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Types, Courses and Outcomes of Renal Failure in Hospitalized Patients: A Single Center Experience

Yatan Hastalarda Böbrek Fonksiyon Bozukluğu Tipleri, Seyirleri ve Sonuçları: Tek Merkez Deneyimi

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ABSTRACT

Aim: The aim of this study was to determine how to eliminate the treatment uncertainties, and correct and prevent inappropriate treatment in patients with renal failure.
Material and Methods: We retrospectively evaluated the biochemistry department's records of 438 patients with creatinine values >1.5 mg/dL that were followed-up at our hospital for the last five years. Demographics, type of renal dysfunction, related risk factors (use of nephrotoxic agents, surgical procedures, comorbidity, etc.), dialysis treatment, complications, and clinical outcome of these patients were recorded and analyzed.
Results: The most important result of the study is that the quality of the medical data recorded was very poor. The most common type of acute renal injury was prerenal acute renal injury. Among the cases, the most common etiological factors were dehydration and use of nephrotoxic agents. Surgical procedures and comorbid conditions facilitated the development of renal dysfunction, and all complications observed were more common and serious in the elderly patients. Among the patients with chronic renal injury, more of those with diabetic nephropathy required hospitalization. Interestingly, nosocomial infections were the most common cause of mortality in the patients hospitalized due to renal dysfunction.
Conclusion: Only a few medical records were suitable for retrospective evaluation. We think that if the quality of hospital data collection/storage systems could be improved, the quality of research data obtained in such studies would likewise improve and these data will bring preventive and corrective approach to mortality and morbidity.
Keywords: Renal injury; morbidity; mortality.

ÖZ

Amaç: Bu çalışmanın amacı, böbrek hasarı olan hastalarda tedavi belirsizliklerinin nasıl giderileceğinin belirlenmesi ve tedavideki uygunsuzlukların düzeltilmesi ve önlenebilmesidir.
Gereç ve Yöntemler: Kreatinin değeri >1,5 mg/dL olan ve hastanemizde son beş yılda takip edilen 438 hastanın biyokimya anabilim dalı kayıtları geriye dönük olarak değerlendirilmiştir. Hastaların demografik özellikleri, böbrek fonksiyon bozukluğu tipleri, ilişkili risk faktörleri (nefrotoksik ajanların kullanımı, cerrahi prosedürler, komorbidite, vb.), diyaliz tedavisi, komplikasyonlar ve klinik sonuçları kayıt altına alındı ve analiz edildi.
Bulgular: Çalışmanın en önemli bulgusu, kaydedilmiş olan tıbbi verilerin kalitesinin çok düşük olmasıdır. En sık görülen akut böbrek hasarı tipi prerenal akut böbrek hasarı idi. Olgular arasında en yaygın etiyolojik faktörler dehidratasyon ve nefrotoksik ajanların kullanımı idi. Cerrahi işlemlerin ve eşlik eden hastalıkların böbrek fonksiyon bozukluğu gelişimini kolaylaştırdığı, gözlenen tüm komplikasyonların yaşlı hastalarda daha sık ve ciddi seyirli olduğu belirlendi. Kronik böbrek hasarı olan hastalar arasında, diyabetik nefropatisi olanların çoğunun hastaneye yatması gerekiyordu. İlginç olarak, böbrek fonksiyon bozukluğu ile izlenen yatan hastalarda en önemli mortalite nedeninin nozokomiyal infeksiyonlar olduğu belirlendi.
Sonuç: Retrospektif değerlendirme için sadece birkaç tıbbi kayıt uygundu. Hastane veri toplama/depolama sistemlerinin kalitesinin iyileştirilebilmesi durumunda, bu tür çalışmalarda elde edilen araştırma verilerinin kalitesinin de aynı şekilde gelişeceğini ve bu verilerin mortalite ve morbidite konusunda önleyici ve düzeltici bir yaklaşım getirmeyi kolaylaştıracağını düşünmekteyiz.
Anahtar kelimeler: Böbrek hasarı; morbidite; mortalite.

