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SM Journal of Nephrology and Kidney Diseases

Research Article

Comparison between Fractional Excretion of Sodium and Urea in Acute Kidney Injury in Children

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Article Information

Received date: Dec 14, 2018
Accepted date: Dec 21, 2018
Published date: Dec 24, 2018

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Keywords Acute Kidney Injury; Sodium; Urea

Abbreviations AGE: Acute Gastro Enteritis; AGN: Acute Glomerolo Nephritis; AKI: Acute Kidney Injury; ATN: Acute Tubular Necrosis; BP: Blood Pressure; BUN: Blood Urea Nitrogen; CCr: creatinine clearance; CRF: Chronic renal failure; CRP: C reactive protein; FENa: Fractional Excretion of Sodium; FEUN: Fractional Excretion of Urea Nitrogen; GFR: Glomerular Filtration rate; Hb: Hemoglobin; HUS: Hemolytic Uremic Syndrome; IRF: Intrinsic Renal Failure; NS: Nephrotic Syndrome; PD: Peritoneal Dialysis; PRF: Pre Renal Failure; RBC: Red Blood Cell; RIFLE: Risk Injury Failure Loss End stage; RRT: Renal Replacement Therapy; SCr: Serum Creatinine; SNa: Serum Sodium; SUr: Serum Urea; TLC: Total Leukocyte Count

Article DOI 10.36876/smjnkd.1018

ISSN: 2576-5450

Abstract

Introduction: Acute Kidney Injury (AKI) is grave condition. It accounts about 35 % of mortality in all kidney disease. Fractional excretion of Sodium (FENa) has been used to differentiate between Pre renal & Intrinsic Renal Failure. Keeping on view of limitation to the use of FENa, Fractional Excretion of Urea Nitrogen (FEUN) has been emerged as an alternative to FENa in the differentiating the type of renal failure for diagnosis & intervention. Material & Method: The children beyond neonatal period & upto14 years, those who presented with AKI to pediatric ward of SCB Medical College & hospital and SVP PG institute of Pediatrics, Cuttack during the period of October 2015 to September 2017 were taken into study.

Result: Incidence of AKI was found to be 1% of all hospitalized children.75% of patients presented with pre renal failure, intrinsic renal failure was seen in 25% cases. The diuretics have no effect on FEUN & FENa while evaluating intrinsic renal failure. FEUN is a more sensitive test to identify PRF cases from IRF among the patients presented as ARF.

Conclusion: The Fractional Excretion of Urea (FEUN) is a better indicator than fractional excretion of Sodium (FENa), in differentiating Pre Renal Failure (PRF) patients from Intrinsic Renal Failure (IRF) patient among those presented initially as Acute Kidney Injury.

Introduction

Acute renal failure is a sudden reduction in of renal function to a point at which body fluid homeostasis can no longer be maintained. The cardinal feature of the condition is reduction in glomerular filtration rate resulting in increase in serum creatinine to more than twice the normal level for the age of the patient [1]. Acute kidney injury (AKI), previously coined as Acute Renal Failure (ARF) is characterized by an acute reduction in Glomerular Filtration Rate (GFR) with increase in urea and creatinine concentrations and the inability of the kidneys to regulate water, electrolyte and acid-base balance [2,3]. AKI is divided into three categories etiologically; Pre renal (PRF), Intrinsic Renal Failure (IRF) and post renal failure. As finding the cause of AKI is common problem in clinical scenario [4], and also early diagnosis of type of the AKI may improve the outcome in the patients [5,6]. Taking on this account, Fractional Excretion of Sodium (FENa) has been used to differentiate between PRF and IRF [7]. Further evidences also suggest that frequently used diuretics in the treatment of pre renal conditions like congestive heart failure, hepatic failure with ascites and to enhance urine output in oliguric patients leads to increased urinary Na and FENa [2,4,7]. There are also some pre renal conditions where there increased urinary sodium and FENa , like pre renal azotemia due to vomiting and nasogastric suction. In such cases the bicarbonate maintains urinary sodium and FENa at the higher levels [8]. The limitation to use the FENa are hemoglobin uric Acute Tubular Necrosis (ATN) [9], myoglobinurc ATN [7,9,10], contrast nephropathy [7,10], sepsis [4,11] ATN superimposed on chronic volume depletion [7,12], non-oliguric ATN [4,12,13], polyuric ATN after burn [10], acute glomerulo nephritis [10], acute interstitial nephritis [13,14] & acute rejection [10] where we find low levels of FENa (<1%) in IRF. High levels FENa (>2%) PRF is found in diuretic therapy [2,4,7,10], glucosuric states [2], metabolic alkalosis [4,15], aldosterone deficiency [7].

