



Possibilities of Sonography in Differential Diagnostics of Hematuria

1. Khamidov Obid Abdurakhmanovich
2. Yakubov Doniyor Zhavlanovich
3. Alieva Umida Zairovna
4. Bazarova Sabina Akmalovna
5. Mamaruziev Sherzod Rakhmatullaevich

Received 24th May 2021,
Accepted 25th June 2021,
Online 17th Aug 2021

ABSTRACT: Ultrasound diagnostics is a method that is unique in its capabilities and has a number of advantages over other traditional diagnostic methods. The absence of radiation exposure, the absence of the need to use contrast agents with allergenic, nephrotoxic effects, the absence of dependence of the information content of the study on the functional state of the kidneys (chronic renal failure, acute renal failure), economic accessibility make sonography the "first echelon" method in examining patients with hematuria.

Keyword: ultrasound, hematuria, sonography

^{1,2,3,4,5}Samarkand State Medical
Institute, FPE Department of Medical
Radiology, Republic of Uzbekistan,
Samarkand

Materials and research methods. For the period from 2014 to 2019. ultrasound examinations were carried out in 1332 patients with hematuria aged 17 to 83 years (average age was 53 ± 0.12 years), 436 women and 896 men. Ultrasound examination was carried out on devices from Siemens Sonoline Sienna, Sonoline G60S, Toshiba ЕиВ-420 using multifrequency convex transducers with a frequency of 2.8-5.0 MHz, linear transducers with a frequency of 5.0-10.5 MHz, convex endocorporeal transducers with a frequency of 4, 2-9.0 MHz. Scanning was carried out in real time in a "gray scale" using Doppler sonography if necessary. All patients underwent a complex ultrasound examination of the kidneys, urinary tract, and bladder using a standardized polypositional technique with quantitative analysis. Kidney ultrasound included an assessment of the following quantitative parameters: length, width, thickness of the kidneys, the width of the parenchymal layer in the middle third of the kidney outwardly and inwardly from the image of the central echocomplex, pelvic-parenchymal index (ABI), diameter of the cups and pelvis, and the volume of the kidney. The architectonics of the parenchyma was assessed — the echogenicity of the cortical layer, the shape and size of the renal pyramids, and the values of the medullary-parenchymal index (MPI) were determined. Ultrasound of the ureters was performed at a location from the pyeloureteral segment along the anatomical projection of the ureters to the vesicoureteral junction (PMS). During abdominal scanning, the degree of ureteral dilatation, if any, the tortuosity of the course, the presence of pathological inclusions, the ratio with other anatomical formations of the retroperitoneal space, primarily the vascular structures, were assessed. Endocorporeal ultrasound was used to assess the length and diameter of the juxtavesical ureter, intramural and submucous sections, the state of the orifice, and the shape of the urine bolus coming

from the ureter. Bladder ultrasound was performed in two stages — transabdominal and endocorporeal access.

Results. The group of patients with diffuse changes in the renal parenchyma was 180 patients aged 17 to 62 years (92 women and 88 men). In 123 patients, chronic glomerulonephritis (CGN) in the acute stage was diagnosed, in 12 patients - acute pyelonephritis, in 45 patients - toxic nephropathy against the background of poisoning with nephrotoxic poisons with clinical manifestations in the form of ARF of varying severity. Echographic changes were localized in the renal parenchyma and were symmetrical. In patients of this group, there was an increase in the size of the renal pyramids and MPI. With exacerbation of mesangial-proliferative CGN, the size of the pyramids reached $0.9 + 0.04$ cm, while the MPI was $48.2 + 1.4\%$. The exacerbation of membranous CGN was accompanied by an increase in the size of the pyramids up to $1.3 + 0.11$ mm with an MPI of $56.2 + 2.5\%$. Acute pyelonephritis was accompanied by an increase in renal pyramids up to $1.1 + 0.04$ mm and an MPI of $51.3 + 1.2\%$. The most significant changes in parenchymal sonographic parameters of observation or in case of poisoning with nephrotoxic poisons. At the same time, the MPI values were $58.7 + 2.7\%$. With MFI values of more than 60%, most patients (79%) showed a change in the shape of the pyramids from round to triangular, an increase in the transverse dimensions of the kidneys due to an increase in the thickness of the parenchymal layer, and a moderate increase in the echogenicity of the cortical layer. In 87% of cases, these changes were accompanied by an increase in plasma creatinine values, which is a reflection of a transient deterioration in renal function against the background of diffuse changes.

