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Original Research Article

To study causative agents and outcome in patients of acute febrile illness

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Abstract

Introduction: Acute febrile illness is a major public health problem in north-eastern Uttar Pradesh and the adjoining regions of Bihar and Nepal. It leads to heavy morbidity and mortality. This study aims to find out what causes Multiple Organ Dysfunction Syndrome (MODS), how it shows up in a patient's body, and what other factors lead to it in our tertiary care hospital in the Eastern UP.
Methodology: This observational study was done over one academic year (January 2018 to December 2018) with 200 patients attending the department of medicine at Nehru Hospital, B.R.D. Medical College, Gorakhpur.
Results: In our study, mortality in MODS was significant in scrub typhus and without MODS was significant in dengue patients. It was found that serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and serum creatinine changes had significant p-value (.0001) for MODS patients.
Conclusion: Out of known etiologies, 17.5% of scrub typhus, 10% of dengue, 2.5% of malaria, enteric fever dot, and sepsis can be prevented by educating people and taking preventive measures. Early hospitalisation and proper treatment can prevent these complications.

Keywords: Acute febrile illness, multiple organ dysfunction syndrome, enteric fever dot, serum glutamic-oxaloacetic transaminase, serum glutamic pyruvic transaminase and scrub typhus

Introduction

Acute febrile illness is a major public health problem in north-eastern Uttar Pradesh and the adjoining regions of Bihar and Nepal. It leads to heavy morbidity and mortality. Fever has been a prominent feature of the disease since antiquity [1-3]. The febrile response is orchestrated by the central nervous system through endocrine, neurological, immunological, and behavioural mechanisms. Other than a regulated rise in body temperature, fever is often accompanied by various sickness behaviours, changes in metabolic and physiological

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characteristics of body systems, and alterations in immune responses [4]. Therefore, fever and the febrile response remain significant contributors to the pathogenesis, clinical presentation, and outcome of many illnesses and diseases [5].

Acute febrile illness is the medical term used to describe the acute onset of fever or elevation in body temperature. This happens when a pathogena pathogen invades the body invades the body and the immune system is activated to fight it. Acute fever or acute febrile illness (a rapid onset of fever and symptoms such as headache, chills, or muscle and joint pains) is common in developing and underdeveloped countries. It can be caused by very diverse pathogens [6-7]. Differential diagnosis of these etiologies based on clinical criteria alone is impossible as the clinical signs and symptoms of most of these infections are very similar and the correct diagnosis is only possible using pathogen-specific diagnostic tests. For patient treatment and management, differential diagnosis of the causative agent is required [8]. In low-income countries, many preventable deaths occur because of delayed or lack of correct diagnosis. According to various studies, early diagnosis and treatment of acute febrile illness has better outcomes.

Acute febrile illness is caused by various viruses, bacteria, fungi, parasites, spirochetes, chemicals, toxins, etc. There is a seasonal and geographical variation of the causative agent causing acute febrile illness [9]. There is a huge burden of acute febrile illness in our setup. Various studies of acute febrile illness have variable data about morbidity and mortality [10]. This study aims to find out what causes MODS in acute febrile illness, how it shows up in the hospital and what happens to patients who are taken to our tertiary care hospital in Eastern UP.

Material and Methods

This observational study was done over one academic year (January 2018 to December 2018) in the department of medicine at Nehru Hospital, B.R.D. Medical College, Gorakhpur. At least 200 patients attended the department of medicine at Nehru Hospital, B. R. D. Medical College, Gorakhpur. The patients who were included in the study followed the case of having a fever for 14 days with or without the involvement of 2 or more organs/systems. The patients who were excluded included those with endorgan diseases causing MODS, any chronic diseases leading to MODS, and afebrile causes of MODS.

Data Analysis: Data analysis was done by using IBM SPSS Statistics version 22 and was analysed by using an appropriate statistical test.

