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AN OBSERVATIONAL STUDY ON THE RENAL FUNCTION TESTS IN PATIENTS OF BURN INJURY

Surgery

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ABSTRACT

The history of burn is as old as the history of human beings. Burn causes both local and systemic changes within the body. It causes coagulation necrosis of the epidermis and also the underlying tissue, with the depth depending on the temperature to which the skin is exposed and duration of the exposure. The purpose of this study is to evaluate the renal function in burn patients in different stages, in order to prevent the renal failure and provide a better line of management for such sufferers. This is a prospective observational study conducted at Rajendra Institute of Medical Sciences, Ranchi from January 2020 to September 2020 on burn patients admitted in the department of General Surgery either directly or referred from the peripheral health centre. Significant factors contributing to impairment of renal function includes severe degree of hypovolemic shock initially and septicemia and its complications later on. Impairment of renal function if diagnosed and managed properly can reduce the mortality of these patients.

KEYWORDS

Burn, Renal function test, Flame, Scald, Sepsis

INTRODUCTION

The history of burn is as old as the history of human beings. The incidence of injury varies greatly between different cultures. The majorities of burn cases in children are scalds and occurs accidently with kettles, pans, hot drinks and hot water bath. Among adolescents, matches and flammable liquids usually the causative factors. In adults, flame burns are more common than the scald burns. Also, electrical and chemical burns are common in adults. The co-morbid conditions in adults, mainly psychological state, epilepsy, alcohol or substance abuse remains the important underlying factors for the burn injury.

Burn causes both local and systemic changes within the body. It causes coagulation necrosis of the epidermis and also the underlying tissue, with the depth depending on the temperature to which the skin is exposed and duration of the exposure.

Significant burn is related to massive release of inflammatory mediators, both within the wound and other tissue. These mediators produce vasoconstriction, increased capillary permeability induced protein loss, edema within the burned and unburned tissue. The edema is greater in burned tissue due to lower interstitial pressure.

Burn also causes changes within the renal system, gastrointestinal system, immune system and metabolism.

During first 24 hours of postburn period there is decrease in renal (PGE2 & PGI2) and splanchnic (PGI2) endogenous prostaglandin release. Loss of these endogenous renal and splanchnic vasodilators may lead to ischemia of both vascular beds. This along with hypovolemia and decreased cardiac output causes a post burn decrease in renal blood flow and GFR. Resulting oliguria, if left untreated, may progress to acute renal failure.

Diminished blood volume and cardiac output result in decreased renal blood flow and glomerular filtration rate. Other stress induced hormones and mediators such as angiotensin, aldosterone and vasopressin further reduce renal blood flow immediately after the injury. These effects result in oliguria, which if left untreated will cause acute tubular necrosis and renal failure. Early resuscitation decreases renal failure and improves the associated mortality.

The purpose of this study is to evaluate the renal function in burn patients in different stages, in order to prevent the renal failure and provide a better line of management for such sufferers.

MATERIALAND METHOD

This is a prospective observational study conducted at Rajendra Institute of Medical Sciences, Ranchi from January 2020 to September 2020 on burn patients admitted in the department of General Surgery either directly or referred from the peripheral health centre.

Detailed history of the patient's condition was noted including the cause of burn and duration from the incident to the presentation to the emergency ward. Local examination included the areas of burn, depth of burn, percentage of burn calculated using "RULE OF NINE". Thorough clinical examination was done to exclude any other associated injury like head injury, injury to abdomen and chest. Resuscitation was done as per ATLS guidelines including intravenous fluid resuscitation using "PARKLAND FORMULA".

Following investigations were done as parameter of renal function:

1. Volume of urine passed on Day 1,3,5.
2. Blood Urea estimation on Day 1,3,5
3. Serum creatinine estimation on Day1,3,5

INCLUSION CRITERIA:

1. Burn patients of all age group requiring admission and resuscitation.
2. Patients with burn over face and extremities.

EXCLUSION CRITERIA:

1. All patients with burn injury but not hospitalized for the same.
2. Old cases of burn.
3. All those cases that surpassed 24 hours of the incident.
4. All deaths on arrival cases who were so severely injured that they did not survive attempts at resuscitation in emergency department.
5. Patients who have taken discharged against medical advice and lost to follow ups.

After approval from Institutional Ethics Committee of Rajendra institute of Medical Sciences, Ranchi, Jharkhand, India, 150 patients of burn injury were included in the study. Informed written consent was obtained from the patients.