The study included 58 patients (31 women and 27 men) aged 17 to 66 years with an established diagnosis of polycystic kidney disease. In 17 cases of clinically compensated polycystic kidney disease, visualization of multiple cortical cysts was more objective using a 7 MHz transducer. At the same time, cysts less than 5 mm in size were reliably visualized. The location in the power Doppler (ED) mode showed a parenchymal vascular tree of normal architectonics, the speed indicators were within the age norm. In 7 patients with microhematuria (all men, two of them were close relatives), the sonographic examination revealed symmetric changes, regarded as "spongy kidney", which was characterized by a change in the medulla with a normal structure of the cortical layer and renal sinus. In 5 cases, echo densification was noted along the periphery of the renal pyramids in the form of a hyperechoic ring without an acoustic shadow (a symptom of an "echo-dense perimedullary ring"). In two observations, the projections of the pyramids were echo-dense, rounded structures. In the projection of the renal pyramids, groups of small cystic formations were visualized, the diameter of which does not exceed 5-6 mm, with echo-dense inclusions up to 2-3 mm in diameter. The described changes are most obvious when locating at a frequency of 5.0-10.5 MHz. Morphometric parameters of the kidneys, echogenicity of the cortical layer of the parenchyma corresponded to normal values.

Fornical necrosis is one of the formidable complications of purulent pyelonephritis, which is associated with the development of necrosis of the renal tissue in the zone of the tops of the pyramids, accompanied by arrosive bleeding. There were 4 patients under observation with fornical necrosis of varying severity. Massive hematuria was detected in one patient, in 3 patients microhematuria was 30-70 erythrocytes in the field of view. In our observation, one patient was under dynamic ultrasound monitoring for 3.5 months after severe polytrauma, complicated by purulent pyelonephritis, urosepsis. The diagnosis of fornical necrosis was established by ultrasound, the purpose of which was dictated by the absence of urine flow through the urethral catheter. In the course of the study, a bilateral tamponade of the dilated cavity system, ureters, and bladder was revealed. The kidneys were symmetrically enlarged with clear signs of interstitial edema, which was clinically accompanied by hypercreatininemia up to 0.153 mmol / L. Sonographic monitoring showed that against the background of active urological treatment, the described sonographic changes underwent a reverse development, urinary pathways were freed from blood clots, signs of interstitial edema regressed, but

at the same time, loose calculi formed in the renal cavity system and calcification of necrotic renal papillae occurred, which was confirmed by postmortem examination. In three other cases, the severity of fornical necrosis was moderate, in two cases it was bilateral, in one case it was unilateral. In all cases, in addition to signs of interstitial edema, echo-dense inclusions in the projection of the pyramidal apices were detected, followed by calcification. The severity of urodynamic disorders was moderate. Under the influence of pathogenetic therapy, signs of interstitial edema and urodynamic disorders underwent a reverse development, which was clinically accompanied by the cessation of hematuria and a decrease in hypercreatininemia.

An ultrasound endocorporeal examination of the distal ureters was carried out in order to establish the causes of hematuria. In cancer of the distal ureter (17 patients), in all cases, hypoechoic tissue formation of sizes from 20 to 45 mm with indistinct irregular contours was revealed, involving PMS and leading to impaired urine passage, which was accompanied by the absence of a urine bolus from the orifice of the affected ureter. Above the tumor lesion, signs of impaired urodynamics of the upper urinary tract of varying severity were revealed up to ureterohydronephrosis. Peristalsis of the dilated ureter was not determined. In two cases, tissue formation in the PMS area continued into the bladder cavity, simulating exophytic tumor growth, which made it difficult to establish the organ of the tumor focus according to ultrasound data. Characteristic was the presence of a pendulum movement of tissue formations in the lumen of the ureter under the influence of urine flow, which led to the advancement of the tumor into the lumen of the bladder and its return to its original position inside the ureter upon completion of the passage of the urine bolus. In both cases, hyperperistalsis of the ureter was noted on the affected side. Distal ureteral calculi (25 observations) were localized in the juxtavesical ureter in 7 patients (28%), in the intramural ureter in 9 patients (36%), in the orifice of the ureter in 5 patients (20%), in the ureterocele in 3 patients (12%). A one-horned patient (4%) had a "stone path" above the site of the vesicoureteral anastomosis stricture. In patients of the first three groups, an echo-dense inclusion from 3 to 7 mm with a clear acoustic shadow in the lumen of the ureter was detected; an increase in the diameter of the ureter to 6-10 mm was observed above the obstruction site, in combination with an increase in the amplitude of the peristaltic wave. The patients of the last two groups also showed ureteral dilatation up to 10-12 mm, it was more extended, accompanied by signs of urodynamic impairment at the level of the cavity system and was not accompanied by an increase in the peristaltic wave. Ureterocele was diagnosed in 98 patients. In 84 cases (86%), this pathology was unilateral. In 47 patients (48%), the size of the ureterocele did not exceed 5 mm and its size changed in different phases of ureteral peristalsis. In 27 patients (28%) the size of the ureterocele ranged from 5 mm to 15 mm, in 22 patients (22%) the size of the ureterocele exceeded 15 mm. In 16 patients of the latter group, the ureter was dilated along its entire length, signs of pyelocalicoectasia in combination with phrenic reflux. Echosemiotics of fornical reflux is characterized by a combination of ultrasound signs of abnormalities in the urodynamics of the upper urinary tract with a decrease in the echogenicity of the pyramids, which leads to an increase in MPI with normal values of morphometric parameters and echogenicity of the cortical layer. In all patients of this group, there were no signs of hyperperistalsis of the affected ureter. In one patient, villous growths of the ureterocele and calculus in its lumen were identified.

