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Adult intraosseous access

Experiences in a remote emergency department

Difficult intravenous access can be a very stressful experience, especially in a remote emergency department. Adult intraosseous access can provide rapid access for fluids and drugs in a critically ill patient in whom intravenous access is difficult or impossible. This article presents two case reports of patients in whom rapid intraosseous access was lifesaving.

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Intravenous (IV) access is a key component in the management of emergencies and significantly unwell patients. At a remote local hospital, two experienced general practice anaesthetists had difficulty securing an adequate IV site in a severely shocked obstetric patient with a major haemorrhage and disseminated intravascular coagulation. On that occasion IV access was eventually achieved using the external jugular vein with the patient in a 45 degree head down tilt. Apart from the threat to the patient's life caused by delayed IV access, the situation was very stressful for the doctors concerned.

Cases using intraosseous access

Subsequently, the emergency department of the hospital purchased an intraosseous (IO) access kit for use in such situations. The kit sat on the shelf unused for about 1 year until, in the space of 2 days, the emergency department received two patients suffering from septic shock, each of whom had a systolic blood pressure of 55 mmHg. At the time, no bedside ultrasound was available to help guide central access. Wide bore vascular access was difficult, and in addition to the need for rapid IV fluid replacement, there was a need for IV antibiotics and inotrope support.[1,2] Intraosseous access enabled these resuscitation requirements to be achieved within 1 minute.

Both patients, one an obese diabetic, 76 years of age, the other a previously fit person, 80 years of age, survived and returned to their previous independent functioning after spending some time in metropolitan intensive care units. During their intensive care unit treatment, both required ongoing inotrope support and ventilation.

Discussion

The system that was used with these patients is a fully sealed battery powered drill to which an IO needle of required length is attached. The manufacturer claims a battery life of 10 years or 1000 needle insertions. With some downward pressure applied, the drill will drive the needle into the bone marrow and supply relatively wide bore IO access.

After removing the solid centre from the needle, an initial flush of the needle with saline is required to prevent the needle becoming clogged, and to create a good connection with the marrow vasculature. Placement of the needle tip in the marrow cavity is confirmed by lack of obvious extravasation on flushing and relative free flow of the flush. A specific connector supplied in the kit must be used. To run fluids rapidly a pressure bag is used. Without a pressure bag the flow rates achieved are slow. In the absence of a pressure bag I have used a large blood pressure cuff wrapped around the fluid bag to speed the delivery of IV fluids in resuscitations.

Drugs that normally require central access such as inotropes can be safely administered through the IO route.

There appear to be two negative aspects of this technique. One is the need to remove the IO needle within 24 hours to prevent the risk of osteomyelitis. The other is the cost of the needle, which is comparable to the cost of a central access kit. The IO route is not a long term alternative to a central line; rather it provides very rapid emergency central access for up to 24 hours.

In these cases the upper tibia was used to site the IO needle; in part because this is a site where dislodgment during transport would be unlikely, however, the upper humerus and the lower tibia are alternate suitable sites. Whichever site is chosen it is essential to ensure the needle is long enough to enter the marrow cavity. An etched line 5 mm from the hub of the needle should be visible when the needle tip reaches the surface of the bone, this will ensure the tip of the needle will be in the cavity once the needle is driven home.

The process of drilling through to the marrow cavity is much less painful than one would expect. However, flushing the site is painful and an option is to flush some lignocaine down the IO needle.

Fairly obvious contraindications include a fracture of the intended target bone or a previous IO needle having been in that bone in the past 2 days. In these circumstances, the fluid would leak from the bone into surrounding tissues rather than being forced into the vascular compartment. Infection in the tissue overlying the bone and implanted orthopaedic metalwork in the bone are other obvious contraindications.

A recent study in which both IO and central vein access were obtained in trauma patients showed that the IO route had a higher first attempt success rate of 90% versus 60% and was significantly faster – average time to infusion being 2.3 versus 9.9 minutes.[3] The current Australian Resuscitation Council guideline for medications in adult cardiac arrest recommends the use of IO access if IV access is not available.[4]

The IO system is relatively straightforward to use and, despite not having used the system before, I encountered no difficulty in accessing the tibial marrow cavity. While my knowledge regarding how to use the technique was based solely on reading the instructions provided with the kit, this is not an ideal situation, it is preferable to practise on a mannequin before using the technique. The manufacturer's website is also useful.[5] Hopefully, resuscitation training programs and anaesthetic refresher courses for rural general practitioners will start including IO access training.

In Esperance (Western Australia), if tertiary care is required there is the need for a Royal Flying Doctor Service plane to make a 1400 km round trip from Perth, as well as the associated delays with ambulance journeys between hospitals and airports. In the case of septic shock patients there is clearly an advantage to being able to provide inotrope support during the many hours required for transfer. Among the key factors previously identified as increasing survival of septic shock patients are early use of antibiotics, adequate fluid resuscitation and inotrope support to maintain a systolic blood pressure over 90 mmHg.[1,2]

Conclusion

Failure to gain adequate IV access is one of the number of situations that can be especially stressful for a single doctor managing a major resuscitation. Adult IO access solves the problem of difficult IV access reliably and rapidly, and does so with the added advantage of allowing the use of drugs that normally require central venous access. From the experience of these two cases, I would recommend all rural and remote emergency departments should consider having an adult IO access kit available.

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