Intraosseous infusion

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INTRODUCTION

There has been a resurgence of interest in the USA in the technique of intraosseous infusion (Rosetti *et al.*, 1985). There is little experience of this technique in the UK (Redmond, 1986). This short paper documents the experimental use of this technique both for infusion of fluids and the administration of drugs.

METHOD

Pigs of various sizes were anaesthetised with halothane and nitrous oxide. The antero-medial surface of the proximal end of the tibia was exposed and a small hole drilled to facilitate the insertion of a 16G bone marrow aspiration needle. The central venous pressure (CVP) was measured via a catheter in the internal jugular vein. The mean arterial pressure (MAP) was measured via a catheter in the femoral artery. The animals were bled until the heart rate increased and both MAP and CVP fell. N Saline was infused into the tibia and the time taken to restore the CVP was measured.

In a separate experiment, a bolus of super-saturated KCl was injected into the tibia and the time taken to circulatory arrest was recorded. This was repeated using the internal jugular vein in two pigs being killed at the end of another experiment.

RESULTS

Experiment 1: 18 kg pig

The CVP was restored from -1 cm H_2O to $+1$ cm H_2O in 5 min following the infusion of N Saline into the tibia.

Passive infusion allowed 200 ml to flow in 5 min. A bolus under pressure allowed 25 ml to flow in 10 s.

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Experiment 2: 35 kg pig

The CVP was restored from 6 cm H₂O to 9 cm H₂O following a 500 ml bleed (approximately 20% blood volume) and the passive infusion of 500 ml N Saline into the tibia over 40 min.

*Experiment 3***Table 1** Time from injection to cardiac arrest

Weight of pig (kg)	Time (s)	
	Internal jugular vein	Tibia
24	20	—
25	25	—
28	—	35

The rate of infusion was slower through the tibia (Table 1). Ventricular tachycardia occurred after 17 s but circulatory arrest in ventricular fibrillation was not complete until 35 s.

It was observed that there was free aspiration from the tibia pre-arrest but not post-arrest.

DISCUSSION

These results confirm the work of others (Bailey & Love, 1956; Valdes, 1977; Berg, 1984), showing that the intraosseous route will deliver drugs and fluid to the circulation. The passive rate is slow, but acceptable rates of infusion can be achieved with bolus injections.

Rapid fluid replacement would, therefore, require the use of syringes. The small volumes involved are likely to limit its use to infants. The 'red' marrow in long bones begins to be replaced by the much less vascular 'yellow marrow' about the age of 5 years (Warwick & Williams, 1973). This limits the use of the tibia to small children and infants although the sternum could be used for drug administration in adults. We recommend further evaluation of this technique for any (probably rare) future clinical use.

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