ULTRASOUND DIAGNOSTICS OF CATHETER-ASSOCIATED THROMBOSIS IN CHILDREN WITH ONCOHEMATOLOGICAL DISEASES

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BACKGROUND

Central venous catheters (CVC) are commonly use in cancer patients for chemotherapy, antibiotic administration, repeated blood sampling. The presence of long-term CVC is the most important risk factor for deep vein thrombosis in children. Catheter-associated thrombosis (CAT) are asymptomatic in most cases, but they may lead to loss of catheter function, catheter-related infection and, rarely, to pulmonary embolism. Unfortunately, screening for CAT in pediatric studies was not systematic and real incidence and optimal diagnostic strategy are still unclear.

Aim of the study - to determine the incidence and ultrasound characteristics of CAT in children with oncohematological diseases.

MATERIAL AND METHODS

Doppler ultrasonography (US) of internal jugular, cubclavian and proximal parts of brachiocephalic veins with high frequency linear transducers (7-18 MHz) were performed in 568 children with oncohematological diseases aged from 2 months to 17 years. Ultrasound studies were performed routinely in all patients before CVC insertion, urgently at occurrence of edema, erythema, tenderness around the catheter exit site, fever and catheter dysfunction and systematically at surveillance of previously identified thrombus.

RESULTS AND DISCUSSION

CAT and its consequences were detected in 182 (32%) patients. Depending on ultrasound and hemodynamic characteristics we have divided them into 2 types: I type – hemodynamically significant thrombi with complete or partial occlusion of the vein lumen, and their consequences – recanalization of the thrombus or obliteration of the vein lumen; II type – hemodynamically insignificant thrombotic overlay («fibrin sheath») around the intravascular portion of the catheter, on the tip of the CVC, or on the vein wall adjacent to the catheter. In some children both type I and type II CAT were found in different veins.

Type I CAT have been identified in 54 (9%) patients. Occlusive venous thrombosis on US could be distinguished by direct visualization of the thrombus, noncompressibility of the vessel, absence of filling of the vein and disappearance of respiratory variations of the flow (Fig.1). Partial vein thrombosis characterized by direct visualization of the thrombus and vascular filling defect with residual flow in the vein (Fig.2). Post-occlusive changes were: small-caliber veins with thickened irregular walls (recanalization) or lack of visualization of the vessel in the typical place (obliteration) with venous collaterals.

Type II CAT have been identified in 151 (26%) patients. Catheter-related «fibrin sheaths» have been visualized on US as a thin irregular echogenic layer around the CVC (Fig.3) or movable echogenic fiber at the tip of the CVC. Catheter-related thrombotic echogenic or hyperechogenic overlay on the vein wall without obstructing of blood flow (residual thrombi) located mainly at the junction of internal jugular and cubclavian veins and at the proximal parts of brachiocephalic veins. In some patients «fibrin sheaths» attached to the vein wall have been visualized at the vein lumen after CVC removal (Fig.4).

Acute occlusive or partial venous thrombosis was managed with anticoagulant therapy for at least three month and CVC removal if it non-functional, malpositioned or not needed. «Fibrin sheaths» at the CVC and vein walls was managed with trombolytic infusion through the line (urokinase) if catheter non-functional, CVC removal if it non-functional, malpositioned or not needed, and without of anticoagulant therapy.

CONCLUSIONS

In our study Doppler ultrasonography allowed to identify catheter-associated thrombosis in a one third of children with oncohematological diseases and allowed to make a differential diagnosis between acute occlusive venous thrombosis and «fibrin sheath» at the CVC or vein walls with different treatment strategy.

Fig.1. Acute occlusive catheter-related thrombosis of the internal jugular vein (A – transverse US scan, B – longitudinal US scan).

Fig.2. Partial catheter-related thrombosis of the internal jugular vein (longitudinal US scan).

Fig.3. «Fibrin sheath» at the CVC in the proximal part of brachiocephalic vein.

Fig.4. Calcified «fibrin sheath» in the internal jugular vein after CVC removal (A – longitudinal US scan, B – transverse US scan).