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Errors In Tumor-Like Diseases Of The Liver And The Way Of Its Correction Using Radiation Diagnostic Methods (CT, MRI) And Their Comparison With Pathomorphological Study.

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I. Introduction.

Diagnosis of tumor diseases of the liver is a significant difficulty even when using NMR-tomography (1). Often, during tomographic studies of diseases of other organs (kidneys, pancreas, or adrenal glands), significant changes in the liver are detected (mute cysts, adenomas, fibro -nodose hyperplasia, multiple focal or focal shadows), which require.

The purpose of our research was to study the characteristics of signals when using a number of techniques (CT, MRI) in comparison with the data of morphological studies (removed biopsies, post-mortem examination of the removed liver, etc.). We used a large amount of our own material, literary sources of domestic and foreign authors.

Hemangiomas. Hemangioma is a common benign tumor that occurs in 20% of cases and is 5 times more common in women than in men. They are often multiple and rarely cause any symptoms. Histologically, these are well-defined spongy-like, blood-filled mesenchymal tumors. Most of them are cavernous hemaniomatous formations, consisting of numerous large vascular channels, separated from each other by thin fibrous septa, covered with a thin single layer of epithelium. Small areas of the tumor are thrombosed or calcified or consist of large areas of hyaline fibrosis.

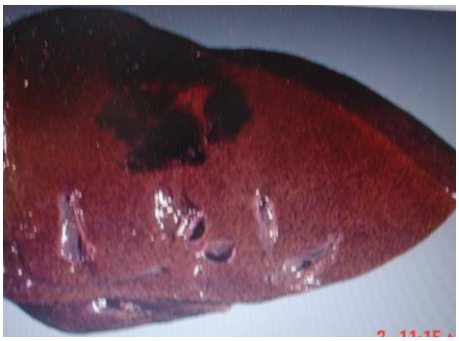


Fig. 1 Macropreparation

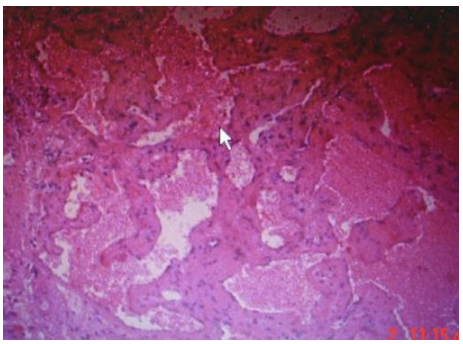


Fig. 2 Micropreparation

Hemangiomas are often localized on the surface of the liver. Small tumors are asymptomatic and are discovered accidentally during radiological procedures. Large hemangiomas cause abdominal pain, are often palpable on the edge of the liver and can cause massive bleeding. Tumors are single or multiple. The right lobe of the liver is most often affected. Tumor sizes can range from 0.5 cm to 4 cm. According to their visual appearance, hemangiomas can simulate cancer (especially with ultrasound and CT), which requires additional diagnostic studies. The most reliable method of diagnosing cavernous hemangiomas is conducting arteriography, which allows you to detect the tumor in both the arterial and venous phases of the study.

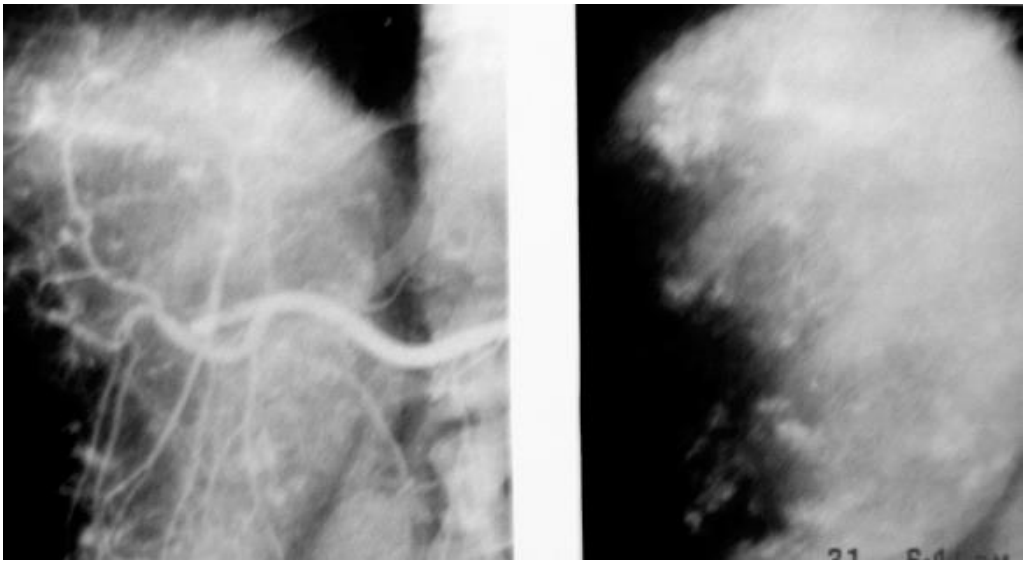


Fig. 3 and Fig. 4 Arteriograms clearly show punctate lacunae containing blood that is kept in the venous phase for a long time.

With CT without contrast, it is quite difficult to differentiate small hemangiomas from metastases.

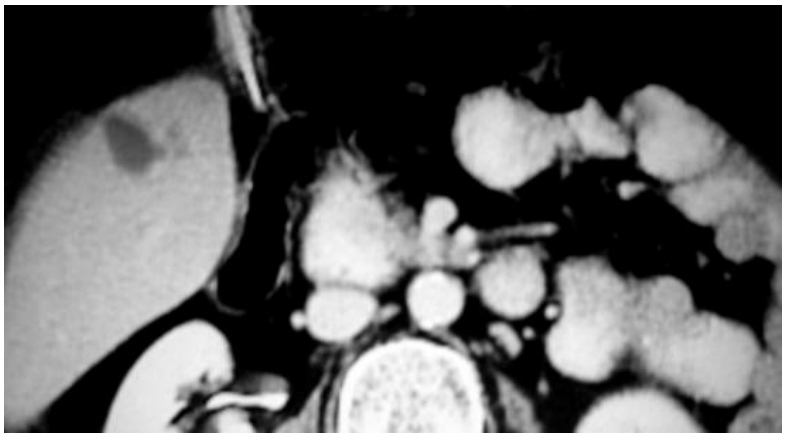


Fig. 4 CT Small hemangioma

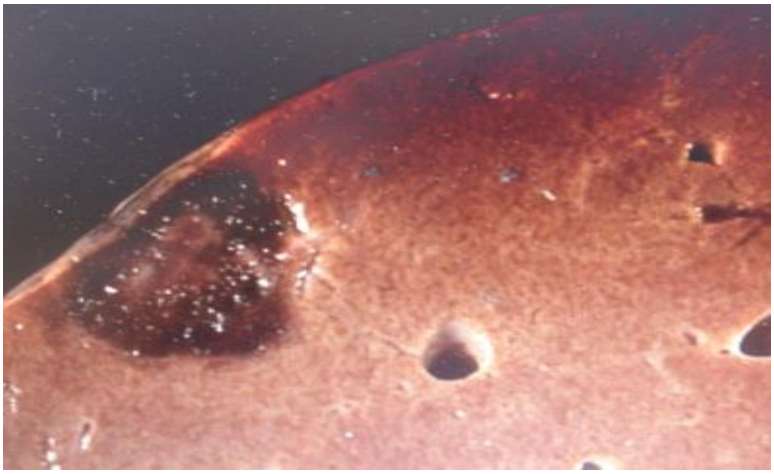


Fig. 5 Hemangioma on the surface of the liver

The contours of a large hemangioma (more than 5-6 cm) are often uneven, hilly, and the structure is heterogeneous. Densitometric indicators are reduced by 20-30 units, the average density above the tumor is about 30 units. The very typical nature of the accumulation of the contrast agent during CT. The contrast comes from

