1. Duration to Establish an Emergency Vascular Access and How to Accelerate It: A Simulation-Based Study Performed in Real-Life Neonatal Resuscitation Rooms

Eva M. Schwindt, Florian Hoffmann, Philipp Deindl, Thomas J. Waldhoer, Jens C. Schwindt

Objectives: To compare the duration to establish an umbilical venous catheter and an intraosseous access in real hospital delivery rooms and as a secondary aim to assess delaying factors during establishment and to provide recommendations to accelerate vascular access in neonatal resuscitation.

Design: Retrospective analysis of audio-video recorded neonatal simulation training.

Settings: Simulation training events in exact replications of actual delivery/resuscitation rooms of 16 hospitals with different levels of care (Austria and Germany). Equipment was prepared the same way as for real clinical events.

Subjects: Medical teams of four to five persons with birth-related background (midwives, nurses, neonatologists, and anaesthesiologists) in a realistic team composition.

Interventions: Audio-video recorded mannequin-based simulated resuscitation of an asphyxiated newborn including the establishment of either umbilical venous catheter or intraosseous access.

Measurements and Main Results: The duration of access establishment (time from decision to first flush/aspiration), preparation (decision to start of procedure), and the procedure itself (start to first flush/aspiration) was significantly longer for umbilical venous catheter than for intraosseous access (overall duration 199 vs 86 s). Delaying factors for umbilical venous catheter establishment were mainly due to the complex approach itself, the multitude of equipment required, and uncertainties about necessary hygiene standards. Challenges in intraosseous access establishment were handling of the unfamiliar material and absence of an intraosseous access kit in the resuscitation room. There was no significant difference between the required duration for access establishment between large centres and small hospitals, but a trend was observed that duration for umbilical venous catheter was longer in small hospitals than in centres. Duration for intraosseous access was similar in both hospital types.

Conclusions: Vascular access establishment in neonatal resuscitation could be accelerated by infrastructural improvements and specific training of medical teams. In simulated in situ neonatal resuscitation, intraosseous access is faster to establish than umbilical venous catheter. Future studies are required to assess efficacy and safety of both approaches in real resuscitation settings.

Reviewer’s Comments:
To establish peripheral venous access is difficult in newborn during cardiac arrest state. UVC has been preferred method of access during neonatal resuscitation. UVC insertion is not without complication. In present study IO access has been found. In the present study, 52.5% of teams decided to try a PVC at least once. The mean duration for PVC attempts in this study was 93 seconds; however, this involved the use of a mannequin (simple skin puncture without realistic venous anatomy), which is why in humans, the time for PVC attempts is assumed to be even longer. In this study it was found that the overall
time for IO establishment was less than half of that for UVC (86s compared with 199s). Further, preparation for UVC was twice as long as that for IO, which was mainly caused by the multitude of instruments necessary compared with the simpler IO equipment. Furthermore, the procedure to establish an emergency vascular access itself (preparation excluded) was significantly shorter for IO compared with UVC. The study results showed that in simulated neonatal resuscitation, medical teams in small hospitals more frequently tended to choose IO than UVC (78% compared to 61% in large perinatal centres) regardless of the absence of an IO recommendation in the current ERC guidelines. In a research article published in journal of pediatrics and neonatal care in 2017 also favoured IO access during emergency resuscitation in newborn being safe, easy, and having fewer complications. In another study published European journal of paediatrics in April 2018 it was shown that siting of a UVC in the emergency situation can be challenging UVC may be inserted in 105s in a mannequin during a simulated resuscitation but have shown that the real-life timings occurred much later (median 540 s). Where a UVC is proving difficult, intra-osseous (IO) access may be a useful option and also there are no randomised-controlled trials of its efficacy against or alongside UVC insertion.

In neonates IO safety has been demonstrated in term and preterm infants and is now recommended as a second-line form of access in many published literatures. IO insertion may be timely in comparison to UVC in the artificial setting. Nottingham Neonatal Services 2018 stated that this should only be used only in extreme circumstances when attempts at UVC insertion have failed. This may be more useful in our set up as most of resuscitation occur at smaller place or hospital with less trained staff.

