We describe a near-fatal event, probably due to air embolism, following an air arthrogram for developmental hip dysplasia in a baby aged four months. The sequence of events and the subsequent treatment are described. There is little information about this complication in the literature. The presumed mechanism and alternative methods for confirmation of placement of the needle are discussed. We no longer use air arthrography in children.

Arthrography with contrast is useful in the evaluation of hips in children. The common approaches are anterior and medial. If the tip of the needle is not in the joint, contrast material may spread extra-articularly. Although not thought to carry significant adverse effects, extravasation of contrast material may obscure the joint even if the needle is later placed correctly. In order to avoid this it has been suggested that after aspiration to exclude blood, a small amount of air be injected to confirm intra-articular placement of the needle. Occasionally, the air arthrogram alone is sufficient for the examination. Once an arthrogram is obtained the air is withdrawn and contrast material injected. We report a complication of this procedure.

Case report
A baby boy aged four months and weighing 6 kg, with bilateral club feet and developmental dysplasia of the left hip was treated with serial casting of his feet. A Pavlik harness for the hip failed and was discontinued. Once adequate alignment of the feet was achieved, the baby underwent bilateral percutaneous tenotomy of the tendo Achillis with concurrent air arthrography of the hip, closed reduction and a spica cast. The reduction was thought to be non-concentric and a change of cast with repeated arthrography was arranged two weeks later. Under general anesthesia and intravenous prophylactic cefazolin, the cast was removed and an arthrogram with 2 ml air was performed through a medial approach. The joint was penetrated at the first attempt (Figs 1 and 2), the air was aspirated immediately and 3 ml of contrast material were injected. During the injection of contrast material immediately following the aspiration of air from the joint, there was a sudden drop in end-tidal carbon dioxide (ETCO₂) and oxygen saturation (O₂sat) followed by severe bradycardia. The gas mixture was turned to 100% oxygen and ventilation switched to manual without difficulty. Auscultation of the lungs was normal. The heart rate was considered slow (70 beats/minute), so external cardiac massage was undertaken and an immediate bolus of 0.5 mg Atropine sulphate (Teva Pharmaceutical Company, Jerusalem, Israel) given. The blood pressure was unrecordable and the peripheral pulse not palpable. There was no reading on pulse oximetry, and the ETCO₂ was 15 mmHg (normal, 35 to 40). As no signs of improvement were noted, 50 µg of epinephrine were administered intravenously, whereupon the ETCO₂ increased to 45 mmHg and the heart rate, blood pressure and O₂sat returned to normal. It was estimated that conditions of near-arrest lasted for about five minutes. Later, echocardiography failed to show any abnormality except for a hypercontractile left ventricle, attributed to epinephrine. The blood gases and chest radiograph were normal.

As resuscitation was prolonged and the right pupil appeared to respond slowly to light it was decided not to extubate the baby, but to transfer him to the Paediatric Intensive Care Unit. Over the next 12 hours he was weaned off the ventilator and extubated. He was haemodynamically stable but had a tremor of his limbs and trunk. However, he was moving all limbs spontaneously, was alert, and a brain ultrasound was normal. Next day, the tremor resolved and he was discharged. As the hip was irreducible, a spica cast was not applied and he
NEAR-FATAL AIR EMBOLUS DURING ARTHROGRAPHY OF THE HIP IN A BABY AGED FOUR MONTHS

Discussion

In our patient it is possible that the moribund signs were the result of an anaphylactic reaction to the dye or the antibiotics. Although before operation the family had denied any history of allergy, they later recalled a previous rash in response to augmentin. Also, during the first arthrogram, the patient received both contrast dye and cefazolin, which may have caused sensitisation. However, he was stable for over 30 minutes after administration of cefazolin, making anaphylaxis unlikely. The ETCO₂ and O₂sat fell simultaneously as the contrast material was injected, too early for an anaphylactic reaction, of which other common features such as bronchospasm and laryngeal or facial oedema were absent. The baby stabilised quickly without prolonged haemodynamic support.

There are various case reports concerning air emboli after arthrography.²⁻⁷ Most relate to babies or young children,²,³,⁶,⁷ and one involved the injection of CO₂.⁶ We found only one report of air embolism during arthrography in an adult.⁴

Techniques to confirm accurate positioning of the tip of the needle have been published. Yun and Reinker⁸ described a method whereby the vacuum created by distraction of the hip joint induces movement of air bubbles in attached tubing, confirming accurate localisation. Their technique was safe and reproducible even in inexperienced hands, and there were no complications or extracapsular injections of contrast in more than 50 cases.⁸ Straw, Chell and Dhar,⁹ using the medial approach, described the ‘adduction sign’, in which distension of the hip joint by the injection of normal saline causes an abducted hip to adduct, thereby confirming intra-articular placement of the needle.

Because of their size, young children are probably more sensitive to intravascular air and a very small volume of intravascular gas may be catastrophic. Although the dramatic collapse of our patient may have had many causes, it was probably the result of embolism after the injection of a relatively small volume of air. We recommend alternative methods to air arthrography to confirm intra-articular placement of the needle.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References