RESULTS & OBSERVATIONS

Table No. 1 Age And Sex Distribution Of Cases

AGE GROUPS (in years)	MALE		FEMALE	
	No.	Percentage	No.	Percentage
0-10	7	4.66%	5	3.33%
11-20	9	6.0%	10	6.66%
21-30	16	10.66%	29	19.33%
31-40	18	12.0%	23	15.33%
41-50	13	8.66%	8	5.33%
Above 50	8	5.33%	4	2.66%
Total	71	47.33%	79	52.66%

Table No. 2 Different Causes Of Burn

CAUSATIVE FACTOR	NO. OF CASES	PERCENTAGE
FLAME	126	84%
SCALD	15	22.5%
ELECTRICAL	9	13.5%

Table No. 3 Time Interval Between Injury And Hospitalization

TIME INTERVAL	NO. OF CASES	PERCENTAGE
Within 6 hours	30	20%
7-12 hours	46	30.66%
12 - 24 hours	52	34.66%
24 - 48 hours	14	9.33%
After 48 hours	8	5.33%

Table No. 4 Pecentage Body Surface Area Of Burn

PECENTAGE BODY SURFACE AREA OF BURN	NO. OF CASES	PERCENTAGE
Less than 15	24	16%
16-30	51	34%
31-45	39	26%
46-60	15	10%
61-75	13	8.66%
More than 75	8	5.33%

Table No. 5 Urine Output V/s Extent Of Burn

Extent of Burn (%)	URINE OUTPUT (ml/24 hr)		
	Oliguria (<400 ml) No. of Patients	400 - 1000 ml N0. of patients	Above 1000 ml No. of Patients
Below 15	D1 D3 D5	D1 D3 D5	D1 D3 D5
16-30	--- --- -	12 --- ---	12 24 10
31-45	8 4 -	22 25 10	21 22 41
46-60	8 5 3	23 26 27	8 8 9
61-75	9 9 3	6 6 5	--- --- 4
Above 75	10 10 3	3 3 5	--- --- ---
	8 8 -	--- --- ---	--- --- ---
	--		
Total	43 36 9	66 60 47	41 54 64
Percentage	28.6% 24% 6%	44% 40% 31.3%	27.3% 36% 42.6%

Table No 6 Level Of Blood Urea

BLOOD UREA (mg/dl)	D1		D3		D5	
	No.	%Age	No.	%Age	No.	%Age
Below 40	88	58.6	91	60.6	74	61.6
41 - 80	45	30	43	28.6	38	31.6
Above 80	17	11.3	16	10.6	8	6.6
Total	150		150		120	

Table No 7 Blood Urea Level With Extent Of Burn On Day 1

Extent of Burn (%)	Below 40 mg/dl		41-80 mg/dl		Above 80 mg/dl	
	No.	%	No.	%	No.	%
Below 15	24	16	--	--	--	
16-30	38	25.33	13	8.66	--	
31-45	18	12	21	14	--	
46-60	6	4	4	2.66	5	
61- 75	2	1.33	6	4	3.33	
Above 75	--		1	0.6	5	
					3.33	
					7	
					4.66	
Total	88		45		17	

Table No 8 Blood Urea Level Extent Of Burn On Day 3

Extent of Burn (%)	Below 40 mg/dl		41-80 mg/dl		Above 80 mg/dl	
	No.	%	No.	%	No.	%
Below 15	24	16	--	--	--	
16-30	40	26.66	11	7.33	--	
31-45	19	12.66	20		--	
46-60	6	4	13.33		4	
61- 75	–		5	3.33	2.66	
Above 75	2	1.33	6	4	5	
			1	0.6	3.33	
					7	
					4.66	
Total	91		43		16	

Table No 9 Blodd Urea Level With Extent Of Burn On Day 5

Extent of Burn (%)	Below 40 mg/dl		41-80 mg/dl		Above 80 mg/dl	
	No.	%	No.	%	No.	%
Below 15	24	16	--	--	--	
16-30	38	25.33	13	8.66	--	
31-45	18	12	21	14	--	
46-60	6	4	4	2.66	5	
61- 75	2	1.33	3	4	3.33	
Above 75	--		--	0.6	--	
					3.33	
					--	
					4.66	
Total	74		38		8	

Table No. 10 Level Of Serum Creatinine

SERUM CREATININE (mg/dl)	D1		D3		D5	
	No.	%Age	No.	%Age	No.	%Age
Below 1.2	92	61.3	90	60	78	65
1.3 - 3	43	28.6	44	29.3	30	25
Above 3	15	10	16	10.6	12	10
Total	150		150		120	

Table No 11 Cause Of Death Within 5 Days

CAUSE OF DEATH	NO. OF PATIENTS	PERCENTAGE
Renal Failure	10	6.6%
Cardio-Respiratory Failure	7	4.6%
Septicemia	7	4.6%
Shock	6	4%
Total	30	

DISCUSSION

There were total of 150 cases of burn due to different causative factors in this study, with maximum number of cases in the age group of 21 to 30 years with 10.66 % males and 19.33% females. Majority of cases were Female (52.66%), with Male casualties as 47.33%.