2. Monitoring peripheral perfusion and microcirculation

Arnaldo Dubin, Elizabeth Henriquez, and Glenn Hernández

Curr Opin Crit Care 2018;24 (30)173-180

Microcirculatory alterations play a major role in the pathogenesis of shock. Monitoring tissue perfusion might be a relevant goal for shock resuscitation. The goal of this review was to revise the evidence supporting the monitoring of peripheral perfusion and microcirculation as goals of resuscitation. For this purpose, we mainly focused on skin perfusion and sublingual microcirculation.

Recent findings

Although there are controversies about the reproducibility of capillary refill time in monitoring peripheral perfusion, it is a sound physiological variable and suitable for the ICU settings. In addition, observational studies showed its strong ability to predict outcome. Moreover, a preliminary study suggested that it might be a valuable goal for resuscitation. These results should be confirmed by the ongoing ANDROMEDA-SHOCK randomized controlled trial. On the other hand, the monitoring of sublingual microcirculation might also provide relevant physiological and prognostic information. On the contrary, methodological drawbacks mainly related to video assessment hamper its clinical implementation at the present time.

Summary

Measurements of peripheral perfusion might be useful as goal of resuscitation. The results of the ANDROMEDA-SHOCK will clarify the role of skin perfusion as a guide for the treatment of shock. In contrast, the assessment of sublingual microcirculation mainly remains as a research tool.

Reviewer’s Comments

Parameters related to macrocirculation, such as the mean arterial pressure (MAP), central venous pressure (CVP), cardiac output (CO), mixed venous saturation (SvO₂) and central venous oxygen saturation (ScvO₂), are commonly used for hemodynamic assessment of sick patients. There is a dissociation between these parameters and the microcirculation state in septic shock patients. Microcirculation (defined as blood vessels with diameter <100 mm) is an organ of cardiovascular system composed of a branching network of vessels classified as arterioles, capillaries, and venules. These vessels distribute blood to the body’s tissues and are the site where exchange of heat, solutes, and inflammatory cells occurs between blood and tissue. Changes in microcirculatory blood flow may be directly related to organ dysfunction. Persistence of microcirculatory changes spite of normalization of macrocirculatory parameters is
associated with higher mortality. Optimization of tissue perfusion and oxygenation is the final goal of resuscitation. Measurement of blood pressure, cardiac output, and tissue perfusion might be misleading in assessing the microcirculation in shock. For this purpose, the monitoring of both skin perfusion and sublingual microcirculation are potentially valuable tools. Various other indirect and direct methods have been developed to monitor microcirculation. Tissue perfusion and oxygenation are key components of adequacy of circulatory assessment in shock. There are several controversies about the usefulness of bedside monitoring of microcirculation and peripheral perfusion during resuscitation. Skin perfusion, a flow sensitive variable assessed measuring capillary refill time (CRT) is good marker of perfusion and may indirectly reflect microcirculation but has some limitation also. CRT does not correlate well with microcirculation and is only reliable for assessing in dehydration, reduced systolic volume and increased lactate in children. CRT is first variable to normalize within two hours as compared to lactate. Peripheral perfusion normalization was correlated with improvement in the pulsatility index of highly relevant vessels such as the mesenteric, splenic, renal, and hepatic arteries, and thus with perfusion of visceral organs. One study demonstrated that targeting peripheral perfusion was safe and associated with less fluid administration and organ dysfunctions. Targeting microcirculation resuscitation is associated with better outcome as shown in studies. In a recently published study in Chinese Medical Journal May, 2018 concluded that monitoring of peripheral and sublingual microcirculation might therefore be a valuable adjunct for identifying those septic shock patients. Thus, monitoring and optimization of tissue perfusion by direct viewing and microcirculation management may become an achievable goal in the near future in the hemodynamic resuscitation.