Results

The present study was conducted on 200 consecutive cases of acute febrile illness (AFI) patients who were admitted to the Department of BRD Medical College Gorakhpur during the months of January 2018 to December 2018. In our study, 71 patients, 37 (30.8%) male and 34 (41.5%) female, are AFI patients between the ages of 20 and 30, followed by patients between the ages of 31 and 40, with 36 (30%) male and 14 (17.5%) female. Patients' maximum effects were effected in this 20-30 year old age group. [Table 1]

Table 1: Gender and age distribution of AFI patients

Age	No. of patients % (n=200)	Male % (n=120)	Female % (n=80)
< 20	28(14%)	16(13.3%)	12 (15%)
20-30	71(35.5%)	37(30.8%)	34 (41.5%)
31-40	50(25%)	36 (30%)	14 (17.5%)
41-50	29(14.5%)	15 (12.5%)	14 (17.5%)
51-60	22(11%)	16 (13.3%)	6 (7.5%)

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Out of 118 male AFI patients, 16 (13.6%) presented with MODS, and out of 82 female patients, 10 (12.5%) presented with MODS. There is no significant difference in the number of MODS in relation to gender. In our study, the total number of MODS cases was 26 (13%), in which the maximum number of patients with MODS presented between 31-40 age group was 7 (17.5%) out of 40 patients, and between 51-60 age group was 5 (26.3%) out of 19 patients. MODS were more common in the elderly population. In our study, out of 200 AFI patients, vomiting, pain in the abdomen, tachycardia, facial puffiness and skin blenching were the most common clinical features. Most people came to the hospital with fever (200 cases), vomiting (56 cases), abdominal pain (55 cases), oedema (11 cases), puffy face (45 cases), and blemished skin (35 cases).Out of 26 (13%) MODS cases, pain abdominal 14 (25.5%), vomiting 12 (21.4%), facial puffiness 24 (92.3%), and skin blenching 20 (77%) were present. Pain abdominal 41 (23.6%), vomiting 44 (25.3%), facial puffiness 22, (11.5%) and skin blenching (15 (8.6%) were present in 174 (87.5%) cases without MODS. Out of 200 AFI patients, 5 (2.5%) were suffering from malaria, 20 (10%) were suffering from dengue, 35 (17.5%) were suffering from scrub typhus, and 8 (4%) were suffering from enteric fever. Out of 20 patients suffering from dengue, 5 (19.2%) developed MODS. Enteric fever, eight patients, in which two (7.7%) developed MODS. In our study, out of 200 patients, 35 (17.5%) suffered from scrub typhus, of which 11 (42.3%) suffered from MODS. Scrub Typhus was a leading cause of MODS in our study. Hepatomegaly was the most common finding on abdominal examination, found in 33 (22.8%) out of which 12 (46.2%) with MODS and 24 (13.8%) without MODS, and splenomegaly was present in 4 (2.8%) out of which 1 (3.8%) with MODS and 3 (1.72%) without MODS. [Table 2]

Table 2: Distribution of gender, comparison between different age group, clinical features, causative agents, radiological investigation in patients of AFI presented with and without MODS

	No. of patients (n=200)		**With MODS % (n = 26)**		**Without MODS % (n = 174)**		**OR (95%CI)**	**p-value**
	No.	**%**	**No.**	**%**	**No.**	**%**		
Gender								
Male	118	59.0	16	13.6	102	86.4	1.12 (0.48-2.63)	0.77
Female	82	41.0	10	12.4	72	87.8	1.00 (Ref.)	
Age in years								
<20	24	12.0	1	4.2	23	95.8	1.00 (Ref.)	
20-30	66	33.0	5	7.6	61	92.4	1.88 (0.20-17.01)	0.57
31-40	40	20.0	7	17.5	33	82.5	4.87 (0.56-42.38)	0.15
41-50	29	14.5	5	17.2	24	82.8	4.79 (0.51-44.20)	0.16
51-60	19	9.5	5	26.3	14	73.7	8.21 (0.86-77.73)	0.06
>60	22	11.0	3	13.6	19	86.4	3.63 (0.34-37.82)	0.28
Clinical Features								
Fever								
Present	200	100	26	100	174	100	-	-
Absent	0	0	0	0.0	0	0	1.00 (Ref.)	
Edema								
Present	11	5.5	4	15.4	7	4	4.33 (1.17-16.01)	0.01*
Absent	189	94.5	22	84.6	167	96	1.00 (Ref.)	
Vomiting								
Present	56	28.0	12	46.2	44	25.3	2.53 (1.02-5.88)	0.02*
Absent	144	72.0	14	53.8	130	74.7	1.00 (Ref.)	
Pain in abdomen								
Present	55	27.5	14	53.8	41	23.6	3.78 (1.62-8.82)	0.001*
Absent	145	72.5	12	46.2	133	72.4	1.00 (Ref.)	
Headache								
Present	5	2.5	1	3.8	4	2.3	1.70 (0.18-15.82)	0.63

