



PERCUTANEOUS RENAL BIOPSIES IN GENERAL HOSPITAL KARLOVAC BETWEEN 2009 AND 2020 - OUR RESULTS

Vlasta Kupres¹, Davorin Katušin² and Žarko Belavić³

¹Department of Internal Medicine, Department of Nephrology with Haemodialysis,
General Hospital Karlovac, Karlovac, Croatia;

²Department of Urology, General Hospital Karlovac, Karlovac, Croatia;

³Polyclinic IDC Zabok, Fresenius Medical Care Croatia, Zabok, Croatia

SUMMARY – We analyse data of 60 patients submitted to renal biopsy in General Hospital Karlovac between 2009 and 2020. The biopsies were performed percutaneously under ultrasound guidance. Biopsy material was analysed by nephropathologists either in Clinical Hospital Dubrava or in University Hospital Centre Zagreb using light, immunofluorescence, and electron microscopy. Indications for biopsies were nephrotic syndrome in 26 (43.3%) patients, nephritic syndrome in 12 (20.0%) patients, unclear renal failure in 12 (20.0%) patients and suspect rapidly progressive glomerulonephritis in 10 (16.7%) patients. Pathological diagnosis was made in 57 (95.0%) patients. The most common primary glomerulonephritis was IgA nephropathy diagnosed in 8 (13.3%) patients. Among secondary glomerular diseases, pauci-immune crescentic glomerulonephritis was the most observed – in 12 patients (20.0%). The complications after the procedure were noticed in 5 (8.3%) patients (3 patients with perirenal bleeding and 2 patients with macroscopic haematuria). Microscopic haematuria was present in 20 (33.3%) patients. No complication required surgical treatment. Percutaneous renal biopsy under ultrasound guidance is a safe diagnostic procedure that can provide a definitive diagnosis as a requirement to introducing different (immunosuppressive) treatment.

Key words: *percutaneous renal biopsy, indications, complications, results*

Introduction

The first paper on percutaneous renal biopsy of native kidneys with an aspiration needle was published in 1951 by Paul Iverson and Claus Brun, although this technique was first introduced by Nils Alwall in 1944 when he applied and adapted the percutaneous liver biopsy technique to the kidneys¹. Alwall used X-rays to localize the right kidney and sampled the kidney tissue in a sitting position. In 1962, the use of radiological imaging procedures to localize the kidneys was introduced, which were later replaced by real-time ultrasound imaging.

The first kidney biopsy in the General Hospital Karlovac was performed on April 6, 1977, by nephro-

logist Borivoj Vitas. Until March 31, 1982, he had done a total of 15 kidney biopsies. All were done with X-ray diascopy. The first ultrasound-controlled kidney biopsy was performed on February 7, 1991. It was performed by urologist Željko Poka with the help of radiologist Ante Polović².

This paper will present the indications for the procedure, results, and complications of the procedure in patients with percutaneous ultrasound-guided renal biopsy at the General Hospital Karlovac from February 2009 to February 2020.

Methods

The indication for a biopsy was set by a nephrologist. This paper does not present the results of kidney tumour biopsies where the indication was set by a

Correspondence to: *Vlasta Kupres*, Polyclinic IDC Zabok, Bračak 8 A, 49210 Zabok
E-mail: vlasta.kupres@gmail.com

Table 1. Distribution of the patients according to the stage of renal injury.

Stage	Description	GFR ml/min/1.73 m ²	Number of patients
1	Kidney damage with normal GFR	≥ 90	14
2	Slight decrease in GFR	60 – 89	11
3	Moderate decrease in GFR	30 – 59	11
4	Significant reduction in GFR	15 – 29	7
5	Final stage kidney disease	< 15	17