the periphery to the center. Contrast enhancement persists for a long time (up to 20-30 minutes after administration) due to the low speed of blood flow through the vascular spaces in the hemangioma.

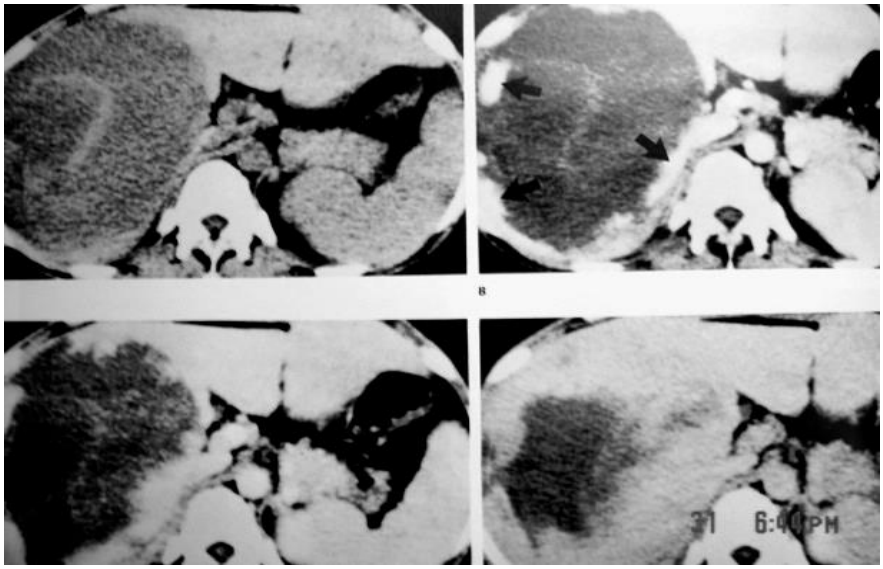
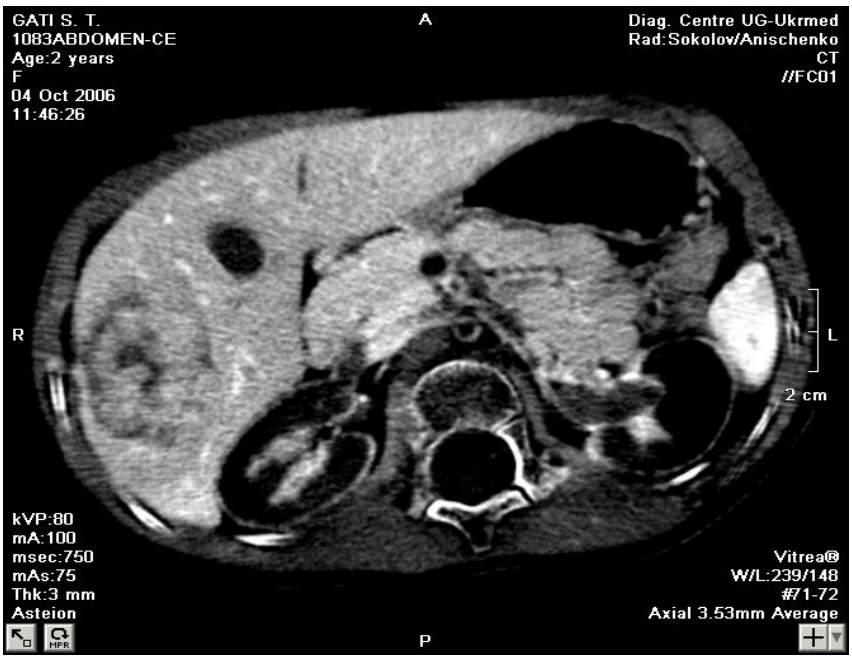


Fig. 6 CT Hypointense area in the right lobe of the liver. After 30 sec. after the introduction of diversity, an intense increase in diversity on the periphery is noted. After 1 min, the contrast moved to the center. After 4 min, contrast enhancement persists in the center of the tumor and on the periphery.



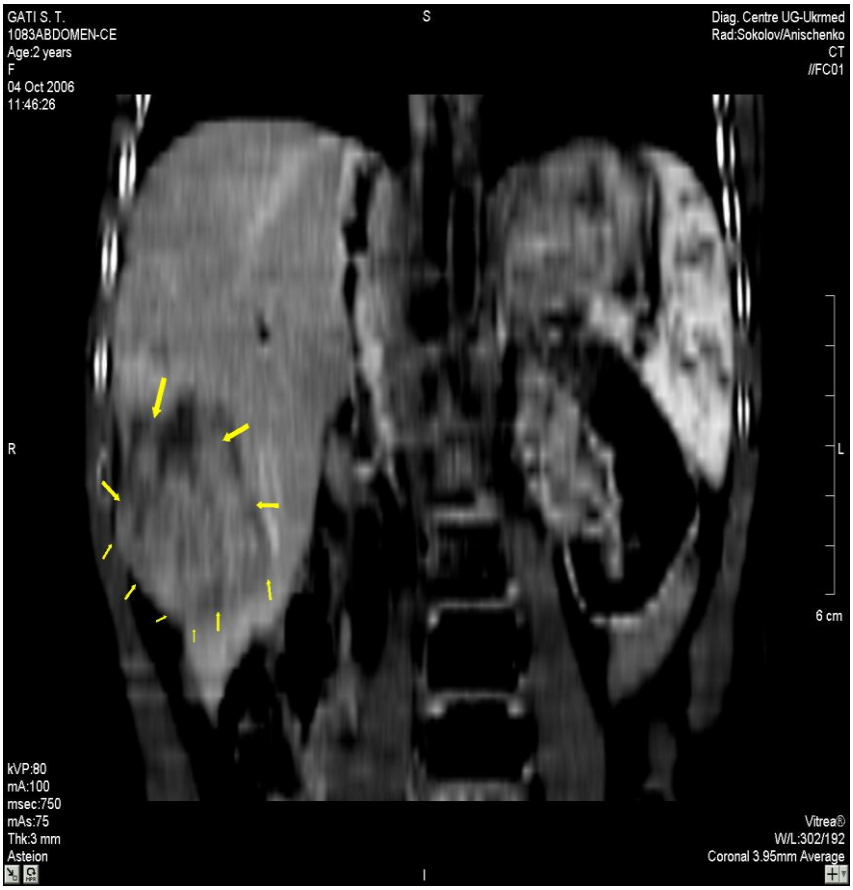
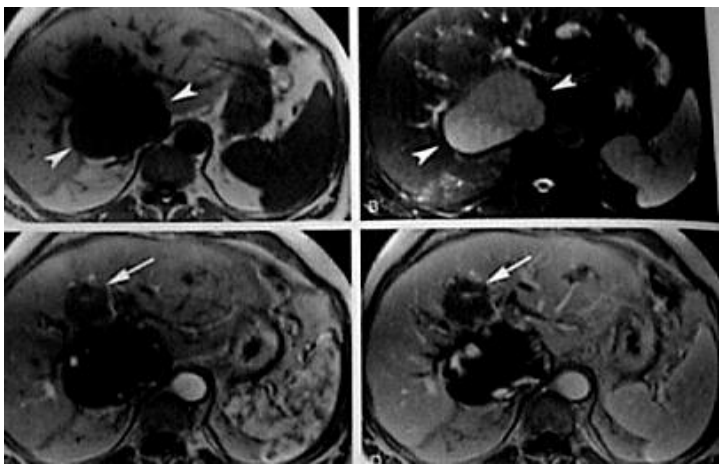