Absent	195	97.5	25	96.2	170	97.7	1.00 (Ref.)	
Tachypnea								
Present	15	7.5	26	100	5	2.9		
Absent	185	92.5	0	0	169	97.1		
Tachycardia								
Present	50	25	21	80.8	29	16.7		
Absent	150	75	5	19.2	145	83.3		
Facial Puffiness								
Present	45	22.5	24	92.3	20	11.5		
Absent	155	77.5	2	7.7	154	88.5		
Skin Blenching								
Present	35	17.5	20	77	15	8.6		
Absent	165	82.5	6	23	159	91.4		
Causative Agents								
Malaria								
Yes	5	2.5	0	0.0	5	2.9	-	-
No	195	97.5	26	100	169	98.1	1.00 (Ref.)	
Dengue								
Yes	20	10.0	5	19.2	15	8.6	2.52 (0.83-7.65)	0.09
No	180	90.0	21	80.8	159	91.4	1.00 (Ref.)	
Scrub Typhus								
Yes	35	17.5	11	42.3	24	13.8	4.58 (1.88-11.15)	0.0001*
No	165	82.5	15	57.7	150	86.2	1.00 (Ref.)	
Enteric fever								
Yes	8	4.0	2	7.7	6	3.4	2.33 (0.44-12.22)	0.30
No	192	96.0	24	92.3	168	96.6	1.00 (Ref.)	
Sepsis								
Yes	51	25.5	10	38.5	41	23.6		
No	149	74.5	16	61.5	133	76.4		
Unknown etiology								
Yes	81	40.5	8	30.8	73	42		
No	119	59.5	18	69.2	101	58		
Radiological Investigation								
CXR								
Abnormal	2	1	1	50	1	50	6.92 (0.41-114.17)	0.11
Normal	198	99	25	12.6	173	87	1.00 (Ref.)	
Ultrasound finding								
Hepatomegaly	33	22.8	12	46.2	24	14	2.71 (1.03-7.08)	0.04*
Hydronephrosis	1	0.7	0	0	1	0.5	-	-
Splenomegaly	4	2.8	1	3.8	3	1.7	2.41 (0.23-24.92)	0.46
Normal	107	73.8	13	50	146	84	1.00 (Ref.)	

Binary logistic regression, #Multiple response, OR-Odds ratio, CI-Confidence interval, Ref: Reference, *Significant

Out of 200 patients, Hb less than 8 was found in 32 patients, 8-12 was 97 patients, and more than 12 was 71 patients. TLC of less than 4000 was found in 4 patients, 4000-12000 in 101 patients, and more than 12000 in 95 patients. In 85 patients, the platelet count was less than 100,000, while in 115 patients, it was greater than 100,000. Patients presenting with MODS had Hb less than 12 and TLC greater than 20000 and a platelet count less than 100000. [Figure 1 and Table 3]