urologist or oncologist. In addition to standard diagnostic processing related to the underlying kidney disease, all patients underwent a complete blood count, coagulogram, and renal ultrasound prior to percutaneous kidney biopsy. The kidney biopsy itself in all patients was performed percutaneously using a biopsy gun and under ultrasound control. At the beginning of the procedure, the patient was placed in a supine position with a pillow under the abdomen for better exposure of the kidneys for biopsy. The side of the biopsy, the left or right kidney, were determined according to the criterion of better availability of an individual kidney for a biopsy if there were no other reasons. After washing and disinfecting the skin of both lumbar regions, the skin was infiltrated with a local anaesthetic at the site of the planned puncture and a skin incision 5–10 mm long was made. We used a 14 cm long Bard® Biopsy-Cut gauge needle and a Radioplast AB Biopsy® biopsy gun to take the biopsy material. To guide the biopsy, we used an ultrasound flex Focus 400 BK Medical® with a 5 MHz convex probe with a needle adapter and puncture line display software. The biopsy material was usually taken from the lower half of the selected kidney, usually in two samples. In the case of obtaining macroscopically unsuitable material, punctures were repeated immediately until two adequate samples were obtained. After the procedure, the patients rested in a supine position with a slight compression of the punctured loin with a bandage material for 6 hours. During this period, blood pressure and pulse, as well as urine colour, were regularly monitored. Blood counts and urine sediment and, if necessary, renal ultrasound were monitored 8 and 24 hours after the procedure. Within a few hours of the biopsy, the material obtained by biopsy was transported to a nephropathologist - from 2009 to April 2016, to the Department of Pathology, Clinical Hospital Dubrava, and April 27, 2016, the Department of Pathology and

Cytology, Zagreb University Hospital Centre. In all cases, renal biopsies were performed in hospitalized patients with patient discharge 24 to 48 hours after the biopsy. The dismissal was followed by sparing from greater physical exertion for about 10 days.

Results

In the period from February 2009 to February 2020, 60 percutaneous kidney biopsies were performed at the Karlovac General Hospital. Two patients underwent re-biopsy 4 and 5 years after the first biopsy, respectively. The most common indication for renal biopsy was nephrotic syndrome (*24-hour urine protein* >3.5 g) in 26 (43.3%) patients, nephritic syndrome in 12 (20.0%) patients, unclear renal impairment in 12 (20, 0%) of patients, and suspected rapidly progressive glomerulonephritis (GN) in 10 (16.7%) patients. Biopsy was performed in 27 (45.0%) men and 33 (55.0%) women. The male to female ratio was 1:1.22. The median age of all patients at the time of biopsy was 56.0 years, or 61.1 years in men and 52.6 years in women. The age range of the patients ranged from 21 to 79 years.

The average creatinine in our patients was 279.6 µmol/L at the time of biopsy, 368.4 µmol/L in men, and 206.9 µmol/L in women. The normal renal function had 14 (25.4%) patients, of which 2 were men and 12 were women. Renal failure with glomerular filtration rate (GF) <15 ml/min was present in 17 (28.3%) patients, of which 9 were men and 8 were women (Table 1).

The pathohistological diagnosis was made in 57 (95.0%) patients, while in 3 (5.0%) patients, despite the existence of technically correct biopsy material, the pathologist could not comment on the final diagnosis. The most common primary glomerular diseases were IgA nephropathy (8 patients or 13.3%), focal segmen-

tal glomerulosclerosis (FSGS) (8 patients or 13.3%), membrane nephropathy (6 patients or 10.0%). The most common secondary glomerular diseases are pauci-immune glomerulonephritis and vasculitis (12 patients). Two patients were diagnosed with lupus nephritis, and 2 patients were diagnosed with AL amyloidosis. Some of the appoint diagnoses are very rare, e.g., immunotactoid glomerulopathy.

More serious complications after percutaneous kidney biopsy were recorded in 5 (8.3%) patients, 3 patients developed a perirenal hematoma, and two had macrohematuria after the biopsy. The size of the perirenal hematoma measured by ultrasound averaged 58 mm (range 10–110 mm) in the maximum diameter. In all three cases, spontaneous resorption of the hematoma occurred with conservative measures. Macrohematuria stopped spontaneously after 3 days. Microhematuria, which today is no longer even considered a complication after the procedure, was recorded in 20 (33.3%) patients. None of the complications required surgical care or blood transfusion.

