



WWJMRD 2017; 3(12): 1-3
www.wwjmr.com
International Journal
Peer Reviewed Journal
Refereed Journal
Indexed Journal
UGC Approved Journal
Impact Factor MJIF: 4.25
e-ISSN: 2454-6615

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ESR As Biomarker of Typhoid, Dengue and Malaria: A Study in North East India

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Abstract

Erythrocyte Sedimentation Rate or Sed Rate or ESR is the hematological test which indicates the inflammation of a disease condition. As this test never specifies any disease, our study tries to check whether it can be used as a biomarker or not. A total 1290 (One thousand two hundred ninety) numbers of fever subjects from North Eastern states of India were enrolled for our study and out of which 227 (Two hundred twenty seven) numbers were showed elevated ESR. This 227 (Two hundred twenty seven) numbers subjects were tested for typhoid, dengue by serological tests and malaria by microscopy and checked the correlation-comparisons with ESR. Our study concludes that ESR may play an important role to suspect a subject for typhoid, dengue or malaria with comparisons its clinical condition.

Keywords: ESR, fever, hematology, serology, microscopy

Introduction

Erythrocyte Sedimentation Rate or ESR is the test at which red blood cells (RBCs) allowed to sediment and recorded at the end of one hour to check nonspecific inflammation. Within this one hour first ten minutes (10 minutes) rouleaux formation occur, second forty minutes (40 minutes) sedimentation or settling the RBCs occur and in last ten minutes (10 minutes) Sedimentation slows/stops and RBCs packed at the bottom of the ESR tube (westergren tube/wintrobe tube) ^[1]. As ESR indicates inflammation of nonspecific diseases and typhoid, malaria and dengue are three common epidemiologically prevalence diseases in north eastern states of India our study includes these three tests to check ESR elevated patients ^[2, 3].

Typhoid is a bacterial disease which represents fever, headache, abdominal pain, coated tongue, weakness, terry stool, lethargy etc. In the year 2000, worldwide 21.7 million typhoid cases reported out of which 2, 17,000 (two lakh seventeen thousand) cases were death and 90% of them were from Asia ^[4]. Again malaria is a parasitic disease which represents fever, headache, rigor, sweating etc. In 2006, only from Assam 1707 (One thousand seven hundred seven) numbers patients were death due to malaria and 200 from them were from Lakhimpur district which was the border district with Arunachal Pradesh ^[5]. Dengue too represents fever, headache, Nausea, vomiting, Muscle pain, joint pains, skin rash etc. These proves how medically important these disease are actually. In all three diseases fever and headache symptoms are common. That is why our study included these three tests for elevated ESR patients as these are prevalence in our study area. ESR considered as elevated above 20 mm at the end of hour.

Materials and Methods

Blood samples were collected from the 1290 (One thousand two hundred ninety) numbers of enrolled fever patients with the help of disposable syringe, tourniquet, spirit swab, sterile test tube, test tube rack etc. All age groups were included for the study. Consent received from the patients prior to collect the blood samples. One part of collected blood samples allowed to clot in sterile plain tubes, second part diluted with tri-sodium citrate in 1:3 ratio in another sterile tubes and from the third part smear (both thick and thin) were prepared for malaria microscopy. Clotted bloods in plain tubes were centrifuged after 20 minutes of

collection and serums separated to another tubes.

ESR: Diluted blood with tri-sodium citrate drawn up to the '0' mark of westergren tube and allowed to stand for one hour. At the end of one hour ESR recorded. Reading of ESR more than or equal 20 mm at the end of hour considered as positive as per the different books (Text book of Medical Laboratory Technology by Godkar, Medical Laboratory Technology Methods and interpretations by Sood) and serum of that patients were tested for typhoid, dengue and malaria.

Typhoid

Widal test from serum was done for typhoid. Agglutination against somatic (O) and flagellar (H) antigen of salmonella was the main principle of this test. The titer 1:80 or more ratios were considered as positive.

Dengue

Both NS1 ELISA and IgM ELISA tests were done based on the onset of the patient's. Panbio NS1 ELISA kits and NIV IgM ELISA kits were used with the help of Robonik ELISA reader and washer.

Malaria

Both thick and thin smears were prepared from the all patients but malaria microscopy enrolled for the study only from those whose ESR reading more or equal 20 mm at the end of hour. Smears were stained with JSB staining solution and allowed to dry after staining. Dried smears were observed under microscope (oil immersion) with the help of microscopy oil.

Results and Discussion

A total 1290 (One thousand two hundred ninety) numbers of samples were tested for ESR and out of which 227 (Two hundred twenty seven) numbers were showed elevated ESR and recorded as positive (Figure 1). This 227 (Two hundred twenty seven) numbers subjects were tested for typhoid, dengue and malaria and checked the correlation-comparisons with ESR. Total 94 (ninety four) numbers of samples found positive for typhoid, dengue and malaria. 76 (Seventy six) numbers of samples found positive for only typhoid and 4 (four) numbers of samples found concurrent positive for typhoid with dengue. Again 13 (thirteen) numbers of samples found positive for only dengue and 1 (one) number sample found positive for Pf malaria (Figure 2).

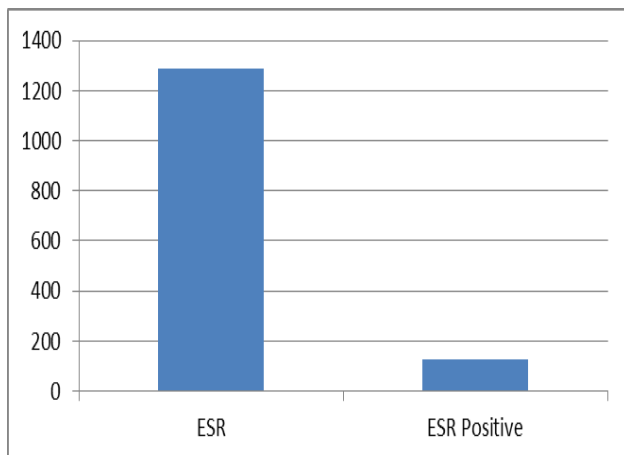


Fig. 1: Fever patient's ESR test result.

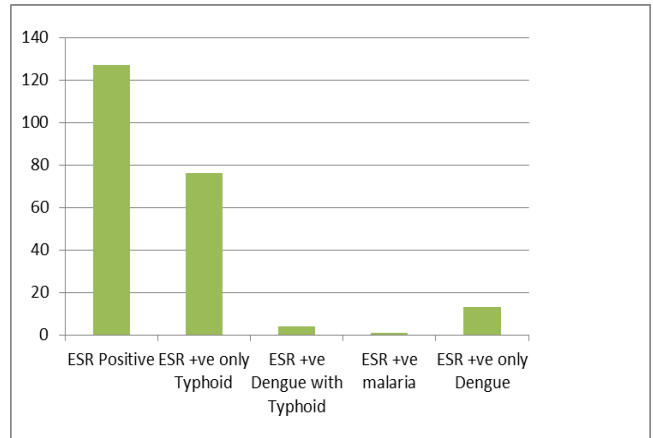


Fig.2: ESR positive ratio with typhoid, dengue and malaria

Concurrent infection of typhoid and dengue observed in our study but no co-infection observed with malaria. In a study (2015) by ST deshkar reported triple concurrent infection of typhoid, dengue and malaria [6]. Again a triple concurrent infection with dengue, typhoid and malaria reported in 2013 by Suresh V and team where they found the patient with elevated ESR [7]. Though we did not found triple concurrent infection but elevated ESR with concurrent infection of dengue with typhoid found by us and our all positive cases (dengue, malaria and typhoid) were with elevated ESR. Another study by Bahwere P *et al.*, in 2001 reported elevated ESR with bacteremia and malaria [8]. Muniraj K and team too found typhoid with elevated ESR in 2015, in our study to 76 (seventy six) numbers of patients found with only typhoid and raised ESR [9]. In 1999 Brigden ML and in 2014 Hersch EC *et al* reported possibilities of elevated ESR in different diseases [10, 11]. Again another publication in 2015 by Srikanth N *et al* and Dhillon SPS *et al* in 2017 also reported elevated ESR in typhoid fever [12, 13]. Francis U *et al* reported elevated ESR in malaria positive patient [14]. Cunha BA and team reported in their publication regarding malaria, dengue and other diseases with increase ESR [15]. From all the articles as well as from our study we can conclude that elevated ESR may use as a biomarker of different diseases based on epidemiologically prevalence diseases and comparison with clinical condition of the patients. In our study too we choose three epidemiologically prevalence disease in North Eastern states of India. But this point also must notice that out of 227 (two hundred twenty seven) numbers of elevated ESR only 94 (ninety four) patients were confirmed by our included tests. So, other 133 (one hundred thirty three) patients having possibilities to having other epidemiologically prevalence infections which could be confirm by laboratory tests only.

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