INTRODUCTION

Worldwide, renal injury (RI) is a serious health problem whose treatment is challenging; follow-up of patients is difficult both for patients and physicians, and is an economic burden to everyone involved. Collection of data regarding the causes, complications, treatment, and consequences of RI is an ongoing process. Collection of such data is necessary in order to identify and prevent this problem. Data collected in every country and hospital are important, even though they may differ. In Turkey, national data collection activity has been increasing, however, inadequacies remain. In England, acute renal injury (ARI) data were collected and published in 2007 (1).

With early recognition of RI and adequate measures, partial or complete recovery is possible, and the disease progression rate can be lowered. Currently, due to the fact that there is an ever-increasing number of medical specialties and healthcare problems, many renal complications that could be diagnosed early, and reversed or at least minimized are misdiagnosed by physicians; this is according to our observations made in Turkey and in the hospital in which the present study was conducted. We think that appropriate investigation of this issue will increase the knowledge of physicians treating such patients. The present retrospective study aimed to evaluate the types, causes, follow-up, and outcome of renal impairment in patients hospitalized due to renal function diseases.

MATERIALS AND METHODS

The study included all patients with serum creatinine levels >1.5 mg/dL who were treated as inpatients at Mersin University Medical Faculty Hospital for five years. This study was approved by the local Ethics Committee of Mersin University Medical Faculty (30/11/11/06). Serum creatinine levels were obtained from the biochemistry department's electronic data files. Among the patients, those with complete personal data, clinical follow-up notes, a definitive diagnosis, records of all laboratory and investigative work leading to diagnosis, and final state at discharge were included. Adult patients that did not meet these criteria, children, and those with ≥2 charts were excluded from the study.

The following data were recorded for all the participants: chart number, age, gender, social security number, reason for referral, type of renal function failure, type of primary renal disease if any, comorbid diseases, surgical history (hospitalized patients), treatment history, follow-up blood pressure measurements, need for dialysis, type of dialysis performed (hemodialysis or peritoneal dialysis) and complications, access points for hemodialysis and complications, systemic complications during hospitalization, history of renal transplantation and related complications, most recent clinical conditions, and cause of death.

Statistical Analysis

SPSS v.22 was used for data analysis. The frequency and percentage of characteristics that could be related to renal function failure or considered a risk factor, such as cause for referral, comorbid diseases, surgical history, history of drug treatment, need for hemodialysis, blood pressure, type of dialysis performed and complications, history of blood transfusion, history of diabetes, renal transplantation and complications, and outcome, as well as patient age, gender, and social security status were calculated.

RESULTS

In total, 30619 registered patients with serum creatinine levels >1.5 mg/dL were ascertained at our hospital during the study period. Among these patients, 438 that had complete personal data, clinical follow-up notes, a definitive diagnosis, all laboratory and investigative work leading to diagnosis, and final state at discharge included in their charts were included in the study.

In all, 156 (35.6%) of the patients were female and 282 (64.4%) were male. Mean age was 58.4±16.9 years. The types of renal function failure in the patients are shown in Table 1. Most of the patients with ARI had prerenal etiology (84.8%, n=206), whereas 7.0% (n=17) had renal and 8.2% (n=20) had postrenal etiology.

Among the patients, 33.3% (n=146) underwent surgical intervention. The majority of ARI patients that were diagnosed via surgery had prerenal etiology (83.9%; n=78).

Most of the patients (52.3%, n=229) had a history of nephrotoxic drug use. The most commonly used drugs were non-steroidal anti-inflammatory drugs (NSAIDs) and radiocontrast agents. Of the 243 patients followed-up for ARI, 60.5% (n=147) had a history of nephrotoxic drug use. Among the patients treated with drugs, 20.4% (n=30) used only NSAIDs, 7.5% (n=11) used only nephrotoxic antibiotics (aminoglycoside, amphotericin B, vancomycin), 32.7% (n=48) used only contrast agents, and 0.7% (n=1) used only antineoplastics (cisplatin, oxaliplatin), whereas 8.8% (n=13) used NSAIDs and nephrotoxic antibiotics, 11.6% (n=17) used NSAIDs and contrast agents, 4.8% (n=7) used NSAIDs and antineoplastics, 6.1% (n=9) used nephrotoxic antibiotics and contrast agents, 3.4% (n=5) used nephrotoxic antibiotics and antineoplastics, and 4.1% (n=6) used contrast agents and antineoplastic agents (Table 2). In total, 60.7% (n=125) of the 206 patients with ARI of prerenal etiology used nephrotoxic drugs.