Discussion

Indications for kidney biopsy

Indications for kidney biopsy vary depending on the centre and national guidelines of each country. In a review paper, Fiorentino *et al.* investigated the indications for kidney biopsy by reviewing a large number of national and institutional registries and concluded that in most cases, the indications include nephrotic syndrome, urinary disorders such as proteinuria and haematuria, acute renal failure as well as chronic kidney disease³.

In Croatia, we most often follow indications that are traditionally divided into well-defined syndromes based on symptoms, signs, and laboratory signs and include nephrotic syndrome, asymptomatic proteinuria and/or haematuria, acute and chronic nephritic syndrome, rapidly progressive nephritic syndrome, and unclear renal failure⁴.

At General Hospital Karlovac, we perform only native kidney biopsies

Contraindications for kidney biopsy

Absolute contraindications include adult polycystic kidney disease, marked renal impairment, markedly

reduced kidneys (<8 cm longitudinally) due to advanced chronic kidney disease and pregnancy after 30 weeks, and peripartum.

Relative contraindications include coagulation disorders such as haemorrhagic diathesis, uncontrolled arterial hypertension, solitary kidney, horseshoe kidney, hydronephrosis, acute nephritis or renal abscess, multiple solitary cysts, pregnancy before 30 weeks, and uncooperative patients⁴.

The results

In the Department of Nephrology with Haemodialysis of the General Hospital Karlovac, a cross-sectional study of the findings of native kidney biopsies in the period from 2009 to 2020 was performed. It includes the presentation and distribution of the characteristics of patients who underwent kidney biopsy, laboratory findings, indications, and pathohistological diagnoses. Data on kidney biopsies performed in Croatia and their analysis have been published little and mainly relate to Clinical Hospital Dubrava, Zagreb, where they analyse not only materials obtained by kidney biopsy from their institution but a large number of centres in Croatia. When talking about kidney biopsies and registers of kidney biopsies in the world, there are large differences and inconsistencies in the data because there is no systematic and uniform approach to indications and pathohistological findings, i.e., diagnoses that would allow quality comparison of data. We compared our results with the available results from University Hospital Osijek and Clinical Hospital Dubrava. The median age of patients in General Hospital Karlovac at the time of biopsy was 56.0 years; the median age in University Hospital Osijek was 53 years, and in Clinical Hospital Dubrava, 48 years. Biopsy was performed in 27 (45.0%) men and 33 (55.0%) women. The ratio of men to women was 1: 1.22, respectively, F:M = 1.22. In University Hospital Osijek and Clinical Hospital Dubrava, men underwent biopsies more often (University Hospital Osijek 62.2%; Clinical Hospital Dubrava M:F = 1.4). In the world, biopsies are more common in men, with a ratio of M:F = 1.2. Most patients, both in the world and in our country, had increased blood creatinine concentrations (Table 1).

The most common indications for kidney biopsy in OB Karlovac were: nephrotic syndrome in 26 (43.3%)

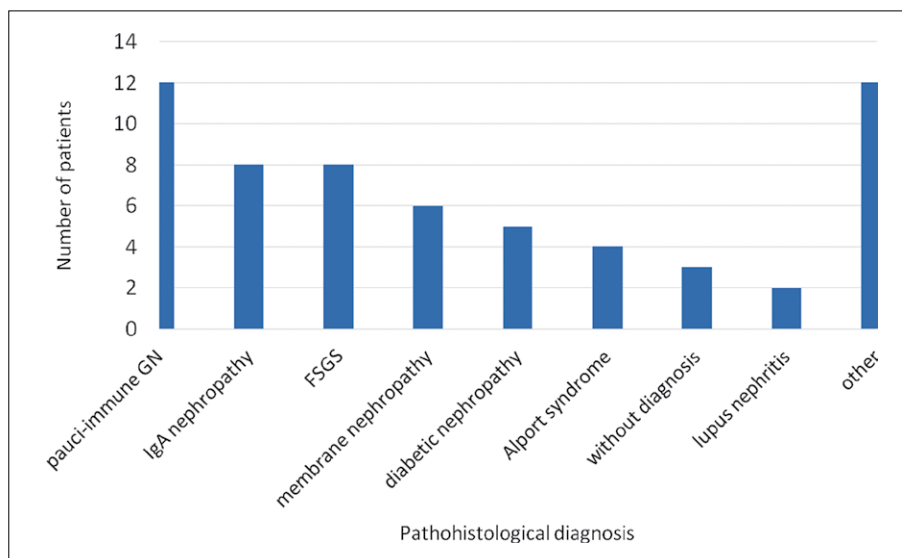


Figure 1. Frequency of pathologic diagnoses in the biopsy material.

