

DIAGNOSTIC ULTRASOUND IN SURGERY CLINICS

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The author presents a short survey of ultrasonic applications in diagnosis of various heart diseases, peripheral blood vessel disorders and abdominal pathologies before the operation and intraoperatively and in the treatment of various kinds of disorders. In the author's opinion ultrasound renders nowadays a great help to the surgeon and will become even more useful in the coming years.

The second half of the 20th century and especially the last 20 years have witnessed the coming of the ultrasound era in medicine. With each passing year ultrasound has been used more widely as a diagnostic tool and as a physical agent for treatment of various pathologic conditions.

The present paper deals with ultrasound usage experience which has been acquired within 10 years in the USSR, in National Research Center of Surgery (USSR Academy of Medical Science, Moscow). We have used ultrasound in diagnosis of various heart diseases, peripheral blood vessel disorders and abdominal organ pathology (Table 1). All the cases presented were treated surgically.

Table 1. The use of diagnostic ultrasound

Organs examined	Number of patients	Number of examinations
Heart	5211	14852
Peripheral vessels	2298	6894
Abdominal organs	4166	4704
Total number	11675	26450

Table 2. Echocardiography

Echocardiography techniques	Number of examinations
Onedimensional echocardiography	7956
Twodimensional echocardiography	5014
Doppler echocardiography	1720
Contrast echocardiography	162
Total number	14852

The fact that most of our cases were diagnosed before the surgery made it possible to establish critically the diagnostic value of ultrasound.

Echocardiography is used diagnostically when dealing with heart troubles. Table 2 shows four basic techniques of echocardiography applied in our Center.

The techniques listed in Table 2 were used according to the diagnostic information needed. One dimensional echocardiography is a well established mode for the detection of the prolapsed mitral valve, atrial tumours (myxoma), complete atrioventricular canal, tetralogy of Fallot and hypertrophic subaortic stenosis which had been diagnosed earlier only in autopsy.

Twodimensional echocardiography is in many cases a supplement to the one-dimensional ultrasound technique. It enables one to get a better spatial location of various components inside the heart and makes it possible to determine the type and degree of mitral and aortic orifice stenosis, the degree of insufficiency of these two valves and their mobility. Bacterial endocarditis vegetations are usually very well seen on the twodimensional echocardiograms of the mitral and aortic valves.

Doppler echocardiography is rather a good technique for detecting intracardiac turbulent blood flows — the phenomenon which is always present in such heart pathology as various septal defects, valve incompetence and aortic and pulmonic valve stenosis. Doppler ultrasound makes the diagnosis of these heart abnormalities more precise and more reliable.

The contrast echocardiography makes it possible to visualise the intracardiac blood flows, to detect and measure various intracardiac shunts and blood flow direction and to diagnose the heart valve insufficiency. It helps to verify the dubious structures inside the heart chambers.

Table 3. Doppler echoangiography

Doppler techniques	Number of examinations
Ultrasound pulse detection	5619
Blood vessels scanning and echoflowmetry	1275
Total number	6894

Table 4. Ultrasound scanning of abdominal cavity organs

Techniques of scanning	Number of examinations
Manual scanning	4086
Computerised automatic scanning	618
Total number	4704

The systemic approach to these echocardiographic techniques is a valuable source of information for heart surgeons. They usually find it useful while determining the nature of heart pathology and how risky the operation could be. This significantly lessens the number of invasive diagnostic techniques performed.

Peripheral blood vessels are investigated with the use of various Doppler ultrasound pulse detectors and Doppler flowmeters (Table 3).

Ultrasound pulse detectors are applied when determining the blood flow in regions where simple palpation does not bring satisfactory results. Those regions are the popliteal space, the region around the malleolus and the patients with hypotony and edema. The Doppler instruments give the sound and graphical information, helping to determine the direction of blood flow and its linear velocity.

Doppler twodimensional flowmeters have the ability not only to produce sound signal and blood flow characteristic curve, but make it possible to give detailed information about the blood vessel walls, their internal surface in longitudinal and cross-sectional views. Besides the linear and volume blood flow can be determined too.

The latest generation of Doppler flowmeters with colour image of the probed vessels possesses the possibility to differentiate between the arterial and venous blood flow.

Thus, nowadays the ultrasound has become a tool for "listening" to the blood flow; it permits determination of its direction and velocity, and what is very important, it gives an opportunity to visualize the blood vessel lumen and to detect various hindrances to the blood flow. The Doppler ultrasound techniques help to diagnose the pathological changes in the brachio-cephalic vessels of the aortic arch and the vessels of the upper and lower extremities. This kind of information is very important when Raynaud, Takaysu and Leriche syndromes are suspected. Its importance is also obvious when dealing with patients suffering from anterior-venous shunts and aneurysms of arteries.

In our Center the ultrasound is also extensively used for detecting pathological changes in such organs of abdominal cavity as liver, gall-bladder, pancreas and kidneys. Usually the contact manual ultrasound scanning and computerized ultrasound tomography are used for that purpose (Table 4).

With the help of these ultrasound scanning techniques we detect stones in the lumen of the gall-bladder and in the bile ducts. Besides we diagnose various abnormal volume tissue formations in the parenchymal organs of the abdominal cavity — the liver, pancreas, kidneys and some other organs. The information we get has become more precise and enabled us to reduce the number of unnecessary diagnostic operations.

Computerized ultrasound tomography gives the possibility not only of seeing the abdominal cavity organ anatomy but also of characterising the microstructure and the level of local blood circulation.

We use ultrasound not only for diagnosis before the operation but intra-operatively as well. The tiny gall stones in the bile ducts, large vessels and peripheral blood flow in kidneys, liver and other abdominal organs are also determined during the operations.

We widely use ultrasound for the treatment of various kinds of disorders.

In the Center it is common to apply the ultrasound in the following procedures:

1. cutting the ribs, sternum and various soft tissues
2. trachea, bronchi and oesophagus endoscopic surgical manipulations
3. endarterectomy
4. hemostasis during the operations
5. surgeon's hands cleaning
6. surgical tools sterilisation
7. cleansing of purulent wounds and cavities
8. phonophoresis of medicines and drugs (antibiotics, hormones etc.).

The present short survey helps to draw the conclusion that ultrasound renders a great help to the surgeons nowadays. And this kind of help will become more useful as with each passing year the ultrasound technique is modernised and so is the clinical experience.