The Need to Emphasize Nephrology Knowledge in Residents-in-Training

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Abstract

Background: Chronic kidney disease is an increasingly prevalent health problem with the potential for poor outcome of end-stage renal disease. Hospitalized critically ill patients are prone to acute renal injury from numerous factors such as poor renal perfusion secondary to ischemia and hypotension, nephrotoxin exposure, and intravenous contrast exposure. Aims: We set to explore resident awareness and knowledge about chronic kidney disease management, timely nephrology referrals, preventing inadvertent acute kidney injury (AKI), and the understanding of basic electrolyte physiology. Materials and Methods: We conducted a cross-sectional study using an online questionnaire survey of internal medicine, Medicine/Pediatrics and Family Medicine residents in the United States to determine the knowledge of residents during their training about nephrology. Results: The survey questionnaire was sent out to 270 residents. Forty-seven (17%) respondents completed the survey. Out of them, 57% of the residents chose to refer a patient with an estimated glomerular filtration rate <30 mL/min/1.73 m² to a nephrologist; 66% felt that it was safe to use aspirin in stage IV chronic kidney disease; 82% did not want to use metformin or Lovenox in stage IV chronic kidney disease; 87% answered that they would make the patient resume angiotensin converting enzyme inhibitor or angiotensin II receptor blockers (ARBs) about 48-72 h after contrast exposure. Only 7.5% decided to hold angiotensin converting enzyme inhibitors/ARBs before contrast exposure. Meanwhile, 70% correctly identified the efferent arteriole as the site of action of angiotensin converting enzyme inhibitors/ARBs and 76% identified nitrofurantoin as a contraindication in renal insufficiency. Conclusion: Residency offers a golden opportunity for resident physicians to create a strong foundation of concepts in medicine. There are several basic areas in the field of nephrology that need to be further emphasized during residency training to help improve patient care and potentially decrease the incidence of AKI.

Keywords: Chronic kidney disease, nephrology, residents

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Introduction

The current postgraduate training aims to prepare future internists and family physicians in the basic fields of nephrology, cardiology, and pulmonology. It is unknown whether the degree of emphasis placed in the field of nephrology is sufficient to adequately prepare the future internist and family physician in chronic kidney disease (CKD) management, timely nephrology referrals, prevention of inadvertent acute kidney injury (AKI), and the understanding of basic electrolyte physiology. Due to the presence of a small number of nephrologists, a large proportion of patients with early CKD are likely to be seen by primary care physicians.

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Late referral of patients with CKD has been reported in their study. Similarly, Go et al. reported that an independent graded association was observed between a reduced estimated glomerular filtration rate (eGFR) and the risk of death, cardiovascular events, and hospitalization in a large, community-based population, thus highlighting the clinical and public health importance of chronic kidney disease. A large number of patients with chronic kidney disease are seen by primary care physicians in the early stages of CKD, secondary to the small number of nephrologists. The referral rate of individual physicians varies widely, suggesting a high level of uncertainty about the appropriate referral practice. Late referral of patients with CKD has numerous serious complications such as suboptimal pre-end-stage renal disease care and increased mortality and morbidity. Meanwhile, overreferral can lead to fragmented care, overtesting, and wastage of health resources. Stack et al. noted that late nephrology referral was associated with greater death risk in new patients with ESKD, and more frequent pre-ESRD care confers increased survival benefit.

AKI encompasses a wide spectrum of injury to the kidneys. It is a common problem amongst hospitalized patients. Such patients are usually under the care of doctors practicing in specialties other than nephrology. It is known that renal function is vulnerable to modest hypotension, hypovolemia, sepsis and copious nephrotoxins. In developed countries AKI is seen in 13-18% of all people admitted to the hospital. As clinicians we may be inadvertently contributing to the development of AKI, by the use of drugs that are harmful to the kidney. Thus there is a need to ensure awareness about prevention of AKI.

Educational efforts to improve resident awareness and better understanding of CKD management, avoiding inadvertent AKI and good insight in to electrolyte physiology may improve patient care and clinical outcomes. We performed this cross-sectional online survey to assess the basic knowledge of renal disease in IM, Med/Peds and FM residents. To our knowledge, this is the first study to examine this aspect of AKI, CKD, and electrolyte knowledge of residents in training.

