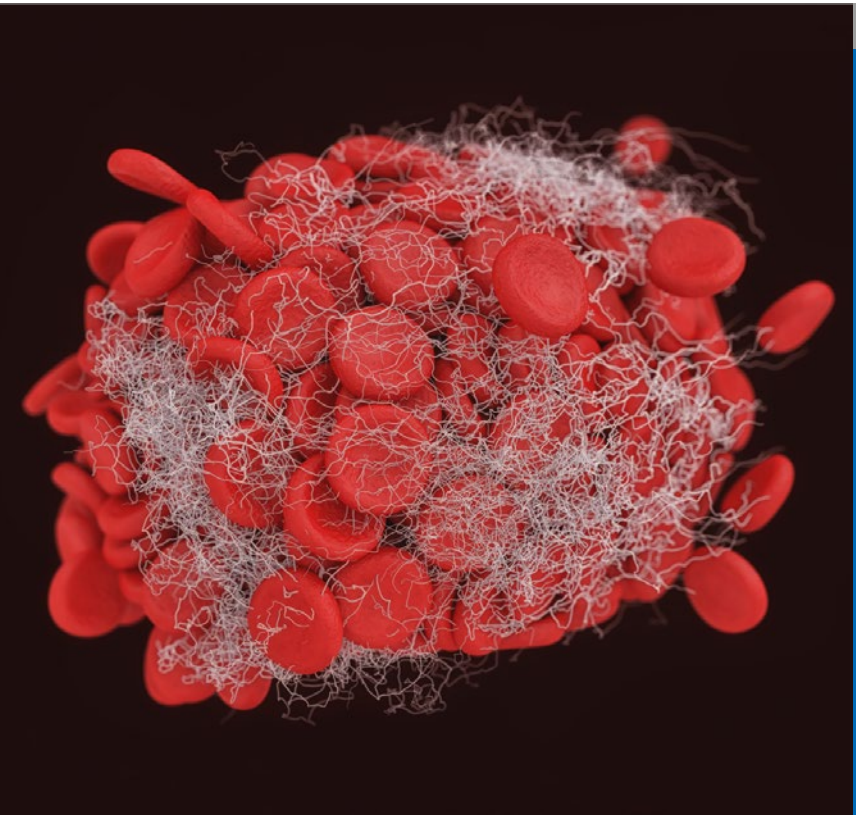
SWISS SOCIETY OF NEONATOLOGY

Right atrial floating mass



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Title figure:
Thrombus (Source: www.medmix.at)

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We report on a male infant born at term in a peripheral hospital by emergency Cesarean section due to a non-reassuring cardiotocogram and meconium-stained amniotic fluid. The mother was a healthy 34-year-old primipara with an uneventful pregnancy and without a history of diabetes (however, no oral glucose tolerance test had been performed).

The infant was large for gestational age with a birth weight of 4'910 g (> P97), head circumference 38 cm (P97) and length of 56 cm (P94). Apgar Scores at 1, 5, and 10 minutes were 5, 9 and 9, respectively, and primary resuscitation included stimulation, oral suctioning and brief ventilation by mask. The arterial umbilical cord-pH was 7.09.

At the age of 30 minutes, the patient developed respiratory distress with an increased oxygen requirement. In addition, there was severe hypoglycemia (0.7 mmol / l). He was transferred to the intensive care unit, where he required intubation and mechanical ventilation due to profound desaturation.

Echocardiography on the first and second days of life showed a structurally normal heart but suggested elevated pulmonary vascular resistance with an estimated right ventricular systolic pressure of 65 mmHg (tricuspid valve jet maximum velocity by continuous wave Doppler, systolic blood pressure at time of echocardiography 90 mmHg) and bidirectional

shunting across the ductus arteriosus. Furthermore, the interventricular septum (7 mm) and the left as well as the right ventricle were hypertrophied with signs of volume overload (dilated right atrium, right ventricle and venae cavae).

Laboratory findings included elevated inflammatory markers (C-reactive protein 50 mg / l, a white blood cell count of 14.9 G / l with a left shift (I:T ratio of 70 %), a platelet count of 116 G / l), elevated liver function tests (ASAT 752 U / l, ALAT 776 U / l), signs of mild acute renal failure (creatinine 89 µmol / l), elevated INR (2.7), an initial lactate of 3.2 mmol / l with maximum increase up to 8.2 mmol / l six hours later. Sepsis with hemodynamic instability triggered the placement of an umbilical venous catheter and treatment with antibiotics (amikacin and amoxicillin) as well as initiation of inotropic support (epinephrine and norepinephrine). The tip of catheter was located in the right atrium by X-ray (Fig. 1). The patient also received a packed red blood cell transfusion and fresh frozen plasma for anemia and disseminated intravascular coagulation. After three days, the patient was extubated. Blood cultures remained negative.