Fig. 7 Hypointense area in the left lobe of the liver

MRI allows distinguishing three types of hemangiomas, which have some specific features:

Type 1. Homogeneous intense signal to the arterial phase after the introduction of gadolinium. An isotensive or slightly hypertensive signal approaching a normal liver signal some time after contrast administration.
Type 2. Peripheral signal enhancement with the appearance of an intermittent ring in the arterial phase with rapid signal enhancement over tumor vascular formations with slight signal accumulation over hyaline-scar tissue and subsequent signal homogenization.
Type 3. Peripheral amplification of the signal with the formation of a discontinuous ring in the arterial phase. Further enhancement in the periphery with sparing enhancement in the center, no enhancement over scarring tissue, with a long contrast delay even 15 min after its introduction.



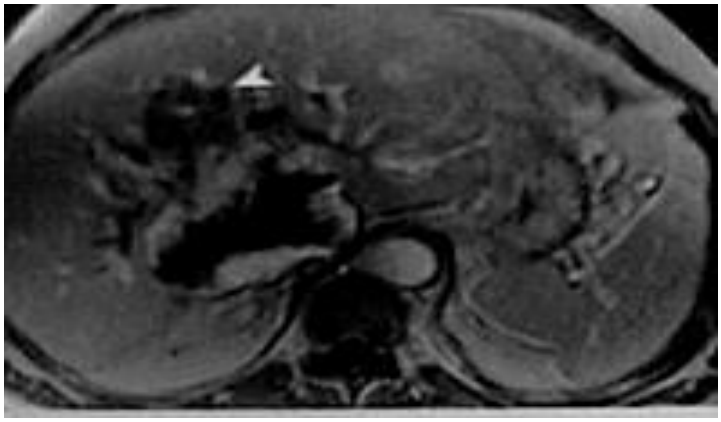


Fig. 8 MRI with hemangiomas A. Absence of signal enhancement in T1-weighted image;

B. Fibrous septa and heterogeneous intense signal are visible on T2-weighted image;
S. After the introduction of gadolinium, contrast enhancement is visible in the form of a discontinuous ring on the periphery
D. The trend of signal amplification in the venous phase.
E. Further preservation of a pronounced intense signal on the periphery of the tumor, absence of a signal in the center of the scar tissue.

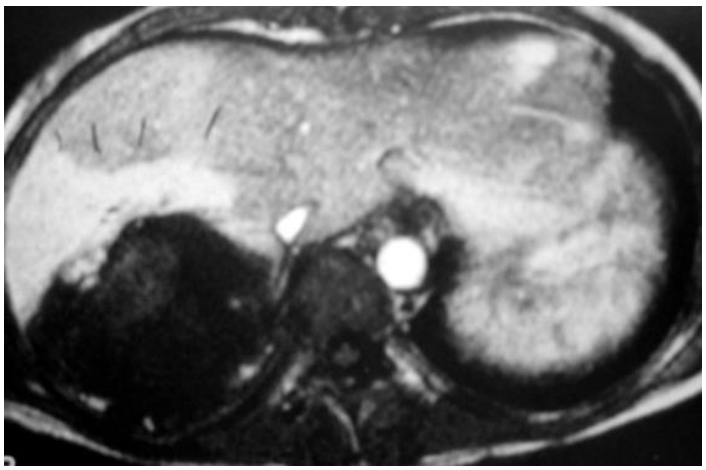


Fig. 9 MRI for hemangioma with hemorrhage. Typical signal enhancement over the wall of a large hemangioma on T1-weighted image after gadolinium injection.

When differentiating with a malignant tumor, it should be taken into account that during MRI, hemangiomas have a hypotensive signal at T1 and an intense signal at T2, and the signal is very strong at T2 even 15 minutes after contrast. Cancerous tumors are characterized by the following signs: pronounced heterogeneity of the internal structure due to the formation of pairs in the center of scar tissue; malignant tumors do not have a clear outline, they can be surrounded by parenchyma, changed due to swelling or sprouting of liver tissue; hemangiomas rarely contain scar tissue that differs from scar tissue tissue contained in tumors: it is, as a rule, smaller in size and has high values of T2 time due to the increased water content, which is not characteristic of a tumor. On MRI with contrast enhancement, the hemangioma is maximally contrasted in the late parenchymal phase in the form of separate inclusions and areas of high contrast, going from the periphery to the center, which is characteristic only for hemangiomas.

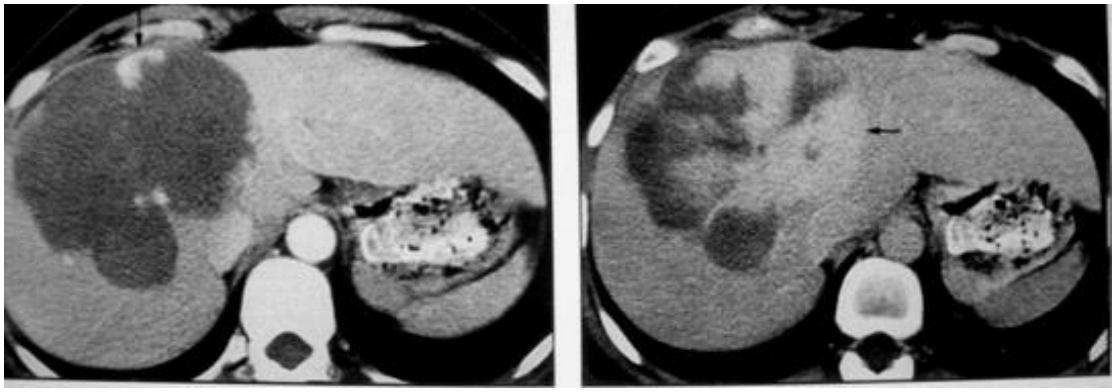


Fig. 10 A clear accumulation of contrast is visible in the form of separate areas in the center of the tumor (indicated by arrows).