**Materials and Methods**

We conducted a cross-sectional study using an online questionnaire survey of Internal Medicine (IM), Medicine/Pediatrics (Meds/Peds), and Family Medicine (FM) residents. We reviewed the official Kidney Disease Outcomes Quality Initiative (KDOQI) and Kidney Disease Improving Global Outcomes (KDIGO) guidelines and identified some themes pertinent to nonnephrologists offering care to patients with abnormal renal parameters.

We designed questions testing the knowledge for identifying risk factors for AKI, especially in the hospitalized setting, timings and site of action of potential nephrotoxic agents, interpretation of urine electrolytes in the setting of AKI, medications to avoid in AKI and the late stages of CKD, management of CKD complications, management of basic electrolyte disturbances, and the timing of nephrology referral.

A 25-item questionnaire was developed consisting of clinical vignettes with multiple choice questions. We posted the questionnaire using an online survey program that allowed the respondents to complete the survey and submit the response online. The link to this online survey was sent by e-mail to the chief residents of Internal Medicine, Medicine/Pediatrics and Family Practice residency programs in the United States to distribute to residents-in-training. Participation was voluntary, and responses were anonymous. No identifying data were collected. Approval from the Institutional Review Board was obtained.

**Statistical analysis**

Due to the nature of the study and the sample size, all data results were reported as percentage values.

**Results**

The survey was sent out to 270 residents, out of which 47 (17%) respondents completed the survey from February 2015 to June 2015. There were 37 (78.72%) IM residents, 7 (14.89%) Med/Peds residents, and 3 (6.38%) FM residents who responded [Figure 1]. Their postgraduate year (PGY) distribution was as follows: 12 were in PGY 1, 24 were in PGY 2, 9 were in PGY 3, and 2 were in PGY 4. The distribution of the subspeciality interest of the respondents is given in Figure 2.

Of the respondents, 57% chose to refer a patient to a nephrologist when the glomerular filtration rate was less than 30 mL/min/1.73 m² while 40% residents preferred to wait till eGFR was less than 60 mL/min/1.73m² for referring their patient. 100% of the residents identified appropriately the need for calcium gluconate for hyperkalemia with ECG changes. While only 30% identified that the overcorrection of...
chronic hyponatremia is a concern for central pontine myelinolysis.

About medications that were to be avoided in the late stages of CKD or for prevention of AKI, 66% felt safe to use aspirin from the NSAID group in stage IV CKD while appropriately so 82% did not want to use metformin or Lovenox in stage IV CKD. Among the respondents, 88% answered that they would make the patient resume angiotensin converting enzyme inhibitor (ACEI) or angiotensin II receptor blockers (ARBs) about 48-72 h after contrast exposure. However, only 7.5% decided to hold ACEIs/ARBs while no one decided to hold NSAIDs before contrast exposure. Among the respondents, 76% identified Nitrofurantoin as a contraindication in renal insufficiency and 79% identified the avoidance of hydrochlorothiazide (HCTZ) in a patient with eGFR less than 30 mL/min/1.73m². Regarding contraindications of erythropoietin, 70% identified them correctly.

Fifty-five percent interpreted urine sodium correctly in the setting of prerenal AKI. Among the respondents, 95% correctly picked checking iron studies before deciding to give iron or erythropoietin-stimulating agents. Intravenous (IV) contrast for magnetic resonance imaging (MRI) and positron emission tomography-computed tomography (PET-CT) without omnipaque was considered a risk for AKI by 5% and 7.5% of the residents, respectively. About 5% of the residents did not want to stop nonsteroidal anti-inflammatory drugs (NSAIDs) and ACEI/ARBs before major surgery. About 30% of the residents did not know the mechanism of renal injury from ACEIs/ARBs and NSAIDs; 30% of the residents were not able to identify the timings of contrast-induced nephropathy; and 86% of the residents were able to identify the impact of proteinuria on cardiovascular mortality and risk for AKI.

Figure 1: Characteristics of respondents

Figure 2: Subspeciality interest of respondents

Discussion

Our study was designed to assess the perception of nephrology knowledge in the management of CKD and its complications, identification of the risk factors for AKI, insight of critical concerns in electrolytes correction, interpretation of urine electrolytes in prerenal AKI as well as determining when physicians felt it appropriate to refer CKD patients to the nephrologist. Our study helps identify areas in the field of nephrology that may benefit from increased emphasis during residency training to help improve the performance of future interns.

