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CASE STUDY

Clinical and microbiological study of patients with acute febrile illness at a tertiary hospital

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ABSTRACT

Background: Acute febrile illness is also called asAcute undifferentiated febrile illnesses)AUFIs (and cause considerable morbidity, mortality and economic burden specially in developing tropical nations .This study was conducted to study Clinical and microbiological profile of patients with acute febrile illness at a tertiary hospital. **Material and Methods:** A Hospital based Prospective Cross sectional study was carried out in consecutive cases of both sexes and all adults (age more than 15 years) admitted to medical wards with a history of fever less than 10 days and continued to have oral temperature above 37.5^0 c. **Results:** Out of the 230 patients satisfied the inclusion criteria, 119 were males and 111 were females. The hospital stay varied from 5 – 10 days and the median hospital stay was 5 days. The AUFI were more during the post monsoon and winter season. The spectrum of clinical profile observed in our study were in the order ofDengue, Enteric fever, Malaria, Typhoid followed by Scrub typhus, Leptospirosis and Chikungunya in 132 (56.2%), 67 (29.13%), 13 (5.53%), 7 (2.97%), 6 (2.55%), 5(2.17%) and 5 (2.13%) respectively. 5 among them had dual infection and suffered from Dengue and Enteric fever. Irrespective of the gender, patients start attending the hospital from the fourth day of fever. The mean affected age was 40.9 years. The presentation of fever was maximum on the fourth day and sixth day of fever. The presenting features were more once the duration of disease increases, even though the commonest were myalgia, headache and chills. None of the patients had any complications and they were discharged within a period of 5 – 10 days. **Conclusion:** The distribution of disease among the 230 cases were in the order of Dengue, Enteric fever, Malaria, Typhoid followed by Scrub typhus, Leptospirosis and Chikungunya.

Keywords: Acute undifferentiated febrile illnesses)AUFI), Dengue, Enteric fever, Malaria, Typhoid, Scrub typhus, Leptospirosis, Chikungunya

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INTRODUCTION

Acute febrile illness)AFI (is described asany illness along with fever oftwo weeksor shorter in duration, whose onset israpid,caused by diverse pathogens with noevidence of organor system-specificetiology [1].

Acute febrile illness is also called asAcute undifferentiated febrile illnesses)AUFIs(and cause considerable morbidity, mortality and economic burden specially in developing tropical nations[2].

Fever can be due to many causes like infections, autoimmune disorders like rheumatoid arthritis, malignancies, overexposure to sunlight or sunburn, heat stroke due to prolonged strenuous exercise or exposure to high temperatures, dehydration, silicosis, amphetamine abuse, atropine toxicity, drug-induced, alcohol withdrawal syndrome, etc.[3]

In the Western world, AUFIis mostly due to self-limited viral conditions. In thedeveloping world, the differential diagnosis for AUFImostly includes potentially significant illnesses such as Malaria, Dengue Fever, Enteric Fever, Leptospirosis, Rickettsiosis, Hantavirus and Japanese Encephalitis[4].These infections have identical clinical signs and symptoms, and the correct diagnosis can be obtained by using pathogen specific diagnostic tests[5].

Confirmation of etiology remains a challenge and it requires careful evaluation of clinical findings related to fever .The prevention of complications and the reduction in mortality and morbidity among the febrile cases solely depends on the good correlation between clinical findings and confirmatory diagnostic tests, appropriate laboratory parameters and

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epidemiology of the illness .This study was conducted to study Clinical and microbiological profile of patients with acute febrile illness at a tertiary hospital.

MATERIAL AND METHODS

A Hospital based Prospective Cross sectional study was carried out at the Department of Microbiology, Trichy SRM Medical College Hospital and Research Centre, Irungalur, Trichy, Tamilnadu, for a period of one year (January 2018 to December 2018), after an approval from the Institutional research board and Institutional ethics committee.

Inclusion criteria

- Consecutive cases of both sexes and all adults (age more than 15 years) admitted to medical wards with a history of fever less than 10 days and continued to have oral temperature above 37.5^0 c, willing to participate in present study

Exclusion criteria

- Patients on antimicrobial drugs
- Patients who are Immunocompromised or on immunosuppressants
- Those who have any one of the following or a combination of them namely, focal sepsis, skin and soft tissue infections, urinary tract infections, infective endocarditis, osteal and hematological disorders, respiratory tract infections, who are on devices, recent surgeries and surgical site infections, autoimmune disorders, overt malignancies, traumatic injury or vascular accidents.
- Pregnant women or those <15 years were not included.
- Semiconscious, conscious or comatose cases.

