International Journal of Community Medicine and Public Health
Agarwal AK et al. Int J Community Med Public Health. 2020 Jun;7(6):2193-2202
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20202470

Original Research Article

Evaluation of liver function test in malaria positive cases in tertiary care hospital of Bareilly

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Received: 22 February 2020
Revised: 15 April 2020
Accepted: 16 April 2020

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ABSTRACT

Background: Malaria is a life-threatening disease. The aim of this study was to evaluate liver function test in malaria positive cases.
Methods: A cross sectional study was done to find out changes in liver function test in malaria positive cases. Study was done in Central Pathology Lab, RMCH, Bareilly, Uttar Pradesh. Blood samples were collected in EDTA and plain vacutainer tube. Blood smear was examined for malaria parasite within RBCs. Malaria rapid test was done for detection of *Plasmodium* species and liver function test was done for effect of malaria.
Results: In this study it was found that maximum malaria positive cases (25.50%) in 21-30 years age group. and in males (22.56%) in 11-20 years age group and in females (34.75%) in 21-30 years age group. Maximum cases of *P. vivax* (27.66%) in 21-30 years age group, *P. falciparum* (33.33%) in 21-30 and 41-50 years age group and mixed malarial infection (21.92%) in 31-40 years age group was found maximum *P. vivax* cases (51.06%) and mixed malarial infection (65.75%) in male and maximum *P. falciparum* (66.67%) in female was found. Maximum above normal limit serum bilirubin (63.75%), direct serum bilirubin (67.93%), SGPT (38.45%), SGOT (70.52%) and ALP (48.01%) was found in malaria positive cases. Maximum deranged serum bilirubin (83.33%), direct bilirubin (100.00%), SGOT (100.00%), ALP (83.33%) was found in *P. falciparum* and maximum deranged SGPT (50.68%) was found in mixed infection.
Conclusions: Malaria remains a major health problem in developing countries it affects the liver function test which helps in management of malaria patient.

Keywords: *Plasmodium vivax, P. falciparum*, SGPT, SGOT, ALP

INTRODUCTION

Malaria is one of the most common parasitic disease characterized by febrile paroxysm with definite intermittent periodicity, repeating every third or fourth day, depending upon the species of the parasite involved. It is caused by *P. falciparum, P. vivax, P. ovale, P. malariae*, and rarely *P. knowlesi* in human.[1] According to World Health Organization (WHO) approximately 270 million people suffer from malaria every year all over the world with 1-2 million deaths annually, out of which 80% deaths are caused by *P. falciparum*.[2] Malaria transmission to the human host is established by sporozoites infection to the liver.[3] The malarial sporozoites once injected in blood by the bite of female Anopheles mosquitoes are attached to hepatocytes through receptor for thrombospondin and properdin.[4] According to the WHO involvement of liver in *P. falciparum* malaria is not an

uncommon presentation and presence of jaundice (bilirubin ≥3 mg/dl) is one of the signs of malaria.[3,5] Malarial parasites are responsible for liver cell damage, jaundice with or without increased liver enzymes.[6] The infection of liver cells by the sporozoite form of malarial parasite can cause organ congestion, sinusoidal blockage and cellular inflammation. These changes in hepatocytes can lead to the leakage of parenchymal (transaminases) and membranous (alkaline phosphatase) enzymes of the liver to the circulation. Hence increase in liver enzymes and ALP observed in infected patients also demonstrated that the serum activities of these liver enzymes rise with increase in malaria parasite density. This change could confirm that the hepatic stage of the parasite's life cycle in human host is accompanied by significant disturbance in hepatocytes parenchyma and membrane leading to leakage of liver enzymes in to the general circulation.[7,8] Hyperbilirubinemia mainly unconjugated is a common feature of falciparum malaria and is attributed to both parasitized and non-parasitized erythrocytes and partly due to liver damage.[9] The aim of this study was to evaluate liver function test in malaria positive cases.

METHODS

A cross sectional study was done in Central Pathology Lab of Department of Pathology, RMCH, Bareilly, Uttar Pradesh, India and was conducted from September 2018 to August 2019. The study included 502 malaria positive patients attended in OPD and IPD. Informed consent was taken.

Inclusion criteria

All malaria positive cases were selected during September 2018 to August 2019.

