

PATIENTS REFERRED TO NEPHROLOGY SPECIALIST WITH INCOMPLETE DIAGNOSTIC WORKUP – HOW BIG IS THE PROBLEM?

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In daily work, we notice an increasing number of patients referred to a nephrologist without diagnostic tests necessary for proper assessment and treatment plan. Our aim was to show how many patients are referred to a nephrology specialist for the first time with complete diagnostic workup. We included 184 patients (89 male and 95 female) newly referred to the Merkur University Hospital nephrology specialist due to chronic kidney disease (CKD, stages 3A and above) from 2017 until 2020. We analyzed blood pressure values, 24-h ambulatory blood pressure monitor (ABPM) and laboratory test results (hemoglobin, hematocrit, glucose, potassium, creatinine, sodium, cholesterol, calcium, urates, and urine) of patients having presented them at the check-up. Most of the referred patients had CKD stage G3 (G3A 15 patients, G3B 82 patients, 52.15%), while 71 (38.17%) patients had CKD stage G4 and 18 (9.67%) patients CKD stage 5. Women were statistically significantly older (74.08 vs. 70.49 years, $p < 0.05$) with higher heart rate (76.11 vs. 70.76 bpm, $p < 0.05$) than men. Although 160 (86.02%) patients had verified arterial hypertension, only 44 (23.66%) patients had ABPM results. Ninety (48.39%) patients had their urate levels measured; 104 patients had their urine analyzed, of which 28 (26.92%) patients had no albumin values, and 76 had albumin values measured in urine (A1 (8.65%), A2 (51.92%), and A3 (12.50%)). Hematuria was found in 49 (47.11%) patients. Only 14.52% of patients referred for the first time to the nephrology specialist had complete diagnostic test results mandatory for successful first clinical check-up. Multicenter data should be obtained to get more consistent results.

Key words: chronic kidney disease, primary care physicians, referral to nephrologist

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INTRODUCTION

In a modern clinical care setting, where precision and efficiency are the key measures, there is a growing pressure on physicians to do increasing amounts of quality work in as short time as possible. This situation combined with the fact that many modern healthcare settings suffer from patient overload and increasingly longer waiting lists to clear, has led to the fact that a proper, standardized specialist examination in Croatia should take 15 minutes or less, according to the Croatian Bureau of Health Insurance. Within that short timeframe, it is expected that a physician takes thorough medical history, completes quality physical examination, reviews laboratory results brought by the patient, establishes a differential diagnosis and therapy

plan, and makes records of all these steps. A patient referred with incomplete diagnostic workup, i.e., visiting a specialist for the first time without having done all diagnostic tests necessary for quality diagnostic workup, therefore poses another obstacle in the already arduous task for the physician. Faced with a patient with incomplete diagnostic workup, the specialist has a difficult choice of either making diagnoses and therapy modifications with incomplete data or scheduling the patient for a return visit with the results of all the missing necessary diagnostic tests done at the earliest possible date, thus taking up another time slot in the already overfilled clinic schedule. There are multiple variables influencing the quality and completeness of patient referrals, including but not limited to primary care physician (PCP) education regarding diagnos-

tic tests necessary for quality specialist examination, availability of facilities where these diagnostic tests can be performed, and patient compliance in completing this diagnostic workup. Several studies investigated incomplete referrals and their repercussions on the healthcare system. The article by Forrest *et al.* (1) from 2007 showed that only 80% of patients referred to a specialist completed the examination they were referred to, with the main reason for noncompletion being the lack of patient compliance. Another article by Patel *et al.* (2) from 2018 paints a much darker picture, showing that out of a very large patient sample of 103,737 people referred to a specialist, only 34.8% completed the examination they were referred to. The authors report on the problems with patient access to clinical facilities, long wait times, and geographical distance to hospitals as the main negative predictors of incomplete referrals and unfinished diagnostic processes. Besides compliance and other patient-related variables, PCP education and thoroughness, as mentioned above, play a very important role (3).

Being aware of the potential problems and difficulties mentioned above that incomplete referrals can bring about, we decided to check how many referred patients had complete test results necessary for successful check-up of chronic kidney disease (CKD) in a single nephrology clinic operating as part of a tertiary care center in Zagreb.

