Paediatric Watch
Lessons from the frontline
Edition 1/2020 (v2)

Communication, escalation and intraosseous results in the deteriorating infant…

A 10-month-old infant with a complex medical and developmental history was brought into the emergency department of a district hospital at approximately 03:00 with a two-day history of fever, diarrhoea and respiratory symptoms. In the previous two weeks, the infant had been treated for symptoms of gastroenteritis at two different emergency departments and was discharged home on both occasions.

The initial assessment described the infant as floppy, lethargic, cyanosed centrally with mottled limbs. The infant was commenced on oxygen via a non-rebreather mask. Insertion of an intravenous (IV) cannula was unsuccessful however an intraosseous needle was inserted, and a sample was collected. The results indicated an elevated potassium and white cell count (WCC); however, it was uncertain whether these were accurate and reliable as they were from an intraosseous sample. A 10mL/kg 0.9% sodium chloride bolus was administered plus a 10% dextrose bolus.

It was recognised the infant was very unwell, and care was escalated to the Rural Referral Hospital (RRH) paediatrician who contacted the aeromedical retrieval service.

It was not possible to move the infant by air due to unavailability of aircraft, and a decision was made to transfer via road ambulance to the RRH with the GP VMO as an escort. Maintenance fluids were administered via the intraosseous for approximately 2 hours before it became dislodged. It was decided not to replace the intraosseous before transferring the infant.

On arrival to the RRH at approximately 09:00 the infant was reviewed by a paediatrician who noted them to be alert with mild work of breathing. An initial impression was the infant was dehydrated with a viral illness of respiratory or abdominal origin.

Another attempt to gain IV access was unsuccessful however blood was collected for pathology testing and a nasogastric tube was inserted for rehydration. It was noted at approximately 11:00 the infant was hypoglycemic with observations in the Red Zone. At 11:10 antibiotics were administered via an intramuscular injection.

At approximately 11:30 the infant was transferred to the paediatric ward. During handover the infant was noted to display jerking movements, was not responding to pain and had non-reactive pupils. The infant was commenced on oxygen and a dose of intramuscular injection glucagon was administered. Approximately 50 minutes later the infant progressed to a cardiac arrest and CPR was commenced. There was a return of spontaneous circulation and the infant was later transferred to a paediatric tertiary hospital.

Following arrival to the tertiary hospital arterial blood gas results indicated a severe metabolic acidosis, hyperkalaemia and raised lactate. Further results indicated an acute renal failure, hypoglycaemia and elevated white cells. Following investigations, it was determined that the infant had a hypoxic ischaemic brain injury, severe dehydration, electrolyte disturbances and gastroenteritis. In consultation with the infant's family a decision was made to palliate, and the infant died two days later.

Lessons Learnt

Intraosseous samples: the dislodged intraosseous needle was not replaced prior to transfer from the district hospital based on the slight improvement in the infant's condition and guidance from the paediatric specialist. This led to the transfer of an acutely unwell infant with no vascular access for fluids or medications should there be deterioration during transfer to the RRH.
There was confusion over interpretation of the intraosseous sample results which led to a focus on treating the infant for gastrointestinal losses.

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Intraosseous samples are not to be tested using Point of Care Testing (PoCT) devices such as I-STAT, glucometers or blood gas analysers, as this practice is not supported by the Therapeutic Goods Administration. The PoCT devices and blood gas analysers may be damaged by the intraosseous sample and the results may not be reliable.

An intraosseous sample may be used to inoculate a blood culture bottle. Intraosseous samples can be sent to the laboratory for analysis however must be clearly labelled as an intraosseous sample. Clinicians need to be careful interpreting results from intraosseous samples, especially potassium, WCC and platelets, as they differ significantly to results from blood samples.

The recommended alternative method involves obtaining a blood sample by venepuncture or capillary sampling. Alternative methods in identifying hyperkalaemia may include ECG features.

NSW Health Pathology have provided an Information Sheet on collecting good quality capillary blood samples.

Communication and escalation: The RCA identified there were conflicting views and interpretations on the severity of the infant's condition. Gaps in clinical handover and sharing of clinical information between treating teams were identified as a contributing factor impacting on the recognition of how critical the infant's condition remained following the initial escalation. This included gaps in the infant's condition on initial arrival, medical history such as comorbidity, response to intervention and ensuring appropriate management plans. Critical information including observations in the Red Zone were not handed over from the RRH ED to the paediatric ward nor was this in line with NSW Health Recognition and management of patients who are deteriorating policy.

Use of ISBAR to structure the handover may have eliminated the gaps in information about the severity of the infant's condition.

Children with physical co-morbidities are a significant red flag for deterioration. Failure to recognise deterioration is a common feature in paediatric RCA's. It is especially common in children with other significant physical or developmental problems. Over the previous two years, one sixth of all RCAs involved a child with significant physical or developmental problems where clinical deterioration was not recognised in a timely manner. Clinicians need to have a low threshold for early escalation and senior review for any child with significant physical or developmental problems.

Delay to antibiotics: The patient met criteria for the Paediatric Sepsis Pathway on arrival to emergency at the district hospital. However, focusing care on gastrointestinal losses, dehydration and hypovolemia resulted in a missed opportunity to commence timely antibiotics. This was despite access being available (via the intraosseous route early in admission) and alternate routes such as intramuscular administration also being possible.

Antibiotics were administered 7 hours after the initial presentation to emergency. It was acknowledged by the RCA team reviewing the case that blood cultures taken were positive for staphylococcus aureus. Patients with risk factors signs and symptoms of sepsis should be placed on the Clinical Excellence Commissions' Paediatric Sepsis Pathway and treated as such until proven otherwise by a senior doctor. This involves commencing the sepsis bundle which includes oxygen, vascular access, bloods, antibiotics and fluid resuscitation.

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