

mini-Review

Osmotic fragility test and its application in tropical medicine

Viroj Wiwanitkit

Wiwanitkit House, Bangkhae, Bangkok 10160 Thailand

Received January 12, 2009; Accepted March 5, 2009

Abstract

Osmotic fragility (OF) test is an important basic hematological test. It is basically used for test for fragility of red blood cell. Its application in tropical medicine is available and acceptable. In this brief review, the author summarizes and addresses important application of OF in tropical medicine.

Keywords: Osmotic fragility; Tropical medicine

INTRODUCTION

Osmotic fragility (OF) test is a basic hematological test. It is a non specific but useful test. It is presently used for many screening purposes. Its application in medicine is interesting. In this article, the author briefly reviews and discusses on important application of OF test in tropical medicine

Osmotic Fragility Test^[1-3]

OF test is a basic test that can be easily performed at low cost. The main reagent for this test is saline (sodium chloride). The basic principle of OF test bases on the osmolarity principle. The red blood cell is mainly tested by OF. It is presently observed that the water from the hypotonic area will migrate to the hypertonic area. Comparing between the concentration within red blood cell and saline solution, the lower concentration can be seen in external saline solution, hence, the water will migrate from outside solution into inside red blood cell. For sure, this flux change can make physical insult to the affected red blood cell. Swelling of red blood cell, a mass with a certain boundary, cell membrane, can be ex-

pected. Finally, the membrane of the red blood cell will be torn and the rupture of red blood cell to liberate the internal content, red pigment, can be expected. This results in hemolysis, red appearance of the solution used for the OF test. IT can be seen by naked eye and read as positive result. It can be noted that there are two important factors determining the test, the saline solution and the red blood cell. Basically, the solution in different concentration in series is used for standard classical OF test. At present, a new on tube OF test is also available. For red blood cell, pathology of membrane or its internal content are also important things leading to the change of OF pattern. This is the basic principle of OF test.

Thalassemia and osmotic fragility test

Thalassemia is a common tropical disorder. It is classified as a common tropical anemia. This tropical disorder can be seen in many areas of the world. It is accepted as one of the most common congenital disorders. The affected cases usually suffer from chronic anemic symptoms. The bone deformity owing to chronic erythropoietic stimulation can be observed. To treat thalassemia is hard. It must base on gene therapy or stem cell therapy. The better way is to prevent the disorder by antenatal screenin of the risk pregnant subjects in the endemic areas. There are many means to screen thalassemia. However, OF test is a basic and easy to perform test. There are

Correspondence to: Viroj Wiwanitkit, Wiwanitkit House, Bangkhae, Bangkok 10160 Thailand
Tel: 6624132436
E-mail: wviroj@yahoo.com

many papers confirming the usefulness of OF test in screening for thalassemia^[4-8]. Good diagnostic property is mentioned.

Hemoglobin E disorder and osmotic fragility test

Hemoglobin E is an important hemoglobinopathy. The point mutation in beta 6 is the rooted genetic disorder for hemoglobin E disorder. The disease is classified as a tropical anemia. It is very common in Southeast Asia, especially the area between Thailand, Laos and Cambodia. Similar to thalassemia, antenatal screening program for hemoglobin E is set. There are also many papers confirming the usefulness of OF test in screening for hemoglobin E disorder^[9-11]. Good diagnostic property is also mentioned.

Malaria and osmotic fragility test

Malaria is a common tropical mosquito borne infection. The disease is caused by parasite. The protozoa, *Plasmodium spp*, is causative agent. Acute febrile illness is the nature of this disease. The gold standard for diagnosis of malaria is microscopic examination of the blood film. However, OF test is also mentioned for its usefulness in diagnosis of malaria. The membrane defect due to malarial infection is noted as the cause of increased OF in malaria^[12,13]. The root cause of membrane defect is owing to erythrocyte aging in malaria^[14].

Babesiosis and osmotic fragility test

Babesiosis is an important blood infection. The protozoa, *Babesia spp*, is causative agent. This disease is common in tropical South America. The gold standard for diagnosis of babesiosis is microscopic examination of the blood film. However, OF test is also noted for its usefulness in diagnosis of babesiosis but in veterinarian science (no report in human beings). The membrane defect due to babesia infection is noted as the cause of increased OF in babesiosis^[15,16].

REFERENCES

1 **Kogawa H**, Yabushita N, Kageyama K. Osmotic fragility test of erythrocytes with a cold planet centrifuge. *C R Seances Soc Biol Fil* 1998; 192(5):997 – 1006.

2 **White JC**, White JM. The red cell: a haematological odyssey. *Br J Haematol* 1972;23:(Suppl):27-33.

3 **Stoltz JF**, Vigneron C, Streiff F, Larcen A. Current ideas on the rheology of erythrocytes. *Biorheology* 1971;8(1):11-22.

4 **Sangkitporn S**, Chongkitivitya N, Pathompanichratana S, Sangkitporn SK, Songkharm B, Watanapochana U, Pathong W. Prevention of thalassemia: experiences from Samui Island. *J Med Assoc Thai* 2004;87(2):204 – 12.

5 **Tongsong T**, Wanapirak C, Sirivatanapa P, Sanguansermisri T, Sirichotiyakul S, Piyamongkol W, et al. Prenatal eradication of Hb Bart's hydrops fetalis. *J Reprod Med* 2001;46(1):18 – 22.

6 **Wanapirak C**, Tongsong T, Sirivatanapa P, Sanguansermisri T, Sekararithi R, Tuggapichitti A. Prenatal strategies for reducing severe thalassemia in pregnancy. *Int J Gynaecol Obstet* 1998;60(3):239 – 44.

7 **Rowley PT**, The diagnosis of beta-thalassemia trait: a review. *Am J Hematol* 1976;1(1):129 – 37.

8 **Lehmann H**, Lang A. Various aspects of alpha-thalassemia. *Ann N Y Acad Sci* 1974;232(2):152 – 8.

9 **Wiwanitkit V**, Using of osmotic fragility (OF) and dichlorophenol-indolephenol (DCIP) tests screening for antenatal clinic: appraisal of usefulness of the program in rural Thai communities. *Rural Remote Health* 2006;6(2):587.

10 **Wiwanitkit V**, Combined osmotic fragility and dichlorophenol-indolephenol test for hemoglobin disorder screening in Thai pregnant subjects: an appraisal. *Lab Hematol* 2004;10(2):119-20.

11 **Wiwanitkit V**, Suwansaksri J, Paritpokee N. Combined one-tube osmotic fragility (OF) test and dichlorophenol-indolephenol (DCIP) test screening for hemoglobin disorders, an experience in 213 Thai pregnant women. *Clin Lab* 2002;48(9-10):525-8.

12 **Areekul S**, Rigidity of red cell during malarial infection. *J Med Assoc Thai* 1973;56(3):163-7.

13 **Seed TM**, Brindley D, Aikawa M, Rabbege J. Plasmodium berghei: osmotic fragility of malaria parasites and mouse host erythrocytes. *Exp Parasitol* 1976; 40(3):380 – 90.

14 **Sherman IW**, Eda S, Winograd E. Erythrocyte aging and malaria. *Cell Mol Biol (Noisy-le-grand)* 2004; 50(2):159-69.

15 **Wright IG**, Osmotic fragility of erythrocytes in acute Babesia argentina and Babesia bigemina infections in splenectomised Bos taurus calves. *Res Vet Sci* 1973; 15(3):299-305.

16 **Makinde MO**, Bobade PA. Osmotic fragility of erythrocytes in clinically normal dogs and dogs infected with parasites. *Res Vet Sci* 1994; 57(3):343 – 8.

Executive Editor: Yan Lei