Fractional excretions of other substances like urea [4,15], chloride [15], uric acid [16,17] and lithium [16,17] are also proposed to overcome this limitation of FENa. Use of lithium clearance is quite impractical, given the limited availability of this determination in many laboratories & need to administer lithium in such patients. Uric acid clearance does not appear to have any advantage over the use of urea due to its complex renal metabolism. So FEUN has been emerged as an alternative to FENa in differentiating the type of renal failure for diagnosis & intervention. The Fractional Excretion of Urea Nitrogen (FEUN) is primarily dependent on volume status and not affected by commonly diuretics [2,4,18,19]. This index was previously studied by Corey et al [18] for diagnosing pediatric acute renal allograft rejection.

How to cite this article Jena PK, Murmu MC and Jena AP. Comparison between Fractional Excretion of Sodium and Urea in Acute Kidney Injury in Children. J Nephrol Kidney Dis. 2018; 2(2): 1018. https://dx.doi.org/10.36876/smjnkd.1018

Keeping all the above observations in view the present study is designed to know the sensitivity and specificity of FEUN in differentiating PRF from IRF and to compare it with FENa in children suffering from AKI in our setup.

Aim & Objectives

To compare the sensitiveness between Fractional Excretion of Sodium (FENa) & Fractional Excretion of Urea Nitrogen (FEUN) in diagnosis of AKI.

Fractional excretion of Sodium (FENa): fractional excretion of any substance is defined as the ratio of the rate of filtration of that substance (the urinary concentration of that substance times the urinary flow rate, divided by the plasma concentration of that substance)

Materials

Material of this study included children beyond neonatal period, those who presented with AKI to pediatric ward of SCB Medical College & hospital and SVP PG institute of Pediatrics, Cuttack. The study was done from October 2015 to September 2017 after obtaining ethical committee clearance from institute ethical committee.

Inclusion criteria

i) Age : more than 28 day up to 14 years with clinical evidence of developing AKI were screened for evidence of AKI by laboratory parameters were included in the study. Those suspected clinically were screened for serum creatinine and included in the study if its value was 1.5 mg/dl or more in children >1years and 1mg /dl or more in infants [20,21].

Exclusion criteria

All suspected children who did not satisfy laboratory criteria were excluded from the study. Those children with chronic renal failure or acute or chronic renal failure were excluded. Newborns and post renal azotemia cases are excluded due to their defective handling of solutes by the nephrons in these two conditions. Patients on osmotic diuretics, acetazolamide, patient taking steroids, patient having internal bleeding were excluded from the study.

Methods

In all patient with AKI admitted to the pediatric ward, clinical diagnosis was made by history, clinical examination and laboratory data including urine microscopy and urine biochemistry as stated in textbooks [20,21].

A. Criteria to diagnose AKI: Serum creatinine >1mg/dl in infants, Serum creatinine >1.5mg/dl in older children.

B. Criteria to differentiate IRF from PRF:

1. History of volume depletion in PRF decreased Cardiac output states in PRF, Sepsis with hypotension present in PRF, Liver failure with ascites favors PRF, History of ingestion of toxin, drugs, crush injury supports IRF, Prolong renal hypo perfusion unresponsive to high dose loop diuretics favors IRF.

