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Development and effectiveness of scoring index mobile application for hemodialysis in renal failure

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Abstract
Aim and Objectives: *1. To develop a mobile application with the help of renal failure severity scoring system which is already develop in NSCB medical college Jabalpur for deciding on need for urgent dialysis.*
2. To propose nomenclature of this mobile application.
Material and Methods: *This study was conducted in 387 patients admitted in medicine wards N. S. C. B. MCH Jabalpur with diagnosis of altered renal function due to various causes (acute and chronic), over a period of one year (October 2013 to September 2014). A self structured mobile application develop with the help of renal failure severity scoring system develop in which included Variables like Age, Sex, Etiology, Acute kidney injury, Chronic kidney disease, Physical signs (Pulmonary edema, Acidotic breathing, Urine output, Signs of uremic encephalopathy), Biochemical parameters (Blood urea, Serum creatinine, Serum potassium, Serum bicarbonate) and by this mobile application asses the patients who need for urgent dialysis. The data of the present study was recorded into computer and after proper validation, error checking, the data was compiled and analysed using the SPSS Window.*
Result and Conclusion: *It was observed that, during the period of study out of 387 Cases of renal failure, 230 ultimately required dialysis (59.4%). 99 patients expired that included both dialysis and none dialysis. Net mortality was 25.58%.*
Keywords: *Acute Kidney injury (AKI), Chronic kidney disease (CKD), End stage renal disease (ESRD), Glomerular filtration rate (GFR), Renal replacement therapy (RRT). Hemodialysis (HD).*

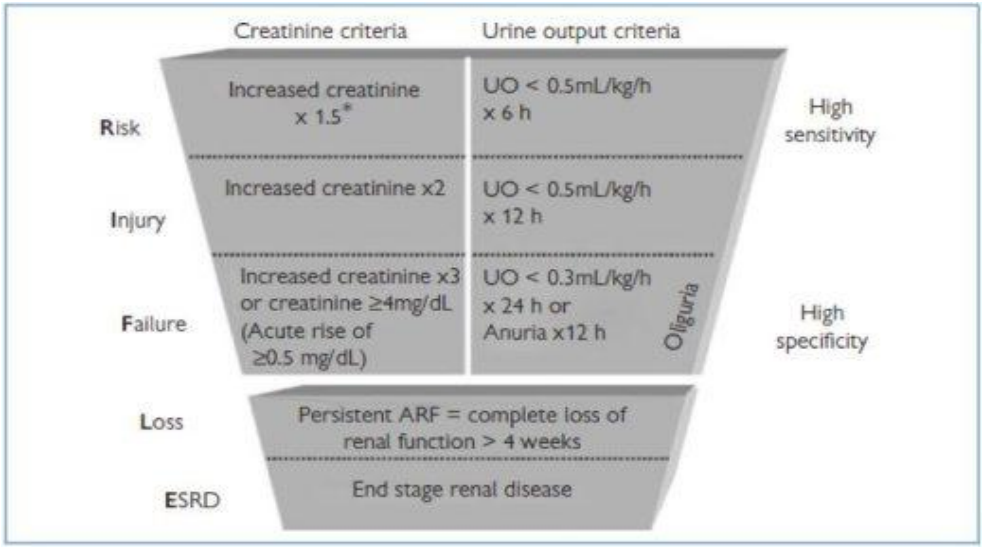
Introduction

Acute kidney injury (AKI)—or acute renal failure (ARF), as it was previously termed— is defined as an abrupt or rapid decline in renal filtration function. This condition is usually marked by a rise in serum creatinine concentration or by azotemia (a rise in blood urea nitrogen [BUN] concentration).[1] However, immediately after a kidney injury, BUN or creatinine levels may be normal, and the only sign of a kidney injury may be decreased urine production.

RIFLE classification system

In 2004, the Acute Dialysis Quality Initiative work group set forth a definition and classification system for acute renal failure, described by the acronym RIFLE (Risk of renal dysfunction, Injury

to the kidney, Failure or Loss of kidney function, and End-stage kidney disease).[2,3] Investigators have since applied the RIFLE system to the clinical evaluation of AKI, although it was not originally intended for that purpose. AKI research increasingly uses RIFLE. See below.



