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*Ultrasound images of thrombosis of caval vein inferior  
– three selected cases*

Thrombosis of caval vein inferior can be caused by numerous factors or it may occur as a complication of certain diseases (6,10,11). Among the best known factors causing thrombosis are the following: cirrhosis of the liver, nephrosis, cardiological surgery, parenteral nutrition, persistent thrombus in deep thrombosis of pelvis veins, inflammatory processes, presence of vascular catheters, fibrinolysis disturbance, traumatic thrombus, neoplastic diseases. Moreover, chronic idiopathic thrombus of the caval vein inferior is also mentioned (12). Because of multiplicity of these causes, clinical symptoms also vary, which makes the diagnosis difficult and delays appropriate therapeutic treatment. Application of ultrasonographic studies in the caval vein inferior thrombosis, allows early diagnosis and application of therapeutic treatment as early as possible. Thanks to ultrasonographic examinations in B presentation and in the Color Doppler and the Power Doppler options, it is possible to evaluate the width of the caval vein inferior, the speed and energy of flow, as well as identify the narrowing or occlusion of the vessel. In spite of these specific symptoms of the thrombosis of the vena cava inferior. ultrasonographic evaluation of the caval vein inferior may be frequently difficult, especially in children. In this paper we present three interesting cases of caval vein inferior thrombosis in children.

C a s e 1

A 14-month-old girl was admitted to the Surgery Clinic on account of the hydrocephalus, lumbar myelomeningocele, and deformity of legs. The girl underwent surgical procedure of hydrocephalus and valve implantation of the right ventricle in the right parietal area. A catheter was also introduced into the caval vein inferior. After several days, the condition of the girl worsened. Her temperature increased, and a pain occurred on pressure of the abdomen. In an ultrasonographic examination, hepatomegaly was found; the kidneys were also enlarged and had higher echostructure (Fig. 1a). The Power Doppler and the Color Doppler did not show flow in the caval vein inferior or in the right renal

vein. Thrombosis of both vessels was found, which caused changes in the size and echostructure of the liver and kidneys (Fig.1b). The catheter was removed from the caval vein inferior, a central insertion was applied. Control ultrasonographic examination done two days after antithrombotic treatment showed partial recanalization of the caval vein inferior whose width was 4 mm (Fig.1c). In the next control examination after two weeks restoration of patency of the caval vein inferior was found, of a width of 12 mm, and the renal vein dexter of a width of 5 mm.



Fig. 1a. Case 1. An ultrasound examination. The right kidney was enlarged and had higher echostructure. The Power Doppler and Color Doppler did not show flow in the renal vein



Fig.1 b. Case 1. An ultrasound examination showed thrombus in the lumen of the caval vein inferior



Fig.1 c. Case 1. An ultrasound examination showed partial recanalization of the caval vein inferior whose width was 4 mm

## Case 2

A 15-month-old girl was admitted to the Department of Intensive Therapy on account of thermal burn. The size of burn was about 70% of the body area and comprised the chest, back, buttocks, crotch and legs. The child was in a very bad general condition on controlled respiration, without contact, and weakly reacting to pain stimuli. On admission to the DIT, she had catheters introduced to the caval vein inferior via thigh veins. On the third day the temperature increased to 40°C, and an oedema of the face and legs occurred. An ultrasonographic examination, the caval vein inferior was visualized, with a visible thrombus in the caval vein inferior closing vascular lumen (Fig. 2a). In the Doppler option examination, no flow in this vessel was found. Thromboses were also visible in both renal veins near ostiums to the caval vein inferior (Fig. 2b). Vessel catheters were removed and a central insertion was applied. In spite of medical treatment the clinical symptoms maintained for 14 days. Control ultrasonographic examinations showed progressive recanalization of the caval inferior and renal veins. Two months after the outset of treatment, an ultrasonographic examination showed restoration of patency of caval vein inferior which had 13 mm of width and non-obiterated renal veins.



Fig. 2 a. Case 2. An ultrasound examination showed the caval vein inferior with trombus. In the Doppler option no flow in this vessel



Fig. 2 b. Case 2. An ultrasound examination. Thromboses in the right renal vein

### Case 3

A 15-year-old girl was admitted to the Surgery Clinic on account of ascites of unknown etiology. The girl had a cyclic pain of abdomen and during last three days a circumference of her abdomen distinctly increased. During this time, the girl did not have high temperature, nor did she report any other symptoms. An ultrasonographic examination showed heterogeneous hepatomegaly, especially in the tail lobe of the liver. The liver veins were narrow and almost invisible. The caval vein inferior lumen was narrow and pressured at the level of the tail lobe.

Moreover, increased mesentery nodes were visible, although the changes in the small and large intestine were not observed. In the control ultrasonographic examination, progressive decrease in the width of the liver vein with still existing flow in the caval vein inferior was found, while the flow in the caval vein was preserved. In the next examination done after 12 days clinical symptoms of a thrombus of caval vein inferior appeared. On the basis of clinical symptoms and results of diagnostic investigations, malignant processes, bacterial or tuberculous inflammation, of peritoneum and cirrhosis were excluded, while liver hyperaemia which was found in the histopathological examination allowed us to suggest the presence of the Budd-Chiari syndrome. Next, the existence of such syndrome was confirmed by the angiographic and Doppler examinations of the liver.