Among the patients, 13.9% (n=61) required dialysis; 96.7% (n=59) of the patients that underwent dialysis had chronic renal injury (CRI), whereas 3.3% (n=2) had ARI. In all, 88.5% (n=54) of the patients that underwent dialysis received hemodialysis, 8.2% (n=5) received peritoneal dialysis, and 3.3% (n=2) that received hemodialysis previously had peritoneal dialysis during follow-up. The primary renal disease in most of the 54 patients that had hemodialysis was unknown (Table 3). Etiology in the 21 patients that had hemodialysis for the first time is shown in Table 3.

Among the 56 patients that underwent hemodialysis, the primary method of access to blood was an arteriovenous fistula (41.1%, n=23), a permanent jugular catheter (19.6%, n=11), a transient jugular catheter (28.6%, n=16), a transient femoral catheter (8.9%, n=5), and a permanent subclavian catheter (1.8%, n=1).

The patients' blood pressure was followed-up and recorded; 40.8% (n=179) of the patients had normal blood pressure, 40.0% (n=175) had elevated blood pressure, and 19.2% (n=84) had low blood pressure.

The clinical follow-up results in the ARI patients are summarized in Table 4 and the cause of mortality in all the patients that died is shown in Table 5.

Among the 184 CRI patients, 32.1% (n=59) required dialysis and 64.4% (n=38) of these patients were chronic

dialysis cases; 78.9% (n=30) of these 38 patients and 85.7% (n=18) of the 21 patients that received dialysis for the first time received dialysis due to end stage renal disease (ESRD). In all, 59.8% (n=110) of the 184 CRI patients in the study had chronic renal disease and 13.0% (n=24) of these 184 patients were died. In 1.1% (n=2) of these 184 patients, outcome could not be ascertained due to such reasons as self-initiated discharge or lack of file data, etc. The cause of death in 24 of the 184 CRI patients in total was as follows; 29.2% (n=7) were cardiovascular disease, 29.2% (n=7) were infectious disease, 16.7% (n=4) were cerebrovascular disease, and 25.0% (n=6) were unknown.

DISCUSSION

Currently, RI is a clinical problem with an increasing prevalence rate. As it affects all organ systems, it has a wide complication spectrum, therefore, it concerns not only nephrology departments, but all other departments and its management should be approached in a multidisciplinary manner. The present retrospective study aimed to determine how to eliminate treatment uncertainties, and correct and prevent inappropriate treatment in RI patients at our hospital. We collected data regarding RI types, etiology, and consequences, and patient file quality, as compared to national and international data quality and reliability.

The prevalence of both ARI and CRI is increasing worldwide, which has led to expanding epidemiological research on RI in many countries (2-4). It has been reported in the archives of Turkish Nephrology Association that the numbers of new dialysis patients and dialysis centers have increased in 2006 substantially, as compared to the year before. The number of ARI cases reported in Turkey in 2006 was approximately 4000. Prevention of this disease will in turn decrease its associated healthcare expenditures significantly. ARI is a disease that could lead to ESRD and even mortality if not diagnosed early and treated accordingly. ARI and CRI share high mortality and morbidity rates due to comorbid disorders, and are expensive to treat (5-7). Unfortunately, in Turkey the prevalence, etiology, relationship to gender and age, accompanying clinical and social consequences, treatment modalities, preventive measures, and treatment outcomes of ARI and CRI, and the total work force loss they cause are poorly known.