METHODS

In this cross-sectional study, we included 184 patients (89 male and 95 female) newly referred from family medicine practice to the Merkur University Hospital nephrology specialist due to CKD (stages 3A and

above) from 2017 until 2020. All analyzed patients lived and were referred from Croatia. All patients from the patient pool were referred by a single PCP, who is experienced in nephrology referrals and current guidelines. We analyzed blood pressure values measured at the check-up, number of 24-h ambulatory blood pressure monitor (ABPM) test results done before check-up, and laboratory test results (hemoglobin, potassium, sodium, calcium, creatinine, cholesterol, urates, and urine) of patients having presented them at the check-up. Glomerular filtration rate was estimated with the CKD-EPI formula, while CKD and albuminuria stages were graded by KDIGO classification from 2020 (4). The number of patients having ultrasound findings, parathyroid hormone (PTH), phosphate, and high-sensitivity C-reactive protein (hsCRP) levels were not analyzed because these data were missing in more than 90% of patients. Data were expressed as mean and percentage, and Student's t-test was used on parametric variable analysis performed by Statistica v. 10.0.

RESULTS

Most of the referred patients had CKD3 stage (3A 15 patients, 3B 82 patients, 52.15%), while CKD4 stage was found in 71 (38.17%) and CKD5 in 18 (9.67%) patients. Women were statistically significantly older (74.08 vs. 70.49 years, $p < 0.05$) with higher heart rate (76.11 vs. 70.76 bpm, $p < 0.05$) than men, and had significantly higher values of cholesterol (5.86 vs. 4.78 mmol/L for total cholesterol, $p < 0.01$; 3.66 vs. 2.54 mmol/L for LDL cholesterol, $p < 0.01$, and 1.31 vs. 1.11 mmol/L for HDL cholesterol, $p = 0.05$). There were no statistically significant differences between genders in other examined parameters. Differences between CKD stages are listed in Table 1.

Table 1. Mean values of examined parameters for chronic kidney disease (CKD) stage 3B and 4. The last two columns describe the rate of patients with values above or below normal values.

	CKD stage 3B (N=82)	CKD stage 4 (N=71)	p	Threshold value	Values above (%)
Age (years)	73.36±10.97	72.39±11.66	0.596	/	/
SBP (mm Hg)	138.04±16.86	135.84±25.64	0.539	≥140	52.22
DBP (mm Hg)	81.33±10.37	77.7±12.44	0.058	≥90	22.78
HR (/min)	72.37±14.19	75.13±15.73	0.321	≥80	35.21
BMI (kg/m ²)	27.76±6.96	32.52±6.64	0.012	≥30	45.71
Hemoglobin (g/L)	130.67±17.26	116.21±22.88	<0.001	≥135 males, ≥120 females	54.16
Hematocrit	0.38 ± 0.06	0.34±0.06	0.005	<0.41 males, <0.36 females	76.47
Potassium (mmol/L)	4.71±0.56	4.75±0.72	0.750	>5.00	28.22
Sodium (mmol/L)	138.16±3.31	137.73±3.73	0.549	≤136	18.85
Calcium (mmol/L)	2.31±0.26	2.17±0.36	0.122	≤2.0	4.28
Glucose (mmol/L)	7.01±2.14	6.57±2.18	0.306	≥7.0	34.64
Uric acid (mmol/L)	468.97±116.55	505.14±154.62	0.248	>420	69.23
LDL cholesterol (mmol/L)	3.22±1.20	2.92±0.99	0.430	>2.6	56.25

The number of patients having certain test results significantly varied depending on CKD stage. The rate of patients having test results was 26.67% in CKD stage 3A, 12.20% in CKD stage 3B, 15.49% in CKD stage 4, and 11.11% in CKD stage 5 not on dialysis (Table 2). Although 160 patients had verified arterial hypertension (86.02%), only 44 (23.66%) patients had ABPM results (9 were dippers, 20.45% non-dippers). Anemia significantly depended on CKD stage and was found in 77 (45.83%) and hyperkalemia in 46 (28.22%) patients. Ninety (48.39%) patients had their urate levels measured, of which 63 (70.0%) had hyperuricemia (more pronounced in men, 499.54 vs. 436.36 mmol/L, $p < 0.05$); 104 patients had their urine analyzed, of which 28 (26.92%) patients had no albuminuria levels, 9 (8.65%) patients had A1, 54 (51.92%) patients had A2, and 13 (12.50%) patients had A3. Hematuria was found in 49 (47.11%) patients.

The rate of CKD patients having test results was as follows: potassium 87.63%, glucose 68.28%, complete blood account 66.67%, albuminuria 55.91%, uric acid 48.92%, calcium 37.63%, and LDL 25.81% (Table 2). Only 14.52% of patients referred for the first time to the nephrology specialist had complete diagnostic test results (Figure 1).