2. Physical examination : blood pressure- hypotension favors PRF. Heart Rate - Tachycardia, cold calmly skin, feeble pulse suggests PRF, Hydration status -dry tongue &mucus membrane suggests PRF, Presence of Congestive Heart Failure (CHF) suggests PRF, Presence of rales in chest suggest IRF, Presence of Ascites, peripheral edema suggests IRF.

C. Finding of Urine Analysis: Urinary sediment non-revealing in pre-renal cases, presence of muddy brown granular casts found in patients with IRF

a. Indices:

Index	Pre-renal failure	Intrinsic renal failure
Urinary osmolality	>500	<350
Urinary specific gravity	>1.020	<1.010
Serum urea/creatinine	>20:1	<20:1

b. Other parameter used: FENA= [(Urine Sodium/Plasma Sodium)/(Urine creatinine/Plasma Creatine)]× 100

FEUN= [(Urine Urea/Plasma Urea)/(Urine creatinine/Plasma Creatine)]× 100

Blood chemistries were performed on an automated analyzer for serum electrolytes, creatinine & urea. Urine electrolytes were determined by flame photometry. Urine urea nitrogen and creatinine were determined by spectrophotometrically. All the investigations are done in the department of biochemistry, SCB Medical College, Cuttack.

Investigations

Blood- Hb, DC, TLC, TPC, CPS, Serum CRP(Q), Serum urea creatinine, serum sodium, potassium

Urine- Routine, Microscopy, urinary urea, sodium & creatinine. Urinary osmolality, urinary specific gravity.

Statistics

Statistics analysis was performed using the appropriate statistical method. Comparison among the group was tested using the student t test where quantitative data are used. All test were performed using Graph pad, Microsoft excel 2007 and SSPS 16 statistical software programmers. *P* value was calculated by Chi-square test without Yates correction. Area under the curve is calculated by prism calculator of graph pad software. *P* value of <0.05 was considered to be significant.

Data obtained from the study were complied, tabulated.

Observation: (Tables 1-9).

Table 1: Age & Sex Distribution in the Study Population.

Sl No	Age Group	Female	Male	Total	N=%
1	< 1year	3	2	5	4.9
2	1-5 year	19	15	34	33.33
3	6-10 year	19	26	45	44.11
4	11-14year	4	14	18	17.64
	Total	45	57	102	

The maximum number of cases was clustered in 6-10years age group (44.11%). The male children out numbered females, ratio being 1.2:1.

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Table 2: Cause In Relation To Type of Aki in the Study Group (N=102).

SL NO	Cause	Type of Aki				Total	
		Prf		Irf			
		Number	%	Number	%	Number	%
1	Snake Bite	4	5.1	4	16	8	7.8
2	Sepsis	25	32'46	1	4	26	25.4
3	Scd Nephropathy	-	-	2	8	2	1.9
4	Ns	4	5.1	-	-	4	3.9
5	Malaria	4	5.1	11	44	15	14.7
6	Hus	-	-	1	4	1	0.9
7	Hepatic Encephalopathy	-	-	1	4	1	0.9
8	Agn	-	-	5	20	5	4.9
9	Age	30	38.96	-	-	30	29.41
10	Chf	10	12.98	-	-	10	9.8
		77	100	25	100	102	100

The four main cause of AKI in this study are AGE, Sepsis, and CHF & Malaria contributing to 69% of the population. AGE (38.96%) & Sepsis (32.46%) mostly contributed to PRF type of AKI and Malaria (44%), AGN (20%) & Snake bite (16%) are the cause for IRF type of AKI.

Table 3: FENa Levels In the Study Group (n=102).

FENa	PRF (n=77)	IRF(n=25)
<0.6	46	0
0.6-0.8	10	0
0.8-1.0	3	1
1.0-1.2	6	1
1.2-1.5	1	3
1.5-2	2	2
>2	9	18

Out of 77 patients in PRF group FENa was <1% in 76.62 % (59) cases, of which 59.74% had FENa level <0.6. In IRF group 72% patients had levels >2%.

