THE POINTY END OF PRACTICE

By Katrina Swire
“Every day in Australia hospital clinicians utilise intravenous fluid bags in the treatment of patients. Ordinarily this is a very routine task which presents with very little risk, but like every medical task even the most routine task can have tragic consequences.” Justice David O’Connell

2 such cases that highlight how this routine task can go dramatically wrong will be presented.
CASE STUDY 1

• 22yo Female patient ASA PS 1 scheduled to undergo a gynaecological procedure.
• She received 500mls crystalloid preloading in the waiting area.
• Spinal anaesthesia Heavy 0.5% Bupivacaine was administered - sensory level T5.
• Before moving onto the operating table a 2nd 500mls crystalloid was commenced.
• Commencement of surgery observations Bp110/60, HR 75 - 57 beats/min.
• The Anaesthetist thought that this was still the first 500ml crystalloid having not noticed that the second bag had been attached.
• Assuming that she was under loaded, the Anaesthetist inserted the IV into a pressure bag. Pressurising the IV for faster administration.
• The surgery commenced.
• Within a few minutes the patient became restless dislodging her monitoring, started to gasp and became unresponsive.
• Prior to becoming unresponsive there was no bradycardia or hypotension.
• Cardiac arrest was suspected and CPR was commenced.
• The patient was intubated and ventilated on 100% oxygen. ETCO2 was low.
• Multiple doses of adrenaline administered.
• It was noted that the Intravenous line was filled with air.
CASE STUDY 1

• After 7-8 minutes of CPR a carotid pulse returned.
• Heart rate 150b/min, ETCO2 30mmHg.
• Bp now recordable 150/100 mmHg, spontaneous respiratory effort returned.

• Over the next 30 minutes the patients condition continued to stabilise but she remained unconscious, with dilated pupils not reactive to light, ECG sinus tachycardia.

• The pupil size subsequently reduced and she became more responsive.

• She was transferred to ICU for monitoring and further management.
WHY DID THIS HAPPEN?

• Why did this happen what was the cause?
  • Anaphylaxis? Tachycardia, hypotension, wheeze, rash: ABSENT
  • Cardiac event? Arrhythmias, Electrolyte imbalance: ABSENT
  • High Spinal? Causes progressively decreasing HR& BP-arrest : ABSENT
  • Aspiration? Ruled out by X-Ray
  • Remembering that the IV line was full of air. Air embolisms was considered?
The sudden onset of restlessness and rigidity can be accounted for by the hypoxia due to air embolism.

Whilst in ICU a Trans Thoracic Echocardiography was conducted revealing

- Dilated right atrium, right ventricle and pulmonary artery, and the present of air bubbles.

This prompted the medical team to consider a diagnosis of Cardiac Arrest secondary to a Air Embolism.
HOW DID THE AIR GET IN?

• After conducting a root cause analysis and simulating the circumstances of this case.

• It was revealed that the Anaesthetist had inadvertently expanded the partially collapsed, half empty bag, when disconnecting the IV fluid to administer IV paracetamol. Filling it with air before reattaching it to the patient.

• This by itself would not have been an issue as the semi rigid plastic IV bag would have collapsed when the IV fluid was infused. Stopping before entering the patient due to the patient's normal blood pressure.

• By adding the pressure bag to the air filled IV fluid bag a catastrophic set of circumstances occurred.
TREATMENT FOR VENOUS AIR EMBOLISM

• Recommended treatment included
  • Immediate Cardiac Compressions (to disrupt the air in the heart into smaller bubbles)
  • Steep Trendlenberg’s position.
  • Cannulation of internal jugular vein (to aspirate the air from right side of heart)
• Support of symptoms
• Consider hyperbaric treatment
OUTCOME FOR THE PATIENT?

- Immediate cardiac compression would have helped dispersing of the air inside her heart.
- ICU admission and ventilation support was required.
- Although neurologically slow to respond initially there was no long term neurological deficits.
- The patient was extubated after 7 hours and spent 24 hours in ICU.

- The patient went on the make full recovery after an extended stay in hospital.
VIDEO
• Ruby was a young girl a few months short of her 4th birthday. In early August 2012 Ruby had been unwell for a few days with high fever and she was seen by her GP.