patients, acute and chronic nephritic syndrome in 12 (20.0%) patients, unclear renal failure in 12 (20.0%) patients and suspected rapidly progressive glomerulonephritis in 10 (16.7%) patients. In University Hospital Osijek, the most common indications were nephrotic syndrome (25.1%), nephritic syndrome (16.7%), and acute renal impairment (6.0%), while in Clinical Hospital Dubrava, the most common indications were nephrotic syndrome and asymptomatic renal disorders. proteinuria and/or haematuria)^{6,7}. The indications agree in frequency with those in world reports where nephrotic syndrome ranks first with a frequency of 35.5 to as much as 70% (Figure 1).

The mean value of the number of glomeruli in the obtained sample was 25.5 glomeruli (from 7 to 69). For comparison, Clinical Hospital Dubrava had an average of 11.9 glomeruli per sample⁵. The significantly higher mean number of glomeruli in our samples can be explained by the fact that we used a 14-gauge needle (1.626 mm) during the biopsy, in contrast to the research in Clinical Hospital Dubrava where a 16-gauge needle (1.290 mm) was used⁵. The improvement in sample quality brought about by the use of a thicker needle should, of course, be considered in the light of the observation of a higher frequency of complications associated with the use of a thicker needle⁸.

The most common pathohistological findings in General Hospital Karlovac are similar to other Croatian centers whose data are available. In University

Hospital Osijek, they were IgA nephropathy, pauci-immune GN, hereditary nephritis, FSGS, and membrane glomerulonephritis, while in Clinical Hospital Dubrava, the most common diagnoses were IgA nephropathy, FSGS, membrane glomerulonephritis, hereditary nephritis, and pauci-immune GN. Of the total number of patients, 12 were diabetics. Diabetic nephropathy was verified in 5 patients, which means that in every person with diabetes with significant proteinuria, if there are no signs of diabetic retinopathy on the fundus, a kidney biopsy should be considered because it may be another aetiology of proteinuria. Regarding hypertension, 39 out of a total of 60 patients were hypertensive. Only in one of the patients, changes in blood vessels in the form of malignant hypertension were verified pathohistologically as the cause of renal failure. We did not find data in the available literature on the number of subjects with diabetes and hypertension.

Complications

The frequency of percutaneous kidney biopsy complications in our study is comparable to the data found in the literature. Horvatić *et al.* found the incidence of postoperative perirenal hematoma in biopsied patients of 3.6% (5.0% in our center), and macrohematuria in 0.8% (3.3% in our counter)⁵. Corapi *et al.*, in their meta-analysis of complications of percutaneous kidney biopsies, which includes 34 individual reports from all

over the world, find macrohematuria in 3.5% of subjects and the need for erythrocyte transfusion after biopsy in 0.9% of cases⁸. The somewhat more frequent occurrence of postoperative complications in our patients can be explained by the fact that we performed our biopsies with a thicker gauge needle, which is 0.33 mm thicker than the 16 gauge needle used in the work of Horvatić *et al.*⁵. A similar observation of the higher frequency of the need for erythrocyte replacement when using a 14-gauge needle is made by Corapi *et al.*⁸. In addition, the same authors cite a more frequent need for postbiopsy transfusion in patients with average higher creatinine levels, in women, elderly patients, hypertensives, and in patients with acute renal failure, compared to chronic⁸.

Conclusion

In our study, conducted in the nephrology department of general hospital and in a relatively limited number of patients, we observed good agreement of our results with literature data with respect to indications for renal biopsy, as well as with regard to the frequency of pathohistological diagnoses found in biopsy material. Unlike most other reports, we indicated a kidney biopsy more often in women than in men. Improving the quality of samples provided by the use of thicker biopsy needles, such as those we used in our work, should be considered in the light of the observation of a higher frequency of complications associated

with the use of such needles. In our study, the percutaneous ultrasound-controlled renal biopsy also proved to be a safe diagnostic method that, allows a definitive diagnosis to be made, which is a prerequisite for specific treatment.