Our study identified specific perceptions among residents-in-training, some of which were of concern. Of the residents, 57% performed well in involving a nephrologist for a grade B recommendation of eGFR less than 30 mL/min/1.73 m² while about 40% of the residents stated that they would refer to a nephrologist if the patient had an eGFR of less than 60 mL/min/1.73 m². Over-referral can lead to fragmented care, overtesting, and wastage of health care resources. In general, internists should be able to make the diagnosis of CKD and be aware of the basic CKD complications and their management. They should inform their patients of the early CKD diagnosis, as delayed referral results in increased morbidity and mortality and often patient dissatisfaction with the providers and subsequently failure to follow up with a nephrologist. CKD complications such as anemia and bone mineral disease usually start appearing toward late stage 3 CKD and early stage 4 CKD. Timely referral not only helps in the management of these complications to reduce the overall patient morbidity and mortality but also helps raise patients’ awareness about their disease so that they can work with their physicians to delay the progression of CKD to ESRD.

Residency offers a golden opportunity for physicians in training to create a strong foundation of the concepts in medicine. Educational efforts to improve resident awareness and knowledge of renal electrolytes during daily medicine rounds through noon conference, grand
rounds, and lectures by nephrologists may be helpful. Case-based learning may be a better tool during the nephrology rotation. Our study helps identify some of the weak points in the nephrology knowledge of residents. In the light of the current trend of decreased interest in nephrology as noted by 44.1% of unfilled nephrology programs and an increase to 24.1% of unfilled nephrology positions as per data from the 2014 National Resident Matching Program (NRMP) match, one may expect a further decrease in the number of nephrologists and subsequent need for primary care physicians to be aware of the basic identification and management of AKI, CKD, and their complications.

In 2002, the National Kidney Foundation (NKF) developed the Kidney Disease Outcomes Quality Initiative (KDOQI) clinical practice guidelines to facilitate primary care physician management of CKD by early detection, formulation of an action plan for each stage of CKD, monitoring of CKD progression, assessment of complications, and timely referral to a nephrologist. The definition of AKI has been evolving over the recent years. In 2004, the Acute Dialysis Quality Initiative (ADQI) group published its consensus definition of AKI, known as the risk injury failure loss end-stage renal disease (RIFLE) definition. In 2007, the Acute Kidney Injury Network (AKIN) published its definition of AKI, which was an evolution of the RIFLE definition. The recent International Kidney Disease: Improving Global Outcomes (KDIGO) guidelines proposed a merger of RIFLE and AKIN, with some simplification. All these efforts have been made by the nephrology community to help provide medical care providers a simple means to identify patients who need to be referred to a nephrologist and the timing of the referral to minimize complications pertaining to CKD. We believe that all these guidelines should be brought to the attention of residents-in-training as the timing of referral of patients with CKD by their primary care physician to the nephrologist affects patients’ prognosis and clinical outcomes.

In the current practice of medicine, the use of ACEI/ARBs and NSAIDs is very common be it for CAD, CHF, or postoperative pain management. Knowing the basic mechanisms of action of these drugs and how they can alter the kidneys’ autoregulation in times of hemodynamic fluctuations and hence use them with caution can potentially reduce the incidence of AKI. Similarly, being aware that certain drugs may be nephrotoxic once the patient’s GFR is reduced and hence either their dose needs to be adjusted or the drug needs to be replaced with another agent is potentially helpful to decrease patient morbidity.

Our study has several strengths such as the multi-institutional random sample of residents from IM, Med/Peds and FM residencies. This is evident from the number of responses we received during the short study period. Also, it covers a broad spectrum of questions from the field and is the first study to look at this data of residents. It helps us identify the basic weaknesses in the knowledge base.

There are several limitations to our study as well. We surveyed only residents; we did not survey the attending physicians, which may have helped establish a level of performance expected for residents and may have been useful for comparison. We do not have the data of the nonresponders, and this bias could not be accounted for. Although we tried to touch on a number of topics, we obviously could not and did not cover them all. Lastly, our sample size was small.

**Conclusion**

Residency offers a golden opportunity to resident physicians to create a strong foundation of concepts in medicine. Educational efforts to improve resident awareness and create a better understanding of CKD and AKI may improve patient care and clinical outcome. There are several areas of weakness in the basic nephrology knowledge, which need to be emphasized during training.

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**Conflicts of interest**

The authors declare that they have no competing interests.

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