Exclusion criteria

Those suspected cases that were not malaria positive.

Laboratory investigations

Collection of sample

5 ml of blood was collected from each patient under aseptic conditions by venipuncture technique in EDTA vacutainer tube (2.5 ml) for the diagnosis of malaria. A thin smear was prepared and stained with Leishman's stain and examined under×100 oil emersion lens by method described by Dacie and Lewis 10 and 2.5 ml. blood was collected in plain vacutainer tube for Liver function test.

Parasitological examination

Diagnosis of malaria was done by microscopy of peripheral blood smear (PBS) examination and Rapid malarial antigen test. PBS remains gold standard for confirmation to the diagnosis of malaria. Thin blood smear stained with leishmen stain and is examined microscopically under oil immersion lens for the presence of type of malaria parasite (*P. falciparum* or *P. vivax*) within RBCs.[10]

Malaria rapid diagnostic test (mal card) by J. Mitra and Company Pvt. Ltd.

Rapid malarial antigen test was performed by following the procedure given by the manufacturer instructions. Antigen Histadine release protein II (HRPII) test for detection of *P. falciparum* and pLDH for *P. vivax.*

Principles (antigen-antibody reaction)

It is an immunoassay based on the sandwich principle. The conjugate contains colloidal gold conjugated to monoclonal anti-pan specific pLDH (parasite lactate dehydrogenase) antibody. The test uses monoclonal anti-Pf, pLDH antibody.

Liver function test

Diagnosis of liver function was done by Auto analyzer of ERBA-EM360 System by the use of commercially prepared reagent of liver functions. Serum bilirubin, direct bilirubin, serum glutamic pyruvate transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), and serum alkaline phosphatase (ALP) using Erba diagnostic kits, Mannheim GMBH according to manufacturer instructions.

Table 1: Normal value of serum bilirubin, direct bilirubin, SGPT, SGOT and ALP.

Liver function parameters	Within normal limit	Above normal limit
Serum bilirubin	0.3-1.3 mg%	>1.3 mg%
Direct bilirubin	0.1-0.4 mg%	> 0.4 mg%
SGPT (ALT)	7-41 U/l	>41 U/l
SGOT (AST)	12-38 U/l	>38 U/l
ALP	33-96 U/l	>96 U/l

Assays of liver function parameters

Serum bilirubin concentration was determined using ERBA EM 360 systems automatically by colorimetric assay and serum bilirubin and direct bilirubin was determined by Diazo method.[11,12] SGPT, SGOT, parameters were determined using ERBA EM 360 systems. This assay follows the recommendations of the IFCC but was optimized for performance and stability13, 14. ALP parameter was determined using ERBA EM 360 by colorimetric assay in accordance with a standardized method. In presence of magnesium and zinc ions, p-nitro phenyl phosphate is cleaved by phosphatases in to phosphate and p-nitro phenol.[15] Normal value of serum bilirubin, direct bilirubin, SGPT, SGOT and ALP

according to the Harrison's Principle of Internal Medicine.[16]

Statistical analysis

Statistical analysis was done using SPSS version 22, data was present in frequency and percentage, Chi-square test was appropriate for find association between different variables' $p<0.05$ consider statistically significant.

RESULTS

In our study maximum malaria positive cases (25.50%) was found in 21-30 years age group and minimum cases (00.80%) in 71-80 years age group while maximum malaria positive cases (22.56%), (34.75%) was found in males in 11-20 years age group and in females in 21-30 years age group respectively.

Maximum *P. vivax* (27.66%), *P. falciparum* (33.33%) and mixed malarial infection (21.92%) cases were found in 21-30 years age group, 21-30 and 41-50 years age group, 31-40 years age group respectively. While maximum cases of *P. vivax* (51.06%), mixed malarial infection (65.75%) was found in male and *P. falciparum* (66.67%) in female.

Table 1: Demography profile of malaria positive cases.

