IJBHS 2010129/6409

Haematological changes associated with *Salmonella typhi* and *Salmonella paratyphi* in humans

A. Dangana*[1], J. Ajobiewe[2] and A. Nuhu[3]

[1]Haematology Department, Federal Medical Centre, Bida, Nigeria
[2]Medical Microbiology Department, National Hospital Abuja, Nigeria
[3]Haematology Department, National Hospital Abuja, Nigeria

ABSTRACT: The effect of typhoid's/paratyphoid fevers (enteric fever) were studied on basic haematological parameters of patient, packed cell volume (PCV) hemoglobin estimation (Hb), reticulocytes count, and differential leucocytes count and white blood cell count(WBC) were carried out a comprehensive study of 200 sample were collected from culturally confirmed salmonella patients and apparently healthy individuals were used as control. result obtained show that there was a significant decrease in the PCV, Hb, and WBC and also lymphocytes with reticulocytes count was significantly higher and a relatively higher in neutrophils as against those of apparently healthy control individuals, but there was a significant increase in monocytes and eosionophils,but there was no significant difference in basophiles count.

Key words: salmonella: Reticulocytes: cyanmethaemoglobin; packed cell volume.

Introduction

Salmonella infections are still a leading cause of human's food born infection in the world today. These infections primarily originated from eating contaminated food, water, chicken egg, products and meat product. Considering the high frequency of food contamination and emergence of multi- drug resistance salmonella strains, control of salmonella in food has become worldwide challenge (CDC, 2004), salmonella is an important worldwide health problem affecting both humans and animals and it pose a serious danger to public health of distribution (CDC, 2004, Morse, 1994).

Mucosal penetration occurs in the distal ileum resulting in transient asymptomatic bacteremia, the organism survive and multiply within the mononuclear phagocytes and characterized by a rapidly developing infiltration which contains neutrophils as the predominant cell type and which is associated with necrosis of the upper mucosa in large areas of the terminal ileum and colon (Robert, 2005, Richard, 2005).There is a high incidence of mortality and morbidity rate of salmonella infection in the development countries than in the developed world (Murray and Myrous 1995.) and it is a continuing problem necessitating hospital admission for individuals, patients and causing outbreaks of the typhoid and paratyphoid fever which might not be due food-born but an endemic incident caused in residential institution and hospital or by contaminated formites (Motajeni *et al*,1999). All sanitary conditions in respect of derange of house and localities were reported to the most ready means of the spread of the contagion of the fever (Pankor, 2000).

---

*To whom correspondence should be addressed. E-mal: isalemit@yahoo.co.uk Tel: +234(0)8032103952

The clinical phase of the disease begins 1-3 weeks when the persistence bactereamia occur. Haematogenous spread to lead payer patches and the gall bladder reintroduce bacteria to the got lumen and allowing continued fecal oral spread of the disease. (Donald, 2005; David, 2005).According to the world health organization1980 census approximately 12.5 million world wide cases occurred per year despite the successful progress in the treatment of infectious diseases during the past years, more effort is required to the management of enteric fever and septicemic infections. (Ryder and Blake, 1989).

Hematological manifestation of typhoid and paratyphoid

It is generally accepted that typhoid and paratyphoid fever are associated with leucopenia and this is severe as a diagnostic aid (wealtheral *et al,* 1990) Cheesbrough, 1999 also stated that the total white blood cell is low and anemia may be involved. As early as 1996 Hoff brand *et al* stated that neutrophils leucocytosis is a feature of complicated typhoid fever and that lymphopenia is associated with typhoid because of typhoid fever, specific mediators released by cells which act on bone marrow to increase proliferation of neutrophils.

So far from the literature, no report has been made concerning typhoid and Para typhoid on eosinophlis, basophiles and monocytes. It is recognize that tissue invasion by micro-organism is accompanied by substantial stimulation of neutrophils granunopoesis which account for increase in neutrophils counts in the blood (Firkin *et al* 1989). Firkin *et al*,1989 reported that subject with sub acute or chronic infection which indicated that production of neutrophils increase up to 12 times the mean rate in healthy individuals. This research work would help evaluate the effect of typhoid/paratyphoid fever on haematological parameters, also to establish the early diagnosis of enteric fever, which remains a pressing clinical problem in the world and also to help in the effective diagnosis of typhoid/paratyphoid fever using haematological parameters.