Table 4: FEUN Levels in the Study Group.

FEUN	PRF		IRF	
	Number	%	Number	%
<30	49	63.63	1	4
30-35	20	25.97	4	16
35-40	8	10.39	3	12
>50	0	0	17	68
Total	77	100	25	100

About 89.61% of patient from PRF group had below the cut off value of <35% ad among them 63.63% had levels below <30%. Only 10.39% had levels below 35%. 68% of patient of IRF had level above the cut off value of 50% for IRF.

Table 5: Comparison of Screening Test Results By Diagnosis between Fena & Feun in Prf (N=77).

Prf (N=77)			*P* Value
	Fena	Feun	
Sensitivity	76.62	89.61	0.0315 (S)
Specificity	96	80	0.081(Ns)
Positive Predictive Value	98.33	93.24	0.1566(Ns)
Negative Predictive Value	57.14	71.4	0.3778(Ns)

On comparing the performance of the two tests the sensitivity of FEUN is found to be higher than the FENa (P=0.0315, Significant).

Table 6: Comparison of Screening Test Results By Diagnosis between Fena & Feun in Irf (N=25).

IRF (n=25)			*P* Value
	FENa	FEUN	
Sensitivity	72	68	0.7576 (NS)
Specificity	88.31	100	0.0020(S)
Positive Predictive Value	66.66	100	0.0076(S)
Negative Predictive Value	90.66	90.5	0.986(NS)

The sensitivity of FENa is found to be higher than the FEUN (*P*=0.7576,insignificant) & the specificity and PPV of FENa was less in comparison to FEUN and it was statistically significant as evidenced by *P* values(0.0020 for specificity,0.0076 for PPV).

Table 7: Overall Performances of Different Indices in Aki.

	PRF	IRF	*P* VALUE
S UREA	104.24±18.8	101.24±13.7	0.4646(NS)
S CREATININE	3.49±1.8	6.8±0.85	<0.0001
S UREA/ S CREATININE	33.7 ±9.1	14.90±1.45	<0.0001
URINARY UREA	390.55±55.71	425.84±65.22	0.0097
U. SPECIFC GRAVITY	1.026±0.003	10006±0.002	<0.0001
U. OSMOLALITY	565.09±40.83	314.56±22.41	<0.0001
U. SODIUM	16.46±4.44	34.78±11.23	<0.0001
FENa	0.76±0.59	2.94±1.17	0.0001
FEUN	21.80±7.86	50.51±7.60	<0.001
FENa<1%	76.6%	4%	<0.0001
FEUN<35%	89.61%	20%	<0.0001

All the values are given in Mean±SD, except FENa & FEUN which are given in %. The last two cutoff values of the test compared for their ability to differentiate PRF from IRF found to be statistically significant.

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Table 8: Effect of Diuretic in Relation With Fena & Feun In Prf (N=77).

PRF	Number	FENa		False Negative	*P* VALUE	FEUN		False Nagative	*P* VALUE
		<1%	>1%			<35%	>35%		
No Prior Diuretics	50	46	4	8	<0.001 (S)	45	5	10	0.8788 (N .S.)
With Prior Diuretics	27	13	14	51.8		24	3	11.11	
Total	77	59	18			69	8		

The association of diuretic with false negative FENa was found to be statistically significant as *P* value found to be <0.001 indicating that the prior diuretic use significantly alters the diagnosing ability of FENa in PRF. The association of diuretic with false negative FEUN was found to be statistically insignificant as *P* value found to be 0.8788 indicating that the prior diuretic use had no significance on FEUN in PRF.

Table 9: Effect of Diuretic in Relation With Fena & Feun In Irf (N=25).

IRF (N=25)	FENa (false negative)		TOTAL	*P* Value	FEUN		Total	*P* Value
	<2%	>2%			<50%	>50%		
No Prior Diuretics	0	5	5	0.119(NS)	1	4	5	0.5201 (NS)
With Prior Diuretics	7	13	20		7	13	20	
Total	7	18	25		8	17	25	

The association between diuretic with false negative FENa & FEUN was found to be statistically insignificant (*P* value =0.119 and 0.5201 respectively) indicating that prior diuretics use has no significance on FEUN during diagnosis of IRF.

