

An intraoperative biopsy of native kidney in recipients with chronic kidney disease

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The clinically introduced intraoperative morphological study of native kidney during transplantation of related kidney in patients with end-stage chronic renal failure, with intact water-excretory function before dialysis, and in the period of initiating the hemodialysis sessions significantly expanded our understanding of the pathogenesis, morphological characteristics of renal parenchyma diseases, and causes of their relapses in kidney transplant.

Keywords: intraoperative biopsy of native kidneys, chronic renal failure.

INTRODUCTION

Recurrent diseases of a transplanted kidney result in a graft loss in about 6% of cases after primary transplantation and in 10% after retransplantation for glomerulonephritis (GN) [1, 2]. Data on the incidence of recurrent underlying kidney diseases in the graft have been contradictory because of varied follow-up periods, and biopsy schedules for individual patients. A relative proportion of the graft losses as a result of recurrent and de novo kidney diseases has increased due to reduced rates of mortality and rejection. The cause of dysfunction is also difficult to be differentiated between a recurrent disease and disease de novo [3-5]. GN problem remains relevant due to diagnostic difficulties, inadequate therapy, poor prognosis in some forms of the disease [6-8]. To date, GN diagnosis in nephrology has been mainly based on clinical signs and laboratory parameters that do not always reflect the true severity of the pathological process in the kidneys. A widespread use of kidney morphology study in vivo has considerably enriched our understanding of specific kidney morphology and pathomorphism processes in GN [9-12]. Kidney biopsy studies started in clinical practice in the last century; and their use has been greatly expanded in the recent 25 years with the advent of sophisticated puncture needles, new imaging techniques, including the real-time ultrasound-guided imaging, and a scanning tomography. All these have significantly reduced the risk of procedure-related adverse side effects and made it possible to obtain the kidney tissue, and, moreover, in the amount sufficient for a complete morphological study involving the light and electron microscopy [13, 14].

We should mention that the available literature lacks publications investigating the intraoperative biopsy of a native kidney in patients with stage V chronic kidney disease (CKD) in the predialysis period prior to

related kidney transplantation. There are contradictory opinions among authors on the feasibility and the necessity of renal biopsy in these patients.

Objective: to improve the outcomes of related kidney transplantation by making intraoperative biopsy of native kidneys.

MATERIAL AND METHODS

From 2011 to May 2016, 220 related kidney transplantations were performed at the *National Scientific Center of Human Organ and Tissue Transplantation of the Republic of Tajikistan*. A native kidney biopsy was performed in 18 of those patients (12.7%) with different types of GN during the related kidney transplantation procedure. The biopsy was obtained to make a diagnosis:

- 1) In nephrotic syndrome of unclear origin: 3 (16.6%) cases;
- 2) In unclassified proteinuria: 4 (22.2%) cases;
- 3) To exclude the urological source of bleeding in haematuria in 3 (16.6%) cases;
- 4) To clarify the morphological type of GN in 6 (33.3%);
- 5) In the cases of suspected interstitial nephritis: 2 (11.1%) cases.
- 6) To assess the prognosis of the disease and prevent a recurrent GN of the graft.

We should mention that the morphological diagnosis of the kidney disease was not established in those patients before transplantation. In all patients with an intact water-excretory function of the native kidney, the related kidney transplantation surgery was performed before the dialysis or in the period of the programmed hemodialysis induction.

Contraindications to native kidney biopsy:

- Kidney size less than 6.0 cm;
- Programmed hemodialysis for more than 3 months;
- Severe obesity.

The biopsy technique

During the kidney transplantation, the skin incision by Hokey is made in the right or left iliac fossa, thus preparing the bed for a transplant in the extraperitoneal space. Paranephral fatty tissue is palpated from the upper angle of the wound upward and laterally; the tissues are separated by blunt and sharp dissection; the lower pole of the right kidney is isolated and the needle biopsy is performed using a special 14-gauge Braun needle in an open (surgical) method. An open method of the needle biopsy is considered to be reliable, providing a sufficient sample from both the renal cortex, and medulla in almost 100% of cases. A biopsy sample containing a minimum of 8–10 glomeruli is required to make an adequate histological diagnosis. An open biopsy allows such a sample to be obtained in 100% of cases.

RESULTS

Glomerular changes in GN-related injury are characterized by a limited set of histological response which includes the cellular proliferation (epithelial, endothelial, mesangial cells) in glomeruli, the migration of exogenous circulating leukocytes (polymorphonuclear leukocytes, macrophages, lymphocytes) and platelets to glomeruli, the expansion of mesangial matrix, the basement membrane changes, and the development of sclerosis and hyalinosis. The Morphological Classification of GN is based on these most likely changes. One should note that the extent of lesions is

classified as diffuse GN when the process affects all the glomeruli, focal GN when only a few glomeruli are affected, segmental GN when only a part or a segment of a glomerular loop is affected, and as global GN that affects whole glomerular loops (Table. 1).