However, due to the small size of tumor formations, differentiation is difficult. Sometimes hemangiomas contrast very slowly, almost at the end of the study. In such cases, studies performed before contrast, in which hemangiomas appear isointense on T1-weighted images or hyperintense on T2-weighted images, help. It should be noted that in case of suspicion of hemangioma, puncture cannot be recommended due to the high risk of bleeding. Observation of the patient in dynamics and repeated studies are necessary

Fibrous nodular hyperplasia (FNH)

Fibrous nodular hyperplasia (FNH) or nodular transformation of the liver (NTP) or "regenerative liver hyperplasia" refers to a not uncommon tumor-like disease. FNGs are localized and well-defined nodular masses within a healthy liver that are well differentiated from tumors. Histologically, these are typical complexes of pseudospherical hepatocytes and ductal, radially diverging, fibrous strands that create fibrous webs or septa in the center. Fibrous septa extending to the center consist of vascular tubules, bile ducts, and inflammatory cells.

Two types of PNH have been described: the telangiectatic type, which contains dilated vessels; solid type, which is characterized by central fibrosis and a blood-containing area in the center of the damage.

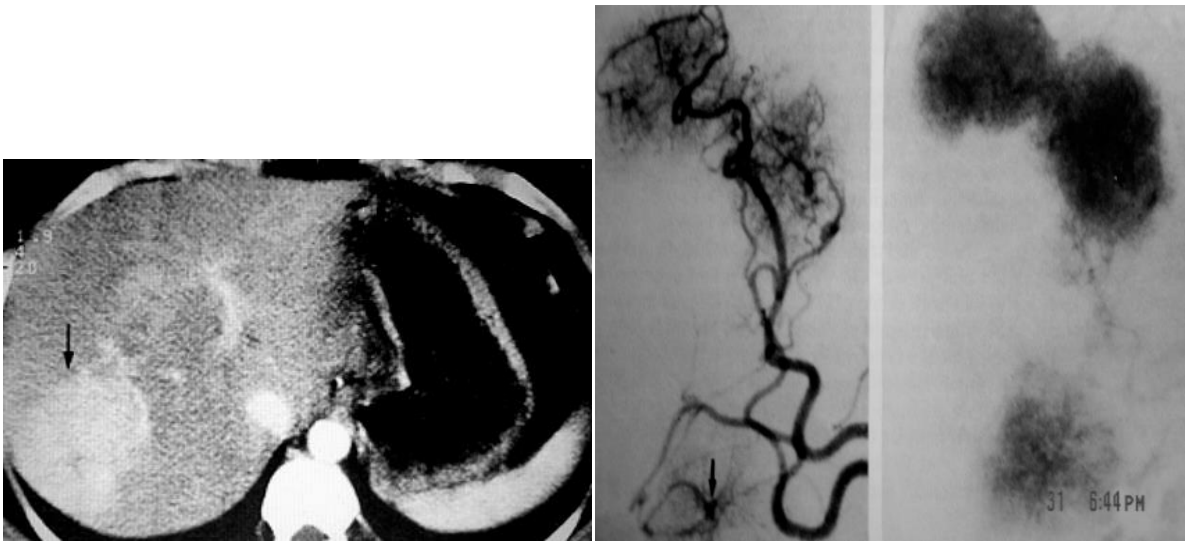


Fig. 11 CT Contrast for the arterial phase.

Fig. 12 (A). In the arterial phase, several hypervascular masses (indicated by an arrow) with radially located vessels are visible.

(IN). Several vascular glomeruli are identified in the venous phase.

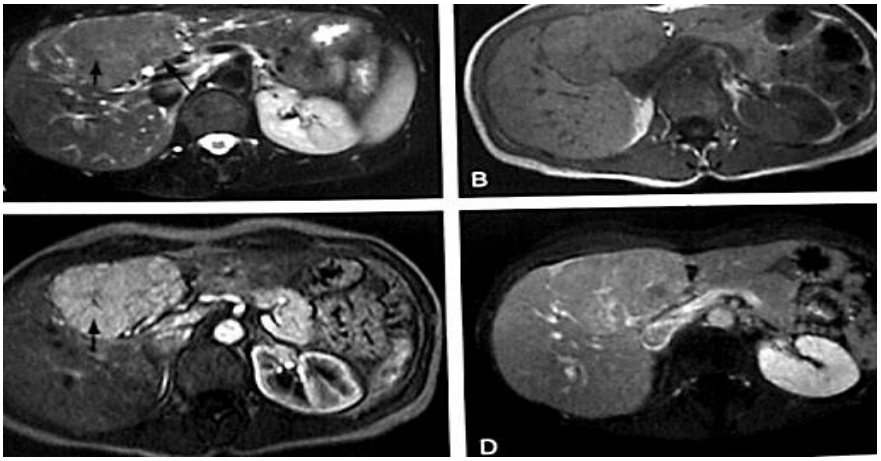


Fig. 13 MRI (A) In T2 - the image with arrows indicates damage to the liver with a moderately isotensive signal in the center;

(IN). In the T1 image, the signal is low over the lesion;
(WITH). In the arterial phase, a very intense signal over the injury is determined;
(D). In the next phase, the damage becomes isotensive over the liver with a slight increase in the signal over the central beam.

