SHORT REPORT

Should paediatric central lines be aspirated before use?

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As blood clots commonly occur in the lumens of paediatric haemodialysis central-venous lines, they must be routinely aspirated before use to prevent pulmonary emboli. The smaller diameter lines used for parenteral nutrition and cancer chemotherapy are seldom managed this way. We looked for clots formed when children undergoing cancer chemotherapy had their heparin-locked central lines accessed, and compared with the lines of children undergoing haemodialysis. Patients undergoing haemodialysis had clots aspirated on 83% of occasions, and each child had clots at least once. Clots also occurred in the smaller lines, but they were less frequent (64%, $p=0.01$), and had a lower median weight than those in dialysis lines (14.1 v 25.2 mg, $p=0.01$). When small diameter central lines are used without initial aspiration, small pulmonary emboli are likely to occur, but are unlikely to be individually clinically important. Daily use, as with long-term parenteral nutrition, might result in >3 g of clot being embolised annually. Consideration should be given to aspirating all paediatric central lines before use.

Children's haemodialysis lines are fairly large to facilitate high blood flows, and blood clots commonly form in their lumens, hence these are routinely aspirated and discarded to prevent pulmonary embolisation. Although instilling alteplase rather than heparin into haemodialysis lines reduces the frequency and weight of clots formed, it does not eliminate them completely.¹ The clinical risk posed by pulmonary emboli is real, as we were reminded just before this study. A 12-year-old patient who had been established on haemodialysis for 2 years was connected on just one occasion to his dialysis lines without prior aspiration (in error), and almost immediately collapsed and required cardiopulmonary resuscitation. He had no other identifiable cause for his collapse, and made a full clinical recovery. Despite this clear clinical picture, his radiographic and radionuclide imaging was unremarkable.

Smaller, surgically placed central-venous lines are used for a wide range of clinical indications in children, including administration of cancer chemotherapy,^{2–4} total parenteral nutrition^{3,5} and antibiotics in cystic fibrosis.² Few access protocols consider routinely aspirating and discarding the line contents before use, and in those with subcutaneous reservoirs this would be impossible. However, if clots do form in smaller lines as they do in larger ones, accessing them this way will inevitably generate small pulmonary emboli. Although individual small emboli would be unlikely to cause considerable harm, it is possible that long-term use might lead to cumulative lung pathology. Most children who had central-venous lines in situ for at least 3 months for gastrointestinal problems, or for treatment of leukaemia, had suggestive evidence of pulmonary emboli on electrocardiography or echocardiography, which was confirmed in two cases after death.³ We therefore compared aspiration of clots from central lines sited for administering cancer chemotherapy in children with those from children undergoing haemodialysis.

METHODS

For 1 month, every time a child in the paediatric haemodialysis unit or the children's oncology unit had their line sampled for a clinical indication, it was aspirated to look for clots. The lines were routinely locked with a volume of heparin solution approximately 0.2 ml greater than the estimated lumen volume. The haemodialysis lines were instilled with heparin at 5000 or 25 000 units/ml, and the chemotherapy lines with heparin 10–100 units/ml, according to the different departmental protocols. When accessing the line, a volume of blood 0.5 ml greater than the volume of the line lumen was aspirated and expelled onto gauze. The liquid blood soaks into the fibres, and any clot is left on the surface. Clots were collected into preweighed sealed tubes using the tip of a needle, and weighed to within 0.1 mg.

Statistical analysis

The proportion of lines in which clots were detected was compared between the groups using Fisher's exact test. When clots were collected, the distribution of their weights was non-normal, so these were compared between the groups using the Mann–Whitney U test.

RESULTS

Six children having regular haemodialysis had their 7FR or 10FR central lines sampled for clots between 8 and 14 times during the study period, giving a total of 65 occasions. All children had clots on at least one occasion, and overall clots were present in 54 (83%) of aspirations. No child was known to have a prothrombotic tendency. When present, the clots weighed a median of 25.2 mg (range 0.7–143.6 mg). In all, 31 children having chemotherapy for cancer had their lines sampled between 1 and 4 times during the study period, totalling 78 occasions. Their lumen diameters ranged from 0.7 to 1.6 mm. Not all children had clots, but they were present on 50 (64%) occasions, which was significantly less frequent than for the dialysis lines ($p=0.01$). When present, the clots weighed a median of 14.1 mg (range 0.3–85 mg), which was significantly less than those from dialysis lines ($p=0.01$).

Aspiration was seldom noted to be difficult when clots were present. One clot was aspirated after the line had been locked with heparin for just 90 min, and one clot developed while a line was being used to infuse normal saline at a rate of 75 ml/h.

DISCUSSION

Clots form easily in relatively large central lines, such as those used for haemodialysis, presumably because blood enters the distal lumen. Although alteplase reduces the clot frequency and size compared with heparin locks, it does not eliminate them.¹ Owing to the risk of pulmonary embolus, it is routine practice for children's dialysis lines to be aspirated before every use. The case of the child who received an accidental embolus clearly shows the necessity for this. Occasionally, the clots removed from lines are so large (fig 1) that they are certain to be clinically important.

This study has shown that smaller, easily dislodgable clots also develop in the lumens of narrower central lines, albeit less

Figure 1 A large clot aspirated from a central-venous haemodialysis line.

frequently. We are not aware of children undergoing chemotherapy or parenteral nutrition developing symptoms suggestive of acute pulmonary embolus, but it is apparent that small subclinical clots must be occurring, as evidenced by cardiac and postmortem studies in children with lines for at least 3 months.³ Cumulatively, these small clots may cause morbidity. Most children with cancer require their lines for about 1 year, but some groups of children require long-term or permanent central-line treatment, such as those with cystic fibrosis² or those receiving parenteral nutrition for short bowel syndrome.³⁻⁵ A child having a clot weighing about 14 mg dislodged on 60% of days would have 3 g of thrombus showered into their lungs annually.

If cumulative small thrombi did cause the gradual development of pulmonary damage, this might be difficult to detect, or even suspect clinically, especially in children whose other serious disorders had necessitated the use of a long-term central line. Given the inevitability that many of these children must be having repeated small pulmonary emboli, consideration should be given to aspirating clots from all paediatric central lines before use, especially in children likely to need long-term or lifelong treatment.

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