The majority (84.8%) of the ARI patients in the present study had prerenal etiology. The most common cause of prerenal ARI was dehydration and use of nephrotoxic agents. Most (60.5%) of the patients that were followed-up due to ARI and the majority of the 206 prerenal ARI patients used nephrotoxic drugs. The most common nephrotoxic agents used were contrast agents and NSAIDs. Radiocontrast nephropathy is one of the most common causes of nephrotoxic ARI (8). NSAIDs are relatively cheap and accessible in Turkey, and the fact that even one dose can affect renal functions is neglected by physicians. Moreover, although there were hints of renal function disorder in some patients' routine test results, these drugs were routinely prescribed. The most common cause of ARI in hospitalized patients is acute tubular necrosis (ATN) due to ischemia and nephrotoxic agents (5,8). ATN is a consequence not only of ischemia and

Table 1. Types of renal function failure in the patients (n=438)

	n (%)
Acute Renal Failure	243 (55.5%)
Prerenal	206 (84.8%)
Renal	17 (7.0%)
Postrenal	20 (8.2%)
Chronic Renal Failure	170 (38.8%)
Acute exacerbation of Chronic Renal Failure	14 (3.2%)
Unknown	11 (2.5%)

Table 2. Distribution of nephrotoxic drugs used by acute renal injury patients (n=147)

	n (%)
NSAIDs	30 (20.4)
Antibiotics	11 (7.5)
Contrast agents	48 (32.7)
Antineoplastics	1 (0.7)
NSAIDs + Antibiotics	13 (8.8)
NSAIDs + Contrast agent	17 (11.6)
NSAIDs + Antineoplastic	7 (4.8)
Antibiotics + Contrast agent	9 (6.1)
Antibiotics + Antineoplastic	5 (3.4)
Contrast agent + Antineoplastic	6 (4.1)

NSAIDs: non-steroidal anti-inflammatory drugs

Table 3. Etiology in the hemodialysis patients

	All (n=54)	Already (n=33)	New (n=21)
Diabetic nephropathy	11 (20.4)	4 (12.1)	7 (3.3)
Glomerulonephritis	3 (5.6)	3 (9.1)	-
Hypertension nephropathy	2 (3.7)	-	2 (9.5)
Nephrotic syndrome	2 (3.7)	1 (3.0)	1 (4.8)
Nephrolithiasis	1 (1.9)	1 (3.0)	-
Polycystic kidney	2 (3.7)	-	2 (9.5)
Amyloidosis	2 (3.7)	-	2 (9.5)
Obstructive nephropathy	2 (3.7)	1 (3.0)	1 (4.8)
Lupus nephritis	2 (3.7)	1 (3.0)	1 (4.8)
Vesicoureteral reflux	1 (1.9)	1 (3.0)	-
Myeloma kidney	1 (1.9)	1 (3.0)	-
Unknown	25 (46.3)	20 (6.6)	5 (23.8)

Table 4. Outcomes in acute renal failure patients (n=243)

	n (%)
Functional full recovery	137 (56.4)
Death	93 (38.3)
Chronic renal failure	7 (2.9)
Unknown	6 (2.5)

Table 5. Causes of death in acute renal failure patients (n=93)

	n (%)
Infection	34 (36.6)
Cardiovascular disease	20 (21.5)
Cerebrovascular disease	7 (7.5)
Respiratory failure	2 (2.2)
Gastrointestinal bleeding	1 (1.1)
Unknown	29 (31.2)

nephrotoxic agents individually, but also in combination (9). In the 2006 report of the Turkish Nephrology Association, dehydration was the most common etiology, but surprisingly nephrotoxic agent use was not listed. Nonetheless, the use of nephrotoxic agents is regarded as one of the most common causes of ARI in some European countries (10). This example is an important sign that data collection in Turkey is not yet efficient or reliable.

In the present study 56.4% of the patients with ARI had complete recovery, 2.9% progressed to CRI, and 38.3% died. When compared with international data, the percentage of patients with complete recovery is similar (58%), whereas the mortality rate is higher and the rate of progression to CRI is lower.

Renal failure is a common problem in surgical patients that increases morbidity and mortality rates (11). Of the 438 patients in the present study, 146 had undergone surgical interventions, 93 of these patients had ARI, of which 78 had prerenal etiology. In these patients, dehydration and nephrotoxic drug use were common, which indicates that high-risk surgical patients should be carefully monitored before, during, and after surgery for hemodynamic instability, electrolyte-fluid balance, and use of drugs that adversely affect renal functions. Moreover, necessary consultations should be offered, even when the slightest abnormality is noted, in order to prevent more serious complications. Clinical trials have shown that early nephrology consultation is important in both ARI and CRI (12-14).