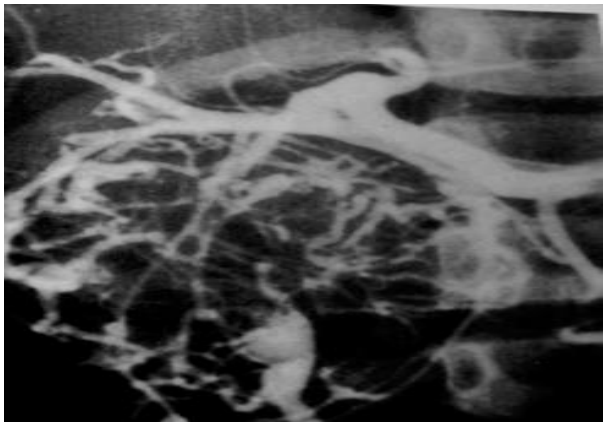


Fig. 14 Arteriogram shows a hypervascular mass

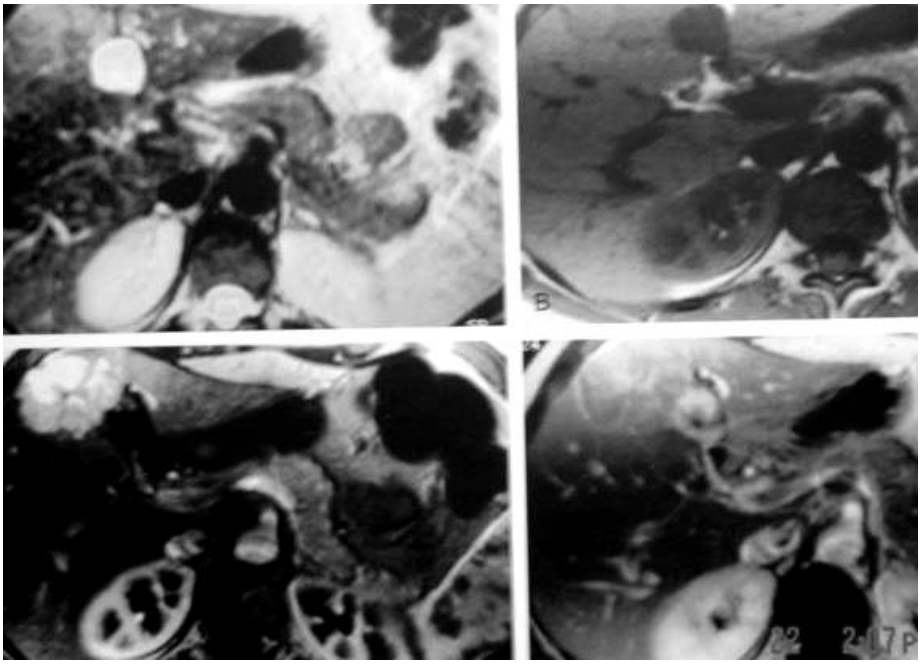


Fig. 15 MRI of fibronodular hyperplasia together with hemangioma of the liver located next to the lesion

AND). In the T2-weighted image, an isointense signal over the PNH and a high signal over the hemangioma is determined. (B)- In a T1-weighted image, an isointense signal over the PNH and a hypointense signal over the hemangioma are determined. (C). In the early arterial phase, an intense signal over the PNH and the appearance of a ring-shaped shadow over the hemangioma is determined (D). In the next phase, an isotensive signal over the PNH and preservation of the signal over the hemangioma is determined.

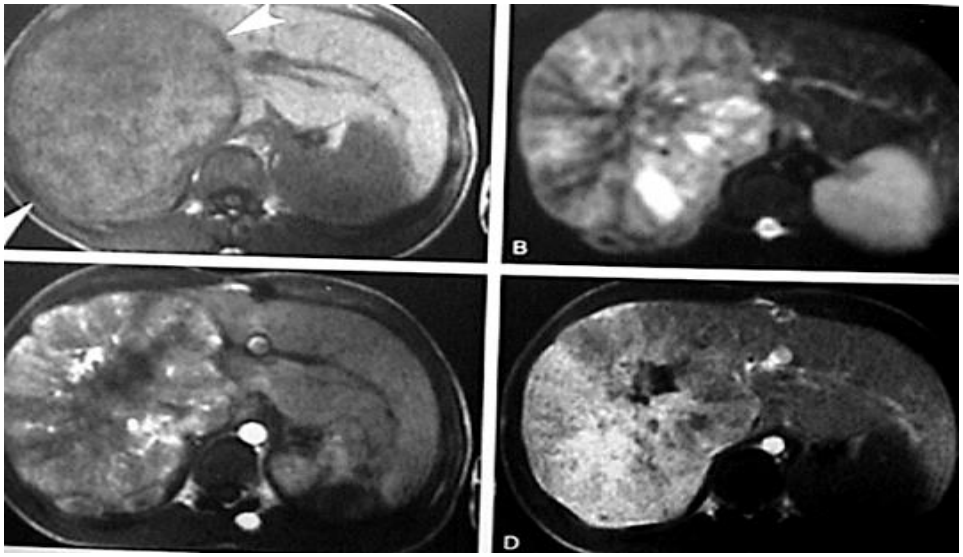


Fig. 16 MRI fibrolaminar carcinoma.

A. Inhomogeneous isointense signal in T1-weighted image B. Inhomogeneous hyperintense signal in T2-weighted image with scalloped contours on the periphery. Above the central scar (heavy), the contrast is reduced S. The tumor is presented in the form of intense inhomogeneous signal enhancement immediately after the introduction of gadolinium, with a conspicuous central scar that gives a hypointense signal; D. The tumor is more homogeneous and homogenized in the venous phase with an isointense signal.

Adenoma.

Hepatocellular adenoma, a benign epithelial formation, usually appears in patients who use estrogens or androgens, in diabetics with impaired carbohydrate metabolism. Adenoma of the liver belongs to benign tumors originating from disorganized hepatocytes. Diagnosis of adenoma is extremely important due to the high risk of bleeding, rupture, malignancy and the need for surgical intervention. On CT, the adenoma may look slightly hypodense or isodense, which makes it difficult to detect and identify. After contrast, the adenoma is heterogeneous, with alternating zones of increased (due to areas of hemorrhage), normal, and decreased density. The maximum contrast occurs in the arterial phase, unlike hemangiomas, in which contrast is most often observed in the venous phase.

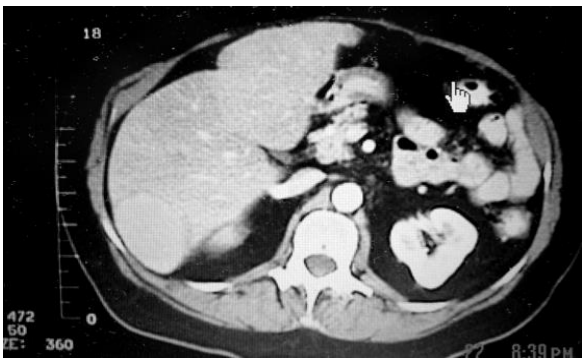


Fig. 17 CT scan of adenoma

Fig. 18 Macropreparation of adenoma

On MRI, in 31% of cases, adenomas have a peripheral complete or incomplete rim, often hypointense on T1-weighted and almost any intensity on T2-weighted images.

