

## CASE REPORT

# Peripheral intravenous infusion—another cause of air embolism

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We report an unusual complication of intravenous infusion. A 4-week-old baby developed acute cardiopulmonary distress because of air embolism caused by improper preparation of peripheral intravenous set. The estimated amount of infused air was 12 ml (approximately 3.5 ml/kg). The infant recovered promptly after short supportive treatment. □ *Air embolism, intravenous infusion*

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Pulmonary air embolism is a well-known complication of neurosurgery and cardiac surgery (1, 2). We report a case of pulmonary air embolism in a neonate that occurred during insertion of a peripheral vein infusion line because of improper flushing of the intravenous set. Surprisingly, we could not find a similar case in the medical literature, and to the best of our knowledge this is the first report of air embolism in a neonate through a peripheral intravenous line.

Pediatricians should be aware that in neonates and young infants even a small amount of intravenous air can cause symptomatic air embolism.

### Case report

A 4-week-old previously healthy neonate was admitted to the pediatric department because of fever of 39°C, which had started several hours prior to admission. The vital signs were normal, and no signs of respiratory distress or hemodynamic impairment were noted. The remainder of the physical examination was also unremarkable. Sepsis work-up, including blood cultures, lumbar puncture, and supra-pubic urine aspiration, was performed. A peripheral intravenous (iv) line was inserted in the dorsal vein of the right foot, and infusion of NaCl 0.3% and glucose 5% was initiated.

Approximately 1 min after connecting the iv set before the installation of the infusion set to an infusion pump, the baby became cyanotic, and grunting was noted. Respiratory rate was 15/min, heart rate 60/min and blood pressure was unmeasurable. The skin became mottled. Oxygen saturation measured by pulse oximeter was 80% (normal >95%).

Artificial ventilation with an ambu bag and 100% oxygen, as well as cardiac massage, was initiated

immediately. Concomitantly, the intravenous set was noted to be "empty", i.e., fluids were seen only in the distal part of the iv set. The infusion was immediately stopped, and the set was disconnected, flushed thoroughly with a solution of glucose 5% and NaCl 0.3%, and reconnected. No drugs were given. After approximately 3 min, vital signs began to improve gradually. The baby started crying, and blood pressure, respiratory rate, and O<sub>2</sub> saturation normalized. The skin mottling gradually resolved over the next few minutes.

Blood gases after 10 min still showed metabolic acidosis with pH of 7.23 and base excess of –12.5 mEq/L. Blood chemistry, including glucose, sodium, potassium and calcium, was normal.

Fifteen minutes after the event the physical and neurological examinations were normal, and all parameters remained stable until discharge. Blood gases, rechecked after 4 h, normalized. Chest X-ray revealed no abnormalities. The infant was treated with ampicillin and gentamicin for 48 h. Blood, cerebrospinal fluid, and urine cultures were sterile. He was discharged 2 days later and is doing well.

### Discussion

Iatrogenic pulmonary air embolism is a serious complication of a variety of surgical procedures. It has been reported to occur in up to 27% of neurosurgical operations performed in the sitting position, and in 0.1% of cardiopulmonary bypass operations (1, 2). Air embolism has also been associated with epidural and caudal anesthesia, accidental ingestion of hydrogen peroxide, spinal surgery, interventions involving the paranasal sinuses, and adenoidectomy (3–5). It has been reported in children and adults who sustained thoracic trauma or

underwent insertion of a central venous catheter (6, 7). Most iatrogenic air emboli are venous. However, paradoxical emboli can occur in children with right-to-left cardiac shunt or patent foramen ovale (2). The clinical signs and symptoms of air embolism are respiratory distress, cyanosis, mottling of the skin, hypoxemia, bradycardia, seizures, and shock. Similar clinical manifestations were observed in our patient. Treatment is based on supportive cardiac and respiratory care, and administration of 100% oxygen or even hyperbaric oxygen (8).

In experimental studies, an air dose of 0.5 ml/kg/min has been required to produce cardiorespiratory instability in a dog model (9). Symptomatic air embolism in children has been reported when gas volumes of 0.4 ml/kg (4) and 0.2 ml/kg (10) were introduced into the central circulation of infants.

In addition, the adverse effects of air embolism are proportional to the volume and the rate of the administered air (9). In our patient, whose weight was 3.5 kg, a clinical picture compatible with sudden air emboli was noted within seconds after approximately 12 ml of air (a volume of two-thirds of the iv set and extension tube) had entered the bloodstream. This relatively larger amount of air administered before the appearance of symptoms was probably due to the fact that our patient received peripheral rather than central infusion and at a slower rate.

The symptoms of our patient resolved within a few minutes. Other possible causes of sudden cardiovascular deterioration were considered but appeared unlikely. Glucose, calcium, sodium, potassium and chloride levels and the results of the sepsis work-up were within normal limits, as were lumbar puncture findings and brain ultrasound. We concluded that the air embolism had resulted from improper flushing of the infusion set before its connection to the iv catheter.

Although air embolism is extremely rare in infants with peripheral iv line insertion, awareness of this possibility is important, and all necessary preventive measures should be taken. These include, in addition to aseptic technique and careful examination of the type of fluid and medication given through the infusion, special attention to flushing of the set and removal of air bubbles before the set is connected to the patient.

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