Age group (years)	Male N (%) % group wise	Female N (%) % group wise	Total N (%) % group wise
0-10	21 (07.90) (70.00)	09 (03.81) (30.00)	30 (05.98) (100.00)
11-20	60 (22.56) (60.61)	39 (16.53) (39.39)	99 (19.72) (100.00)
21-30	46 (17.29) (35.94)	82 (34.75) (64.06)	128 (25.50) (100.00)
31-40	53 (19.92) (55.79)	42 (17.80) (44.21)	95 (18.92) (100.00)
41-50	25 (09.40) (45.45)	30 (12.71) (54.55)	55 (10.96) (100.00)
51-60	39 (14.66) (69.64)	17 (07.20) 30.36)	56 (11.15) (100.00)
61-70	19 (07.14) (54.29)	16 (06.78) (454.71)	35 (06.97) (100.00)
71-80	03 (01.13) (75.00)	01 (00.42) (25.00)	04 (00.80) (100.00)
Total	266 (100.00) (52.99)	236 (100.00) (47.01)	502 (100.00) (100.00)

Table 2: Correlation of type of malaria with age and sex.

Demographics	*P. vivax*	*P. falciparum*	Mixed	Total	P value
Age group (years)	**N (%) % group wise**	**N (%) % group wise**	**N (%) % group wise**	**N (%) % group wise**	
0-10	24 (05.67) (80.00)	00 (00.00) (00.00)	06 (08.22) (20.00)	30 (05.98) (100.00)	
11-20	86 (20.33) (86.87)	01 (16.67) (01.01)	12 (16.44) (12.12)	99 (19.72) (100.00)	
21-30	117 (27.66) (91.41)	02 (33.33) (01.56)	09 (12.33) (07.03)	128 (25.49) (100.00)	
31-40	78 (18.44) (82.11)	01 (16.67) (01.05)	16 (21.92) (16.84)	95 (18.92) (100.00)	
41-50	42 (09.93) (76.36)	02 (33.33) (03.64)	11 (15.07) (20.00)	55 (10.96) 9100.00)	0.148[#]
51-60	47 (11.11) (83.93)	00 (00.00) (00.00)	09 (12.33) (16.07)	56 (11.16) (100.00)	
61-70	25 (05.91) (71.43)	00 (00.00) (00.00)	10 (13.69) (28.57)	35 (06.97) (100.000	
71-80	04 (00.95) (100.00)	00 (00.00) (00.00)	00 (00.00) (00.000	04 (00.80) (100.00)	
Total	423 (100.00) (84.26)	06 (100.00) (01.20)	73 (100.00) (14.54)	502 (100.00) (100.00)	
Sex					
Male	216 (51.06) (81.20)	02 (33.33) (00.75)	48 (65.75) (18.05)	266 (52.99) (100.00)	
Female	207 (48.94) (87.72)	04 (66.67) (01.69)	25 (34.25) (10.59)	236 (47.01) (100.00)	0.042[#]
Total	423 (100.00) (84.26)	06 (100.00) (01.20)	73 (100.00) (14.54)	502 (100.00) (100.00)	

[#]statistically not significant, * statistically significant.

Table 3: Correlation of liver function test with age and sex.

Liver function test	Within normal limit N (%) % group wise	Above normal limit N (%) % group wise	Total N (%) % group wise	P value
Serum bilirubin				
Age group (in years)				
0-10	18 (09.89) (60.00)	12 (03.75) (40.00)	30 (05.97) (100.00)	
11-20	29 (15.93) (29.29)	70 (21.88) (7071)	99 (19.72) (100.00)	
21-30	49 (26.92) (38.28)	79 (24.69) (61.720	128 (25.50) (100.00)	
31-40	32 (17.58) 33.68)	63 (19.69) (66.32)	95 (18.92) (100.00)	
41-50	14 (07.69) (25.45)	41 (12.81) (74.55)	55 (10.96) (100.00)	0.022*
51-60	24 (13.19) (42.86)	32 (10.00) (57.14)	56 (11.16) (100.00)	
61-70	13 (07.14) (37.14)	22 (06.87) (62.86)	35 (06.97) (100.00)	
71-80	03 (01.66) (75.00)	01 (00.31) (25.00)	04(00.80) (100.00)	
Total	182 (100.00) (36.25)	320 (100.00) (63.75)	502 (100.00) (100.00)	
Sex				
Male	96 (52.75) (36.09)	170 (53.13) (63.91)	266 (52.99) (100.00)	
Female	86 (47.25) (36.44)	150 (46.87) (63.56)	236 (47.01) (100.00)	0.935#
Total	182 (100.00) (36.25)	320 (100.00) (63.75)	502 (100.00) (100.00)	
Direct bilirubin				
Age group				
0-10	17 (10.56) (56.67)	13 (03.81) (43.33)	30 (05.97) (100.00)	
11-20	29 (18.01) (29.29)	70 (20.53) (70.71)	99 (19.72) (100.00)	
21-30	40 (24.84) (31.25)	88 (25.81) (68.75)	128 (25.50) (100.00)	
31-40	28 (17.39) (29.47)	67 (19.65) (70.53)	95 (18.92) (100.00)	
41-50	14 (08.70) (25.45)	41 (12.02) (74.55)	55 (10.96) (100.00)	0.080#
51-60	22 (13.66) (39.29)	34 (09.97) (60.71)	56 (11.16) (100.00)	
61-70	09 (05.59) (25.71)	26 (07.62) (74.29)	35 (06.97) (100.00)	
71-80	02 (01.25) (50.00)	02 (00.59) (50.00)	04(00.80) (100.00)	
Total	161 (100.00) (32.07)	341 (100.00) (67.93)	502 (100.00) (100.00)	
Sex				
Male	88 (54.66) (33.08)	178 (52.20) (66.92)	266 (52.99) (100.00)	
Female	73 (45.34) (30.93)	163 (47.80) (69.07)	236 (47.01) (100.00)	0.606#
Total	161 (100.00) (32.07)	341 (100.00) (67.93)	502 (100.00) (100.00)	