## RESULTS AND DISCUSSION

In the presented cases a thrombosis of the caval vein inferior occurs as a complication in various diseases. The thrombosis of the caval vein inferior in children accompanied extensive burn, the Budd-Chiari syndrome and prolonged presence of catheters in vessels. All these causes can also lead to the development of thrombosis in older patients (2,3,8). It is worth mentioning here that in two children catheters were applied to the caval vein inferior, and those were removed after the appearance of symptoms of thrombosis. In adult patients, a thrombosis of the caval vein inferior occurring as a complication of a catheterization is rarely described in the literature (5, 12). In children, non-specific clinical symptoms can make the diagnosis of thrombosis caval vein inferior more difficult. Pain of hypogastrum, dorsum and legs, oedema, and general weakness, described as the IVC syndrome in children are recognised with greater difficulty than in adults ( 8, 9 ). This results first of all from the young age of the patients, which is the cause of difficulties in specifying exact anamnesis as well as from accumulation of symptoms of the pivotal disease. These ultrasonographic examinations in the diagnosis of the caval vein inferior in children are very important.

In all the presented cases, the use of ultrasound in B presentation, Color Doppler and Power Doppler has enabled early diagnosis of the thrombosis of the caval vein inferior. According to Talbot, ultrasonographic criteria of the caval vein inferior thrombosis are the following: loss of elasticity of the occluded section of the vein, presence of propagated thrombus, lack of vein dilatation during the Valsalva test, expansion of vein with a blood clot, pathological flow or its lack in Doppler ultrasonography. Despite these specific symptoms of the thrombosis of the caval vein inferior, ultrasonographic evaluation in children may be difficult. The lack of cooperation with the examiner, great motility of children, tenderness of the abdomen on deep palpation, cause that the use of the Doppler option is limited. Yet even ultrasound evaluation in B presentation has an important diagnostic value. In Case 3 discussed in the present paper, hepatomegaly and pressures of the tail lobe on the caval vein inferior was observed as a result of difficulties in the blood flow through liver veins. It was found in an ultrasound examination in B presentation (13). The pressure caused a decrease in the vessel flow, which worsened the hemodynamic conditions and led to the thrombosis of the caval vein inferior. In two other cases, the thrombus of the renal veins accompanying the thrombosis of the caval vein inferior induced changes in the size and echostructure of kidneys, which was found in B presentation of ultrasound. Obviously, the best diagnostic method in diagnosing the thrombosis of the caval vein inferior is the use of the Doppler option. It enables one to detect the caval vein inferior thrombosis (4). In the thrombosis of the caval vein inferior, the thrombus mass is highly echogenic and it indents into the lumen of the vessel. The newly formed thrombus has lower echogenicity than the older one. In the peripheral part relative to the thrombus, the caval vein inferior is dilated, and in the afferent part, the vascular lumen is narrowed. In all the presented cases, ultrasound studies enabled

direct imaging of the presence of a thrombus in the caval vein inferior. Ultrasound control examinations also had significant diagnostic value. They enabled the evaluation of the effects of the treatment and recanalization of the vessel. The time of regression of thrombosis in the cases under discussion ranged between 2 and 16 weeks.

Pharmacological treatment included intravessel administration of anticoagulant drugs (Syncumar, Plazinogen, Heparin). In no case presented here was there any need for angioplastics or intrahepatic collateral anastomosis surgery –TIPS (1, 14). The results of application of Doppler ultrasound examinations in the cases under discussion have confirmed the diagnostic usefulness of this technique in detecting thrombosis of the caval vein inferior in children. Worth noticing is the usefulness of B presentation to the confirmation of a suspicion of the caval vein inferior thrombosis in children. Ultrasonographic examinations in children in the cases of possible occurrence of the caval vein inferior thrombosis also have special importance because of their accessibility and non-invasive nature.

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## SUMMARY

Thrombosis of vena cava inferior can occur as complication of numerous diseases. Because of a variety of causes, the clinical signs accompanying thrombosis are often ambiguous, which is the cause of delay in initiation of appropriate treatment

This article presents three interesting cases of thrombosis of vena cava inferior in children accompanying extensive burn, the Budd-Chiari syndrome, and prolonged presence of catheters in vessels. The use of ultrasound in B presentation, Color Doppler and Power Doppler has enabled early diagnosis and application of appropriate treatment.

## Zakrzepica żyły głównej dolnej w obrazie USG – trzy wybrane przypadki

Zakrzepica żyły głównej dolnej może występować jako powikłanie wielu różnych schorzeń. Ze względu na różnorodność przyczyn objawy kliniczne są często niejednoznaczne, co powoduje opóźnienie właściwego postępowania terapeutycznego. W niniejszej pracy przedstawiamy trzy ciekawe przypadki wystąpienia zakrzepicy żyły głównej dolnej u dzieci, towarzyszące rozległemu oparzeniu, zespołowi Budd-Chiari oraz długotrwałej obecności cewników naczyniowych. Zastosowanie we wszystkich tych przypadkach badań ultrasonograficznych w prezentacji B oraz przy użyciu opcji Color Doppler i Power Doppler umożliwiło wczesne rozpoznanie i wdrożenie odpowiedniego leczenia.