According to William G Marshal (1983), the mean age group of major burns was 40 +/- 17 years with 70% males and 30% females [1]. In this study, female preponderance can be explained by the fact that females are more exposed to fire during cooking, lightening the kerosene lamp and stoves. The highly inflammable synthetic loose dresses, dowry system, failure in life is also associated with the high incidence of burn in females.

On analysis of causative factors, 84% cases were due to flame burn, followed by scald (22.5%) and electric burn (13.5%). Blocker et al (1960) in a statistical analysis of 1000 burn cases, observed that 78.3 % cases were due to flame and flash burn and 12% were scald injury. Campbell et al (1969) and Pushkar (1983) observed major electric burn in 2-3% cases.

In this study, scald burn was most commonly observed in the age group of children due to splashing of hot water while playing in cooking area; whereas electric burn was mainly due to faulty live wire lines (high voltage), observed in electricians.

Majority of patients (~ 50%) attended the hospital within 12 hours of injury. Rest of the patients reported after 12 hours. Due to limited and inadequate facilities for transportation of the patients from a distant place and rural areas. Secondly, poverty is another important factor with our patients who are not able to arrange for transport to higher burn centre.

Regarding the extent of burn, 60% of cases were in the range of 16-45% BSA burn. Warden et al (1987) mentioned some factors to define the seriousness of thermal injury. Extent of burn was one of the most important factors. They said that examination of Total Body Surface Area (TBSA) burned was necessary for immediate fluid replacement and to determine the severity of burn [2].

In comparison of Urine output with respect to the Extent of burn, it was observed that, Oliguria (<400ml/24hr) was reported in 28.6% of cases on Day1, 24% on Day3 and 6% on Day5; that signifies the improvement in the urine output following resuscitation. Rest of the patients maintained adequate urine output. Bull et al (1954) observed urine output between 500-1000 ml on Day 1, in cases of larger burn even when adequate colloidal and non-colloidal fluid therapy was given [3]. Sevitt et al (1965) reported decrement in urine flow in early post burn period even after adequate transfusion [4]. Agrawal (1973) noticed diuresis from 6 to 12 days of post burn period [5]. The findings of this study are comparable to the above-mentioned studies and Oliguria in early post burn period is common in all of them. In major degree of burn, oliguria is found in spite of adequate fluid replacement therapy.

Sevitt (1965) observed temporary reversible functional disorder of kidney with fall in urine output, reduced glomerular filtration rate probably from vasoconstriction, and moderate rise of blood urea and plasma creatinine [4]. He further noted the persistent functional disorder in two forms. Oliguric form of renal failure caused by insufficient balance between decrease in water filtered and reduction in tubular reabsorption. Non-oliguric form of renal failure in which the relatively normal urine output was described owing to a decreased tubular absorption which compensate for the reduced glomerular filtration rate.

On further analysis, 58.6% of patients were reported as having normal blood urea level on Day1, while 41.3% of patients reported as having raised blood urea level. Similar trend was seen to followed on Day3 and Day5. It was observed that higher the degree of burns, higher was the blood urea level, further complicating the renal function. Bull et al (1954) found the mean blood urea 40mg/100ml for first four days in patient with less than 30% burn and 60mg/100ml in higher degree burn [3]. He also got high blood urea level in a few cases during nitrogenous intake and excretion phase. He believed that it was due to excessive urea production rather than diminished renal function.

Serum creatinine level also revealed the same trend as blood urea level with higher level proportional to higher degree of burns. Ekunad et al (1970) regarded the increased serum creatinine level as a sign of incipient renal failure present before decreased urine output [6]. They further analyzed that serum creatinine level along with urinary output measurement could give better information about renal function in the early stage of burn.

In this study, 20% patients died by the end of Day 5 most commonly due to renal failure followed by cardio-respiratory failure, septicemia and shock. Delayed presentation for treatment may be one of the factors responsible for the mortality. Ekunad (1970) stated that renal function was affected by several aspects of burn pathology like hypovolemia, low cardiac output, increased sympathetic activity, hypoxia, toxemia and septicemia [6].

In comparison to above observations, the findings of this study are not deviating from the reported observations of others.

CONCLUSION

Renal function is significantly impaired in cases of burn and is directly proportional to the depth and percentage of total body surface area involved. Significant factors contributing to impairment of renal function includes severe degree of hypovolemic shock initially and septicemia and its complications later on. Development of ARF is a very bad prognostic indicator. Besides deterioration in the glomerular function, there is also depression of the tubular functions of kidney. Maintenance of satisfactory function of all vital organs including kidney is the principal view of burn treatment. Impairment of renal function if diagnosed and managed properly can reduce the mortality of these patients.

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