Materials and Methods

Study Population: This comprised of 200 culturally confirmed typhoid/paratyphoid patient attending Vom Christian Hospital and Dadin Kowa General Hospital in Plateau State, Nigeria. This number consisted of 100 culturally confirmed typhoid/paratyphoid patients and 100 apparently healthy control individuals.

All the patients were interviewed verbally using a pre-designed questionnaire and consent was obtained for the study from the authority of the hospital after which their blood sample was collected and analyzed for the various haematological parameters according to Dacie and Lewis (2001),hemoglobin estimation ,haematocrit, total WBC, differential WBC, and reticulocytes.

INCLUSION CRITERIA: Typhoid/paratyphoid is defined as true positive by cultural methods of isolation on culture media and those that consented after informed consent from the patient.

EXCLUSION CRITERIA: Patients not infected with Salmonella typhi/paratyphi, opportunistic infection, or severe bacterial infection order than salmonella and helminthes infections any sickle cell anaemia (SCA) and malaria patients were excluded from the study.

SAMPLE COLLECTION: Whole blood sample was drawn with minimum stasis into 5ml E D T A bottle via antecubital vein using a disposable plastic syringe and needle each sample was then mixed gently and thoroughly to ensure anticoagulation and prevent cell lysis. Aliquots were used to determine the haematological parameters within two hours of collection Student t-test was employed as a statistical tool.

Results

The haematological values obtained from the control and test subjects on salmonella typhy/paratyphy are shown in table1.the parameters analyzed were PCV, Hb, reticulocytes count, WBC and differential leucocytes count and

the result obtained were compared between typhoid/paratyphoid and apparently healthy control individuals were carried out using d-value and the calculated d-value as shown in Tables 1 and 2 respectively.

Table 1: Haematological parameters in typhoid/paratyphoid patients and apparently healthy individuals.

Parameters	Typhoid/Parathyphoid Patients		Apparently Healthy Control	
	Mean	S.D.	Mean	S.D.
WBC x 10	3,802.2	1,643.15	5,045	1245.6
PCV %	34.14	8.75	47.56	51.81
Hb g/dl	14.6	3.12	18.63	3.23
Retics	0.454	0.271	0.164	0.156
Neutrophils	41.84	16.08	41.64	9.20
Lymphocytes	53.12	16.67	55.6	8.15
Monocytes	3.12	2.59	1.28	1.06
Eosinophils	1.32	2.42	0.34	0.14
Basophils	0.04	0.19	0.02	

Table 2: "d" test comparison of the haematological values obtained from typhoid/paratyphoid patients and apparently healthy individuals.

Parameters	Calculated d-value	Tabulated d-value	Probability	Remarks
WBC x 10	4.26	1.60	$p < 0.05$	Significant
PCV %	1.82	1.60	$p < 0.05$	Significant
Hb g/dl	10.04	1.60	$p < 0.05$	Significant
Retics	6.55	1.60	$p < 0.05$	Significant
Neutrophils	0.075	1.60	$p > 0.05$	Not Significant
Lymphocytes	0.94	1.60	$p > 0.05$	Not Significant
Monocytes	3.93	1.60	$p < 0.05$	Significant
Eosinophils	2.62	1.60	$p < 0.05$	Significant
Basophils	0.59	1.60	$p > 0.05$	Not Significant

Remarks
$P < 0.05$ Significant
$P > 0.05$ Significant.

Discussion

Salmonella typhi/paratyphi remains an important enteric pathogens in many part of the world, and there is a high incidence of mortality and morbidity rate of salmonella infections in the developing countries of the world (Murray *et al*,1995).based on the findings, the result obtained in this present study shows that there was a significant decrease

in the level of PCV, and Hb with reticulocytes count significantly higher (P<0.05) in typhoid/paratyphoid patient compared to the apparently healthy control individuals as shown in Table 1.

The low PCV and Hb observed in typhoid/paratyphoid patient indicate that anaemia could be involved. However, their blood picture revealed normocytic normochromic anaemia in the majority of the patients which agree with the findings of Cheesbrough 1991, Melvin and Remedios 1993, who state that typhoid/paratyphoid fevers is associated with low PCV, Hb, and those with prolonged cases of have normocytic normochromic anaemia, about 22% of typhoid/paratyphoid patient show marked anaemia, while 78% of the anaemia may have been compensated.