Bladder pathology as a cause of hematuria was identified in 736 patients. Bladder stones (45 patients) were characterized as echo-positive mobile formations with an acoustic shadow ranging in size from 3 to 30 mm, in 67% (30 patients) of cases, stones were multiple. In 78% (35 patients), patients had different bladder outlet obstruction. the degree of severity. Echosemiotics of diverticula (38 patients) was characterized by the presence of anechoic rounded formations with a clear echo-dense wall, adjacent directly to the bladder and having an opening connecting the diverticulum with the bladder volume. Polypositional scanning, when the scanning plane is aligned with the plane of the orifice of the diverticulum, allows visualization of the opening connecting the volume of the bladder and the diverticulum with maximum accuracy. Also, for a clearer visualization of the anastomosis, the color

Doppler mapping (CDM) mode was used, which made it possible to clearly visualize the movement of urine flows from the diverticulum and back. In all cases, diverticula were localized in the lower segment of the bladder, of which in 65% of cases along the posterior wall, in 35% of cases along the lateral walls. The sizes of diverticula ranged from 12 mm to 35 mm, averaging 23 ± 0.55 mm. 78 patients with cystitis clinic were examined. Only in 12 cases (15%) were changes in the bladder wall revealed, which consisted in a significant thickening of the inner layer of the bladder wall (in some cases up to 8-9 mm) in combination with a decrease in its echogenicity. In the ED mode, signs of hypervascularization were noted in this area. The middle and outer layers of the bladder wall retained a normal echo structure. In the remaining 66 cases, sonographic changes were absent, despite the typical and vivid clinical picture. The urine in the bladder cavity had a finely dispersed suspension in 66 cases (85%). Infravesical obstruction, formed in the elderly due to prostatic hyperplasia, was observed in 96 patients. At the same time, the wall of the bladder was thickened due to the internal hyperechoic layer in all patients of this group. In the inner hyperechoic layer, multiple small anechoic inclusions up to 3-4 mm in diameter were visualized, which were regarded as pseudo-diverticula. The middle hypoechoic layer and the outer hyperechoic layers of the bladder wall remained unchanged. In 24 patients with urethral pathology as the cause of bladder obstruction, the changes were of a similar nature, however, the thickening of the bladder wall was more significant, with pseudodiverticula localized in all layers of the bladder wall. In some cases (5 patients), it was possible to visualize a thin - about 1-2 mm orifice connecting the cavity of the pseudodiverticulum with the volume of the bladder. In three cases, small calculi were found in the cavity of the pseudodiverticula. Bladder cancer as a cause of hematuria was identified in 438 patients aged 32 to 88 years (397 men and 41 women). Identification of a bladder tumor as a source of hematuria is the task of the initial ultrasound examination carried out at the early stages of the patient's examination. In the course of such a study, pathological formations are identified, their size, number and localization are determined. The degree of invasion, the effect of the tumor on urodynamics, and distant changes are the goals of an expert ultrasound scan performed in specialized urological departments. In 56% of cases (245 patients), invasive bladder cancer was detected. Transitional cell carcinoma was the predominant morphological form (89% or 389 patients). Ultrasound examination most often revealed exophytic single or multiple foci on a broad base with a coarse villous free edge of the tumor (72%). The endophytic form was observed in 28% (123 patients). A characteristic feature of the localized endophytic form of bladder cancer was the presence of low-echogenic tissue, which slightly deforms the inner contour of the bladder and has a significant submerged growth beyond the bladder wall into the perivesical tissue. The solid form of endophytic bladder cancer led to extended changes in the bladder wall with loss of structure. The wall of the urinary bladder in this case looked like a rather uniform thickened hypoechoic structure without the presence of an exophytic component. Small up to 4 mm exophytic foci located in the upper segment of the bladder had the greatest difficulty in identifying. In 83 cases, bladder diverticulum cancer was detected in the form of tissue formations ranging in size from 5 to 23 mm. In 69 cases of tumors, the focus was single, in 7 cases - multiple; in 7 cases, tissue growths filled the entire volume of the diverticulum. In five cases, changes were revealed near the orifice of the ureter in the form of an exophytic formation (three observations), an endophytic local change (two observations), which upon further examination were documented as distant foci of a tumor of the homolateral kidney and renal pelvis. In one case, there was a tumor lesion of the kidney and cancer of the bladder with the localization of exophytic focus in the region of the heterolateral orifice.

