Paediatric Acute Care: Highlights from the Paediatric Acute Care–Advanced
Paediatric Life Support Conference, Hobart, 2018

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The Paediatric Acute Care Conference (PACC) is an annual conference organised by APLS Australia to advance paediatric acute care topics for clinicians in pre-hospital medicine, EDs, acute paediatrics, intensive care and anaesthesia. The PACC 2018 was held at Hobart, Tasmania. We provide a summary of some of the presentations.

Elliot Long, paediatric emergency physician, presented *Fluids in paediatric DKA (diabetic ketoacidosis)*, asking the question “are we causing harm by giving too much fluid as boluses in DKA?” The concern is that too much fluid can cause brain injury (cerebral oedema). Evidence from observational studies shows that the incidence of brain injury in DKA is at most about 1%. A causal relationship has been assumed where perhaps it should not be – especially as some children have cerebral oedema before any fluid is given. To explore this further, the question is: What is the role of disease severity? It has previously been shown that in DKA risk factors for cerebral injury were a lower CO₂ and abnormal electrolytes; there was no relationship with rate or volume of fluid administered.¹ A recent large randomised controlled trial

compared different rates and volumes of fluid resuscitation and rehydration. There was no difference in mental status outcomes, or in memory or intelligence quotient at two months. In this study the risk factors for cerebral injury were low pH and CO₂, higher glucose and abnormal electrolytes, suggesting that disease severity was the biggest risk factor for cerebral injury in DKA and that moderate fluid boluses were not a risk factor.²

John Fraser, adult intensivist, presented *Fluids in paediatric sepsis*. He began with outlining the research on Early Goal Directed Therapy in sepsis in adults, from the encouraging Rivers³ trial to follow up studies that showed no difference in mortality.^{4,5} John then moved to paediatric evidence showing that recommendations for repeated 20ml/kg boluses in sepsis were based on just two retrospective studies enrolling 34 and 921 patients respectively.^{6,7} The landmark FEAST trial was presented as the only randomised controlled trial in children. Despite initial clinical improvement in the bolus group, increased mortality became evident after 12 hours, with an overall increase in mortality in all subpopulations of children who had received a fluid bolus.⁸ Subsequent analysis suggested a cardiac cause of these deaths.⁹ John presented data for septic and non septic animals showing increased cardiac troponin in both groups after a fluid bolus, and that greater fluid volumes led to abnormalities of inflammatory markers and increased need for vasopressors, thus suggesting a direct effect of saline fluid boluses on the microcirculation.¹⁰ These data need confirmation in clinical trials. Despite all the evidence that cautious use of fluid

bolus resuscitation has better outcomes, current guidelines still recommend 30ml/kg.¹¹

Susan Adams, paediatric surgeon, presented *Fluids in paediatric trauma*. Treatment guidelines for trauma fluid management in the paediatric population should be viewed with caution given physiological differences of children and that evidence is from adult populations. This is a particular issue when titrating low fluid resuscitation to blood pressure in adults; titrating to heart rate may be more appropriate but this has not been investigated. Adult studies showing increased coagulopathy and a rise in inflammatory markers following crystalloid resuscitation may not translate directly to paediatrics. In children there is no good evidence as to the optimal volume and recommendations can only suggest resuscitation to physiological endpoints with frequent reassessment and early consideration of blood when there is need for ongoing fluid resuscitation. There is evidence for early use of massive transfusion protocols and most recommend team based systems,¹² but a lack of evidence for timing of initiation and survival improvements. There is high level evidence for the use of tranexamic acid in adults¹³ but again a lack of data for its role in children.

Jane Cichero, Nurse Lead for Simulation, presented *Clinical scenario testing: testing new hospital systems for functionality using a simulation platform*. While simulation and scenario based learning for clinical teaching is well established, the utilisation of simulation has more recently expanded to; testing for operational readiness,

orientation of staff and identifying critical safety issues including orienting code blue teams,¹⁴ mapping patient transport, testing call systems, clinical handovers, and orientation to new facilities.¹⁵ The simulation process has identified; latent safety threats such as lapses in communication, problematic admission/discharge procedures, faulty equipment, flawed mental models, lack of appropriate resources and unclear policies for delivering patient care.¹⁶ Simulation allows for issues to be resolved before guidelines or new models of care are implemented or new facilities open.¹⁷ A documentation framework assists structuring specifically designed simulation scenarios to capture and report data that inform Clinical Governance and Patient Safety decision makers.¹⁸ This process facilitates the benefits of lessons learnt in clinical scenario testing being translated across and between health care organizations, thereby minimising risk to both patients and staff and enabling safer systems of healthcare.