After enrollment in the study a detailed history was taken, which included age, sex, demographic details, history of presenting illness, past illness, occupation, , history of vaccination, animal bite/handling, visit to foreign countries, transplantations, immune suppressive drugs, history of co-morbid conditions, medication history(current and past), personal history like substance abuse, smoking, alcohol intake, etc .

Detailed clinical history such as duration offever, headache, chills, cough, dyspnoea, myalgia, nauseaand vomiting, calf tenderness, dyspnea, diarrhea/dysentery, jaundice, abdominal pain,rash/eschar, arthralgia, altered mentation, bleeding manifestation, retro orbital pain, burning micturition, focal sepsis, skin and soft tissue infections were elicited. Following this, patients were subjected for a detailed clinical examination of various systems. The parameters were fever, heart rate, respiratory rate, blood pressure, erythrocyte sedimentation rate, eschar, pedal edema, cyanosis, hepatomegaly, splenomegaly, lymphadenopathy, petechiae and ALOC. Followingclinical examination, all patients were subjected to the investigations based on duration of fever.

A total volume of 15 ml of blood was collected from each patient, one 5ml of blood sample was inoculated into blood culture bottles (Brain Heart Infusion Broth), second 5 ml of blood was collected in plain tube for serological tests and biochemical tests and the third 5ml in ethylene diamine tetra acetic acid (EDTA) bulb for hematological profile.The investigations were Complete blood count, peripheral smear study, urine albumin, blood urea, serum creatinine, liver enzymes and serum bilirubin, coagulation profile X-ray chest and diabetic screening were carried out if required. Depending upon detailed examination on suspicion of tropical infectionsMP smear, Dengue NS1 antigen and IgM antibody, Widal test, Scrub typhus IgM, LeptospirosisIgM, Chikungunya IgG/M were performed along with blood culture for Enteric fever group of bacteria and urine culture.

Patients in the study group were followed up till outcome for complications like shock, bleeding manifestations, hepatic failure, renal failure, respiratory distress, cardiac failure, pulmonary edema, musculoskeletal complications andmulti organ failure. Final diagnosis was arrived in these patients based on clinical and / or laboratory parameters for the selected group of AUFI. Patients with AUFI's but could not be placed in any of the common diagnosis either clinically or by investigations were labeled as undiagnosed fever for this study category and not included for the study purpose. Outcome was defined as recovery before hospital discharge, death or Against Medical Advice.

DataStatistical analysis was done using descriptive statistics.

RESULTS

Out of 500 patients admitted in various medical wards for acute febrile illness, AUFI was diagnosed in 230 cases. Among the 230 cases, 119 (51.74%) were males and 111 (48.3%) were females. The mean affected age was 40.9 years. The mean age of the males and females were 39.8 and 42.5 years respectively. Overall, significant (p=<0.01) number of cases were seen above the age group of 35 and above.

Table 1: Age and gender wise distribution:

Age group	Male(%)	Female(%)	Total(%)
15 - 34 years	27(11.4)	31(13.2)	58(25.22)
35 - 44 years	56(24.35)	54(23.4)	110(47.83)
≥ 45 years	36(15.65)	26(11.3)	62(26.96)
Total	119 (51.74)	111 (48.3)	230

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Cases were seen more from the period of September to December and in the month of January. During study period, we noticed increased occurrence of AUFI during post monsoon period and continues during winter, even though cases of AUFI were seen all over the year.

Table 2: Month wise distribution

Month of the year (2018)	Male	Female	Number(%)
January	16	7	23 (9.8)
February	4	5	9 (3.8)
March	1	4	5 (2.1)
April	9	10	19(8.3)
May	6	11	17(7.2)
June	7	8	15(6.52)
July	7	8	13(5.5)
August	6	6	12(5.1)
September	15	10	25(10.6)
October	14	10	24 (10.2)
November	20	15	35 (14.9)
December	16	17	33 (14)
Total	119	111	230

Frequently seen symptoms were myalgia, headache and chills among 97.4, 88.9 and 85.9 % respectively. The other symptoms elicited among the cases are given in Table 23. The commonest symptom noticed among these cases were independent of gender and in the order of myalgia, headache and chills. The signs elicited among the 230 cases were coated tongue, hepatomegaly, splenomegaly and icterus in 89(37.97%), 33(14.04%), 21(8.93%) and 13(5.53%)respectively.

Table 3: Symptoms and Signs

System wise	Symptoms	Number (%)*
Generalized	Chills	202 (85.9)
	Bleeding manifestation	0
Central nervous system	Headache	209 (88.9)
	Altered mentation	4 (1.7)
Respiratory system	Cough	55 (23.4)
	Breathlessness	36 (15.3)
Gastrointestinal system	Loose stools	55 (23.4)
	Nausea/vomiting	41 (17.4)
	Abdominal pain	27 (11.5)
	Diarrhea	14 (5.9)
	Jaundice	5 (2.13)
Genitourinary system	Burning micturition	18 (7.7)
Musculoskeletal system	Myalgia	229 (97.4)
	Arthralgia	61 (25.9)
	Calf tenderness	17 (7.23)
Skin	Rash/eschar	6 (2.56)
Ophthalmic system	Retro orbital pain	58 (24.7)
	Signs	**Number (%)***
Gastrointestinal system	Coated tongue	89 (37.9)
	Hepatomegaly	33 (14.04)
	Splenomegaly	13 (5.53)
Others	Icterus	21 (8.93)
* The number overlapping with each other		

The distribution of disease among the 235 cases were in the order ofDengue, Enteric fever (including S. typhi), Malaria, Scrub typhus, Chikungunya and Leptospirosis in 132 (56.2%), 67 (29.13%), 5(2.17%), 13 (5.53%), 7 (2.97%), 6 (2.55%) and 5 (2.13%) respectively. 5 among them had Dengue and Enteric fever.

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Table 4: Distribution in relation to diseases diagnosed(n=230)

Category		Diseases (AUFI)	Total(%)
Water borne diseases		Enteric fever	67 (29.13)
		Typhoid	5(2.173)
Vector borne diseases	Aedes aegypti	Dengue*	132 (56.2)
		Chikungunya	6 (2.55)
	Anopheles species	Malaria	13 (5.53)
	Trombiculid mite	Scrub typhus	7 (2.97)
Zoonotic diseases		leptospirosis	5 (2.13)

During the study period, Dengue fever was seen in 132 of 230 cases which was the highest one. Distribution of Dengue cases in relation to age and gender are given in Table 25. Male predominance was seen and the male to female ratio was 2.1:1 in the age group 45 and above. The mean affected age was 38 years. Dengue was seen more among the age group 35 and above, but there was no significance in gender when analysed. Five of the dengue cases had unequivocal serological and clinical evidences of Enteric fever. Maximum number of cases were enrolled in the month ofNovember, which tallies with post monsoon period. The most common presenting symptom was myalgia, followed by chills and headache.

Table 5: Clinical aspects of Dengue

Age group	Male	Female	Total
15 - 34 years	15	17	33
35 - 44 years	31	34	65
≥ 45 years	22	13	35

During the study period, Typhoidfever was seen in 72 cases which included 5 Blood culture positives and the remaining 67 based on Widal test in which S. typhi ‘O’ titer was positive with 1:160 dilution or above with one of the clinical symptoms i.e. headache along with bedside signs coated tongue, with or without relative bradycardia and other clinical findings splenomegaly, hepatomegaly or hepatosplenomegaly.The blood culture positive cases also showed a S. typhi ‘O’ titer of 1:160 dilution or above. Maximum number of cases were enrolled in the month ofDecember though cases were documented all over the year. The most common presenting symptom was myalgia, followed by headache. Headache was seen in 51 out of 72 cases but low grade in nature, but intensity was severe in thosewho had concurrent or co-infection with Dengue. Also, clinical examination revealed splenomegaly in 10 cases, which was soft in nature and hepatomegaly in 23 cases and hepatosplenomegaly in 23 cases. Coated tongue was commonly seen in 65 of the 72 cases.