Discussion

Out of total number of cases 12947 admission to pediatrics indoor department in the stated age group during the study period, 102 cases fulfilling the inclusion criteria were included in the present study. So the incidence of AKI in the present study accounts for 1%. Our study is similar to the study conducted by R N Srivastava et al [22] but differ from study conducted by Iqbal et al [23]. Arora P et al [24] & Gokcay G et al [25]. This may be due to inclusion of newborns and higher number of study cases in their series.

Table 1 indicates age and sex incidence of ARF cases of which majority were in the age group of 6-10 years followed by 1-5 years. Similar observation was studied by P. Arora et al [24], R N Srivastava et al [22] and U.T.N. Acharya et al [26]. The Sex ratio (Male: Female) in our study was 1.2:1where males outnumbered female. The study done by P. Arora et al, R N Srivastava et al and U.T.N. Acharya et al had similar sex ratio different being 3:1, 2.3:1,2.1:1 respectively. The reason of male preponderance could be due to gender bias favoring male children, secondly due to higher susceptibility to infection and also more outdoor activities leading to snakebite, mostly above 5yrs age group.

Table 2 describes the etiological diagnosis of ARF in the present work. Acute gastro enteritis was the leading cause followed by sepsis, malaria, CHF, snakebite, AGN & nephritic syndrome.

Four major causes of ARF in this study in order are AGE, sepsis, CHF & Malaria contributing to 69% of the opposed to 86% in the study by A.S. Gokalp et al [27]. This study depicted similarity with the observation of R N Srivastava et al [22] with respect to AGE and sepsis.

P. Arora et al [24] ,U.T.N. Acharya et al [26] and A.S.Gokalp et al [27] observed AGN in 19.2%, 17.1% and 9% cases respectively , our figure of 4.9% is much lower . HUS was a leading cause of ARF in children as per study of R N Srivastava et al [22] and P.Arora et al [24], accounting for 36% and 30.8% respectively. In the present study HUS takes 0.9% of the study group. This change in the pattern is due to geographic variation in the causation of ARF with different referral instructions where the studies were undertaken.

Table 3 shows among 77 patients in PRF group FENa<1% found in 76.62% (59) cases & among the 59 cases 46 patients had FENa<0.6%. About 18patient had FENa>1%. In 14 cases the cause was obvious i.e. Prior furosemide administration. Similar finding was found by Schrier RW et al [2], Carnouvis et al [4] and Rose BD te al [7] in their studies on FENa. In reminders the exact cause was not found. Probably delay in obtaining urine specimen, especially if the patient had received enough fluids, may be responsible in these patients as similar reports found by Fahimi et al [28]. In IRF group among 25 patients FENa>2% found in 72% of cases and only 1 patient found to have level<1%. The cause could not be found in this case. Probably earlier determinations of urinary indices or milder insults or superimposed ischemia might be responsible for this finding as proposed by Brosius et al [29]. It must be emphasized that diuretic therapy induces sodium wasting in the first few days of treatment and after that sodium gradually decreases as mentioned by Espinel CH et al [30] in their study.

Table 4 shows, about 89.61% of patient from PRF group had below the cut off value of<35% ad among them 63.63% had levels below <30%. Only 10.39% had levels below 35%. 68%of patient of IRF had level above the cut off value of 50% for IRF. This data also

supports the previous finding by Kaplan & Kohn [19] in their study in their study that sepsis interferes with expression of urea absorbing channels leading to higher FEUN in this scenario as similar to the finding of Skalar AH [31] in their study. In 25patient of IRF, 5 patient had FEUN<35%, the obvious cause of which could not be found out.