Chronic kidney diseases: CKD is defined as either kidney damage or a decreased glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m^2 for at least 3 months. Whatever the underlying etiology, once the loss of nephrons and reduction of functional renal mass reaches a certain point; the remaining nephrons begin a process of irreversible sclerosis that leads to a progressive decline in the GFR.[4]

Dialysis Requirement [5]

All the patients with CKD eventually require frequent dialysis once their GFR falls below 15ml/min. In AKI, in order to give time for the natural recovery of the kidney function, dialysis is performed in an attempt to maintain the blood chemistry under acceptable limits. Since the rate of accumulation of waste products in hyper catabolic renal failure (AKI) is rapid, urgent /early dialysis has a major role in giving a favorable outcome. Since the kidneys most often are not irreversibly damaged in AKI, timely dialysis is of utmost significance as far as long-term prognosis is concerned.

Indications For and Timing of Initiation of Dialysis [6]

Accepted indications for renal replacement therapy (RRT) in patients with acute kidney injury (AKI) generally include:

Refractory fluid overload

- Hyperkalemia (plasma potassium concentration >6.5 mEq/L) or rapidly rising potassium levels.
- Signs of uremia, such as pericarditis, neuropathy, or an otherwise unexplained decline in mental status
- Metabolic acidosis (pH less than 7.1)
- Certain alcohol and drug intoxications
- Intractable gastrointestinal symptoms
- In asymptomatic adult patients, a glomerular filtration rate (GFR) of 5-9 mL/min/1.73 m^2, irrespective of the cause of the CKD or the presence of absence of other co morbidities.

The Problem

Till now there is no universal consensus on the question "when to start dialysis in patients with renal failure?" So it is high time we develop a simple & effective mobile application with the help of scoring system for renal failure patients which is already develop in our institute for deciding on dialysis that can be followed universally. The mobile application shall assess the severity of individual cases quickly and identify who should be taken for dialysis.

Aims and Objectives

1. To develop a mobile application for renal failure patient for deciding on need for urgent dialysis.
2. To propose nomenclature of this mobile application.

Material and Methods

This study was conducted in 387 patients admitted in medicine wards N. S. C. B. MCH Jabalpur with diagnosis of altered renal function due to various causes (acute and chronic), over a period of one year (October 2013 to September 2014). A self structured renal failure severity scoring system already develop in which included Variables like Age, Sex, Etiology, Acute kidney injury**,** Chronic kidney disease**,** Physical signs (Pulmonary edema, Acidotic breathing**,** Urine output**,** Signs of uremic encephalopathy), Biochemical parameters **(**Blood urea**,** Serum creatinine**,** Serum potassium, Serum bicarbonate) and with the help of this scoring system develop mobile application for assessment of patients who need for urgent dialysis. The data of the present study was recorded into computer and after proper validation, error checking, the data was compiled and analysed using the SPSS Window.

Inclusion criteria

- All patients with altered Renal function tests admitted in medicine wards.
- Age > 15years.

Exclusion criteria

- Age < 15 years.
- Patients with intractable heart failure.
- HIV/ HBsAg positive cases.
- Patients with chronic debilitating illness like extensive PTB etc.

Mobile Application Format

A mobile phone application format (for android phones) of this new dialysis scoring index has been developed with the help of Jabalpur scoring index for hemodialysis which is shown in figure number 1.[7] This can be downloaded free of cost from Google play store (https://play.google.com/store/apps/jabalpur scoring index for hemodialysis) to android mobile phones. It has a highly user friendly format. The user has to just enter the required data in the form of age sex, biochemical parameters, presence or absence of selected physical signs and the application will show the management modality, wether to take up the patient for hemodialysis or to continue conservative line of management deferring hemodialysis. Patent requisition has already been submitted. Mobile application is shown in figure no 2.