Table 6: Clinical aspects of Enteric fever cases

Age group	Male	Female	Total
15 - 34 years	10	10	20
35 - 44 years	20	15	35
≥ 45 years	9	8	17

During the study period, Malaria was seen in 13 of 230 cases. Distribution of Malaria cases in relation to age group and gender are given in Table 20. Simple analysis between age group and gender revealed that the disease was distributed almost equally among both genders without any preference to age or gender. However statistical analysis could not be done, since the numbers available in each cell was small. The malarial cases were recorded occasionally and not on all months of the year. The most common presenting symptom was myalgia, followed by chills and headache.

Table 7: Age and Gender wise distribution in Malaria cases

Age group	Male	Female	Total
15 - 34 years	1	2	3
35 - 44 years	3	3	6
≥ 45 years	2	2	4

Hemoglobin was <12 gm/dl in 44(18.7%) cases and 75 cases had Thrombocytopenia (count <1.5 l/cumm). Leucocytosis was seen in 15(6.4), where the Total count was >10000cells/cumm. Hemoglobin was <12 gm/dl in 5 of 13 cases of malaria and remaining in the other cases. Leukopenia was seen in 79% (n=57) of

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cases and remaining was seen in patients with Dengue. Leucocytosis was seen in 5 cases of Leptospirosis, 7 cases of Dengue fever and one in Scrub typhus. Thrombocytopenia was seen in 4 cases of Malaria and 71 cases of Dengue fever.

Table 8: Hematological parameters

Parameters	Number (%) (n=230)
Hemoglobin (<12 gm/dl)	44(18.7)
Leucocytosis (Total count >10000cells/cumm.)	15(6.4)
Leukopenia <3500/cumm	70(30.34)
Thrombocytopenia (<1.5 l/cumm.)	75(32.6)

Malaria was diagnosed by Peripheral smear in 12 cases. It was negative in other 258 cases, who had AUFI. Routine Dark field microscopy of the plasma of 270 cases helped to recognize Leptospirosis only in 3 cases. Rapid diagnostic test was done for all 235 cases for diagnosing Malaria, Scrub typhus and Chikungunya. 13 cases were positivefor Malaria, 7 were positive for Scrub typhus and 6 for Chikungunya.

For diagnosis of Dengue, ELISA Test for NS1 antigen (early) and IgM antibody (after 5 days of fever) was performed. For diagnosis of Leptospirosis, IgM antibody was performed by ELISA. Dengue NS1 antigen and IgM antibody ELISA were positive in 88 and 44 cases respectively and both were positive in 30 cases. Five cases were positive when tested by Lepto IgM antibody ELISA.

During the study period 97 patients came with history of fever of≤ 5 days. When NS1 antigen was carried out for 97 patients, it was positive in 88 cases and negative in the remaining 11 cases. Thus the positive rate for the diagnosis of Dengue fever in the study area was 76.5%. Analysis of these 88 cases revealed that there was 39 males and 49 females.

Dengue IgM antibodies was carried out for the remaining 133 of the 230 cases who landed in the hospital with the duration of fever > 5 days.Dengue IgM was positive in 44 of the 133 cases. Thus IgM positive dengue cases during the study period was 28.4%. 30 cases of NS1 antigen positive cases showedIgM ELISA positivity when carried out on the 6^{th} and 7^{th} day.

Five Salmonella typhi isolates were obtained from the 270 samples. Among the 5, there was 3 males and 2 females. Though the other blood samples were negative for culture, Widal test was positive in all72(45.3%) out of the 159 cases who had duration of the fever > 7 days. Among these 72 cases, there were 36 males and 31 females. Repeat Widal test was carried out in the paired serum sample one week after the first sample to look for rise in titer. But it was successfully carried out only in 15 of the 72 diagnosed to have Typhoid fever as the remaining 57 were discharged earlier. Out of 15only three showed fourfold rise in titer.

Rapid diagnostic test (Immunochromatographic test) and Heterophile agglutination test were performed for diagnosing Scrub typhus. Out of 235 cases, 7 cases were positive by Rapid diagnostic test (2.97%) and 5 were positive by Heterophile slide agglutination test (2.13%).

Table 9: Results by Laboratory tests in relation to disease.