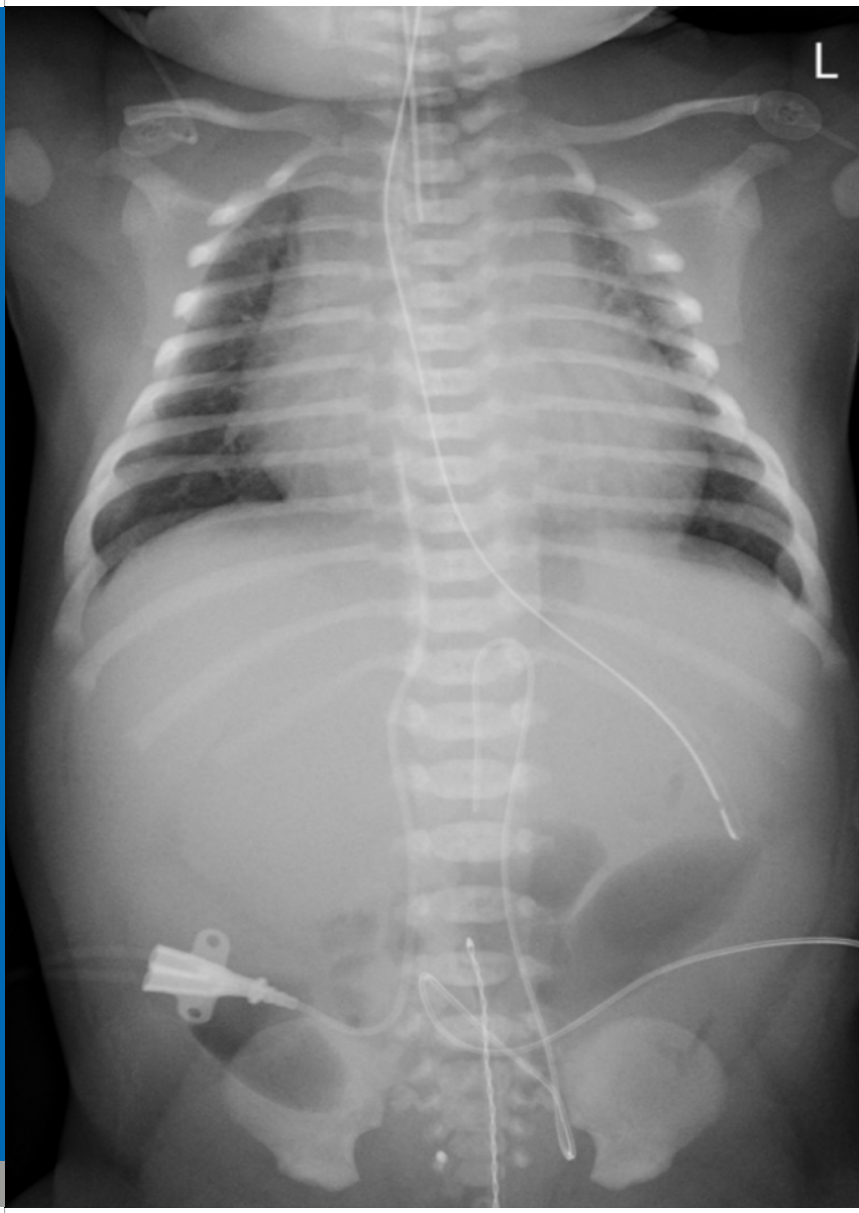

Fig. 1

Chest X-ray of thorax and abdomen: cardiomegaly, tip of the central venous catheter in right atrium (note mal-position of the umbilical arterial catheter in the aorta).

On day seven of life, follow-up echocardiography showed a large floating thrombus in the right atrium (Fig. 2). Continuous intravenous heparin infusion in therapeutic dosing was initiated with 28 U/kg/hour and given over four days, which resulted in complete disappearance of the intracardial thrombus. During that time, the baby became febrile (maximum temperature of 39.5°C) and was treated with amoxicillin/clavulanic acid for 5 days. The patient was discharged at the age of 18 days without anticoagulation.