Table 5 shows, comparing the performance of the two tests the sensitivity of FEUN is found to be higher than the FENa (*P*=0.0315, Significant). It can be concluded now that FEUN is a more sensitive index to diagnose a case of PRF than FENa and a better index than FENa to differentiate PRF from IRF. Similar finding was also reported by Carvousnis et al [4]. The FEUN had higher sensitivity and specificity for prerenal azotemia regardless of diuretic usage, and more importantly the best overall positive and negative predictive value for detecting it (99% and75% respectively). This superiority of FUEN over FENa was also emphasized by Kaplan et al in their study of 87 urine sample of 40 patients with renal dysfunction. They found that in 39 patients FUEN detected correctly where FENa failed to do so. Fahim et al found that FEUN had more sensitivity & specificity than FENa I differentiating PRF from IRF.

Table 6 shows that the sensitivity of FENa is found to be higher than the FEUN(P=0.7576,insignificant) & the specificity and PPV of FENa was less in comparison to FEUN and it was statistically significant as evidenced by *P* values(0.0020 for specificity,0.0076 for PPV). These finding correlated well that of Diskin et al [32] that the FEUN was more accurate than the FENa, giving the right diagnosis in 95%vs 54% of cases(*p*=0.0001). The difference was exclusively due to the FEUN's greater utility in the greater utility in the 67 patient who had received diuretics (98%*vs*49%, *p*<0.0001). Both the FEUN and the FENa accurately detected acute renal tubular acidosis in their study. Another study by Fahimi et al [28] also supported the finding of this study that FEUN less than 35% had greater sensitivity and specificity than an FENa less than 1% for differentiating pre renal from intrinsic causes in pediatric populations. An FEUN of less than 30% had even greater power of distinguishing between the two after performing a cross-sectional study in43 patients referred to a nephrology service because of AKI.

Table 7 describes the overall performance of different renal failure indices in AKI. It was found that all the indices were significantly able to differentiate PRF from IRF as evidence by their statistically significant P values as similar to the finding noted by Fahimi et al [28]. When the two tests are compared in the two renal failure groups , it was found that FEUN is more sensitive in detecting PRF and FENa is little more sensitive in IRF (*P*=0.7576, statistically insignificant). As various studies have focused on the effect of diuretics in the determination of FENa, We investigated the use of diuretics in above cases to find out for any effect on the test if any.

Table 8 from this table it can be concluded that the low sensitiveness of FENa in diagnosing the PRF in the study group might be due to prior use of diuretics in those patients. Similar reports also presented by Schrier RW et al [2] in their study in 2004. Again this finding was supported by Steiner RW [10] in their study of FENA in 1984.Kaplan and Kohn [19] in 1992 in a study of 6 patients who were evaluated prospectively and 87 patient who were evaluated retrospectively a low FEUN(≤35%) was found to be sensitive index to renal perfusion, despite the prior administration of furosemide. Similarly Darmon M et al [33] also studied 203 patients in 2011 and opined that FEUN may be of little help in distinguishing transient AKI from persistent AKI in critically ill patient, including diuretic therapy. Carvounis et al [4] also suggested that FEUN was more sensitive than FENa in detecting prerenal azotemia, especially in those with prerenal azotemia who are receiving diuretics. However Pepin et al in their study found FENa to be superior to the FEUN in patients not taking diuretics and exhibited diagnostic utility in patients taking diuretics as well. But neither of the indices discriminated between the different etiologies exceptionally well in their study. Lim et al [34] in their study conducted in2009 and they found that FEUN was as clinically useful as the FENa at distinguishing transient from persistent AKI in patients on diuretics. In the patients exposed to diuretics, FEUN was found to be more sensitive but less specific than FENa.

Table 9 from this table it can be concluded that prior diuretics use had no relation to FEUN in IRF patients. Dewitte A et al [35] in their study in AKI patient in intensive care units found Fractional excretion of urea less than 40% was found to be a sensitive and specific index in differentiating transient from persistent AKI in intensive care unit patients if diuretics had been administered.