• On her 2nd visit to the GP it was decided to admit her to the local regional hospital for observation and monitoring due to dehydration and high fever.

• Ruby was admitted, an IV was inserted and 850mls was administered over a period of time via an IV pump. In consultation with the closest Base Hospital it was decided that the level of care that Ruby required would best be delivered at the larger Base Hospital and a helicopter aero-medical transfer was organised.
AERO MEDICAL TRANSFER

• When the aero medical team arrived it was requested that the another IV line be used as the pump was too big to fit in the confined space of the helicopter.

• The paramedic and the RN went and select a line that can be used in flight.

• The paramedic then re spikes the original IV bag with an estimate volume of approximately 150 mls left in the IV bag. The new line was then primed and connected to Ruby just as she was loaded onto the helicopter.

• Prior to take off, the Emergency Medical Retrieval Coordinator was contacted and in consultation with the paramedic and considering Ruby’s condition it was decided to increase the IV rate to 250 mls/hour.

• To facilitate this the IV was placed in a opaque pressure bag. Gravity was not an option due to the cabin height of the helicopter.
AERO MEDICAL TRANSFER

• 31 minutes after the IV fluid rate was increased, Ruby’s condition deteriorates. Ruby suffers a seizure then rapidly goes into cardiac arrest. CPR was commenced.

• The lead paramedic requested that the pilot land immediately. As the helicopter was 7 minutes away from the landing site it was decided it was safest and most expedient to proceed to the landing site. The pilot changed flying style to accommodate for Ruby’s time critical condition.

• Ruby was immediately conveyed to the Base Hospital where futile resuscitation attempts were ceased and Ruby was declared dead 40 minutes after landing.
WHAT WAS THE CAUSE?

- Perplexed by Ruby’s rapid deterioration and inexplicable death the hospital performed a Chest X-ray and another the following morning.

- The X-rays revealed air in Ruby’s heart chambers and blood vessels.

- On autopsy, approximately 70mls of air was found replacing the blood in Ruby’s right artery and ventricle. Air was also found inside Ruby’s major blood vessels-aorta, superior vena cava and many superficial veins covering the surface of her brain.

- Unusually air was also found inside the internal jugular vein.
HOW DID THIS HAPPEN?

• It was not immediately known where the air in Ruby’s circulatory system came from.

• In 2014 by a process of elimination and root cause analysis the independent medical expert, acting for the Coroner, concluded that the introduction of air was via the partially used, re spiked IV bag, placed under pressure.

• In short a lethal amount of air had entered the partially used IV fluid bag. Which when re-spiked and administered with the pressure bag resulted in a fatal dose of air being squeezed into Ruby’s circulatory system after the IV had run out.
3 STATEMENTS BY THE CORONER

• If a new IV fluid bag had been used Ruby would still be alive as the air would not have been present in the IV fluid bag.

• If an infusion pump had been used Ruby would still be alive as the pump would have alarmed and ceased the infusion when air was detected in the line, prior to it entering Ruby’s circulatory system.

• If the IV fluid was gravity fed (without the pressure bag) Ruby would still be alive as Ruby’s venous pressure would have stopped the final few centimetres of IV fluid from entering her circulatory system preventing any air from entering her circulatory system.

• COST OF IV BAG $1.00
CORONERS RECOMMENDATIONS

- That IV fluid bags are marked with “SINGLE SPIKE ONLY” in contrasting coloured lettering.
- Education and prohibition of re-spiking IV fluid bags with the possibility this be referred to as “Ruby’s Rule”.
- That the Ambulance Service implement their new Clinical Practice Guidelines for priming of IV lines.
- That the Aeromedical retrieval service attempt to eliminate the use of the opaque pressure bags and if possible to trial IV infusion pumps
- That paramedics should not restock or obtain equipment from hospitals.
HOW SHOULD WE RESPOND?

• Use of re-spikable IV bags? Pros/Cons

• Practice alerts - Banning the re-spiking of IV Fluid Bags? Difficult to enforce?

• Practice alerts - Banning the use of Pressure bags with IV’s? Emergences?

• IV fluids delivered only via pumps with air detectors?

• Central data base for Coronial Recommendations.
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Questions ?