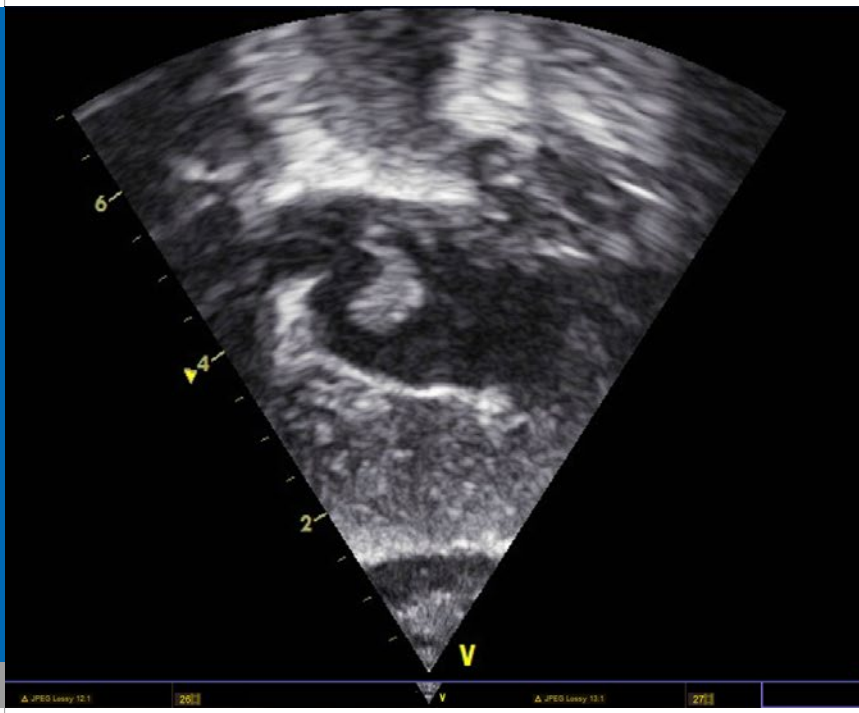

Fig. 2

Modified subcostal echocardiogram: mobile echogenic structure in the right atrium.

DISCUSSION

Thrombus formation and thromboembolic events are an increasingly recognized entity in the neonatal period and are associated with high morbidity (1, 2). Among pediatric patients, neonates carry a high risk due to the relative immaturity of the hemostatic system (Table 1) and the presence of other conditions, both maternal and neonatal (Table 2), leading to a prothrombotic state (10).

The incidence of symptomatic neonatal thrombosis has previously been described to occur in 5.1 per 100'000 live births and 2.4 – 6.8 per 1'000 neonatal intensive care admissions (3, 4). A more recent Italian analysis showed similar data for patients in a neonatal intensive care unit and an incidence for live births of 3.4 – 6.5 per 10'000 (5).

However, most episodes of venous thromboembolism in neonates are associated with central venous catheters (CVC), often causing no signs or symptoms and being found incidentally on routine echocardiography (8). On the other hand, up to 65 % of patients with CVCs develop complications such as infections or obstruction, as well as increasing incidences of catheter-associated thrombosis (up to 50 %) (8, 9).

	Protein	Neonatal compared with adult levels
Neonatal procoagulant proteins	• Factor VIII • Von Willebrand factor activity	Increased
Neonatal anticoagulant proteins	• Factor II • Factor VII • Factor IX • Factor X • Factor XI • Factor XII • Protein C • Protein S • Antithrombin • Heparin cofactor II	Decreased

Table 1. Comparison of anticoagulant and procoagulant levels in neonates and adults (7).

Maternal	Delivery	Neonatal
• Infertility • Oligohydramnion • Prothrombotic disorder • Preeclampsia • Diabetes mellitus • Intrauterine growth restriction • Chorioamnionitis • Prolonged rupture of membranes • Autoimmune disorders	• Urgent Cesarean section • Fetal heart rate abnormalities • Instrumentation • Meconium-stained fluid	• Central venous catheters • Arterial catheters • Congenital heart disease • Sepsis • Meningitis • Birth asphyxia • Respiratory distress syndrome • Dehydration • Congenital nephritic/nephrotic syndrome • Necrotizing enterocolitis • Polycythemia • Pulmonary hypertension • Prothrombotic disorders • Surgery • Extracorporeal membrane oxygenation • Medications (steroids)

Table 2. Risk factors implicated in the development of neonatal thromboses (7).

Right atrial and intracardiac thrombosis is most commonly diagnosed in children who have central venous lines extending into the right atrium (8). Overall, the detection rate varies with the screening methods used (e.g., increasing use of routine echocardiography) and the localization of the thrombus. Despite the high incidence, evidence-based treatment algorithms for thrombosis in neonates are still lacking. Currently available guidelines were published in 2012 (6) and provide recommendations for the management of thrombosis in the pediatric and neonatal population.

Our patient had more than one risk factor as possible cause for thrombus formation: although there was no regular surveillance of the mother's blood glucose levels during pregnancy or thereafter, diabetic fetopathy was highly likely based on postnatal clinical findings of the newborn. Additionally, urgently performed Cesarean section due to fetal distress, respiratory distress syndrome and sepsis in the newborn, leading to disseminated intravascular coagulation, most likely caused a disturbance in the hemostatic balance and promoted the development of the intracardiac thrombus when the tip of the umbilical venous catheter was positioned in the right atrium.

Because of the size (> 2 cm) and the characteristics (mobile) of the thrombus, we decided to treat the thrombus as indicated in a recent guideline (6), fortunately with a good outcome for the patient. We

propose that the presence of certain risk factors as listed in Table 1 should trigger non-invasive imaging in order to identify thrombi and initiate appropriate therapy.

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