On analyzing the overall effect of diuretics on FENa & FEUN. It was found that diuretic administration affect the outcome of FENa while detecting PRF, where as it had no significant effect on FENa while evaluating IRF or on FEUN at any instance. Indicating that FEUN might be a better indicator, while evaluating AKI patients who had been treated with prior diuretics.

Summary

The incidence of AKI was found to be 1% of all hospitalized children. Maximum number of patient were found in age group of 6-10 years (44.1%) followed by <5years (38.13%). Males outnumbered female by the ratio 1.2. Acute gastroenteritis was the leading cause (29.41%) of AKI followed by Sepsis (25.4%) in present study. 75% of patients presented with pre renal, where as intrinsic renal failure was seen in25% of cases. acute gastroenteritis was the leading cause of pre renal failure. Malaria was the predominant cause of intrinsic renal failure. Out of 77 patients in PRF group 76.62% cases had Fractional Excretion of Sodium (FENa) levels below the cut off level of 1% and were correctly diagnosed as PRF by it. It failed to diagnose 23.37% cases in this group. 89.61% cases had FEUN levels below the cut off level of 35% and were correctly diagnosed as PRF by it. It failed to diagnose 10.39% cases in this group. Out of 25 patients in IRF group 72% cases had FENa levels above cut off levels above 2% and were correctly diagnosed as IRF by it. It failed to diagnose 28% cases in the group. 68% cases had FEUN level above the cut off levels of 50% and were correctly diagnosed as IRF by it. It failed to diagnose 32% cases in the group. In the study of 2 indices in PRF patients it was found that the sensitivity of FEUN (89.61%) in differentiating PRF cases from IRF cases was found to be higher and significant(*p*<0.05) in comparison to (76.62%). Hence FEUN is a better index than FENa to correctly diagnose a case of PRF, thus differentiating it from IRF. The association between prior diuretic use with false negative FENa in PRF patients was found to be statistically significant as *P* value found to be <0.05. Hence prior diuretic use significantly alters the diagnosing ability of FENa in PRF group. The association between prior diuretic use with false negative FEUN in PRF was found to be statistically insignificant (*P* value =0.8788) indicating that prior diuretic use had no significant effect on FEUN in identifying

PRF patients. So on comparing the above finding it is concluded that diuretic cannot alter the diagnosing ability of FEUN while evaluating PRF cases, but FENa's diagnostic ability can be modified by diuretics. The association between diuretic use with false negative FEUN& FENa in IRF was found to be statistically insignificant (*P* value =0.5201&0.119 respectively) indicating that prior diuretic use had no significant effect on FEUN in identifying IRF patients. So it is concluded that diuretic has no effect on both the indices while evaluating a case of intrinsic renal failure. But it affects the FENa only, while differentiating pre renal failure causes among AKI causes.

Conclusion

The study concludes that Fractional Excretion of Urea (FEUN) is a better indicator than Fractional Excretion of Sodium (FENa), in differentiating Pre Renal Failure (PRF) patients from Intrinsic Renal Failure (IRF) patient among those presented initially as Acute Kidney Injury. Diuretics have no adverse effect on predictive value of Fractional Excretion of Urea (FEUN), where as it significantly affects the predictive value of Fractional excretion of sodium (FENa) in Pre-Renal Failure patients among those who presented with Acute Kidney Injury. With rampant use of diuretics today's practice for the initial management of AKI, its make FEUN a more valuable tool for differentiating and diagnosing pre renal failure cases from intrinsic renal failure cases. Although FEUN proved to be the best index under the clinical conditions encountered in this study, it must be remembered that none of the indices offers 100% discriminatory ability to differentiate PRF from IRF. FUEN & FENa are tools only; they do not obviate the importance of history, physical examination and direct urinalysis in making a diagnosis of Acute Kidney Injury.

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Citation: Jena PK, Murmu MC and Jena AP. Comparison between Fractional Excretion of Sodium and Urea in Acute Kidney Injury in Children. J Nephrol Kidney Dis. 2018; 2(2): 1018.
https://dx.doi.org/10.36876/smjnkd.1018