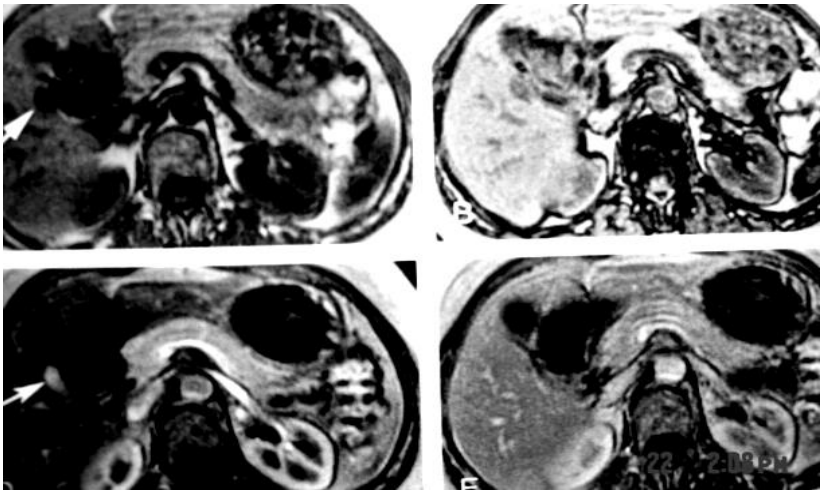
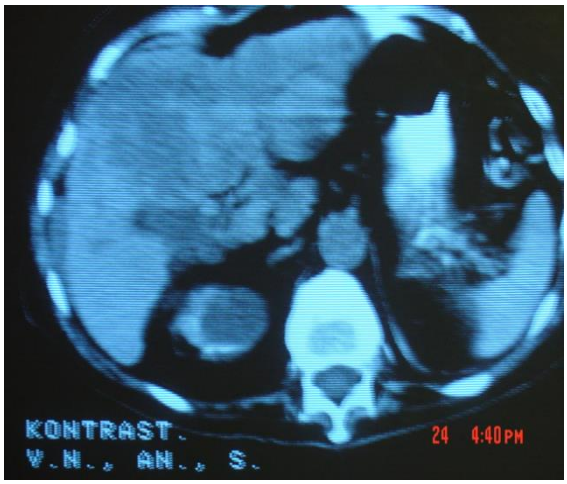


Fig. 19 MRI of liver adenoma. Hypotensive signal in T1 image; moderate T2 signal enhancement. After the introduction of gadolinium, signal enhancement is not noted; in the next phase, only traces of diversity are noted.

Hepatocellular carcinoma (HCC) is a common malignant tumor that occurs most often in men due to alcohol or alcoholic cirrhosis of the liver, chronic viral hepatitis B or C. HCC usually appears in old age, in children it is extremely rare. The occurrence of HCC is due to cellular atypism and dysplasia. There are 2 types of HCC: 1 type – solitary, occurs in 50% of cases; multinodular (multifocal), occurs in 40% of cases and 2 diffuse type - in 10% of cases. CT reveals a heterogeneous formation with unclear contours in the form of a "flame", there are areas of necrosis, tumor thrombi, deep lime; education looks hypo- or isodense with a hyperdense rim. After the introduction of diversity, there is a very rapid contrast of the central parts of the tumor, the appearance of a hyperdense zone around the capsules, if any.



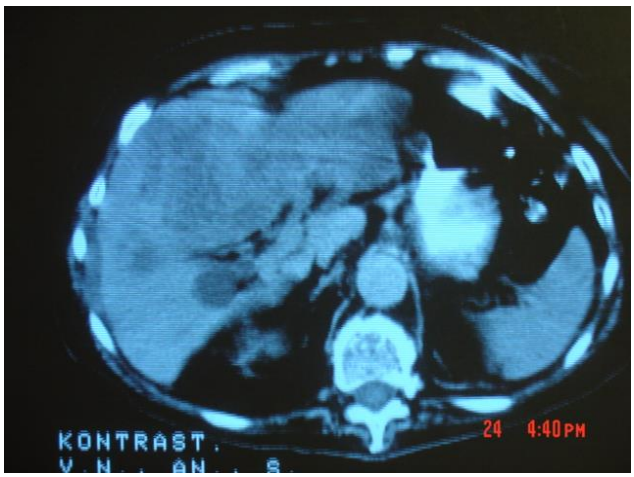


Fig. 20 CT scan (before contrast injection) in hepatocellular carcinoma
Fig. 21 CT (after administration of contrast) in hepatocellular carcinoma

On MRI, multifocal HCC typically shows a moderately hypointense signal in the T1-weighted image and a medium-intensity signal in the T2-weighted image. In subsequent phases, the signal becomes isointense. However, with highly differentiated HCC, the CT and MRI images may be hyperintense in T1 or isointense in T1- and T2-weighted images, due to the high protein content in liver cells. This says a favorable forecast; hyperintensity in the T2 image is a poor prognostic factor, because indicates tumor necrosis. When the tumor invades the vessels, especially the portal vein, a hyperintense signal is noted in the T2-image and the next phase, which resembles a hemangioma. But the presence of ascites, enlargement of the liver and lymph nodes are characteristic of a tumor. Diffuse HCC can occur against the background of acute tachronic hepatitis B and C, liver cirrhosis. The contrast is inhomogeneous and spotty in the arterial phase in the T1-weighted image, separate areas of hypo- and isodense signal with moderately hyperintense signal in T2-images are noted. These signals characterize a tumor with the presence of a significant amount of fibrous stroma (base). These tumors are characterized by increased vascular thrombosis and a high content of protein compounds (α-proteins).

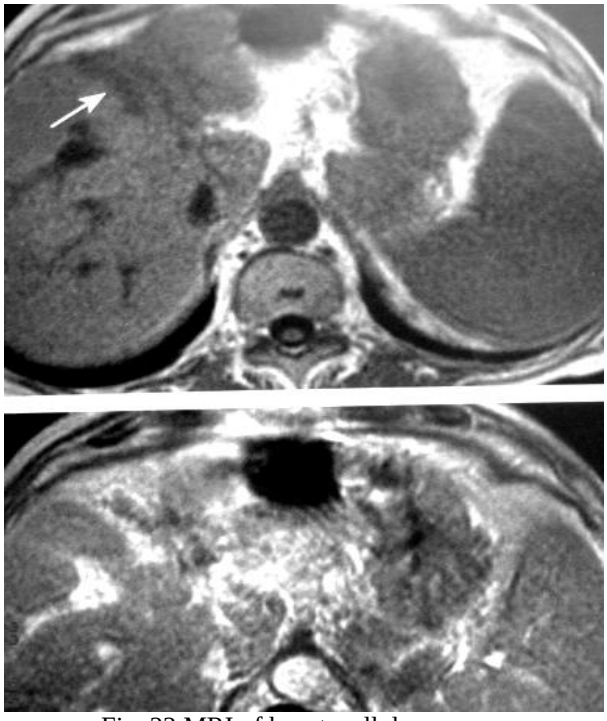


Fig. 22 MRI of hepatocellular cancer.
A. Before introducing contrast,
B. After the introduction of diversity.

Contrasting occurs in the arterial phase. It is represented by an uneven distribution of diversity in the center of the lesion, which helps in differentiation from hemangioma, in which the long-term preservation of the signal on the periphery is noted.