Andrew G Miller, Michael A Gentle, Lisa M Tyler and Natalie Napolitano
Respiratory Care 2018;63(7):894-9.

**Background:** High-flow nasal cannula (HFNC) use has greatly increased in recent years. In non-neonatal pediatric patients, there are limited data available to guide HFNC use, and clinical practice may vary significantly. The goal of this study was to evaluate current HFNC practice by surveying practicing pediatric respiratory therapists.

**Methods:** A survey instrument was posted on the American Association for Respiratory Care’s AAR Connect online social media platform in March 2017. Paper versions of the survey were also distributed at the annual Children Hospitals Association meeting.

**Results:** There were 63 responses, of which 98% used HFNC. HFNC was defined as any heated gas delivered by nasal cannula by 49% of respondents, whereas 21% defined HFNC as heated gas delivered via nasal cannula at flow greater than or equal to the patient’s inspiratory demand, and 16% defined HFNC as any gas delivered via nasal cannula above predefined thresholds. Initial flow was set per provider orders by 34% of respondents, per respiratory therapist-driven protocol by 28%, per patient weight by 15%, per patient age by 15%; 5% of respondents used other methods. Non-invasive ventilation or CPAP was used by 88% of respondents as the next step for patients who failed HFNC, with 7% opting for intubation and 5% using other interventions. Aerosol therapy was delivered by 75% of respondents during HFNC, with 77% of these respondents delivering aerosol via vibrating mesh nebulizer. During aerosol therapy, 13% of respondents decreased HFNC flow, while 23% removed patients from HFNC.

**Conclusion:** There was no consensus on the definition of HFNC, how to set initial flow, or how to make adjustments. Aerosols were delivered by 75% of respondents, predominantly via a vibrating mesh nebulizer placed on the dry side of the humidifier. The definition of HFNC, how to set flow, and aerosolized medication delivery are areas in which more research is needed.

**Reviewer’s Comment:**
Conventional oxygen delivery methods are not sufficient many times. High flow nasal cannula therapy (one of the non-invasive positive pressure ventilation technique) has partially replaced the continuous positive airway pressure (CPAP) in neonatal population. Although HFNC provides some CPAP but it cannot be measured. HFNC combined
With heated humidification has several advantages. HFNC has shown to improve oxygen, decreased respiratory rate and work of breathing. Heated humidification also helps in clearance of secretion and decreasing bronchial hyper-response symptoms. Thus, HFNC is gaining importance as a simple, well tolerated and alternate mode of respiratory support in critically ill children. Some issues are still unresolved like when to start and stop, appropriate indications and escalating the treatment.

4. Pain management in neurocritical care; an update
Athir Morad, Salia Farrokh, and Alexander Papangelou

Pain management in neurocritical care is a subject often avoided because of concerns over the side-effects of analgesics and the potential to cause additional neurological injury with treatment. The induction of sedation by opioids has been attributed to an anticholinergic effect in an experimental animal model and is not likely to represent the effect of analgesia alone. In addition to masking the neurological examination, opioids can cause respiratory depression. Thus, sedation and hypercapnia caused by opioids have been feared to mask the neurological examination and contribute to elevations in intracranial pressure. Nevertheless, increasing attention to patient satisfaction has sparked a resurgence in pain management. As opioids have remained at the core of analgesic therapy, the increasing attention to pain has contributed to a growing epidemic of opioid dependence.

Recent findings
Studies on pain management in neurocritical care continue to explore non-opioid analgesics as part of a multimodal strategy aimed at decreasing overall opioid consumption. Agents including local anaesthetics, acetaminophen, ketamine, gabapentinoids, and dexametomidine continue to demonstrate efficacy. In addition, the prolonged longitudinal course of many recent trials has also revealed more about the transition from acute to chronic pain following hospitalization.

Conclusion
Pain has been recognized to cause a systemic stress response and neurovascular effects that may harm patients recovering from neurologic illnesses. Inadequate pain control is no longer tolerated in the modern era of patient-satisfaction focused health care. Growing concerns over opioid addiction are compelling clinicians to limit the use of opioids thus increasing attention to patient satisfaction mitigated by growing concerns over the harms imposed by opioids. Alternative analgesic therapies are being investigated with promising results.