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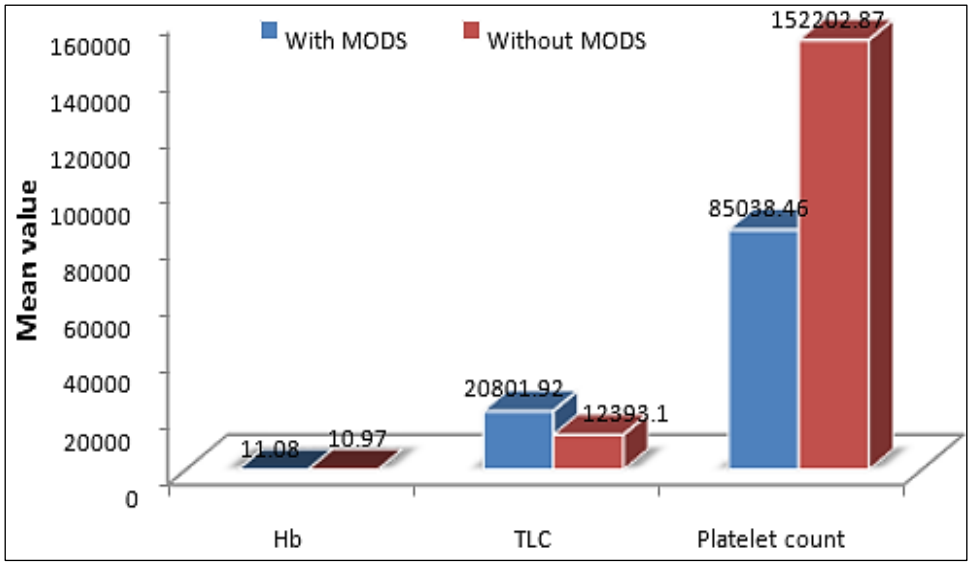

Fig 1: Comparison of biochemical parameters between with and without MODS

Table 3: Comparison of hematological and biochemical parameters in AFI patients presented with and without MODS

Hemoglobin (gl/dl)	No of cases (%) (n=200)	Scrub Typhus % (n=35)	Malaria % (n=5)	Dengue % (n=20)	Enteric fever % (n=5)	Sepsis % (n=51)	Unknown % (n=81)
< 8	32 (16)	2 (5.7)	2 (40)	1 (5)	0	8 (15.7)	18 (22.2)
8-12	97 (48.5)	19 (54.3)	2 (40)	10 (50)	5(100)	23 (45.1)	39 (48.2)
> 12	71 (35.5)	14 (40)	1 (20)	9 (45)	0	20 (39.2)	24 (29.6)
TLC (cells/mm3							
<= 4000	4 (2)	0	0	0	1(20)	0	5(6.1)
4000-12000	101 (50.5)	17 (48.6)	2 (40)	10 (50)	3(60)	0	64(79)
> 12000	95 (47.5)	18 (51.4)	3 (60)	10 (50)	1(20)	51 (100)	12 (14.9)
SGPT (U/L)							
< 40	66 (33)	8 (22.9)	0	9 (45)	3 (60)	20 (39.2)	39 (48.1)
> 40	134 (67)	27 (77.1)	5 (100)	11 (55)	5 (40)	31 (60.8)	42 (51.9)
SGOT (U/L)							
< 45	64 (32)	34 (97.1)	1 (20)	3 (15)	1 (20)	12 (21.7)	33 (40.7)
> 45	136 (68)	1 (2.9)	4 (80)	17 (85)	4 (80)	39 (78.3)	48 (59.3)
Serum creatinine (mg/dl)							
< 1.4	149 (74.5)	22 (62.9)	3 (60)	12 (60)	3 (60)	34 (68.6)	68 (84)
> 1.4	51 (25.5)	13 (37.1)	2 (40)	8 (40)	2 (40)	17 (32.4)	13 (16)
Platelet count (Lac/mm3)							
< 1.5	187 (93.5)	29 (82.9)	4 (80)	11 (55)	2 (40)	44 (86.3)	68 (83.9)
>1.5	13 (6.5)	6 (17.1)	1 (20)	9 (45)	3 (60)	7 (13.7)	13 (16.1)
Urine R/M							
Puscell	20 (10)	0	0	0	0	0	0
Sterile	180 (90)	0	0	0	0	0	0

The AFI causing mortality in dengue patients was 2 (10%) out of 20 patients. The AFI causing mortality in scrub typhus was 8 (22.9%) out of 35 patients. The AFI causing mortality in enteric fever was 1 (12.5%) out of 8 patients. In malaria, there was no mortality. Mortality was higher in scrub typhus patients in compression than in other causative agents. [4th Table]

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Table 4: Comparison of mortality in AFI patients presented with and without MODS

Causative agents#	No. of patients (n=200)	Death		Alive		OR (95%CI)	p-value
		No.	%	No.	%		
Malaria							
Yes	5	0	0.0	5	100.0	-	-
No	195	23	11.8	172	88.2	1.00 (Ref.)	
Dengue							
Yes	20	2	10.0	18	90.0	0.84 (0.18-3.88)	0.82
No	180	21	11.7	159	88.3	1.00 (Ref.)	
Scrub Typhus							
Yes	35	8	22.9	27	77.1	2.96 (1.14-7.66)	0.02*
No	165	15	9.1	150	90.9	1.00 (Ref.)	
Enteric Fever							
Yes	8	1	12.5	7	87.5	1.10 (0.13-9.40)	0.92
No	192	22	11.5	170	88.5	1.00 (Ref.)	