Table 2. Rate of patients having test results in each chronic kidney disease stage from stage 3A to stage 5 not on dialysis

	CKD stage 3A (N=15)	CKD stage 3B (N=82)	CKD stage 4 (N=71)	CKD stage 5 (N=18)
APMB measurement	4 (26.67%)	12 (14.63%)	14 (19.72%)	14 (77.78%)
Complete blood count	12 (80.00%)	40 (49.78%)	54 (76.06%)	18 (100.00%)
Potassium	13 (86.67%)	67 (81.71%)	66 (92.96%)	17 (94.44%)
Calcium	7 (46.67%)	27 (32.93%)	28 (39.44%)	8 (44.44%)
Glucose	9 (60.00%)	50 (60.98%)	53 (74.65%)	15 (83.33%)
Uric acid	8 (53.33%)	48 (58.54%)	29 (40.85%)	6 (33.33%)
LDL cholesterol	6 (40.00%)	27 (32.93%)	13 (18.31%)	2 (11.11%)
Albuminuria	8 (53.33%)	39 (44.56%)	43 (60.56%)	14 (77.78%)
Total	4 (26.67%)	10 (12.20%)	11 (15.49%)	2 (11.11%)

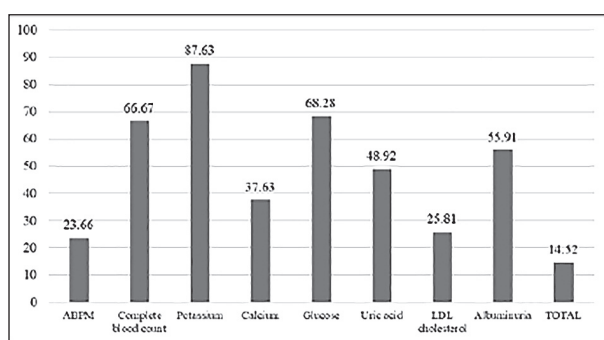


Figure 1. Rate of patients with CKD having test results. ABPM = ambulatory blood pressure monitor.

DISCUSSION

Chronic kidney disease is a growing population health concern worldwide (4). With early identification and effective management, kidney disease progression can be slowed down or prevented. Most patients with risk factors for CKD are treated within primary health-care (5). There are challenges in providing optimal CKD care in the primary care setting (PCPs). Effective co-management of patients with CKD between PCP and nephrologists is increasingly recognized as a key strategy to ensure efficient and high-quality CKD care (3, 6).

While the results of laboratory tests analyzed are congruent with clinical presentation and features of CKD established in modern literature, the percentages of patients having the results of diagnostic tests necessary for a quality first-time examination by a nephrologist in a tertiary care center paint a bleak picture. It is well known that in CKD, the complications of the compromised kidney function and morphology present a significant detriment to both the patient physical health and quality of life (7). The various sequels of CKD, including anemia, hyperkalemia, arterial hypertension, etc. should therefore be carefully and regularly monitored, evaluated, and treated in order to prevent further deterioration of the patient presenting clinical state (8). Among the most worrying results identified in this research is the fact that less than one-fourth of the patients presenting with arterial hypertension had an ABPM result. Complete blood count as a basic and routine laboratory test with results available within 30 minutes and an indicator of the severity of anemia was missing in about one-third of the patients. Albuminuria, which is an important marker and indicator of glomerular dysfunction, was evaluated in only about half of the patients. Still, the most worrying result is, without any doubt, that only 14.52% of the patients who presented for the first-time nephrologist examination had done all diagnostic tests necessary for a proper examination and adequate for the nephrologist to form an opinion and treatment plan. A first-time examination without having an insight into the necessary diagnostic test results requires either repeat visits within a short time period, requiring from the patient to do and bring along all those test results, or, in the worst-case scenario, making a conclusion and treatment plan using incomplete data, which may imply that some more subtle comorbidities and complications remain undetected and unaddressed. Looking at the available literature, it should be noted that incomplete referrals and data on clinical examinations in hospitals are not endemic to a specific area or country, but are a worldwide issue mostly connected with the lack of communication between PCPs and hospital physicians, administrative obstacles for the patient in reaching the healthcare facilities and