Reviewer’s Comment:
Pain management is not priority in intensive care units and lead to various complications which may be related to pain pathophysiology itself or drug induced and opioids are most commonly used drugs to provide relief from pain. Trends toward opioids sparing activity has come and article has beautifully discussed various drugs used as pain killer.

5. The effect of multidisciplinary extracorporeal membrane oxygenation team on clinical outcomes in patients with severe acute respiratory failure
Soo Jin Na, Chi Ryang Chung, Hee Jung Choi, Yang Hyun Cho, Kiick Sung, Jeong Hoon Yang, Gee Young Suh and Kyeongman Jeon

Background
Decision of making about the proper indications and timing of extracorporeal membrane oxygenation (ECMO) is a challenging problem for physicians who manage patients with severe acute respiratory failure. In addition, the medical management and nursing care of patients with severe respiratory failure receiving ECMO support are complex and can be challenging. The Extracorporeal Life Support Organization (ELSO) has suggested that ECMO patients should be managed by a multidisciplinary team. However, there are limited data on the impact of ECMO team on the outcomes of patients with severe acute respiratory failure.

Methods
All consecutive patients with severe acute respiratory failure who underwent ECMO for respiratory support from January 2012 through December
2016 were divided into the pre-ECMO team period (before January 2014, n = 70) and the post-ECMO team period (after January 2014, n = 46). Clinical characteristics and outcomes were compared between the two groups.

Results
The mortality rates in the intensive care unit (72.9 vs. 50.0%, P = 0.012) and hospital (75.7 vs. 52.2%, P = 0.009) were significantly decreased in the post-ECMO team period compared to the pre-ECMO team period. The median duration of ECMO support was not different between the two periods. However, the proportion of patients successfully weaned off ECMO was higher in the post-ECMO team period (42.9 vs. 65.2%, P = 0.018). During ECMO support, the incidence of cannula problems (32.9 vs. 15.2%, P = 0.034) and cardiovascular events (88.6 vs. 65.2%, P = 0.002) was reduced after implementation of the ECMO team. The 1-year mortality was significantly different between the pre-ECMO team and post-ECMO team periods (37.8 vs. 14.3%, P = 0.005).

Conclusion
After implementing a multidisciplinary ECMO team, survival rate in patients treated with ECMO for severe acute respiratory failure was significantly improved. Current findings also support the concept of ECMO team.

Reviewer’s Comment:
ECMO has been used to treat various conditions and acute respiratory failure is one of them. This is highly specialised technique, complex and very costly technique. If services are provided by a trained ECMO team, it will definitely improve the outcome. Although better outcome may depend on various factors including patient selection, disease condition, days of mechanical ventilation and adjunctive therapies but we cannot ignore the role of specialised and multi-disciplinary ECMO team in management of patient with acute respiratory failure.

Nazik Yener, Muhammed Şükrü Paksu, Özlem Köksoy

Ondokuz Mayıs University School of Medicine, Division of Pediatric Critical Care, Samsun, Turkey
The Journal of Critical Care Medicine 2018;4(1):12-16

Introduction
Brain death (BD) is currently defined as the loss of full brain function including the brainstem. The diagnosis and its subsequent management in the pediatric population are still controversial. The aim of this study was to define the demographic characteristics, clinical features and outcomes of patients with brain death and determine the incidence of brain death, donation rates and occurrence of central diabetes insipidus (CDI due to antidiuretic hormone deficiency is a well-described complication of BD in both children and adults and is characterised by polyuria, hypernatremia, and hyperosmolar dehydration) accompanying brain death in children.