Binary logistic regression, #Multiple response, OR-Odds ratio, CI-Confidence interval, Ref: Reference

The total number of male patients who expired was 11 out of 23, of which 5 (45.5%) with MODS and 6 (54.5%) without MODS. The total number of female patients who expired was 12 out of 23, of which 2 (16.7%) with MODS and 10 (83.3%) without MODS. There is significant mortality in male MODS patients. [Table 5] Out of 200 patients presented with MODS, 26 (13%) had SGOT greater than 200, SGPT greater than 170, serum bilirubin more than 4.53, and serum creatinine more than 2.61. [Table 6] Out of 200 patients, 35 (17.5%) had scrub typhus, with 10 (28.6%) having MODS, 5 (2.5%) having malaria, 14 (7%) having dengue fever, with 2 (14.3%) having MODS, and 9 (4.5%) having enteric fever, with 1 (11.1%) having MODS. In our study, out of 200 patients, 56 (28%) suffered from sepsis and 12 (21.4%) presented with MODS. An unknown aetiology was found in 81 (40.5%). In our study, the significant aetiology presented with MODS was scrub typhus. [Table 7]

Table 5: Comparison of mortality in AFI patients presented with and without MODS in male and female patients

Gender/Mortality	No. of patients	With MODS		Without MODS		OR (95% CI)	p-value
		No.	%	No.	%		
Male	**N = 118**	**N=16**		**N=102**			
Death	11	5	31.25	6	5.9	7.27 (1.90-27.79)	0.001*
Alive	107	11	78.75	96	94.1	1.00 (Ref).	
Female	**N=82**	**N=10**		**N=72**			
Death	12	2	20	10	13.9	1.55 (0.28-8.37)	0.6
Alive	70	8	80	62	87.1	1.00 (Ref).	

Binary logistic regression, OR-Odds ratio, CI-Confidence interval, Ref: Reference, *Significant

Table 6: Comparison of biochemical and hematological parameters present in AFI patients with and without MODS

Biochemical parameters	With MODS	Without MODS	p-value
Hb	11.08±2.79	10.97±2.83	0.86
TLC	20801.92±11530.57	12393.10±7509.52	0.0001*
Platelet count	85038.46±63658.90	152202.87±194062.00	0.08

Liver function tests			
SGOT	227.40±147.66	94.31±94.52	0.0001*
SGPT	170.74±140.37	78.75±84.79	0.0001*
Serum bilirubin	4.53±4.64	1.69±2.37	0.0001*
Serum creatinine	2.61±1.34	1.20±1.75	0.0001*

Unpaired t-test, *Significant

Table 7: Comparison of etiology between with and without MODS

Etiology positive for	No. of patients (n=200)		With MODS (n=26)		Without MODS (n=174)	
	No.	%	No.	%	No.	%
Scrub typhus	35	17.5	10	28.6	25	71.4
Malaria	5	2.5	0	0.0	5	100.0
Dengue	14	7.0	2	14.3	12	85.7
Enteric fever	9	4.5	1	11.1	8	88.9
Sepsis	56	28.0	12	21.4	44	78.6
Unknown etiology	81	40.5	1	1.2	80	98.8

In our study, mortality in MODS was significant in scrub typhus and without MODS was significant in dengue patients. [Table 8] The greatest number of MODS cases (26%) were discovered between September 8 (30.8%) and October 10 (38.4%).With respect to September and October, in other months (January to August), very few AFI cases were present. The maximum number of scrub typhus cases was found in October, and MODS cases were also present during September and October. In our study of 200 patients, the total number of expired patients was 23 (11.5%), of which MODS cases were 7 (26.9%), and those without MODS were 16 (9.2%). The total number of alive patients was 177 (88.5%), with MODS cases accounting for 19 (73.1%) and patients without MODS accounting for 158 (90.8%).[Table 9] The total number of patients expired, 7 out of 26 with MODS patients and 16 patients out of 174 without MODS. There is significant mortality without MODS patients. [Figure 2 and Table 10]