Tests	Dengue	Enteric fever	malaria	Scrub typhus	chikungunya	leptospirosis	Total
PS	-	-	12(4.4)	-	-	-	12(4.4)
DFM	-	-	-	-	-	2(0.74)	2(0.74)
Bld culture	-	5(1.85)	-	-	-	-	5(1.85)
WIDAL 0-1:160 H-1:320	-	72(26.6)	-	-	-	-	72(26.6)
Dengue-NSI ELISA	88(76.5)	-	-	-	-	-	88(76.5)
Dengue IgM ELISA	44(28.4)	-	-	-	-	-	44(28.4)
Lepto IgM ELISA	-	-	-	-	-	5(1.85)	5(1.85)
RDT-Chik	-	-	-	-	6(2.22)	-	6(2.22)
RDT – ST	-	-	-	7(2.59)	-	-	7(2.59)
RDT-Malaria	-	-	13(4.81)	-	-	-	13(4.81)
Weil-Felix	-	-	-	5(1.85)	-	-	5(1.85)

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The antimicrobial sensitivity test was performed for the 5 isolates of S. typhi. Ampicillin and Amoxycillin were sensitive only in 2 isolates (40%). All the 5 isolates were sensitive to Chloramphenicol, Ciprofloxacin. Ceftriaxone Cefotaxime and Cefepime.

Table 10: Antibiogram pattern.

Antibiotics	*S. typhi n=5*
Ampicillin	40%
Amoxicillin	40%
Ciprofloxacin	100%
Chloramphenicol	100%
Ceftriaxone	100%
Cefotaxime	100%
Cefepime	100%

Co-infection was observed in 5 cases of Dengue and Typhoid (1.9%). Figure 30 depicts the occurrence. The febrile cases were hospitalised for a duration of 5-10 days depending on the severity of the illness. The mean hospital stay was found to be 6.73 days. The median hospital stay was 5 days. All of the 230 diagnosed cases were provided with appropriate medications and supportive care and all the 230 cases recovered. The clinical course was uneventful and none of the patients developed any untoward events and complications.

DISCUSSION

Acute febrile illness is mostly caused by viruses followed by bacterial agents and parasites. The clinical spectrum though helps to suspect a particular disease, it needs confirmation in order to institute appropriate treatment, supportive care, prevention and containment. To achieve all these, clinical microbiologists play a pivotal role. The description on the clinic microbiological study of AUFI are given in the ensuing paragraphs.

Among the 230 febrile cases, males constituted 119 (51.74%) and 111 (48.3%) were females. There was no significant gender preponderance observed in the present study, in contrary to the study conducted by Gopalakrishnan S *et al.*,[6] where male predominance was noted. By and large, males suffer various infective causes of AUFI probably due to their occupational nature, travel and some extent their behaviour.

In the present study, a large number of cases belonged to the age group of 35-44 years and contribute about 47.83% . This was similar to the study, conducted by Abilash KP *et al.*,[7] and Rani RV *et al.*,[8] in which the most common age group affected were below 40 years, with male to female ratio of 2:1 and constituted 59% of the study subjects. The variations in the occurrence of age group are mostly influenced by the location of the hospital, users and the socio demographic status of the population.

On analysis in relation to month, the number of cases enrolled were maximum from September to December and also in the month of January, due to favourable breeding sites following rainfall. This was similar to the study conducted by Rani RV *et al.*;[8] where large number of cases were seen in the month of December (36). In a study by Shelke YP *et al.*,[1] 62.22% cases were seen in the month of September and August.The seasonal variation vary from region to region, continent to continent, in view of geophysical causes and influence of climate changes.

In the present study, the time of presentation of fever was mostly on the fourth day (14.9%) and sixth day (14%). In a study by Shelke YP *et al.*,[1] the patients visited the hospital mostly on the 5th day of fever (18.88%) and 8th day of fever (25.18%). Health seeking behaviour is variably influenced by education, awareness, social status, income and previous experience.

The analysis of symptoms in relation to age group was done and the most common symptom was myalgia in the age group 35-44 years. In the age groups of 15-34 and≥45 years, headache and chills were common. This was similar to the study conducted by Abilash KP *et al.*,[7] and Shelke YP *et al.*,[1] where the commonest presenting symptom were myalgia and headache. In general, the symptoms are influenced by infective agents, immune response, pre-existing health status, behaviour of the individuals, etc.