Methods
This retrospective study was conducted at a twelve-bed tertiary-care combined medical and surgical pediatric intensive care unit of the Ondokuz Mayıs University Medical School, Samsun, Turkey. In 37 of 341 deaths (10.8%), a diagnosis of brain death was identified. The primary insult causing brain death was post-cardiorespiratory arrest in 8 (21.6%), head trauma in 8 (21.6%), and drowning in 4 (18.9%). In all patients, transcranial Doppler ultrasound was utilised as an ancillary test and test was repeated until it was consistent with brain death.

Results
In 33 (89%) patients, central diabetes insipidus was determined at or near the time brain death was confirmed. The four patients not diagnosed with CDI had acute renal failure, and renal replacement treatment was carried out. The consent rate for organ donation was 18.9%, and 16.7% of potential donors proceeded to actual donation.

Conclusion
In the current study the consent rate for organ donation was relatively low compared to the rest of the world. The prevalence of central diabetes insipidus in this paediatric brain death population is higher than reports in the literature, and acute renal failure accounted for the lack of central diabetes insipidus in four patients.
with brain death. Author believed that the more
information given to a family regarding the medical
condition of their child, the better prepared the family
members will be to having a conversation about organ
donation Further more studies are needed to explain
normouria in brain-dead patients.

**Reviewer’s Comment**
Organ donation is coming up in big way and it has
lot of issues. Though brain death has been defined
but controversy is still on in various countries. Brain
functions like electroencephalographic and blood
flow activity may continue in brain death patients
and CDI may not occur in more than 50% patients.
In present study CDI rate was higher in brain death
patients. Donation rate may increase if family is
properly counselled.

7. **The Effect of Acetaminophen on Temperature in
Critically Ill Children: A Retrospective Analysis of
Over 50,000 Doses**
Samiran Ray, Libby Rogers, Katherine L. Brown,
Mark J. Peters
Acetaminophen is widely used in PICUs. Although
randomized controlled trials suggest that
acetaminophen significantly reduces body temperature
in adults, the effect of acetaminophen on temperature
in critically ill children has not been previously
quantified. Retrospective observational cohort study
conducted at single-centre general and cardiac PICU
in a specialist children’s hospital. All children who
received acetaminophen or had a fever (temperature
≥ 38°C) while on the ICU over a 40-month period
(September 2012 to December 2015) were included
in the study.

**Measurements and Main Results:** Total of 58,177
doses of acetaminophen were administered, with
temperature data available for analysis for 54,084
doses. Temperature decreased by 0.11°C (95% CI,
0.09–0.14°C) 4 hours post acetaminophen dose, after
adjustment for weight and illness severity. In children
who had a fever and were given acetaminophen,
temperature decreased by 0.78°C (95% CI, 0.74–
0.82°C). Temperature decreased by 0.88°C (95%
CI, 0.85–0.92°C) in children who had fever but
did not receive acetaminophen. The change in
temperature associated with fever was significantly
different between those who did and did not receive
acetaminophen (likelihood ratio statistic 246.06; p <
2.2 × 10–16).

**Conclusions**
Acetaminophen is associated with a significant
decrease in temperature in children with fever.
However, temperature may decrease following fever
without acetaminophen in the PICU. The threshold to
use acetaminophen must be understood to determine
the true effect on temperature in any future trials.

**Reviewer’ Comment**
Acetaminophen is most commonly used antipyretic in
ICU’s. There are no PICU trials exploring the effect
of acetaminophen against placebo on temperature.
Several trials explore the comparative effects of
antipyretic agents in non-ICU settings. Present study
aimed to demonstrate the temperature changes in
relation to acetaminophen administration in children
in ICU. Results from the study suggest that the
temperature effect size of acetaminophen may be
more modest than previously reported in children
(0.78°C vs > 1°C). This should be considered when
designing a trial to demonstrate the temperature
effects of acetaminophen in children in ICU. However,
the retrospective nature of this study raises questions
regarding the indication to use acetaminophen in
children with fever on the ICU. The question must
remain whether children with fever will benefit from
acetaminophen for temperature management.

**Source of funding:** Nil
**Conflict of interest:** Nil

How to cite this article:
108-113.

How to cite this URL: