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Differentiating Undifferentiated Fever: Comparative Analysis of Blood Count Profile and Clinical Features in Tropical Hospital

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Abstract: ***Aim: A study on complete blood count profile and clinical features in undifferentiated fever of short duration in our Hospital. Objectives: 1. To knows and compares complete blood count profile (TC, DC, Platelet and Hemoglobin) and clinical findings between undifferentiated fever of short duration commonly seen in our hospital. MATERIALS AND Method: In our Hospital based cross sectional study of 2 year duration in all hospitalized patients with fever duration less than 21 days with no localizing signs and as per the inclusion criteria were considered and detailed history, clinical examination and CBC was done for the patients included in the study as per the inclusion criteria. Among those, 80 malaria cases (thick and thin smear +), 68 Dengue fever (IgM ELISA+), 20 Enteric fever (blood culture +), 20 Leptospirosis (IgM ELISA positive) and 12 Rickettsial fever (scrub typhus) by Weil felix initially and diagnosis is confirmed by IgM ELISA were segregated from the group to make a sample size of 200. Data analysis was done by univariable analysis and managed on Microsoft excel. Characteristics of each disease group were compared with those of the remaining group. p< 0.05 will be considered as significant. . Results of multivariable analyses were presented as the odds ratios (ORs) and 95% confidence intervals (95% CIs). Results: In our study, out of 200 cases of AUF 68.5% patients were male. Of these 200 cases Malaria (40%) and dengue fever (34%) were the most common cause of acute undifferentiated fever (AUF), followed by leptospirosis (10%), Enteric fever (10%) and scrub typhus (6%). Among 80 cases of malaria 70 (87.5%) presented with chills and rigor and 52 (65%) patients were having splenomegaly clinically. Among the 68 cases of dengue fever 35 patients (51.5%) presented with retro - orbital pain, 36 patients (52%) with joint pain. Clinically no patients were having splenomegaly and was a significant finding (p value - < 0.001) in dengue fever group when compared with the other AUF group. Leukopenia was seen in 43 patients (65.2%) and thrombocytopenia in all 67 patients (98.5%) was noted among the dengue fever group. Among the 20 cases of enteric fever 17 patients (85%) presented with diarrhea and 16 patients (80%) were having splenomegaly. Eosinopenia was seen in 14 patients (70%) which was a significant finding when compared with the other AUF group (p value of < 0.001). Among the 20 cases of leptospirosis 17 patient (80%) was having myalgia, 13 patients (65%) was having jaundice and 16 patients (80%) was having muscle tenderness. Clinically hepatomegaly was seen in 13 patients (65%). Leukocytosis was seen in 14 patient (70%) with a significant p - value of <0.001. Among the 12 cases of Rickettsial fever (scrub typhus) 8 (66.7%) patient were having black eschar and lymphadenopathy were noted in 8 patient (66.7%) which was also having a significant p - value when compared with the other AUF group. Leukocytosis was also noted in 11 patients (91.7%) which is significant when compared with the other AUF group. Conclusion: In a resource - limited setting and disease burden areas, simple complete blood count profile and detailed clinical examination will be having significant utility in differentiating the five common aetiology of undifferentiated fever in tropical.***

Keywords: Complete blood count, undifferentiated fever, Clinical features, tropical hospital, comparative analysis

1. Introduction

Acute undifferentiated fever (AUF) is a common cause of patients seeking healthcare in Mangalore, especially between June and September (1). Unlike fever of unknown origin (FUO), which enjoys a standard definition, AUF, also known as “acute febrile illness”, “short febrile illness”, or “acute fever” lacks an international consensus definition. Since FUO requires duration of fever to be longer than three weeks, some authors have defined AUF as fever that resolves within three weeks (2). More traditionally however, AUF has been defined as fever of two weeks or shorter in duration (3) (4). Thus the term AUF is used to denote fevers that typically do not extend beyond a fortnight, and lack localizable or organ - specific clinical features (5). Among the undifferentiated fever of short duration seen in our hospital, dengue fever, enteric fever, malaria, leptospirosis and rickettsial fever are most common diagnoses encountered. All these type of fever of short duration have almost similar way of clinical presentation and usually this type of fever have duration of fever less than 3 weeks. So these fever types cannot be grouped under PUO. So differentiating the common etiological causes of acute undifferentiated fever by means of routine clinical evaluation and simple hemogram can help clinician to start early treatment and can avoid empirical management of all febrile illness with antibiotics. Differentiation of the etiological agents causing the acute febrile illness by simple clinical and hematological profile will be very useful for the medical practitioner working in a resource limited setting like rural health centers.

Hence there is a great need to study on the etiological, clinical and hematological profile of acute undifferentiated fever for the early diagnosis, appropriate treatment strategy and future prevention of various infectious etiologies of acute undifferentiated fever.

In 2010 a prospective observational study done by Chrispal *et al* (6) in Christian Medical College, Vellore on Acute undifferentiated febrile illness with no evident focus of infection on 398 subjects with main objective to describe the

regional etiology and to describe the disease specific profile in acute undifferentiated fever (AFU).

In his study the mean age group of patients admitted with fever was 39.5 with male predominance (60.1%). Most admission was seen between the month of July and October in the study. According to his study rickettsial fever (scrub typhus) (47.5%) was increasingly reported, with other acute fever etiology like malaria (17.1%), enteric fever (8%), dengue fever (7%), leptospirosis (3%), hanta virus (0.3%) and unclear diagnosis (8%). Among the patient diagnosed to have scrub typhus and leptospirosis leukocytosis was reported as a significant variable. Thrombocytopenia was seen among the malaria and dengue fever group and more markedly among the dengue fever group. When the clinical features were compared hepatosplenomegaly was seen significantly among the patients diagnosed to have malaria.

A prospective study was done by KP Abhilash *et al* (7) in all adult patient with acute undifferentiated fever (AFU) of 3 - 14 days duration with no evidence of focus of infection in a tertiary hospital in South India during the period between October 2012 and September 2013. The study included 1258 patients whose fever etiology was confirmed by microbiological tests and difference in clinical features, baseline investigation and outcome was analyzed between the different fever etiology.

According to the study done by KP Abhilash et al scrub typhus (35.9%) was the most common cause of acute undifferentiated fever (AFI). Dengue fever and scrub typhus has shown a seasonal peaking of incidence during the monsoon season were as enteric fever and malaria was not showing any seasonality peaking.

Clinical features like mean time to presentation was longer in the enteric fever and scrub typhus group when compared with the other fever etiology. Bleeding manifestation was mostly associated with dengue fever (14%), malaria (4.6%) and scrub typhus (4.2%). Mortality rate was highest among the scrub typhus group (4.6%) followed by dengue fever (2.2%).

According to the study scrub typhus group has a shown a significant clinical predictors like breathlessness and leukocytosis. Thrombocytopenia and bleeding manifestations were independent predictors among the dengue fever group.

The retrospective study done by Lokhandwala A et al (8) in a tertiary hospital in UAE (United Arab Emirates), study done on a population of 51 serial widal positive and blood culture positive typhoid patients admitted in a tertiary hospital were taken and there medical records and laboratory information were collected and recorded which was taken as cases. As control group an equal number of population was randomly selected and retrieved from patients who were admitted in the same hospital during the same study period with history of fever, and on discharge provided not to have enteric fever (both by blood culture and serial widal tests negative for salmonella)

In the study done by Lokhandwala A et al, out of total of 51 cases 37 patients had eosinophil count of zero i. e.; 73% which shows a significant contrast from the control group where majority did not have absolute eosinopenia. In the same study interestingly patients with positive blood culture had tendency to have more chance for decreased eosinophil count 83% when compared to those positive for serial widal test alone 59%. By the study they concluded that eosinopenia is an important finding that should help timely diagnosis and early treatment initiation of enteric fever. Eosinopenia with relative bradycardia were also mentioned as a diagnostic predictor in a study done by T Matono *et al* 2015 (9).

Leukopenia was mentioned as the most common hematological finding in enteric fever (10) but in this study only 10 cases were reported to have leukopenia. Anemia is also supposed to be seen in enteric fever but in this study only 15% of patients had a hemoglobin level less than 10mg/dl. Thrombocytopenia was present in 35% of cases which was also mentioned in the study done by Kohsla *et al* (11) and Shrivastava *et al* (12) and were 40% and 39.5% respectively in their studies. By various such studies it has been mentioned leukopenia, eosinopenia thrombocytopenia and anemia in enteric fever can be attributed to the myeloid maturation arrest, decrease in number of erythroblasts and magakaryocytes and increased phagocytic activity of histiocytes in bone marrow (10) (12) (13)

2. Materials and Methods

Hospital based cross sectional study was conducted in the hospitals attached to Kasturba Medical College from October 2015 to July 2017 in both male and female patients having fever less 21 days (1, 2) with no evident focus of infection on initial clinical evaluation in the age group between 18 - 80 years. With 95% confidence level and 90% of power with reference to the study the sample size constitute about 180. So almost 200 cases were taken for which

$$n = \frac{z\alpha^2 \text{Ꙍ}^2}{2}$$

Detailed history and clinical examination was done in hospitalized patients with fever duration of 3 - 21 days with no focal localizing signs of infection (Acute undifferentiated fever). Included patient was evaluated for Malaria by thick and thin smear, Dengue fever by IgM ELISA, Enteric fever by blood culture, Leptospirosis by IgM ELISA and Rickettsial fever by Weil felix initially and diagnosis is confirmed by IgM ELISA. After obtaining written informed consent information's were collected from the patients recruited according to the inclusion criteria. Blood reports for hemoglobin, total leukocyte count, differential counts, platelet count of patients was collected within first 3 to 5 days of onset of fever for all patients included in the study population and tabulated in percentages. Data analysis were done by univariable analysis and managed on Microsoft excel. Characteristics of each disease group were compared with those of the remaining group. $P < 0.05$ will be considered as significant.

Results of multivariable analyses were presented as the odds ratios (ORs) and 95% confidence intervals (95% CIs).

3. Results

During the study period, a total of 200 cases of acute undifferentiated fever with no organ specific localizing signs were included in the study after fulfilling the inclusion and exclusion criteria and excluding the undiagnosed cases. Of these 200 cases Malaria (40%) and dengue fever (34%) were the most common cause of acute undifferentiated fever (AUF), followed by leptospirosis (10%), Enteric fever (10%) and scrub typhus (6%).

Most of the patient presented with fever was between the age group of 21 – 40 years. Out of the total cases recruited 68.5% was males and male predominance was seen in all the different types of fever.

Gender	Age group (in years)				Total
	1- 20	21 - 40	41 - 60	61& more	
Male	8 (5.8%)	82 (59.90%)	41 (29.9%)	6 (4.40%)	137
Female	5 (7.9%)	30 (47.60%)	22 (34.9%)	6 (9.50%)	63
	13 (6.5%)	112 (56%)	63 (31.5%)	12 (6%)	200 (100%)

Chills and rigors, vomiting and splenomegaly were found to be more frequent in malaria group and the association was found to be very highly statistically significant (p<0.001). Retro orbital pain, myalgia and congectival congestion were found to be less frequent in malaria when compared with other acute undifferentiated fever group, which was statistically significant. Neither leukopenia nor leukocytosis was seen among the malaria patient when compared with the other acute undifferentiated fever group.

No. (%) of cases	Malaria	AUFI		
Chills & rigors	70 (87.5%)	22 (18.3)	<0.001	31.182 (13.900 - 69.953)
Myalgia	23 (28.8)	69 (57.5)	<0.001	0.298 (0.163 - 0.546)
Vomiting	50 (62.5)	38 (31.7)	<0.001	3.596 (1.986 - 6.514)
Joint pain	4 (5)	46 (38.3)	<0.001	0.085 (0.029 - 0.247)
Hepatomegaly	2 (2.5)	32 (26.7)	<0.001	0.071 (0.016 - 0.304)
Splenomegaly	52 (65)	22 (18.3)	<0.001	8.273 (4.311 - 15.876)

Laboratory findings	No. (%) of cases		p value	Odds ratio (95% CI)
	Malaria	AUFI		
WBC < 4000 cells/ mm^3	17 (21.5)	49 (52.7)	<0.001	0.246 (0.126 - 0.483)
Platelets < 1, 50, 000 cells/ mm^3	66 (82.5)	93 (77.5)	0.391	1.369 (0.667 - 2.807)
Leukocytosis	1 (1.6)	27 (38)	<0.001	0.026 (0.003 - 0.0201)

In dengue fever group when compared with the other acute undifferentiated fever group retro - orbital pain, dizziness, arthralgia, mucosal bleeding and rashes was seen as significant clinical features with p value less than 0.001. Chills and rigor, vomiting, diarrhea and splenomegaly was less frequently seen in dengue fever group when compared and was statistically significant. Leukopenia and thrombocytopenia was found as a statistically significant (p <0.001) parameter in dengue fever.

Clinical features	No. (%) of cases		p value	Odds ratio (95% CI)
	Dengue	AUFI_D		
Retro orbital pain	35 (51.5)	1 (0.8)	<0.001	138.939 (18.356 - 1051.664)
Chills & rigors	18 (26.5)	74 (56.1)	<0.001	0.282 (0.149 - 0.535)
Myalgia	40 (58.8)	52 (39.4)	0.009	2.198 (1.211 - 3.988)
Vomiting	17 (25)	71 (53.8)	<0.001	0.286 (0.150 - 0.537)
Diarrhea	0 (0)	18 (13.6)	<0.001	-
Dizziness	28 (41.2)	15 (11.4)	<0.001	5.460 (2.651 - 11.246)
Joint pain	36 (52.9)	14 (10.6)	<0.001	9.482 (4.567 - 19.687)
Mucosal bleeding	26 (38.2)	5 (3.8)	<0.001	15.724 (5.677 - 43.549)
Rash	21 (30.9)	12 (9.1)	<0.001	4.468 (2, 037 - 9.799)
Splenomegaly	1 (1.5)	73 (55.3)	<0.001	0.012 (0.002 - 0.090)

Laboratory findings	No. (%) of cases		p value	Odds ratio (95% CI)
	Dengue	AUFI		
WBC < 4000 cells/ mm^3	43 (65.2)	23 (21.7)	<0.001	6.747 (3.4 - 13.39)
Females HB < 11 gm/dl	2 (7.1)	14 (40)	0.003	0.115 (0.024 - 0.565)
Males HB < 12 gm/dl	2 (5)	26 (26.8)	0.004	0.144 (0.032 - 0.638)
Platelets < 1, 50, 000 cells/ mm^3	67 (98.5)	92 (69.7)	<0.001	29.130 (3.907 - 217.2)

In our study diarrhea and splenomegaly were found more frequent among the enteric fever group with significant p value (<0.001). Headache and chills and rigor were not found frequently among the enteric fever group. Comparing the hematological profile with the other acute febrile illness

group eosinopenia was found statistically significant (p<0.001) in enteric fever.

Clinical features	No. (%) of cases		p value	Odds ratio (95% CI)
	Enteric fever	AUFI_Enteric		
Chills & rigors	2 (10)	90 (50)	0.001	0.111 (0.025 - 0.493)
Diarrhea	12 (60)	6 (3.3)	<0.001*	43.500 (12.979 - 145.788)
Joint pain	4 (20)	45 (25.6)	0.586	0.728 (0.232 - 2.290)
Cough	4 (20)	5 (2.8)	0.007*	8.750 (2.134 - 35.873)
Spleenomegaly	16 (80)	58 (32.2)	<0.001	8.414 (2.693 - 26.292)

Laboratory findings	No. (%) of cases		p value	Odds ratio (95%CI)
	Enteric fever	AUFI		
Platelets < 1, 50, 000 cells/mm3	5 (25)	154 (85.6)	<0.001*	0.056 (0.019 - 0.168)
Eosinopenia	14 (70)	39 (24.1)	<0.001	7.359 (2.648 - 20.45)

Myalgia, muscle tenderness, conjunctival congestion, jaundice along with hepatomegaly were the significant clinical features seen in the leptospirosis group in our. On comparing the hematological profile leukocytosis was found to be statistically significant.

Clinical features	No. (%) of cases		p value	Odds ratio (95% CI)
	Leptospirosis	AUFI		
Chills & rigors	2 (10)	90 (50)	0.001	0.111 (0.025 - 0.493)
Myalgia	17 (85)	75 (41.7)	<0.001	7.933 (2.244 - 28.042)
Decreased urine output	9 (45)	0 (0)	<0.001*	-
Muscle tenderness	16 (80)	0 (0)	<0.001*	-
Hepatomegaly	13 (65)	21 (11.7)	<0.001*	14.061 (5.043 -39.204)
Icterus	13 (65)	7 (3.9)	<0.001*	45.898 (13.968 - 150.817)
Conjunctival congestion	16 (80)	07 (3.9)	<0.001*	98.857 (26.121 - 374.140)

Laboratory findings	No. (%) of cases		p value	Odds ratio (95% CI)
	Leptospirosis	AUFI		
WBC < 4000 cells/ mm^3	0 (0)	66 (39.8)	0.083*	6.747 (3.4 - 13.388)
Leucocytosis	14 (7)	14 (12.3)	<0.001	0.278 (0.061 - 1.257)
Neutrophilia	14 (73.3)	67 (40.6)	0.006	4.096 (1.409 - 11.908)

In rickettsial infection (scrub typhus) among the clinical features black eschar, hepatomegaly and lymphadenopathy were found to be statistically significant on comparing with other acute undifferentiated fever group. Comparing the hematological profile lymphocytic leukocytosis was found to be statistically significant.

Predictors associated with acute undifferentiated fever.
A multiple logistic regression model done in malarial group showed that symptoms like headache (OR = 11.32; 95% CI = 2.363 - 54.22; P = 0.002), chills and rigors (OR = 91.113; 95%CI = 19.9–417.16; P <0.001) and signs like splenomegaly (OR =5.94; 95% CI = 1.63–21.69; P =0.007 were predictors associated with malaria (Table 3). The Hosmer–Lemeshow test revealed that the goodness of fit of this model was appropriate (x^2 = 6.67; P = 0.573).

Multiple logistic regression model done in dengue group showed that symptoms like rash (OR = 118.25; 95% CI = 3.45 - 4050.09; P = 0.008), Right hypochondrial pain (OR = 280.39; 95%CI = 4.230–18588.272; P <0.008) and joint pain (OR =865.461; 95% CI = 5.524 - 135587.148; P =0.009 were predictors associated with dengue. The Hosmer–Lemeshow test revealed that the goodness of fit of this model was appropriate (x^2 = 0.094; P = 0.99).

Multiple logistic regression model done in enteric fever showed that symptoms like diarrhea (OR =78.98; 95% CI= 10.71 - 582.73; p<0.001), and splenomegaly (OR=21.93; 95% CI 3.9 - 123.3; p<0.001) were predictors associated with enteric fever. The Hosmer–Lemeshow test revealed that the goodness of fit of this model was appropriate (x^2 = 2.466; p = 0.65).