It was observed that there was a significant decrease in wbc at p<0.05 when compared with the apparently healthy control individuals as shown in table1, this agrees with Wealtheral *et al*, 1987. Who stated that typhoid/paratyphoid fever is associated with leucopenia and as such serves as a diagnostic aid. Furthermore, the differential leucocytes count of the test sample show a significant increase in eosinophlis and monocytes count of the patient at p<0.05, while there was no significant increase in basophiles count. The significant increase observed in eosinophlis and monocytes might be attributed to allergic reaction Wintrobe *et al*, 1981.the decrease observed in lymphocytes was not significant compared with the control individuals so also the relative increase observe in neutrophils was not significant p>0.05, which disagree with the earlier statement Hoff brand *et al* 1996, who stated that neutrophils leucocytosis is a feature of complicated typhoid fever. The moderate increase in lymphocyte in apparently healthy individuals as shown in table1 could be linked to the environmental factors and also there was no significant effect on basophiles count.

In conclusion typhoid/paratyphoid fevers are associated with leucopenia, mild neutrophilia and lymphocytosis serves as indications for the diagnosis of the infection and also anaemia is involved. Haematological parameters could be employ in the effective diagnosis of typhoid/paratyphoid fevers which afford a more reliable and earlier diagnosis which could reduced unnecessary antibiotic therapy.

It is hereby recommended that further research should carry out to find out why the number of lymphocyte is generally higher in this environment as seen in both test and control sample.

References

Centre for Disease Control (CDC, 2004): Zoonotic disease. A peer Reviewed Journal Tracking and Analyzing disease Trends.vol.10, No 12 Emerging infectious disease.

Dacie J.V. and Lewis S. M. (2001) Practical Haematology. 9th ed. Churchill Livingstone, Edingburgh.

Cheesbrough M (1999) District laboratory practical manual in tropical countries. Vol 11. Cambridge University Press.

David T N. (2005) American Academy of Ophthalmology; America Association for pediatric ophthalmology and strabismus and phi Beta Kappa.

Donald S. F. (2005) America Association for pediatric ophthalmology and strabismus, and Phi Beta Kappa.

Firkin F, Chesterman, C. C., Pennington D and Rush B(1989) White cells. In: de-Gruchy Clinical Haematology in Medical Practice 5th ed Blackwell Scientific Publications, London. pp. 216 - 225.

Hoffbrand A V, Mitchell L, Edward G D. (1996) Postgraduate haematology 4th ed Oxford University Press Inc, New York. pp. 219-222.

Remedios F C Melvin R M. (1993) Santo Thomas University Teaching Hospital Report on typhoid fever.

Morse V. (1994) Salmonella: A current animals environment health problem. Journal of America Veterinary and Medical Association. p. 165.

Motarjeni Y , Kaferstein F, Moy, G. and Quevodo F (1999) Contaminated weaning food: a major risk factors for diarrhea and associated malnutrition. Bulletin of the World Health Organization. p 71-92.

Murray R P. Drew B.W., Kobayashi, S. G. and Thompson H.J. (1999) Medical microbiology. International Students ed. Wolfe Publishing Ltd, England.

Parker T. M. (2000) Enteric infections: Typhoid and paratyphoid fevers. In: Topley and Wilson Principles of Bacteriology, Virology and Immunity. Vol. 3, Bacterial diseases. p. 407.

Richard W A. (2000) Vaccine for preventing typhoid fever. Coechrane Database System R W(2) CD0012619 (Medline).

Robert C W (2005) Treatment with ciprofloxacine in children with typhoid fever. Journal of Infectious Diseases 30(4): 355-7 (Medline).

Ryder E V, Blake P A (1989) Typhoid fever in the United States. Journal of Infectious Diseases.

Weatheral D J, Ledingham J Gand Warrel D A (1990) Textbook of Medicine. 12th ed. Vol. 1. Oxford University Press.

Wintrobe, M M, Lee G R, Boggs, D R, Bithell, T C, Foerster, J, Anthens J W and Lukons, J. N. (1981) The diagnostic and Therapeutic Approach to Haematology. Lee and Febriger Philadelphia.