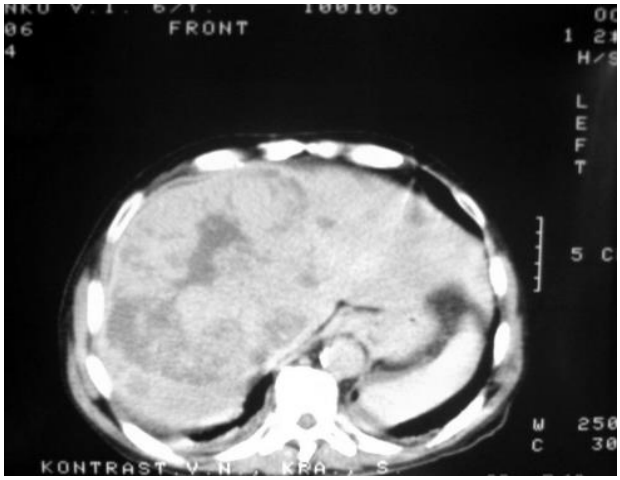


Fig. 23 CT scan of the liver over hepatocellular carcinoma.

In the presence of concomitant diffuse changes in the liver parenchyma (cirrhosis, especially with nodules of regeneration), CT is advisable. CT diagnosis of a tumor facilitates the detection of such specific signs as the presence of a capsule (its late enhancement during contrast), heterogeneity of the internal structure, the presence of intratumoral septa, daughter nodes.

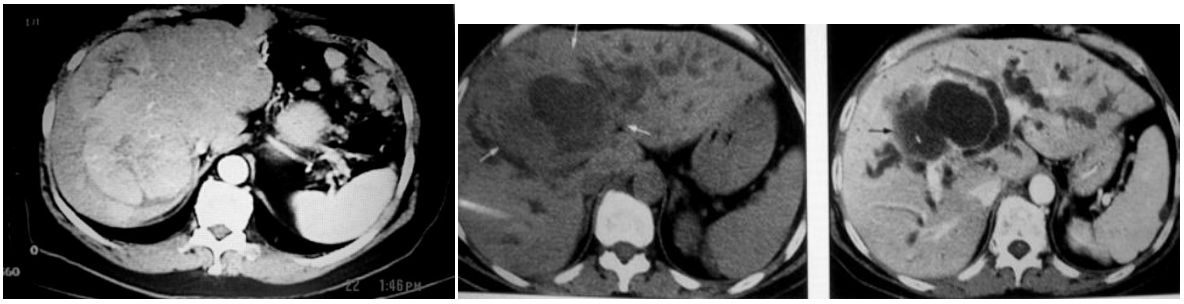


Fig. 24 CT of hepatocellular carcinoma after administration of contrast.
Fig. 25 CT scans before and after contrast enhancement over hepatocholangicarcinoma.

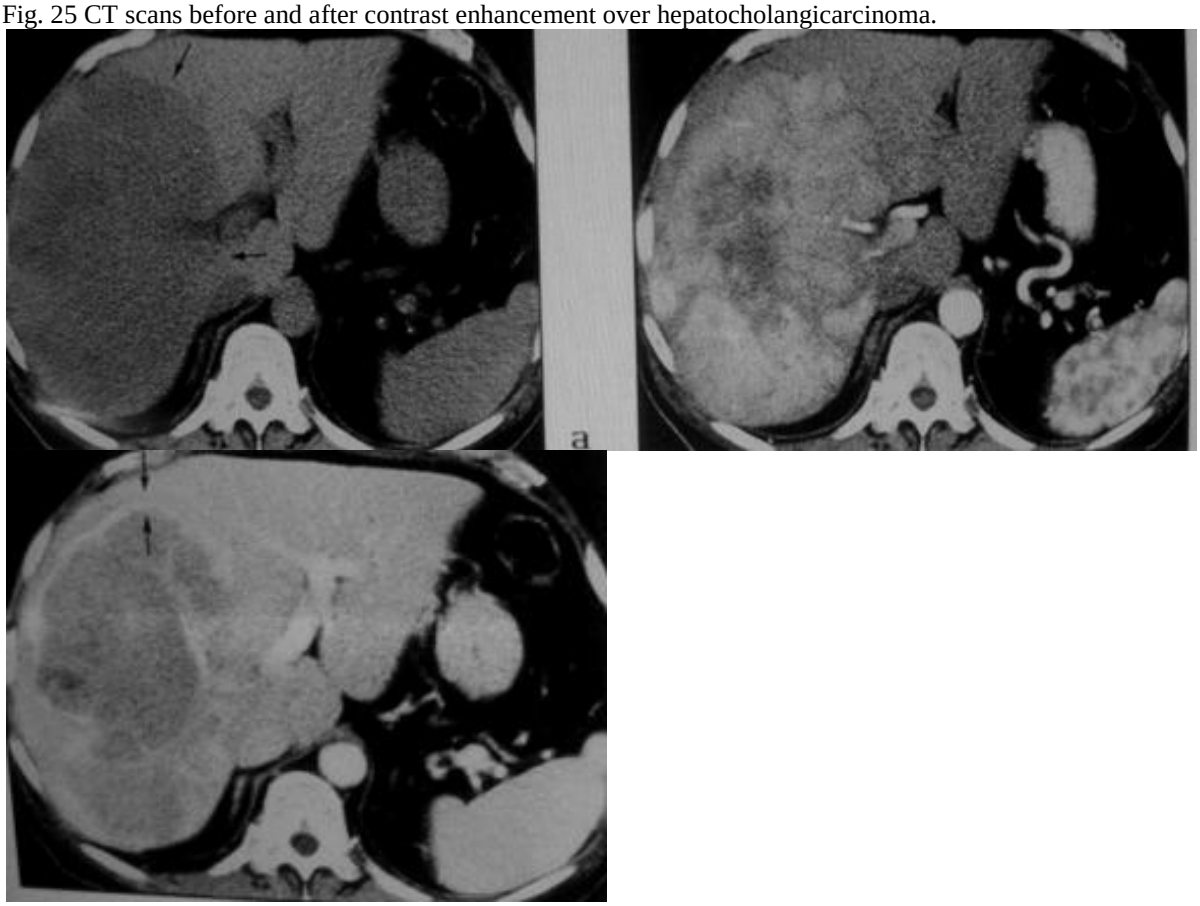


Fig. 26 A. CT Hepatocellular carcinoma Presence of a capsule around the tumor;
B. Enhancement of contrast over the tumor;
C. Heterogeneity of the internal structure, presence of intratumoral septa