services required, and patient compliance (3, 9). For example, a study by Al Shamsi *et al.* from 2018 showed that among 181,192 Saudi Arabian patient referrals and documents examined, more than 50% contained incomplete patient information and data (9). The effect those incomplete referrals can have on a larger scale can best be inferred from a study by Buja *et al.*, where the authors concluded that incomplete and inappropriate patient referrals to the Emergency Department by PCPs increased wait times, delayed referral acceptance, and significantly reduced the quality of the services provided (10). Although this article raises important questions about the chain of referrals from a PCP all the way to a tertiary clinic physician and the efficiency of the Croatian healthcare system, it should be noted that it suffered from some limitations. Being a single-center study analyzing only a single nephrology clinic, the results of this study cannot be generalized to the Croatian healthcare system. Also, since all the patients from the patient pool were referred by a single PCP, who is experienced in nephrology referrals and current guidelines, it is hard to infer the efficiency and quality of referrals of PCPs in general. Multicenter data should be obtained in future studies in order to either confirm or deny the results of this study and the allegations inferred from them. These findings reinforce prior observations of low adherence to guideline-recommended practices in healthcare systems and underscore the urgent need for improved patient management (5, 6). The nephrology workforce has focused attention on patients with kidney diseases (11). If there is not enough time for patients and communication, along with the lack of guidelines for primary care, the question is what can we do at this moment? We need better communications between us. We need to invest additional efforts for education of PCPs and other hospital specialists to increase the number of patients with complete workup results on the first nephrology specialist check-up for CKD. The findings of this article suggest the need for time-efficient strategies that promote better collaboration among all members of the healthcare team for CKD patients.

CONCLUSION

Our results show that only 14.52% of patients referred for the first time to a nephrology specialist had complete diagnostic test results mandatory for the successful clinical check-up and management of CKD. The most important component of the system is communication between primary care and specialist care providers. Poor communication between them can cause significant issues with coordination of ineffective care. Multicenter data should be obtained to get more consistent results.

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S A Ž E T A K

PACIJENTI UPUĆENI NEFROLOGU S NEPOTPUNOM OBRADOM – KOLIKA JE VELIČINA PROBLEMA?

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U svakodnevnom radu uočavamo sve veći broj pacijenata upućenih nefrologu bez potrebne obrade. Stoga smo analizirali koliko je pacijenata adekvatno pripremljenih na primarnoj zdravstvenoj zaštiti upućeno na prvi pregled nefrologu. Uključeno je 184 pacijenata (89M, 95F) upućenih u Kliničku bolnicu Merkur zbog kronične bolesti bubrega (KBB, stadij G3A i više) u razdoblju od 2017. do 2020. godine. Kod pacijenata su pri upućivanju analizirani podaci postojanja laboratorijskih parametara (hemoglobin, hematokrit, glukoza, kreatinin, kalij, natrij, kalcij, kolesterol, urati, urin) uz podatak o nalazu kontinuiranog mjerenja krvnog tlaka (KMAT). Analiza podataka prikazana je u postotcima, srednjim vrijednostima uz Studentov t-test. Većina upućenih pacijenata bila je unutar KBB stadija G3 (15 pacijenata u G3a, 82 pacijenta u G3b, 52,15 %). U KBB G4 bio je 71 pacijent (38,17 %), a 18 ih je bilo u KBB G5 (9,67 %). Žene su bile statistički značajno starije (74,08 vs. 70,49 godina, $p < 0,05$) s višom srčanom frekvencijom (76,11 vs. 70,76/min, $p < 0,05$) nego muškarci. Iako je bilo 160 pacijenata (86,02 %) s hipertenzijom, svega 44 (23,66 %) je imalo KMAT. Devedeset pacijenata (48,39 %) imalo je određenu vrijednost urata, od čega ih je 63 (70,0%) imalo hiperuricemiju ($M / 499.54$ vs. $F / 436.36$ mmol/L, $p < 0,05$). Analizu urina imalo je 104 pacijenta, od kojih s određenom razinom albuminurije (A) kako slijedi: stadij A1 utvrđen je u 9 (8,65 %), A2 u 54 (51,92 %) i A3 u 13 (12,50 %) pacijenata, a 28 (26,92%) nije imalo određenu A. Hematurija je utvrđena u 49 od 104 pacijenta koji su imali analizu urina (47,11 %). Podatci su pokazali da je svega 14,52 % pacijenata koji su upućeni na prvi pregled nefrologu pripremljena, odnosno ima potrebne laboratorijske analize krvi i urina za prvi pregled. Potrebna je multicentrična studija koja će pokazati kolika je veličina problema.

Ključne riječi: kronična bubrežna bolest, primarna zdravstvena zaštita, upućivanje nefrologu