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TECHNICAL NOTE / *Pediatric imaging*

Whole body perinatal postmortem CT angiography

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Case report

We report a case of whole body postmortem CT angiography performed by umbilical vein catheterization with visual and ultrasound guidance in a 37-week-old fetus following in utero fetal death.

Ultrasound and unenhanced CT scan are systematically performed as part of an institutional research protocol after receiving approval from the parents. A multidisciplinary perinatal pathology team then decided to perform postmortem CT angiography because of the possible vascular causes of this late in utero fetal death. An umbilical vein approach was performed by the fetal pathologist and the radiologist (Fig. 1a), using the usual peripheral venous catheter (ProtectIV® Plus Safety I.V. Catheter, 22 Gauge, Smith Medical International Ltd, Rossendale, Lancashire, UK) under visual control with confirmation of correct distal positioning of the catheter by ultrasound. Umbilical vein catheterization is an easy and reproducible technique. After visually identifying (Fig. 1b) the two umbilical arteries (smaller, symmetric, with thicker walls, located at 3 and 9 o'clock facing the umbilical cord) and the umbilical vein (solitary, larger, located between 9 and 3 o'clock), the

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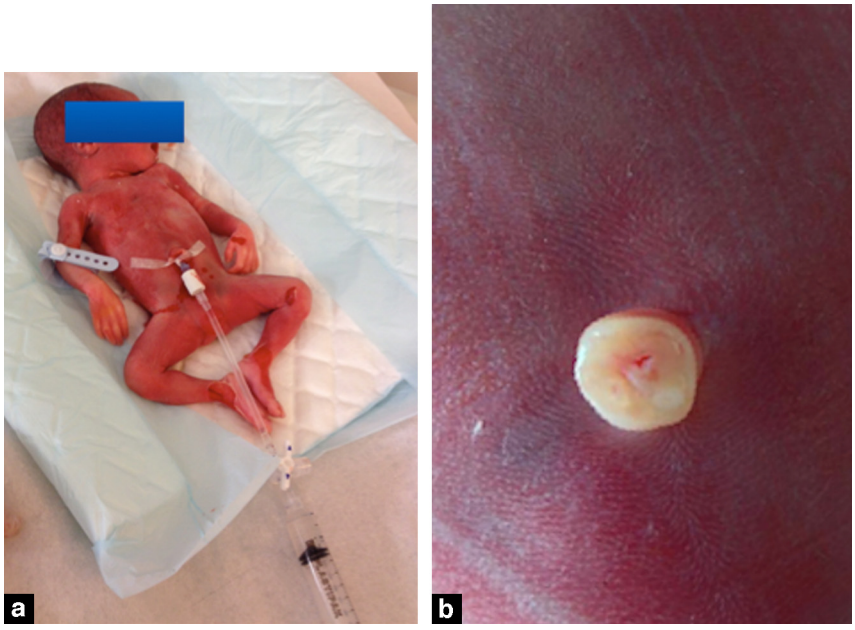

Figure 1. a: overview of the fetus installed on the CT scan, umbilical vein catheter attached, tube and syringe in place ready for injection; b: external macroscopic view of the base of the umbilical cord.

catheter was carefully inserted, without an insertion needle, then securely attached with non-specific material such as Steristrips. CT acquisitions were eventually obtained 15 hours after fetal expulsion with a multidetector dual source 64-slice CT scan (Siemens Definition, Siemens Medical System, Erlangen, Germany). A test injection of water was performed to confirm that there was no perivascular diffusion. Because there are no published data on this undescribed technique, and based on our experience with postmortem CT angiography performed in adults, a mixture of 30% water and water soluble iodated contrast medium (Iobitridol 300 mg/L, Xenetix, laboratoires Guerbet, Villepinte, France) for a total of 180 mL was manually injected with a syringe attached to a short tube, volume corresponding to the estimated volemia of the body using the formula 60 mL/kg [1]. During injection, two complete procubitus/decubitus rotations of the fetal body were performed along the long axis to prevent sedimentation artefacts from the contrast medium. The «whole body» acquisition started immediately after injection-rotation was complete (i.e. 20 s after the beginning of the injection), with the body in the supine position. Imaging parameters included: 100 kV; 250 mAs; collimation 64 × 0.6, rotation time: 0.5 s. Image reconstruction was obtained with 1.25 mm slices with mediastinal, parenchymal and bone windows.

No abnormalities were visible in the initial unenhanced series, in particular there were no signs of intracranial bleeding, or bone disorders.

The contrast enhanced series showed:

- aneurysmal ductus arteriosus with a filling defect suggesting partial thrombosis (Fig. 2a);
- two subcapsular liver hematomas (Fig. 2b);
- no other hemorrhagic, thrombotic or malformative vascular anomalies (Fig. 2c).

All of the CT scan abnormalities therefore suggested that death was due to thrombosis from an aneurysm caused by a ductus arteriosus malformation with secondary fetal distress resulting in subcapsular liver hematomas. The results of conventional autopsy performed following CT scan confirmed these results (Fig. 2d and e); no additional anomalies were found that had not been diagnosed by imaging.

Discussion

Fetopathology plays a central role in public health. Indeed, it involves determining the causes of perinatal death (in utero fetal deaths), understanding the reasons for spontaneous abortions and in the case of medical abortions, improving medical counseling to couples for future pregnancies, as well as evaluating the increasingly frequent practice of prenatal screening and diagnosis (both by imaging and molecular genetics).

Quantitative and qualitative data were provided by the 2012 national isurvey of the SOFFOET [2]. Quantitative results showed that each year 2675 autopsies are performed following therapeutic abortions (TA), 3050 autopsies following in utero fetal deaths (IUFD), 3622 following spontaneous abortions in the first trimester (SAFT) and 385 neonatal autopsies; for a total of 9732 acts, as well as 18,600 placental examinations. Qualitative results showed that (TA) included: genetic disorders (12.5%) polymalformative syndromes (15.2%), cardiac malformations (8.7%), renal disorders (8.7%), cerebral anomalies (23.8%) and fetomaternal disorders (28%).

Moreover, the population pyramid of practitioners in fetopathology shows that 40% will be retired in 10 years and 80% of them do not expect replacement. This situation, which can be found in many countries worldwide, has resulted in the development of «less invasive» autopsy protocols combining external examination, imaging, organ samples and/or targeted biopsies.