In our study, the predominant cause was Dengue (56.2%) among the cases of AUFI, followed by Enteric fever- 29.3%, Malaria - 5.53%, , Scrub typhus – 2.97%, Chikungunya – 2.55%, Typhoid– 2.17% and Leptospirosis – 2.13%. The various studies analysed are given in Table 37, which reveals that the spectrum of AUFI vary from place to place in view of the environment, vectors and their behaviour. Similar findings were noted by Shelke YP *et al.*,[1] Abhilash KP *et al.*,[7] Rani RV*et al.*,[8] Singh R *et al.*,[9] Gopalakrishnan S *et al.*,[6] Phuong HL*et al.*,[10] &Chrispal A *et al.*,[11]

Among the 132 dengue cases, male predominance was observed. Maximum number of cases were enrolled in the month ofNovember. The most common presentation seen in dengue was myalgia, headache and chills. The cases which were positive were detected using Dengue IgM ELISA and NS1 ELISA. Among the 56.2% dengue cases, the positivity observed were Dengue IgM ELISA-19.13% and Dengue NS1 antigen ELISA- 38.3% and both were positive in 13.04%. Our study results were similar to study conducted by Solanke *et al.*,[12] and

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Shelke YP *et al.*,[1] in which positivity observed for Dengue NS1 antigen ELISA was 71.6% and 72.34%, and Dengue IgMELISA was 28.4% and 27.65%. In India, dengue positivity ranged between 8% and 71% among AUFI cases.[13]

Enteric fever was the second most common cause of pyrexia, which accounted for 30.6% of cases. In cases of pyrexia, enteric fever accounted for 3% cases in a study conducted by Rani *et al.*,[7]. Enteric fever was the most common bacterial infection among southern Asian population,[13] and accounted for a tenth of pyrexia cases in a study conducted in north India.[14] Many studies showed that Enteric fever was the etiological agent in 8%–20% among the affected pyrexia cases inIndia.[15]

Cases of Enteric fever were documented all over the year with no gender predominance. Features like myalgia, headache, nausea/vomiting, coated tongue, low total count were seen which was similar to other studies. [1,16] Five (6.9%) cases were positive by blood culture and the isolates were sensitive to both Chloramphenicol and Fluoroquinolones.

The third most common cause in the present study was Malaria (5.53%). Maximum number of cases visited the hospital in the month of November. Both male and female genders were equally affected. The positivity by peripheral smear was 92.3% and Immunochromatographic test detecting HRP2 and pLDH was 76.9%. Singh *et al.*,[9] conducted a study on AUFI and had reported malaria (12.8%) as the second commonest cause among AUFI cases. In the study conducted by Rani *et al.*,[8] and Abhilash KP *et al.*,[8] Malaria was reported as the third common cause in fever cases in about 2% and 4.6%respectively. In a study conducted by Joshi R *et al.*,[14] non-malarial acute undifferentiated fever was observed in 39.9% cases.

The occurrence of co-infection is not uncommon in tropical countries due to factors like poor sanitation, overcrowding, low socioeconomic status and poor immune status. The rate of co-infection between the Dengue and Typhoid cases seen in our study was 5(1.9%). The rate was higher i.e., 7.8% and 12.4% in a study conducted at North-India in 2013 by Sharma Y *et al.*,[17] and Parker TM *et al.*,[16] during the period of 2005-2006 in Egypt respectively. In a study conducted in 2013 at Northwest Ethiopia, co-infection between Malaria and Enteric fever was found to be 6.5%.,[18] co-infection rate was 35%in males while, it was 37% in females, according to a study conducted by Odikamnoro*et al.*,[19] in Ebonyi State at 2017.

Microbiologists must exercise laboratory skills and with the clinical history and clinical course along with the interaction with the treating doctor have to make a diagnosis of dual/ mixed/ concurrent infections. The microbiologists play a major role towards diagnosis, treatment and prevention.

The clinical spectrum of AUFI needs second line of investigations to find out the emerging and re-emerging infective causes, if it is not included under the first 6. Region based study on AUFI is suggested to find outthe pattern and prevalence of the disease causing AUFI, so as to plan for prevention and appropriate measures for containment.Microbiologists involved in AUFI have to work with Public health Department to contribute for policy making and design measures towards prevention and disease containment.

CONCLUSION

AUFI was significantly more ($p<0.05$) among males and observed more during post monsoon and winter seasons (September to January). The distribution of disease among the 230 cases were in the order ofDengue, Enteric fever, Malaria, Typhoid followed by Scrub typhus, Leptospirosis and Chikungunya. 5 of the 230 (2.2%) had dual infection and suffered from Dengue and Enteric fever.

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