Discussion. As the results of the work show, the method of ultrasound diagnostics is highly informative in identifying the causes of hematuria. The pathological process leading to the onset of hematuria can be realized at different levels and in different structures of the urinary system. The resulting pathomorphological changes are accompanied by the formation of sonographic symptoms and syndromes, the identification and interpretation of which is the purpose of ultrasound. Diffuse changes in the renal parenchyma in various nephropathies are characterized by the formation of a

sonographic syndrome of interstitial edema. The trigger in this case is damage to the glomerular filter, which is clinically accompanied by proteinuria and hematuria. Proteinuria, being a damaging factor for the lymphatic vessels of the renal parenchyma, leads to the formation of edema of the parenchyma and, above all, of the renal pyramids. An increase in the hydrophilicity of the pyramids is accompanied by a change in the sonographic characteristics of the renal parenchyma and the morphometric parameters of the kidney as a whole, being a reflection of the symptom complex of interstitial edema of the parenchyma. An important clinical parallel is this sonographic symptom complex with transient hypercreatininemia. Ultrasound semiotics of the "spongy kidney" is due to the peculiarities of the embryofetal morphogenesis of this defect, as a result of which the collecting ducts of the permanent kidney take the form of cystic altered formations with saccular parietal protrusions. As a rule, all collecting ducts, localized in the medulla of the kidney, have been changed, which, on ultrasound, look like small cystic formations in the projection of the pyramids. One of the types of complications of spongiform kidney is the development of intratubular nephrolithiasis, clearly limited to the medulla of the kidney, which is also well visualized during sonographic examination. Echosemiotics of fornical necrosis is due to the formation of two main sonographic syndromes - interstitial edema syndrome against the background of severe purulent pyelonephritis and urodynamic disorders syndrome up to ureterohydronephrosis, a feature of which is the presence of massive blood clots throughout the urinary tract. Purulent urostasis in combination with fornical reflux, local hemodynamic disorders, leads to necrosis, rejection of the renal papillae and profuse bleeding. The massive flow of blood from necrotic papillae into the cavity system of the kidney, ureters, bladder, where it interacts with urine, forms dense clots, is the cause of obstructive urodynamic disorders. A feature of the course of fornical necrosis is the rapid formation of dense calcified clots in the cavity system of the kidney and the calcification of necrotic renal papillae. Ultrasonic differentiation of the layers of the bladder wall reflects the morphological feature and explains the semiotics of many diseases. Endophytic growth of a bladder tumor with a violation of the structure of the wall indicates an infiltrative growth. Sonographic changes in acute cystitis affect only the inner wall layer, leading to its thickening, a decrease in echogenicity, which, in combination with hypervascularization, corresponds to inflammatory changes in the mucous and submucous layers of the bladder wall. subsequently, with decompensation, the formation of protrusions of the mucous membrane between the thinned fibers of the muscle layer. Thus, ultrasound diagnostics is a method based on echolocation, which allows detecting pathomorphological changes at the macro- and microorganic level, which makes it indispensable already at the initial stages of the diagnostic search for the cause of hematuria. Understanding the principles of ultrasound imaging, adherence to the methodology, combined with knowledge of pathomorphology, pathophysiology, allows you to avoid a mechanistic approach and significantly increase the information content of ultrasound diagnostics.

