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THE IMPORTANCE OF RADIATION DIAGNOSTIC METHODS IN PROVIDING VENOUS ACCESS

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Abstract:

It is difficult to imagine modern medicine without high-tech equipment. It makes quick and accurate not only the diagnosis of most diseases, but also ensures the safe and low-traumatic performance of many manipulations. The downside is that doctors lose some skills, but the benefits from the development of technology are disproportionately greater. This article discusses the role of diagnostic equipment (ultrasound, CT) in the most important area - providing venous access necessary for the treatment of children with cancer

Keywords: ultrasound, pediatric oncology, catheterization, venous access, radiography.

INTRODUCTION

The role of venous access in the treatment of oncological diseases is difficult to overestimate. It is this “trifle” that can not only lead to serious complications and affect the prognosis of the disease, but also significantly increase its cost, causing significant damage to the already small healthcare budget [1].

MATERIALS AND METHODS

In previous issues of the journal, we examined in detail the role of venous access in the treatment of children with cancer, the history of its development and the technique of its creation. Continuing the topic started earlier, we propose to consider the place and important role of X-ray and ultrasound equipment during operations for catheterization of the subclavian vein (SV) and implantation of venous port systems, without which the raised problem would have a much more complex solution.

RESULTS AND DISCUSSION

Visualization of peripheral veins

Although the peripheral catheter is not intended for chemotherapy and long-term infusions, its use at a certain stage is inevitable: this includes MSCT and MRI in young children, since such and other diagnostic procedures require

8 injections require general anesthesia. Even anesthesia for port system implantation requires access to the peripheral venous system. Often in children with cancer, puncture of a peripheral vein is accompanied by a long search and unsuccessful attempts [2], which is painful and causes severe psychological trauma. At the same time, it is not always possible to catheterize the veins of the upper extremities, which causes even greater discomfort. Abroad, to facilitate the search for saphenous veins, special devices have been developed based on the use of ultrasonic and light waves in the red and infrared range. Thus, illuminating the puncture site with red light using a compact device improves the contrast of the saphenous veins (Fig. 1), and their observation through a special optical converter in the infrared light range makes it possible to clearly identify and puncture peripheral vessels.

Fig 1. Visualization of the saphenous veins of the hand with red light

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Visualization of the main veins using ultrasound
The most common imaging method is vascular ultrasound. Its advantages are the absence of radiation exposure to the patient, non-invasiveness, accessibility, safety and the ability to obtain information in a short period of time. The undeniable advantage of ultrasound devices is their mobility, which makes it possible to use them in the operating room or in the intensive care unit.
Ultrasound is used to assess the course, diameter, condition of the walls and lumen of blood vessels, their anatomical location relative to each other, the depth of localization from the surface of the skin, the condition of adjacent muscles, lymphatic collector and bones.
Normally, the skin in an ultrasound image appears as a homogeneous, echogenic strip with a thickness of 2 to 6 mm. Subcutaneous fatty tissue is variable in thickness and appears as a layer of moderate echogenicity with a mesh structure of fibrous stroma. Subcutaneous vessels are not normally visualized. Thin (1–2 mm) echogenic superficial fascia follows the contour of the muscle layer, from which it is separated by a layer of subfascial fat. In the muscle layer, individual muscles are clearly differentiated, having reduced echogenicity and a characteristic structure (pinnate in the longitudinal section and honeycomb-shaped in the cross section). Muscle fat layers are characterized by increased echogenicity when compared with muscle tissue. Using the ultrasound method, it is possible to visualize soft tissue edema, the acoustic picture of which looks like an area of local reduced echogenicity of soft tissues with uneven, unclear contours and slightly pronounced narrow fluid layers between muscle fibers and fat lobules. A soft tissue hematoma is visualized as a mono- or polycyclic formation with clear or unclear even contours, hypoechoic inhomogeneous, cellular structure. The abscess is visualized as a formation with fuzzy, uneven contours, irregular shape, heterogeneous in structure, low echogenicity with the presence of anechoic zones and hyperechoic inclusions, giving/not giving an acoustic shadow, around which an echo-dense ridge is defined.
As we have already written in previous issues, for cavacatheterization the optimal access is through the internal jugular vein (IV), although puncture of the PV or external jugular vein is possible. In this case, static and dynamic ultrasound techniques are used to study the vascular bed. The static technique consists of examining the veins of the extracranial and periclavicular region with visualization of the area of interest and applying preliminary markings to the skin before cavacatheterization (it is important to take into account the patient's position during further catheterization, since changing the position of the upper limb and body leads to displacement of the skin and, accordingly, marking places).
The above data illustrate the need to use the most reliable method to control the location of the catheter in the venous bed. It can be determined in three main ways: under visual control during fluoroscopy, by recording an endocardial electrocardiogram (ECG), or using external anatomical landmarks. In the latter case, the distance from the site of vein puncture to the intersection of the right edge of the sternum with the third rib is preliminarily measured to determine the required length of the catheter, which indicates the low reliability of this option and the conditionality of control [2]. Currently this method is not used.
The intracardiac (endocardial) ECG was first recorded in 1945 by Lenegre et al. [3]. Subsequently, its certain diagnostic value was shown, which was explained by the impossibility of performing intraoperative fluoroscopy at that time [3]. In children, the use of ECG monitoring is limited, since during anesthesia, anesthetics can have an ambiguous effect on the conduction system of the heart and cause various rhythm disturbances that make it difficult to determine the amplitude of the P wave [4]. This method is not widely used due to the lack of clearly established electrocardiographic criteria for catheter position [2].

CONCLUSION

Thus, our results show that any clinic treating children with cancer requires the following modern equipment: ultrasound and X-ray machines, electron-optical converters, MSCT, MRI, as well as specialists with the appropriate qualified for its use. Moreover, modern equipment is necessary not only for diagnosis and treatment, but also for creating venous access.

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