Table 8: Comparison of mortality causative agents in male and female of AFI patients presented with MODS and without MODS

Causative agents	No. of patients	Male		Female		OR (95%CI)	p-value
		No.	%	No.	%		
With MODS							
Malaria							
Yes	0	0	0	0	0	-	-
No	26	16	61.5	10	38.5	1.00 (Ref.)	
Dengue							
Yes	5	3	60.0	2	40.0	0.92 (0.12-6.78)	0.93
No	21	13	61.9	8	38.1	1.00 (Ref.)	
Scrub Typhus							
Yes	11	6	54.5	5	45.5	0.60 (0.12-2.97)	0.53
No	15	10	66.7	5	33.3	1.00 (Ref.)	
Enteric fever							
Yes	2	1	50.0	1	50.0	0.60 (0.03-10.82)	0.72
No	24	15	62.5	9	37.5	1.00 (Ref.)	
Causative agents							
Without MODS							
Malaria							
Yes	5	2	40.0	3	60.0	0.46 (0.07-2.82)	0.39

No	169	100	59.2	69	40.8	1.00 (Ref.)	
Dengue							
Yes	15	11	73.3	4	26.7	0.92 (0.12-6.78)	0.93
No	159	91	57.2	68	42.8	1.00 (Ref.)	
Scrub Typhus							
Yes	24	12	50.0	12	50.0	0.66 (0.28-1.58)	0.58
No	150	90	60.0	60	40.0	1.00 (Ref.)	
Enteric fever							
Yes	6	4	66.7	2	33.3	0.60 (0.03-10.82)	0.72
No	168	98	58.3	70	41.7	1.00 (Ref.)	

Binary logistic regression, #Multiple response, OR-Odds ratio, CI-Confidence interval, Ref: Reference

Table 9: Comparison of seasonal variation of causative agent in AFI patients presented with MODS and without MODS

Causative agents	No. of patients	August		September		October		p-value
		No.	%	No.	%	No.	%	
With MODS								
Malaria								
Yes	0	0	0.0	0	0.0	0	0.0	-
No	26	1	3.8	16	61.5	9	34.6	
Dengue								
Yes	5	0		2	40.0	3	60.0	0.39
No	21	1	4.8	14	66.7	6	28.6	
Scrub Typhus								
Yes	11	0	0.0	5	45.5	6	54.5	0.15
No	24	1	6.7	10	41.7	13	54.2	
Enteric Fever								
Yes	2	0	0.0	1	50.0	1	50.0	0.87
No	24	1	4.2	15	62.5	8	33.3	
Without MODS								
Malaria								
Yes	5	0	0.0	3	60.0	2	40.0	0.7
No	169	13	7.7	104	61.5	52	30.8	
Dengue								
Yes	15	0	0.0	8	53.3	7	46.7	0.26
No	159	13	8.2	99	62.3	47	29.6	
Scrub Typhus								
Yes	24	1	4.2	11	45.8	12	50.0	0.09
No	150	12	8.0	96	64.0	42	28.0	
Enteric Fever								
Yes	6	1	16.7	4	66.7	1	16.7	0.56
No	168	12	7.1	103	61.3	53	31.5	