Table 1. The distribution of the patients' biopsy results according to glomerulonephritis morphological type

Morphological variant of nephrosclerosis in the outcome of chronic GN (CGN)	Number	%	Recurrence
Mesangioproliferative GN (MezPGN)	3	16.6	-
Membranous GN	4	22.2	1
Mesangiocapillary GN	3	16.6	1
Focal segmental glomerular hyalinosis/sclerosis (FSGS)	6	33.3	2
Diffused fibroplastic (sclerotic) GN	1	5.6	-
Sclerosis	1	5.6	-
Total	18	100	4

The review of patient history records and biopsy results while predicting the clinical progression rates in diverse chronic GN (CGN) types demonstrated the most favourable course in cortico-sensitive CGN and in inactive nephritic CGN types.

The clinical hypertensive CGN and the active nephritic type very rapidly led the patients to CKD. In the recipients who had been ill for 5 years, the incidence of chronic kidney disease in active CGN types and in nephrotic-hypertensive CGN type appeared higher than in inactive nephritic and nephrotic CGN types. In active nephritic CGN types, Stage V CKD occurred in the interval from 6 months to 2 years in 16 patients. In the cases

of inactive nephritic CGN type with exacerbations, CKD was identified in the period from 1 to 5 years after the onset of the disease in 2 patients. Basing on the defined clinical types of CGN, it is possible to predict the onset of the graft chronic nephropathy (the recurrence) or to exclude such a probability during a 4-year period of the disease. There is a correlation between the morphological type of CGN and its progression that is prognostically important. The chronic nephropathy of the graft as an outcome (a recurrence) within 2 years after transplantation is typical for CGN of active types that represent manifestations of mesangiocapillary GN (MCGN), or for nephrotic-hypertensive types with MezPGN and FSGS as its frequent morphological equivalents (that was seen in 6 patients with CKD and predialysis transplantation in our series). The risk of a severe outcome is nearly excluded in inactive types or in a cortico-sensitive nephrotic type of MezPGN. In nephrotic-hypertensive type of MezPGN, CKD develops more frequently than in the same period in other clinical types inherent to this morphological variant of CKD. Early manifestation of CKD in MCGN was found only in active clinical types. Having analyzed the CGN progression rates in patients, we established a correlation between the onset of CKD and the clinical and morphological types of the disease, as well as the early detection of sclerotic abnormalities in the kidney parenchyma.

The example of microscopy report and conclusion. Biopsy of patient S., born in 1977: kidney biopsy specimen presents cortical and medullary layers (up to 30 glomeruli); 23 glomeruli are completely sclerotic. The surviving glomeruli demonstrate a mesangium expansion, focal thickening of the glomerular basement membrane, a minor focal proliferation of mezangiocytes (cells), sclerosis of individual vascular loops with synechia. The epithelium of the convoluted tubules is in a state of protein degeneration

and focal atrophy (80%). Individual tubule lumens are expanded, sometimes filled with protein cylinders. There is diffuse sclerosis of the stroma (80%) with focal lympho-macrophageal infiltration. Marked arterial and arteriolar sclerosis. No amyloids found. Immunohistochemical study has demonstrated a strong fixation of IgG, a weak fixation of IgM, IgA, and of C3-component complement on the glomerular basement membrane, mesangium, and glomerular capsule, being focal, granular by nature).

At 3 years after transplantation, the patient developed the chronic nephropathy of the graft; a needle biopsy of the graft demonstrated the morphological pattern of the disease recurrence.

A needle biopsy is necessary to be performed intraoperatively to identify the specific features of the kidney morphology pattern that would help to choose the optimal treatment program. In the post-transplant period, the patients with FSGS received plasmapheresis sessions and a high dose of cyclosporine; in the cases of membranous-proliferative type, the plasmapheresis sessions were complemented with a high corticosteroid dose that made it possible to realistically assess the prognosis and the prevention of the disease recurrence.

CONCLUSION

The clinical implementation of intraoperative morphological study of a native kidney during related kidney transplantation in patients with an intact water-excretory function before dialysis and during the induction of a programmed dialysis has significantly expanded our understanding of the pathogenesis and specific morphology of kidney parenchymal diseases. Intraoperative morphological study of a native kidney is now considered as an important component of diagnosis and prognosis of disease recurrence in

the graft. The intraoperative morphological study of a native kidney made real the morphology-based post-transplant diagnosis and treatment, which, in turn, served as an important factor in planning and conducting further studies including prediction, positive and negative criteria, the efficacy evaluation of various prevention schemes (with or without the effect on the immune system). The intraoperative morphological study of native kidneys is one of a few objective tools for an actual assessment of the type, nature, location, severity, and the extent of damage in kidney structures.

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