4. Discussion

Burden of Acute undifferentiated fever (AUF) in Mangalore:
In India rickettsial infection were reported as most common etiological cause for acute undifferentiated fever in many studies (6) (7) (14). But our study showed high proportion of Malaria (40%) followed by dengue fever (34%). On comparing with the other literature reviewed, according to the study done by PP Samuel *et al* (15) and M Lal *et al* (16); dengue fever were reported as the most common etiological diagnosed for majority of the patients admitted with acute undifferentiated fever; whereas in our study dengue fever (34%) was seen as the second common etiological cause for acute undifferentiated fever.

In a study done by SS Bhattacharya *et al* (17) in Rourkela city (Odisha); enteric fever were reported in one third of the patients admitted with acute undifferentiated fever whereas according to our study enteric fever were seen only among 10% of patients admitted with acute undifferentiated fever.

According to the studies done by Chrispal *et al* (6) and *KP* Abhilash *et al* (7) rickettsial infection were seen as the most

common cause for acute undifferentiated fever but in our study only 6% of patients admitted with acute undifferentiated fever were diagnosed as rickettsial infection (scrub typhus). Ho - Chul Jung *et al* (18) reported influenza as the common cause of acute undifferentiated fever in his study done in Suburban university hospital in Republic of Korea. So the etiology of acute undifferentiated fever is different at different regions and may depend up on the seasonal variations, prevalence of the vector and causative organism in each region, environmental and socio - economical structure of the region and social hygiene in the society of the specific regions.

Age and gender distribution of acute undifferentiated fever:

Most of the patients presented with fever were between the age group of 21 – 40 years with male predominance (68.5%) which was almost similar with the other studies done on acute undifferentiated fever (6) (7) (19) (8). Almost 2/3 of the patients admitted with acute febrile illness were male and that may be due to the easy exposure of male population to the vectors like mosquitoes, mites and rats that spreads disease causing the common acute undifferentiated fever because of their outdoor works and activities. And if we see the age distribution, most of the patients were between 21 - 40 years who are the working population in our society and is having high risk of exposure to the vectors causing common acute undifferentiated fever in Mangalore.

Clinical features of acute undifferentiated fever:

According to our study in patients with leptospirosis - jaundice (65%), conjunctival congestion (80%) and hepatomegaly (65%) were found as a significant clinical finding when compared with the other acute undifferentiated fever group. In study done by *KP* Abhilash *et al* (7) breathlessness was reported as a prominent clinical feature in leptospirosis which was not found statistically significant clinical finding in our study.

Our study showed splenomegaly as a prominent clinical finding among the enteric fever (80%) and malaria (65%) patients which were also mentioned as a statistically significant clinical feature in the literature reviewed (6) (8). Hepatomegaly (66.7%) and lymphadenopathy (66.7%) were seen a prominent clinical finding in rickettsial infection in our study.

Among these relevant clinical features compared between the acute undifferentiated fevers recruited in our study; regional lymphadenopathy in rickettsial infection was seen as an important clinical feature that was not mentioned in other studies reviewed. According to the study done by Chrispal *et al* (6) hepatosplenomegaly was reported as the common clinical sign in malaria whereas in our study, only splenomegaly was seen as the important clinical sign among the malarial group when compared with the other acute undifferentiated fever group. In our study out of 20 enteric fever cases studied none of the patients were having hepatomegaly on clinical examination. Bleeding manifestations was commonly seen among the dengue fever and scrub typhus group in the study done by KP Abhilash *et al* (7) but according to our study bleeding manifestations like gum bleeding, excessive menstrual bleeding, malena were significantly common in dengue fever group whereas rickettsial fever (scrub typhus) patients were not having any type of bleeding manifestation during the study.