Chi-square test, #Multiple response

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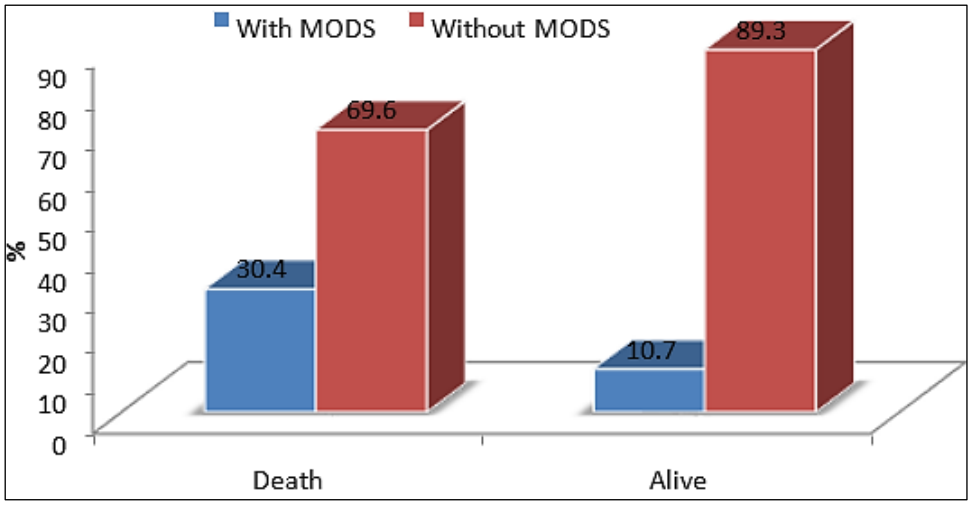

Fig 2: Comparison of outcomes between with and without MODS

Table 10: Comparison of outcome between with and without MODS

Outcome	No. of patients (n=200)		With MODS (n=26)		Without MODS (n=174)		OR (95% CI)	p-value
	No.	%	No.	%	No.	%		
Death	23	11.5	7	26.9	16	9.2	3.63 (1.32-9.96)	0.008*
Alive	177	88.5	19	73.1	158	90.8	1.00 (Ref.)	

Binary logistic regression, OR-Odds ratio, CI-Confidence interval, Ref: Reference, *Significant.

Discussion

During a one-year study of the aetiology of AFI in the fall of 2018, we discovered that the majority of patients presented to a tertiary hospital in BRD Medical College Gorakhpur in the medicine department. A total of 200 consecutively admitted cases of AFI in the department of Medicine at BRD Medical College, Gorakhpur, were included in this study. The point's average age was 35 years. Age (20-60): A similar study was conducted by Singh S *et al.* [11] Both abdominal pain and vomiting have a significant p-value. A similar study was conducted by Mahajan SK *et al.*) [12]. In our study of AFI patients (N = 200), the major causative agent of AFI with MODS was Scrub Typhus 35 (17.5%), in which MODS cases were 10 (28.6%) out of 35, which had a significant p-value (0.0001). There were n = 18 (9%) male scrub typhus patients, and MODS was present in (3%) [13]. Enteric fever cases were 8 (4%) out of 200 patients. 81 (40.5%) patients were of unknown aetiology [14]. Our study found that SGOT, SGPT, and S. creatinine changes had a significant p-value (.0001) for MODS patients in our study. Similar studies have been conducted· Out of 200 patients, the most common complication was acute kidney injury in 50 (25%), shock in 36 (18%), MODS in 26 (13%), and ARDS in 5 (2.5%) out of 200 patients. Eighty-one of unknown aetiology, in which 76 (38%) improved and 5 expired. In our study, the most common causative agent of MODS was scrub typhus, with 24 (12%) similar studies done [15-17].

Conclusion

Disease affected patients of almost all ages. Almost half of the patients were between 20 and 40 years of age, suggesting the disease has a higher incidence in the younger population. The male to female ratio was 1.04:1, which suggested that both males and females were equally affected. The most common findings of the general examination of AFI patients were tachypnea, pyrexia, tachycardia, and pallor. SGPT was raised in 25.5%, SGOT in 28%, and

creatinine was raised in 25.5% of patients. In spite of our best effort and limited resources, the etiologies of 40.5% of AFI cases could not be ascertained. Further research and analysis are required to analyse AFI cases due to known agents. Out of known etiologies, scrub typhus 17.5%, dengue 10%, malaria 2.5%, enteric fever Dot, and sepsis are preventable, so the burden of the above diseases could possibly be reduced by educating people and preventive measures. AFI patients with MODS died at a rate of 30.4%, while those without MODS died at a rate of 69.6%. Complications may be prevented by early hospitalisation and proper treatments with better care. Newer strategies for pathogen identification and continued analysis of exposures and clinical features could help us improve our ability to diagnose, treat and prevent acute febrile illness.

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