Kate Curtis, Professor in Emergency and Trauma, University of Sydney and Clinical Nurse Consultant in Emergency, spoke on *Paediatric Injury Research*, and how this work can influence policy and practice. Over 10 years, hospitalisation rates for injured children in Australia have not changed and deaths due to injury have increased, with greater risk for those living in regional or remote areas. The total annual cost to hospitals was \$212 billion.¹⁹ The NSW Paediatric Trauma Project found that despite 4% mortality and 10% of severely injured children being discharged within 30 days only 50% of children were initially managed in a paediatric

trauma centre. System issues included a delay before requesting a transfer, and differences in arrival time and time on scene between the two NSW aeromedical retrieval services.²⁰ Care delivery problems included communication as well as airway and circulatory assessment and management.^{20,21} Recommendations arising from this work will be prioritised through a Delphi process²⁰ to implement change at the government level. The Childhood Injury Prevention Alliance (<https://stopkidsinjury.org>) aims to help drive policy change by bringing the message to policy makers in government.

Simon Craig, paediatric emergency physician, presented *High flow in bronchiolitis*, a summary of the recent evidence for the use of High Flow Nasal Cannulae (HFNC) in infants with bronchiolitis. HFNC has become a standard of care without adequate evidence to inform who should receive this and when. He summarised two recent Australian studies. In a multi centre PREDICT study over 1400 infants with hypoxia (SpO₂ <92%) received standard oxygen or HFNC at 2L/kg/min. The primary outcome was treatment failure defined as deterioration in vital signs and need for escalation of care. The need for escalation of care was significantly lower in the group who received HFNC, and all low flow infants requiring escalation were rescued with HFNC. Hospital length of stay, duration of oxygen therapy, and ICU admission rate did not differ between groups.²² In a single centre study, approximately 200 children with SpO₂ ≥ 90% were randomised to 1L/kg/min HFNC or standard oxygen.

There was again less treatment failure with HFNC and all low flow patients were rescued by HFNC. There was no difference in duration of oxygen therapy, length of stay or need for ICU.²³ A recommended clinical interpretation presented is that initial treatment for hypoxia in bronchiolitis be standard low flow nasal oxygen therapy up to 2l/min, and that HFNC be used as a rescue therapy when required. For infants with severe respiratory distress who are not hypoxic there is currently insufficient evidence to recommend HFNC.

Elliot Long also presented *Head injury: isolated vomiting and other risk factors*, a summary of a recent PREDICT publication²⁴ on the predictive role of vomiting in identifying important intracranial injury in head injury. Of the 19920 children enrolled 5% (1006) had vomiting as the only symptom, and none of the 662/1006 children with fewer than three vomits had any brain injury identified. Of the remaining 334/1006 with at least three vomits, two had an identified brain injury, one classified as clinically important and none needed neurosurgery. All those with isolated vomiting and brain injury were at least 2 years of age. Isolated vomiting is rarely associated with important brain injury; the most important associated risk factors are signs of skull fracture, abnormal behaviour, headache, concerns of non-accidental injury, altered conscious state, and a high speed motor vehicle accident or a fall of over three metres.

Michelle Williams, community and general paediatrician from Hobart, presented *Troubled Teens*, a summary of major health issues facing teenagers. When trying to establish rapport with adolescents, helpful tips include; be yourself, ask the teenager to explain their thoughts, use self-deprecation and humour, and remember that even just providing food in the ED can be helpful. Adolescents have differing definitions of what sex is. Ask about “people you like” when inquiring about sexual partners; young people often require education on contraception, the risk of transmitted infections and the long term financial hardships associated with teenage pregnancy. Consider if the teenager has a substance use disorder or drinks at harmful levels; alcohol is the most common ‘date rape drug.’ Cannabis leads to a behavioural rather than a physiological addiction. Methamphetamine use leads to ongoing emotional dysregulation, and when combined with a serotonin selective reuptake inhibitor leads to a longer “high.” It may be more reliable to simply directly ask the teenager what they have taken rather than rely on a hospital drug screen. Source of information on substances include young people themselves, Erowid (www.erowid.org), the Australian Drug Foundation (www.adf.org.au/resources/) and the Wastewater survey. Indigenous teenagers and those from socioeconomic disadvantage are at increased risk of mental health problems. Less than one third of teenagers with mental health problems seek help. Suicide may occur in clusters. Deliberate self-harm occurs is not suicidal in intent, often involves the limbs and abdomen, and is an attempt to ease psychological pain.

Free access to full videos of selected paediatric acute care presentations is available via the APLS Australia website (www.APLS.org.au) or via Vimeo (www.vimeo.com).

Author contributions

All authors contributed to the write up and approved the final version.

SSST takes responsibility for the manuscript as a whole.

Competing interests

SSST, EO and JC are APLS instructors. JS is an employee of APLS Australia

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