References

1. Iversen P, Brun C. Aspiration biopsy of the kidney. *Am J Med.* 1951 Sep;11(3):324-30. DOI: 10.1016/0002-9343(51)90169-6.
2. Vitas B, 2020, pers. comm.
3. Fiorentino M, Bolignano D, Tesar V. *et al.* Renal Biopsy in 2015 - From Epidemiology to Evidence-Based Indications. *Am J Nephrol* 2016;43(1):1-19. DOI:10.1159/000444026
4. Galešić K, Galešić Ljubanović D, Horvatić I, Božić B, editors. *Bolesti glomerula – primarne i sekundarne*. 1st ed. Zagreb: Medicinska naklada, 2014.
5. Horvatić I, Hrkač A., Živko M. Značenje perkutane biopsije u dijagnostici bubrežnih bolesti. *Acta medica Croatica* 2007; 61:399-403.
6. Berlančić T. (2018) Patohistološki nalazi u uzorcima prvih 300 bubrežnih biopsija učinjenih u kliničkom bolničkom centru Osijek. Diplomski rad. Osijek: Sveučilište J.J. Strossmayera, Medicinski fakultet. <https://urn.nsk.hr/urn:nbn:hr:152:512661>.
7. Tisljar M, Horvatic I, Crnogorac M. *i sur.* Renal biopsy registry from Croatian university hospital - a review of epidemiological data. *Nephrol Dial Transplant.* 2016;31:i451-2. DOI:10.1093/ndt/gfw189.37.
8. Corapi KM, Chen JLT, Balk EM, Gordon CE. Bleeding complications of native kidney biopsy: a systematic review and meta-analysis. *Am J Kidney Dis.* 2012 Jul;60(1):62-73. DOI: 10.1053/j.ajkd.2012.02.330.

Sažetak

PERKUTANE BIOPSIJE BUBREGA U OPĆOJ BOLNICI KARLOVAC IZMEĐU 2009. I 2020. - NAŠI REZULTATI

V. Kupres, D. Katušin i Ž. Belavić

U radu su prikazani rezultati biopsija bubrega učinjenih u 60 bolesnika u Općoj bolnici Karlovac u razdoblju od 2009. do 2020. godine. Biopsije su izvršene perkutanom putom pod kontrolom ultrazvuka. Tkivo bubrega su analizirali nefropatolozi u KB Dubrava i KBC Zagreb pod svjetlosnim, imunofluorescentnim i elektronskim mikroskopom. Indikacija za biopsiju bio je nefrotski sindrom kod 26 (43,3%), nefritički sindrom kod 12 (20,0%), nejasno oštećenje bubrežne funkcije kod 12 (20,0%), odnosno, sumnja na brzoprogresivni glomerulonefritis u 10 (16,7%) bolesnika. Patohistološka dijagnoza je postavljena u 57 (95,0%) bioprirana bolesnika. Od primarnih glomerulskih bolesti kao najčešća je utvrđena IgA nefropatija i to kod 8 (13,3%) bolesnika. Od sekundarnih glomerulskih bolesti najčešći je pauci imuni glomerulonefritis – vaskulitis i to kod 12 (20,0%) bolesnika. Komplikacije nakon perkutane biopsije bubrega zabilježene su u 5 (8,3%) bolesnika i to kod 3 bolesnika perirenalni hematoma, a kod 2 makrohaturija. Mikrohematurija iza zahvata zabilježena kod 20 (33,3%) bolesnika. Niti jedna komplikacija nije zahtijevala operativno zbrinjavanje. Perkutana biopsija bubrega pod ultrazvučnom kontrolom sigurna je dijagnostička metoda koja najčešće omogućuje postavljanje definitivne dijagnoze koja je uvjet za diferentno (imunosupresivno) liječenje.

Ključne riječi: *perkutana biopsija bubrega, indikacije, komplikacije, rezultati*