Splenomegaly and diarrhea were reported as a prominent clinical finding in enteric fever group on comparing with non enteric acute undifferentiated fever group according to the study done by Chrispal *et al* (6). Similar to the study done by Chrispal *et al* (6); our study also showed splenomegaly and diarrhea as a prominent clinical finding in the enteric fever group.

So according to our study patients presenting with acute undifferentiated fever can be divided into fever with splenomegaly and without splenomegaly by which malaria and enteric fever can be differentiated from other three common cause of acute undifferentiated fever commonly seen in Mangalore. Regional lymphadenopathy which was found to be statistically significant clinical sign in rickettsial group can help the clinician to think in term of rickettsial fever as a cause for acute undifferentiated fever and can make him to search for black eschar which is also a statistically significant clinical finding among the rickettsial fever group.

Laboratory findings of acute undifferentiated fever:

In our study Leukopenia and thrombocytopenia ($p < 0.001$) in dengue fever and leukocytosis in both leptospirosis and rickettsial fever were seen as the significant laboratory finding, which were mentioned as the significant hematological parameters in other studies on acute undifferentiated fever (6) (7) (19) (8) (20). In enteric fever eosinopenia was seen as the significant hematological parameter in our study and was also mentioned as a statistically significant hematological variable in the study done by Lokhandwala A et al (8) khosla *et al* (10) and Shrivastava *et al* (12). Pancytopenia were mentioned as significant hematological finding in the studies done by khosla *et al* (10) and Shrivastava *et al* (12) on blood culture positive enteric fever but in our study leukopenia, anemia and thrombocytopenia were not found statistically significant hematological parameter when compared with other acute undifferentiated fever group.

Hence in brief on comparing the clinical and hematological profile in commonly seen acute undifferentiated fever in Mangalore; Malaria was reported as the common cause of acute undifferentiated fever followed by dengue fever. Most of the dengue fever patients were having headache more specifically retro - orbital headache, arthralgia, generalised rash along with leukopenia and thrombocytopenia. Most of the patients with malaria were having chills and rigor along with fever, vomiting and splenomegaly. Among the enteric fever group diarrhea, splenomegaly and eosinopenia where statistically significant and in patients with leptospirosis conjunctival congestion, myalgia, jaundice along with hepatomegaly and neutrophilic leukocytosis were seen as a prominent features. In patients with rickettsial infection black eschar, hepatomegaly and lymphadenopathy along with lymphocytic leukocytosis were seen as a prominent features.

Clinical predictors in acute undifferentiated fever:
A multiple logistic regression model was used to find the significant clinical predictors in acute undifferentiated fever commonly seen in Mangalore. Predictors associated with malaria were headache, chills and rigor and splenomegaly according to our study whereas in a study done by Epelboin *et al* (21) in 2013 - male patients with age more than 15 years, anemia and tachycardia were reported as the clinical predictors independently associated with malaria when compared with dengue fever group. In Epelboin *et al* (21) study on discriminating malaria from dengue fever; splenomegaly was not at all mentioned as a clinical sign in malaria.

According to the study done by D Chadwick *et al* (22) presence of myalgia, generalised rash (macula - papular) and flushing were more suggestive of dengue fever when compared with non - dengue fever. But in our study right hypochondrial pain and joint pain were seen as the significant predictors for dengue fever.

In a study done by C Kuvandik *et al* (23) splenomegaly, relative bradycardia, rose spots were mentioned as clinical predictors for enteric fever whereas in our study diarrhea, cough and splenomegaly were seen as a significant clinical predictor among the enteric fever patient.

Multiple logistic regressions were not created for small patients cohorts with leptospirosis and rickettsial fever.

5. Conclusion

From our study it was evident that simple haemogram and detailed clinical examination can be used to differentiate the five common etiology of acute undifferentiated fever in tropical areas. Hence to conclude in a resource - limited setting and disease burden areas, simple Haemogram and detailed clinical examination will be having significant utility in differentiating the five common etiology of undifferentiated fever in tropical areas.

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