Results

In present study propose nomenclature of this mobile application is score index for hemodialysis and data were analysed by this application. In present study total 387 number of patient included in which Maximum number of cases were in the age group 20-29 years (24%) followed by 40-49 & 50-59 (20% each). Least number of cases was seen in the age group 70-79 years (2%). Males constituted the majority of cases (56%). Out of 387 cases males constituted 217 cases & female's 170 cases (44%). ESRD was the most common cause of renal failure that required RRT/ HD among patients in this study. Post gastroenteritis renal failure was the most common cause of ARF that demanded HD in our study (16%). Among the physical signs observed in the study group, oliguria was the most common (56%) followed by pulmonary edema (30%), anuria (14%), Uremic encephalopathy (12%) and acidotic breathing. (6%) [Table no 1]

Out of 387 patients, 230 (59.4%) patients needed dialysis according to new grading system. Out of 387 cases 70 cases (18.1%) needed only conservative management with biochemical assessment every alternate day according to new grading system. 87 Cases (22.5%) had to be kept under close monitoring with biochemical monitoring every 12 hourly and physical assessment every 4 hours.[figure no 3]

Figure no1

JABALPUR SCORING INDEX FOR HEMODIALYSIS

SCORING

Etiology	Score	
• Snake bite • Post acute gastroenteritis renal failure • Poisoning • Obstetric renal failure	10 points	
Malaria	8	
• Hepatorenal syndrome • Sepsis • Obstructive uropathy	5	
CKD due to any cause	5	
Other causes not mentioned above.	5	

Variable	Points		
AGE	>50years	10 points	
	<50years	5 points	
SEX	Male	0 points	
	Female	5 points	

PHYSICAL SIGNS

PARAMETER	SCORE	
Pulmonary edema	10	
Acidotic breathing	5	
Urine output/24hrs	ANURIA (<50ml) ---> 10 Oliguria (50-500ml) ---> 5	
Signs of uremic encephalopathy	10	

BIOCHEMICAL PARAMETERS

PARAMETER	SCORE	
Blood urea(mg/dl)	>200 -----> 10 points	
	140 - 200 -----> 5 points	
Serum creatinine(mg/dl)	>8 -----> 10 points	
	6-8 -----> 5 points	
Serum potassium(Meq/dl)	>6 -----> 10 points	
	5.5 – 6 ------>5 points	
Serum bicarbonates (Meq/dl)	<10 -----> 10points	
	10-15 -----> 5points	

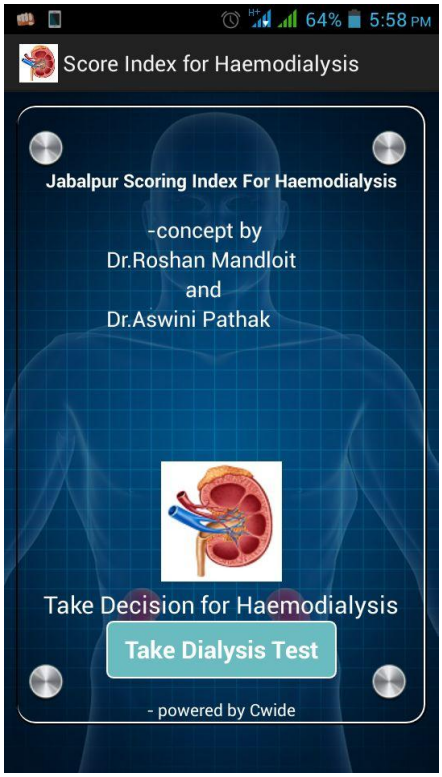
< 30 points → CONSERVATIVE MANAGEMENT (Assess the score)

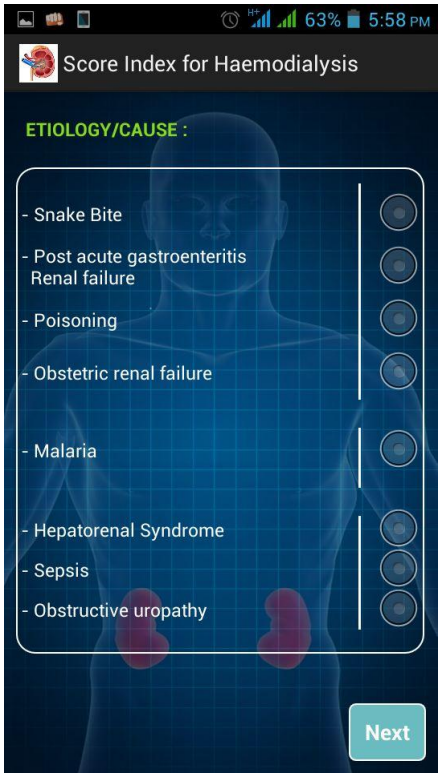
30 --- 45 points → CLOSE MONITORING (Assess the score every 12 hrs. & review)