Literature

1. Ataeva S.Kh., Ravshanov Z.Kh., Ametova A.S., Yakubov D.Zh. Radiation visualization of chronic joint diseases. Central Asian journal of medical and natural sciences, volume 2 issue 2 March-april 2021 P.12-17
2. Ayvazyan AA, Voino-Yasenetskiy AM Malformations of the kidneys and ureters. M., 1988.S. 161-166.
3. Builov VM Ultrasound and X-ray diagnostics of cup-lo diverticula Hannock kidney systems // Sonoase international. 2006. V. 14.P. 9-19.
4. Hamidov O.A., Diagnostics of injuries of the soft tissue structures of the knee joint and their complications. European research. Moscow. October 2020. № 1 (37). P. 33-36.
5. Khamidov O. A., Khodzhanov I. Yu., Mamasoliev B.M., Mansurov D.Sh., Davronov A.A., Rakhimov A.M. The Role of Vascular Pathology in the Development and Progression of

Deforming Osteoarthritis of the Joints of the Lower Extremities (Literature Review). Annals of the Romanian Society for Cell Biology, Romania, Vol. 25, Issue 1, 2021, Pages. 214 – 225

6. Khamidov O.A., Mirzakulov M.M., Ametova A.S., Alieva U.Z. Multispiral computed tomography for prostate diseases. Central Asian journal of medical end natural sciences, volume 2 issue 2 March-april 2021 P.9-11
7. Khamidov O.A., Normamatov A.F., Yakubov D.Zh., Bazarova S.A. Respiratory computed tomography. Central Asian journal of medical end natural sciences, volume 2 issue 2 March-april 2021 P.1-8
8. Khamidov O.A., Urozov U.B., Shodieva N.E., Akhmedov Y.A. Ultrasound diagnosis of urolithiasis. Central Asian journal of medical end natural sciences, volume 2 issue 2 March-april 2021 P.18-24
9. Khodzhibekov M.X., Khamidov O.A., Mardieva G.M. Verification of radiation methods in diagnostics of injuries of the knee joint intra-articular structures. International Journal of Pharmaceutical Research. 2020;13(1), p. 302-308.
10. Mardiyeva G.M., Khamidov O.A., Yakubov D.J., Turdumatov Zh.A. Ultrasound Semiotics of Biker cysts. European science review, Austria, № 1-2 2019, January - February. Volume 2. - P.166-168
11. Namuri Y., Kadota T., Inone E. et al. Bladder wall morphology: in vitro MR imaging-histopathologic correlation // Radiology. 1993. V. 187. P. 151-155.
12. Pereverzev A. S., Petrov S. B. Tumors of the bladder. Kharkov, 2002.301 p.
13. Rustamov U.Kh., Urinboev Sh.B., Ametova A.S. Ultrasound diagnostics of ectopic pregnancy. Central Asian journal of medical end natural sciences, volume 2 issue 2 March-april 2021 P.25-28
14. Shulutko BI Inflammatory kidney disease. SPb., 1998.S. 139-142.
15. Skryabin GN, Aleksandrov VP, Korenkov D. G., Nazarov T.N. Cystitis. SPb., 2006.S. 69-72.
16. Strokova LA A case of ultrasonic necrotizing papillitis // Nephrology. 2005. T. 9.No. 1. S. 95-97.
17. Vasiliev A. Yu., Gromov AI, Kapustin VV, Vasilchenko MI Radiation diagnosis of tumors of the renal pelvis // Medical visualization. 2004. No. 4. S. 66-69.
18. Мардиева Г.М., Муродуллаева Д.М., Хамидов О.А. Ультразвуковая верификация синовита у больных артрозом коленного сустава. Научно-методический журнал «Достижения науки и образования» (Иваново, Россия). № 16 (70), 2020. Стр.54-59.
19. Мардиева Г.М., Хамидов О.А., Якубов Д.Ж., Оллаберганов М.И. Возможности лучевых методов исследования повреждений мягкотканых структур коленного сустава. БИЛОГИЯ В.А. ТИББИЁТ МУАММОЛАРИ №4 (104) 2018. С. 197-201. Самарканд
20. Хамидов О.А. Оптимизация лучевой диагностики повреждений мягкотканых структур коленного сустава и их осложнений Американский журнал медицины и медицинских наук, Америка, 2020, 10 (11) - С. 881-884
21. Ходжибеков М.Х., Хамидов О.А. Обоснование ультразвуковой диагностики повреждений внутрисуставных структур коленного сустава и их осложнений. №3 (31), 2020. С.526-529.
22. Якубов Д.Ж., Муродуллаева Д.М., Хамидов О.А., Мардиева Г.М. Ультразвуковое исследование при повреждении мягкотканых структур коленного сустава. Научно-методический журнал «Достижения науки и образования» (Иваново, Россия). №2 (56), 2020. - С.96-99.