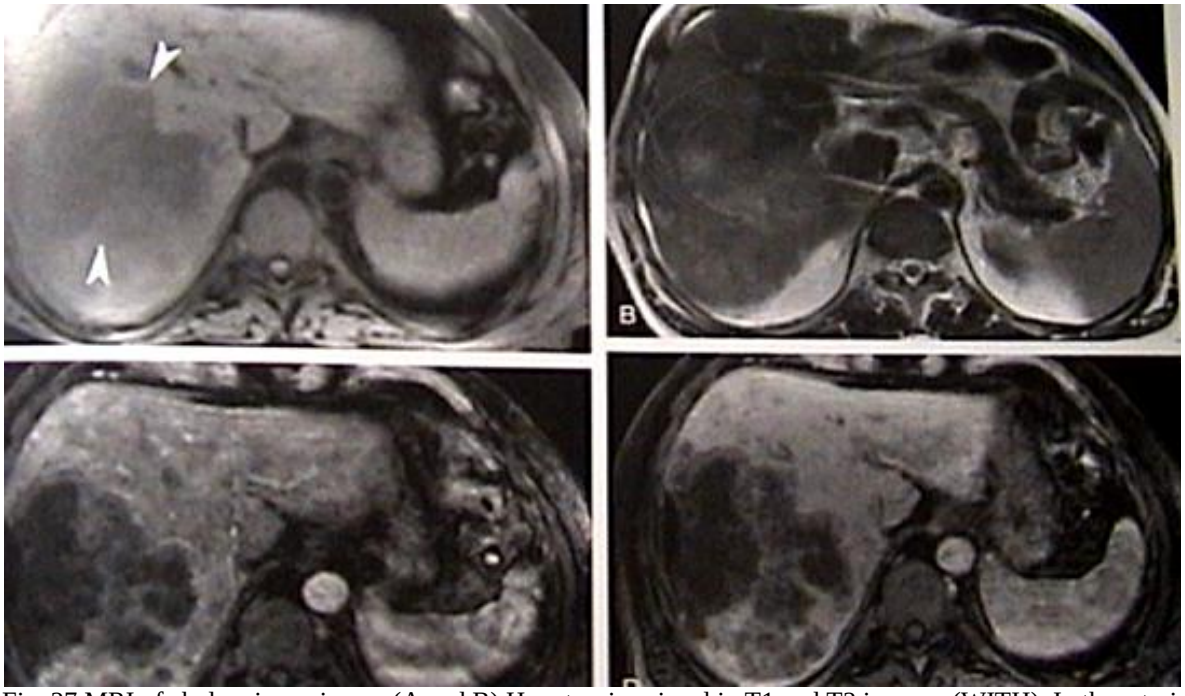


Fig. 27 MRI of cholangiocarcinoma (A and B) Hypotensive signal in T1 and T2 images; (WITH). In the arterial phase, heterogeneous signal amplification is determined; (D) Moderate signal reduction in the portal phase (D).

Metastases in the liver

The diagnosis of metastases in the liver is extremely important. The analysis of the found foci of metastasis based on the results of highly informative methods (MRI and CT) showed that sometimes the ultrasound performed after the tomography revealed far from all even the known foci of pathologies. The presence of foci of different structure is typical for metastatic liver damage. Predominant areas of metastases are not always available for ultrasound imaging. The possibilities of detecting metastatic liver lesions are significantly increased during CT, MSCT and MRI with contrast. The most pathognomonic is the effect of "washing out" of the variety - the appearance of a hypointense focus in the center of the formation a few minutes after the drug is administered. CT most often reveals multiple areas of altered density, inhomogeneous, surrounded by a hyperintense rim, with areas of calcification. The most common are well-defined hypodense rounded cells with slight peripheral enhancement during contrast.

In MRI, the most typical is the detection of rounded foci with a heterogeneous internal structure, hyperintense on T2 and hypointense on T1-weighted images. Visualization of a bright halo around the focus on T2-weighted images (due to edema) is also most characteristic of secondary liver damage.

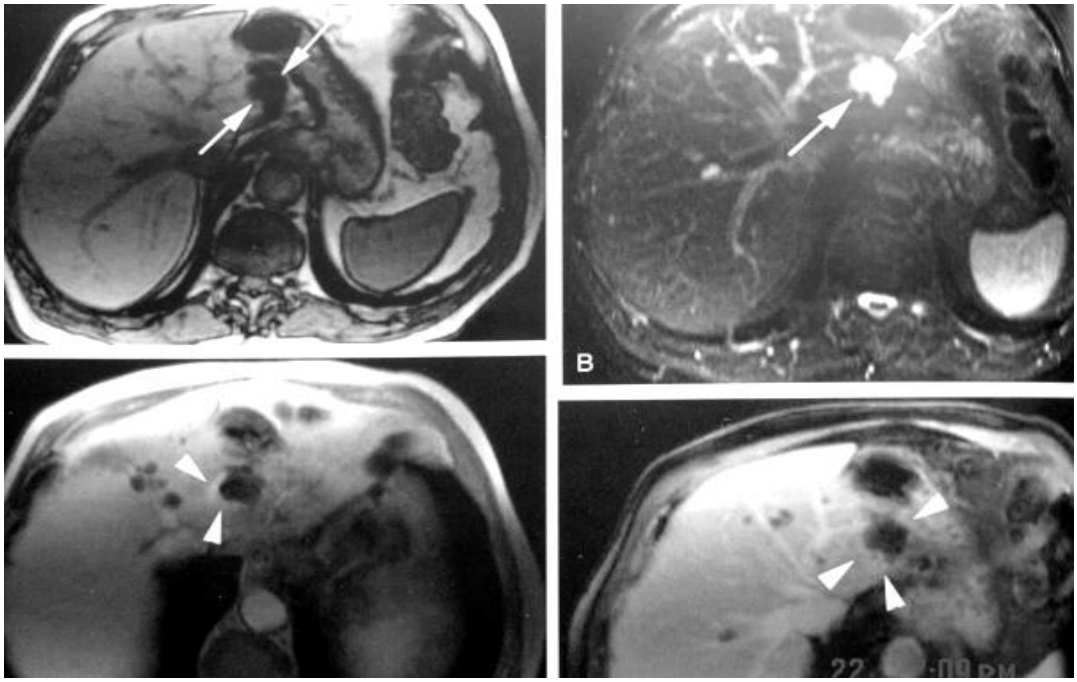


Fig. 28 MRI of liver metastases in stomach cancer

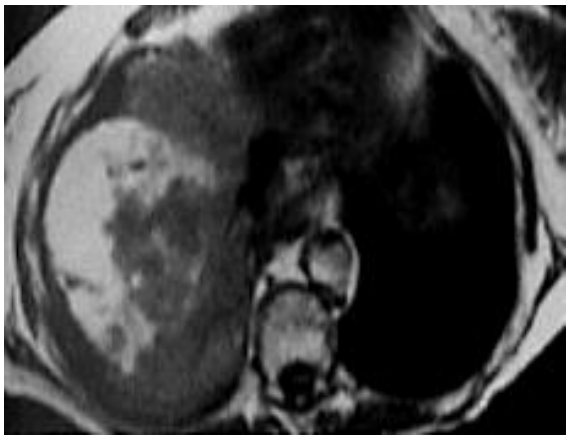


Fig. 31 CT with amplification. Liver metastases with hemorrhages

Conclusion. We studied the peculiarities of the signals when using a number of techniques (CT, MRI) in comparison with the data of morphological studies (removed biopsies, post-mortem examination of the removed liver, etc.

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