Continued.

Liver function test	Within normal limit N (%) % group wise	Above normal limit N (%) % group wise	Total N (%) % group wise	P value
SGPT				
Age group				
0-10	25 (08.09) (83.33)	05 (02.59) (16.67)	30 (05.97) (100.00)	0.049*
11-20	64 (20.72) (64.65)	35 (18.13) (35.35)	99 (19.72) (100.00)	
21-30	83 (26.86) (64.84)	45 (23.32) (35.16)	128 (25.50) (100.00)	
31-40	50 (16.18) (52.63)	45 (23.32) (47.37)	95 (18.92) (100.00)	
41-50	32 (10.36) (58.18)	23 (11.92) (41.82)	55 (10.96) (100.00)	
51-60	31 (10.03) (55.36)	25 (12.95) (44.64)	56 (11.16) (100.00)	
61-70	20 (06.47) 957.14)	15 (07.77) (42.86)	35 (06.97) (100.00)	
71-80	04 (01.29) (100.00)	00 (00.00) (00.00)	04(00.80) (100.00)	
Total	309 (100.00) (61.55)	193 (100.00) (38.45)	502 (100.00) (100.00)	
Sex				
Male	159 (51.46) (59.77)	107 (55.44) (40.23)	266 (52.99) (100.00)	0.384#
Female	150 (48.54) (63.56)	86 (44.56) (36.44)	236 (47.01) (100.00)	
Total	309 (100.00) (61.55)	193 (100.00) (38.45)	502 (100.00) (!00.00)	
SGOT				
Age group				
0-10	06 (04.05) (20.00)	24 (06.78) (80.00)	30 (05.97) (100.00)	0.019*
11-20	30 (20.28) (30.30)	69 (19.49) (69.70)	99 (19.72) (100.00)	
21-30	45 (30.41) (35.16)	83 (23.45) (64.84)	128 (25.50) (100.00)	
31-40	20 (13.51) (21.05)	75 (21.19) (78.95)	95 (18.92) (100.00)	
41-50	14 (09.46) (25.45)	41 (11.58) (74.55)	55 (10.96) (100.00)	
51-60	18 (12.16) (32.14)	38 (10.73) (67.86)	56 (11.16) (100.00)	
61-70	11 (7.43) (31.43)	24(06.78) (68.57)	35 (06.97) (100.00)	
71-80	04 (02.70) (100.00)	00 (00.00) (00.00)	04(00.80) (100.00)	
Total	148 (100.00) 29.48)	354 (100.00) (70.52)	502 (100.00) (100.00)	
Sex				
Male	73 (49.32) (27.44)	193 (54.52) (72.56)	266 (52.99) (100.00)	0.288#
Female	75 (50.68) (31.78)	161 (45.48) (68.22)	236 (47.01) (100.00)	
Total	148 (100.000 29.48)	354 (100.00) (70.52)	502 (100.00) (!00.00)	

Continued.

Liver function test	Within normal limit N (%) % group wise	Above normal limit N (%) % group wise	Total N (%) % group wise	P value
ALP				
Age group				
0-10 years	11 (04.22) (36.67)	19 (07.88) (53.33)	30 (05.97) (100.00)	0.128#
11-20 years	48 (18.39) (48.48)	51 (21.16) (51.52)	99 (19.72) (100.00)	
21-30 years	64 (24.52) (50.00)	64 (26.56) (50.00)	128 (25.50) (100.00)	
31-40 years	57 (21.84) (60.00)	38 (15.77) (40.000	95 (18.92) (100.00)	
41-50 years	32 (12.26) (58.18)	23 (09.54) (51.82)	55 (10.96) (100.00)	
51-60 years	26 (09.96) (46.43)	30 (12.45) (53.57)	56 (11.16) (100.00)	
61-70 years	19 (07.28) (54.29)	16 (06.64) (45.71)	35 (06.97) (100.00)	
71-80 years	04 (01.53) (100.00)	00 (00.00) (00.00)	04(00.80) (100.00)	
Total	261 (100.00) (51.99)	241 (100.00) (48.01)	502 (100.00) (100.00)	
Sex				
Male	154 (59.00) (57.89)	112 (46.47) (42.11)	266 (52.99) (100.00)	0.005*
Female	107 (41.00) (45.34)	129 (53.53) (54.66)	236 (47.01) (100.00)	
Total	261 (100.00) (51.99)	241 (100.00) (48.01)	502 (100.00) (100.00)	

#statistically not significant,* statistically significant.

Table 4: Correlation of liver function test with type of malaria.

Liver function test	Within normal limit N (%) % group wise	Above normal limit N (%) % group wise	Total N (%) % group wise	P value
Total serum bilirubin				
Malaria parasite				
P. vivax	162 (89.01) (38.30)	261(81.56) (61.70)	423 (84.2) (100.00)	0.935#
P. falciparum	01(00.55) (16.67)	05(01.56) (83.33)	06 (01.20) (100.00)	
Mixed	19(10.44) (26.03)	54 (16.88) (73.97)	73 (15.54) (100.00)	
Total	182(100.00) (36.25)	320(100.00) (63.75)	502 (100.00) (100.00)	
Direct bilirubin				
Malaria parasite				
P. vivax	144(89.44) (34.04)	279 (81.82) (65.96)	423 (84.2) (100.00)	0.606#
P. falciparum	00 (00.00) (00.00)	06 (01.76) (100.00)	06 (01.20) (100.00)	
Mixed	17 (10.56) (23.29)	56 (16.42) (76.71)	73 (15.54) (100.00)	
Total	161 (100.00) (32.07)	341 (100.00) (67.93)	502 (100.00) (100.00)	

Continued.

Liver function test	Within normal limit N (%) % group wise	Above normal limit N (%) % group wise	Total N (%) % group wise	P value
Serum aspartate transaminase (SGPT)				
Malaria parasite				
P. vivax	269 (87.06) (63.59)	154 (79.79) (36.41)	423 (84.2)S (100.00)	0.384#
P. falciparum	04 (01.29) (66.67)	02 (01.04) (33.33)	06 (01.20) (100.00)	
Mixed	36 (11.65) (49.32)	37 (19.17) (50.68)	73 (15.54) (100.00)	
Total	309 (100.00) (61.55)	193 (100.00) (38.45)	502 (100.00) (100.00)	
Serum alanine transaminase (SGOT)				
Malaria parasite				
P. vivax	137 (92.57) (32.39)	286 (80.79) (67.61)	423 (84.2) (100.00)	0.288#
P. falciparum	00 (00.00) (00.000	06 (01.69) (100.00)	06 (01.20) (100.00)	
Mixed	11 (07.43) (15.07)	62 (17.51) (84.93)	73 (15.54) (100.00)	
Total	148 (100.00) (29.48)	354 (100.00) (70.52)	502 (100.00) (100.00)	
Serum alkaline phosphatase (ALP)				
Malaria parasite				
P. vivax	213 (81.61) (50.35)	210 (87.14) (49.65)	423 (84.2) (100.00)	0.005*
P. falciparum	01 (00.38) (16.67)	05 (02.07) (83.33)	06 (01.20) (100.00)	
Mixed	47 (18.01) (64.38)	26 (10.79) (35.62)	73 (15.54) (100.00)	
Total	261 (100.00) (51.99)	241 (100.00) (48.01)	502 (100.00) (100.00)	

#statistically not significant, * statistically significant.

In our study we found above normal limit serum bilirubin (63.75%) in malaria positive cases. Maximum deranged serum bilirubin (24.69%), (53.13%) was found in 21-30 years age group and in male respectively. Deranged direct serum bilirubin was found 67.93% in malaria positive cases. Maximum deranged direct serum bilirubin (25.81%) and (52.20%) was found in 21-30 years age group and male respectively.

Deranged SGPT was found in 38.45% in malarial cases. Maximum deranged SGPT (23.32%) and (55.44%) was found in 21-30 years age group and male respectively. Deranged SGOT was found 70.52% in malarial cases. Maximum deranged SGOT (23.45%) and (54.52%) was found in 21-30 age group and male respectively.

Deranged ALP was found 48.01% in malarial positive cases. Maximum above normal limit ALP (26.56%) and (53.53%) in 21-30 age group and in female respectively was found.

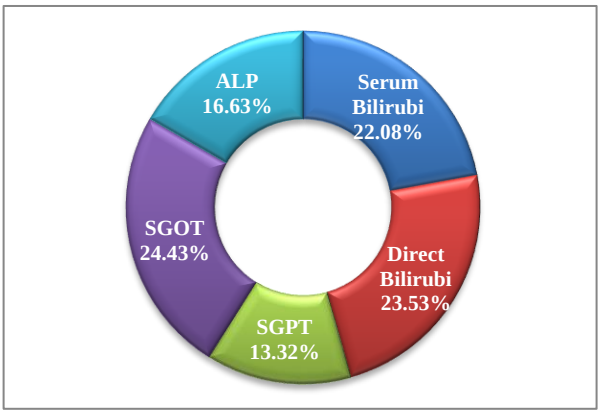

Figure 1: Abnormal values of LFT in malaria positive cases.

Maximum deranged serum bilirubin (83.33%), direct bilirubin (100%), SGOT (100%) and ALP (83.33%) was found in *P. falciparum* and maximum deranged SGPT (50.68%) in mixed infection.

DISCUSSION

Age distribution

Maximum 25.50% malaria positive cases were in age group 21-30 year age group, followed by (19.72%) 11-20 year age group, (18.92%) 31-40 year and least (00.80%) in 71-80 year age group. Similar finding was observed by Ukaegbu et al highest malaria positive cases (18.33%) were in 20-29 years age group and lowest was in (1%) among ≥60 years age group.[17] Archibong et al found highest malaria positive cases (35.15%) in 31-45 years age group and lowest (02.48%) in 61-75 age group.[18] Gupta et al observed (56%) 15-40 year age group, (38%) 18-30 year age group, Jairajpuri et al reported (38.20 %) 21-30 year age group, (20.00%) 31-40 year age group, (2.6%) 61-80 year age group, Khuraiya et al found (34.61%) 21-30 years age group while Gill et al found maximum (43.33%) were under the age of 20 years.[19-22]

Sex distribution

Out of 502 malarial patients, 52.99% were males while 47.01% were females. Ahmad et al, Okwubuo et al reported 52% males and 48 % females malarial cases, Khuraiya et al found 56% males and 44% females, Odikamnoro et al also found more malarial cases in males (56.84%) than in females (43.16%) Gill et al found 63.33% males and 36.66% females, Gupta et al found 65.22% males and 34.78% females, Aundhakar et al in their study found 67% males and 33% females, Jairajpuri et al reported 69% males and 31% females, Kalavathi et al found 77.15% males and 22.85% females.[19-27] The males thought to be at a higher risk due to more outdoor activity and less protection from mosquito bites.