In 50.7% (n=222) of the patients in the present study primary renal disease progressed to renal failure. Diabetic nephropathy and hypertension nephropathy were the two most common renal diseases. In most of the patients the cause of nephropathy was unclear, as the primary disease was unknown or not recorded, which is another indication of inadequate record keeping. According to the literature, diabetic nephropathy and hypertension nephropathy are the most common causes of CRI, and in some countries diabetic nephropathy constitutes the primary cause of >40% of renal replacement therapy, and its incidence is growing (15-17). Both diabetes mellitus and hypertension are diseases that can be controlled with appropriate therapies. It was determined that nephropathy related with both of these diseases does not occur at early ages, but it does occur in both sexes and its incidence increases with age (most commonly in those >68 years of age).

In the present study, it was found that comorbid infectious, neurologic, and/or cardiovascular system diseases were associated with impaired renal functioning. The fact that these diseases were noted in most of the patients illustrates that careful and well-planned management of renal failure patients is critical.

Worldwide, hemodialysis is the most common renal replacement therapy in RI patients. In the present study 88.5% of the patients underwent dialysis and the treatment of choice was hemodialysis. Most (53.3%) of the dialysis patients received dialysis for a long time and the etiology of ESRD was unclear. That such data were not recorded is a significant patient management failure.

Diabetic nephropathy was the most common cause of ESRD in the present study, which is similar to previous reports. Only 1 patient in the present study was accessed via the subclavian vein, which is a positive sign of our treatment protocol, as it is associated with a nearly 50% chance of thrombosis or stenosis in the subclavian vein, rendering that side of the body useless for a fistula in the arm and use of a previous fistula (18).

In all, 175 of all the patients in the present study and 38 of the 54 patients that received hemodialysis were hypertensive, this is an indication that hypertension frequently accompanies renal function impairment and that it is frequently maltreated. Hypertension is also an essential risk factor for cardiovascular and cerebrovascular incidents. It is most probable that uncontrolled hypertension plays a role in the fact that patients with renal function impairment frequently encounter these complications.

An interesting finding of the present study is that complications occurred more frequently and with greater severity in the elderly patients. It is well-known that anatomic and functional loss occurs in all tissue and organs as age increases. Some studies reported that after the age of 30 years there is an annual 1 mL/min decrease in the glomerular filtration rate (19). Renal capacity decreases with age and the kidneys become more sensitive to any stress. A recent study suggested that ARI in the elderly is solely a risk factor for mortality (1). In Turkey the mean age of patients diagnosed as ARI was 51 and 25% of these patients were aged, >65 years. All these data indicate that the management of elderly patients should receive more scrutiny and that complications in this patient group can have rapid onset and be of a critical nature.

In the present study infections were the most common cause of death (36.6%), versus cardiovascular diseases according to national data. In RI patients, infections do not always follow a typical course (there may not be fever, there could be rapid progression to severe sepsis or septic shock), acute phase reaction markers are not always helpful, inadequate host response can be lethal, and drug treatment must be monitored closely (20). The infections or microorganisms that were associated with mortality in the present study could not be obtained from the patients' records, suggesting that infection was not managed well in patients with ARI and that the mortality rate was too high for a group of patients with a health problem that can be prevented or effectively treated.

The present study has some limitations, including the low quality of the data obtained due to a poorly designed data collection/storage system, the lack of some target data that is included in national and international data pools (duration of hospitalization, first 90-day mortality rate for ESRD patients), incomplete follow-up data, and the inability to determine the origin of some essential problems.

In conclusion, our hospital's data collection/storage system was of poor quality. The causes of renal failure observed in the present study are similar to those according to national and international data pools, advanced age and nephrotoxic drug use were important factors in renal function impairment, and the rate of mortality due to preventable causes (infection) was higher than that according to international data. We think that if the quality of hospital data collection/storage systems could be improved the quality of research data would likewise improve, which may help lower morbidity and mortality rates (21).

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