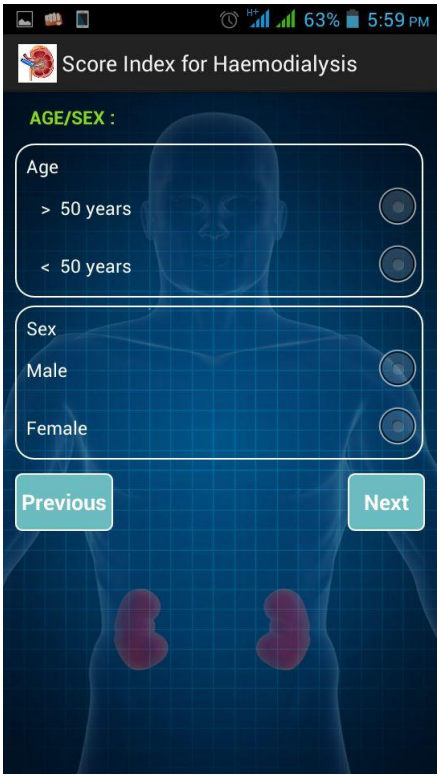
≥ 50 points → URGENT DIALYSIS

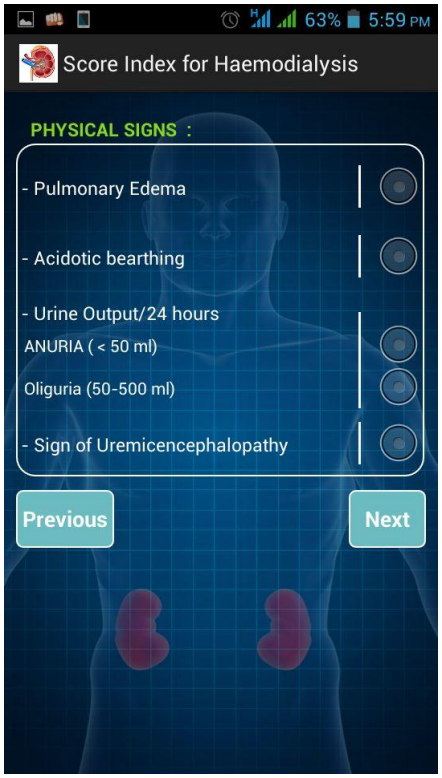
Figure no 2

Mobile App Screen Shots

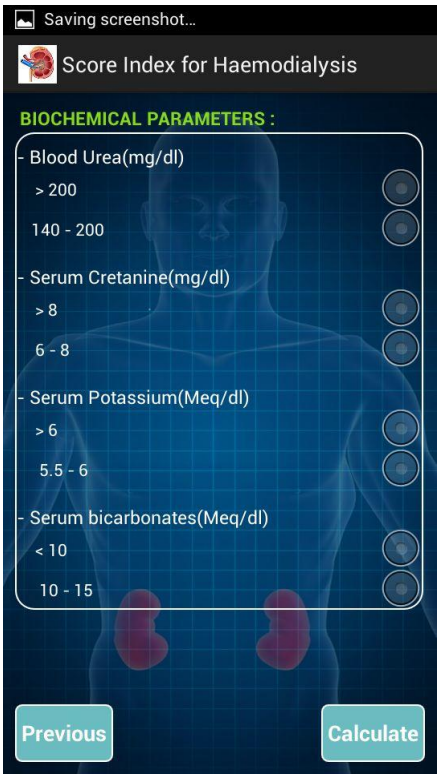


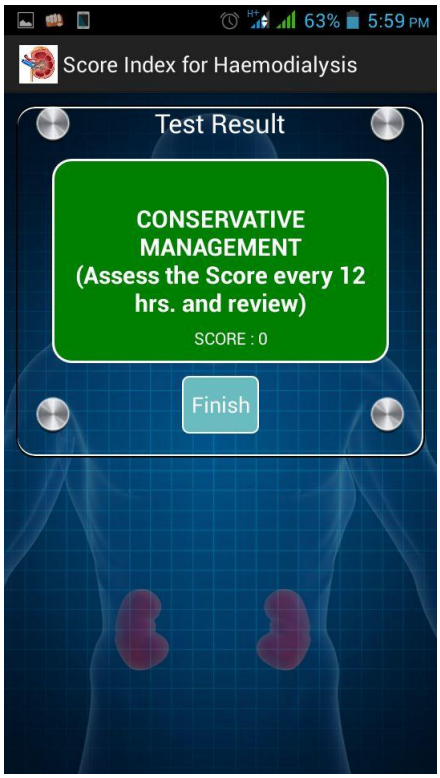






Mobile App Screen Shots





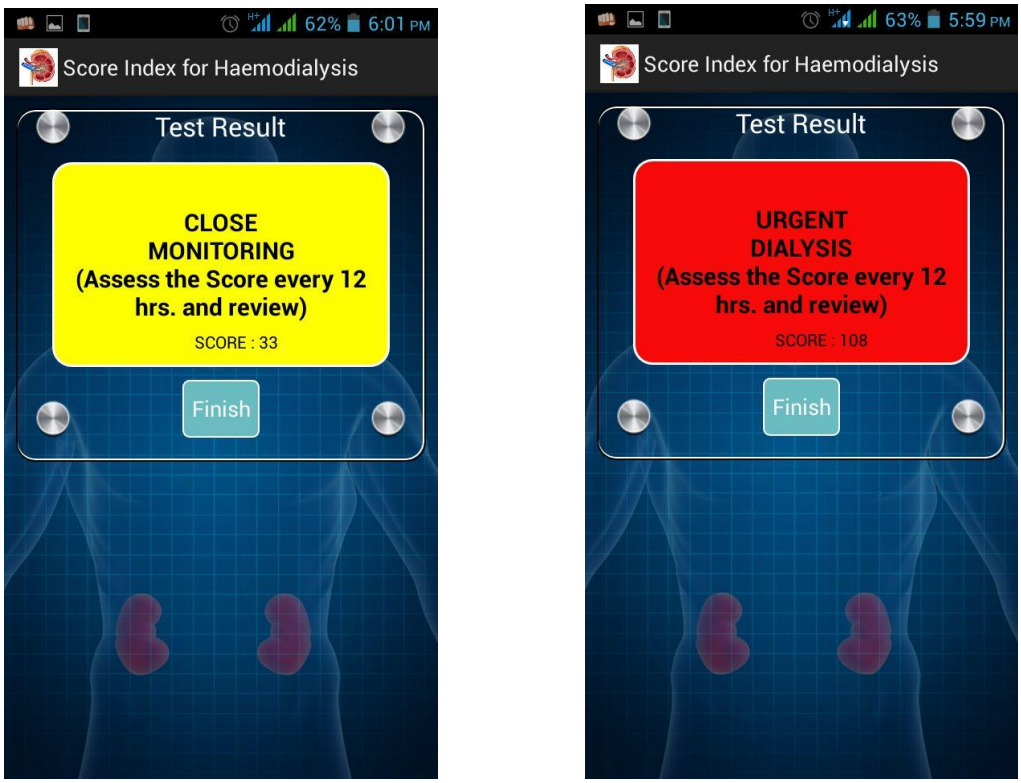


Figure no.3

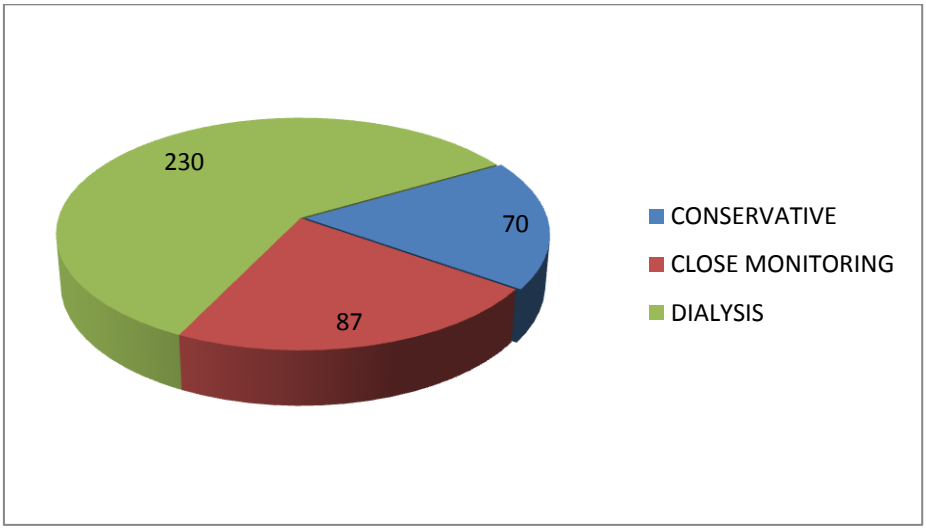


Table no.1

Variable	Frequency	%
Age(years)		
15-19	31	8
20-29	93	24
30-39	55	14
40-49	77	20
50-59	77	20
60-69	47	12
70-79	7	2
Gender		
Female	170	44
Male	217	56
Etiology		
Snake bite	23	6

Post AGE	61	16
Poisoning	5	1.3
Obstetrics renal failure	31	8
Malaria	8	2
Hepato renal syndrome	8	2
Sepsis	8	2
Obstructive	31	8
CKD	204(DM105)	52.7
Physical signs		
Pulmonary edema	116	30
Acidotic breathing	23	6
Anuria	54	14
Oliguria	216	56
Uremic encephalopathy	46	12

Discussions

Age Distribution

Maximum number of cases were in the age group 20-29 years (24%) followed by 40-49 & 50-59 (20% each). Least number of cases was seen in the age group 70-79 years (2%). A study by lindeman R D, tobin j et al (1985) have reported that incidence and progression of renal failure to a level that requires RRT increases with age.[8] Similar results have been reported by Eriksun B O et al in their study on progression of kidney disease.[9]

