% | 2 | 100% | 0 |