In contrast Ukaegbu et al found more malarial cases in female 56.17% than in males 43.83%, while Archibong et al observed 51.98% in females and 48.02% in males.[17,18]

Type of malaria

Out of 502 cases of malaria, 84.26% cases of *P. vivax* were found, 01.20% cases of *P. falciparum* and 14.54% mixed infection. Similar finding by Jairajpuri et al *P. vivax* (87.74%), *P. falciparum* (03.77%) and mixed infection (08.49%).[20] In contrast *P. vivax* 57.14%, 56.51%, 51.69%, 41%, 40% and 28.7%, *P. falciparum* 37.14%, 39.13%, 01.12, 59%,50% and 70.6% and mixed infection 5.72%, 4.34%, 47.19%, 00.90% and 10% by Kalavathi et al, Gupta et al, Faseela et al, Patel et al, Kashikunti et al, Agravat et al respectively.[20,27-31] In contrast Khuraiya et al 50.96% cases were of *P. falciparum*, 46.15% of *P. vivax* and 2.88% of mixed infection Kocher et al reported higher incidence of *P. falciparum* in Bikaner.[21,32]

Correlation of malaria with liver function test

Out of total 502 cases of malaria, 63.75% were having above normal limit serum bilirubin and maximum abnormal serum bilirubin (83.33%) was found in *P. falciparum* followed by (73.97%) in mixed malarial infection cases and least (61.70%) in *P. vivax* cases Kotresh et al found deranged serum bilirubin in 66% cases.[33] Dhariyal et al found deranged serum bilirubin (56.25%).[34] Sridhar et al found deranged serum bilirubin in *P. falciparum* (36.36%) and in *P. vivax* (49.43%).[35] In contrast Abro et al observed (81%) Serum Bilirubin above normal level Okwubuo et al found deranged serum Bilirubin in 90.5% cases.[24,36] Khuraiya et al observed raised serum bilirubin (27.88%).[21]

Abnormal direct bilirubin was found in 67.93% malarial cases in this study and maximum 100.00% was found in *P. falciparum* cases followed by 76.71% in mixed infection while least 65.96% in *P. vivax* cases. Okwubuo et al found deranged Direct Bilirubin in 88.0% malarial cases.[24]

In this study, above normal limit SGPT was observed in 38.45% malarial cases while maximum 50.68% was observed in mixed followed by 36.41% in *P. vivax* while least 33.33% in *P. falciparum* similar finding by Dhariyal et al was reported (37.75%) SGPT (41%) was observed by Okwubuo et al Khuraiya et al observed deranged SGPT (33.65%).[21,24,34] In contrast Abro et al found deranged SGPT (67.6%) and Kotresh et al found 78% cases have deranged SGPT in *P. falciparum*.[33,36] Divyaansh et al found deranged SGPT in *P. vivax* (53.93%) and in *P. falciparum* (81.81%).[31,35]

In this study, deranged SGOT in 70.52% malarial cases were found while 100% in *P. falciparum* followed by 84.93% in mixed infection and least 67.61% in *P. vivax* cases. Similar finding of above normal limit SGOT (74%) was observed by Kotresh et al and 67% by Okwubuo et al in contrast Khuraiya et al found deranged SGOT (31.73%).[21,23,24] Divyaansh et al found deranged SGOT in *P. vivax* (53.93%) and in *P. falciparum* (81.81%).[35]

In this study, abnormal ALP in 48,01% in malarial cases while maximum 83.33% was found in *P. falciparum* cases followed by 49.65% in *P. vivax* and 35.62% in mixed malarial infection.

Sridhar et al found deranged ALP in *P. vivax* (30.33%) and *P. falciparum* (63.63%). In contrast Kotresh et al found deranged ALP in 36% in *P. falciparum* cases.[33,35] In contrast Okwubuo et al found 00.00% deranged ALP.[24]

CONCLUSION

Malaria is a parasitic disease caused by plasmodium species. The study revealed that the impairment of the liver function is a manifestation of malaria. There is positive correlation of liver enzymes and bilirubin it shows that LFT should be performed along with early diagnosis of *P. vivax* infections in order to prevent complications and mortality, malaria have significant impact on LFT, dysfunction of liver is more common in

Falciparum than *Vivax* malaria, *P. falciparum* mainly responsible for raised SGPT, SGOT, ALP and serum bilirubin in the affected patient due to hepatic phase of parasite containing schizoints and hypnozoites.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Agarwal AK, Katiyar GD, Khan S, Chaudhary BC, Singh A, Sharma M. Evaluation of liver function test in malaria positive cases in tertiary care hospital of Bareilly. Int J Community Med Public Health 2020;7:2193-202.