Sex Distribution

Males constituted the majority of cases (56%). Out of 387 cases males constituted 217 cases & female's 170 cases (44%). A study by Iseki et al (1996) has reported that risk of development of renal failure requiring RRT was more in males as compared to females. [10]

Etiology: ESRD was the most common cause of renal failure that required RRT/ HD among patients in this study. Post gastroenteritis renal failure was the 2nd most common cause of ARF that demanded HD in our study (16%). This was followed by obstetric cause and obstructive uropathy (8% each), snake bite (6%), malaria, sepsis, hepato renal syndrome (2%each). A study by Liano F, pascal j had reported that pre renal azotemia is the most common cause of acute kidney injury and accounts for 40- 55% of all cases. [11]

Summary and Conclusions

New mobile application Jabalpur scoring index for hemodialysis based on selected clinical, biochemical parameters has been found to be a simple and effective triage system for identifying the patients who require hemodialysis on priority basis and managing others conservatively. Mortality among renal failure patients who were triaged by this new system over a period of one year from October 2013 to September 2014 was found to be 27.13% which was far less when compared to previous years' data when patients were decided for dialysis without using any scoring system. This system will help the primary level health care providers and general practioners on deciding when to take up a patient for hemo dialysis on priority basis over others. This will also help in decreasing the patient burden for dialysis in an already overburdened tertiary health care system in our country.

Conclusion

- There is an urgent need to develop a comprehensive and practically easy scoring system to identify patients with renal failure who require dialysis on urgent basis among others.
- This study has shown a significant reduction in mortality and morbidity among patients triaged using this new scoring system as compared to previous year.

- In any circumstances, it is the decision of treating physician /nephrologists regarding when to start hemodialysis and whom to be taken urgently that should be followed even if this scoring system indicates different mode of management for the situation.

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