OPEN ACCESS
Saudi Journal of Pathology and Microbiology
Abbreviated Key Title: Saudi J Pathol Microbiol
ISSN 2518-3362 (Print) |ISSN 2518-3370 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com/sjpm

Original Research Article

Naked Eye Single Tube Red Cell Osmotic Fragility Test (NESTROFT) - A Brief Review

Dr. Pallavi BR*

Department of Pathology, Mysore Medical College and Research Institute, Mysore, Karnataka, India

DOI: 10.36348/sjpm.2020.v05i05.001 | **Received:** 21.04.2020 | **Accepted:** 29.04.2020 | **Published:** 04.05.2020

***Corresponding author:** Pallavi BR

Abstract

Naked eye single tube red cell osmotic fragility test (NESTROFT) is a simple test to screen for thalassemia has been described for use in developing countries. We studied the articles published before regarding the use of NESTROFT in screening Thalassemia and found out the average sensitivity and negative predictive value was 95.94% and 95.33% respectively which indicates NESTROFT is a good screening tool for the beta thalassemia.

Keywords: NESTROFT, Thalassemia screening, Haemoglobinopathies.

INTRODUCTION

Haemoglobinopathies are the commonest hereditary disorders in India and one of the major health problems. Previous studies show that the overall prevalence of beta thalassemia is 3-4% for every 8000 to 10000 new births. High performance liquid chromatography (HPLC) is expensive and not available everywhere. Naked eye single tube red cell osmotic fragility test (NESTROFT) is a simple test to screen for thalassemia has been described for use in developing countries.

Principle of naked eye single tube osmotic fragility test

If all the red cells in the tested sample have not undergone lysis in 0.36% buffered saline indicates a positive NESTROFT. These unlysed red cells resulted in the hazy appearance of the contents of the tube and render the line on the paper indistinct. These red cells also sediment at the bottom of the tube as a button when it is left undisturbed for some time. Thus a positive NESTROFT indicates decreased red cell osmotic fragility and increased resistance to osmotic lysis.

METHOD

We searched articles of NESTROFT in pubmed central and collected information including number of patients, sensitivity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV). The results were tabulated and compared.

RESULTS

A total of 17 studies were reviewed which were published in various journals indexed in pubmed. The articles were published between year 1988 to 2012. Total number of patients including all the studies was 5127 ranging from 42 to 1695 with an average of 333.5 and standard deviation of 443.3. The average sensitivity was 95.94% ranging from 87% to 100% with a standard deviation of 3.5%. The average specificity was 76.17% ranging from 28.7% to 100% with a standard deviation of 20.54%. The average positive predictive value was 67.05% ranging from 33.6% to 100% with a standard deviation of 24.52%. The average negative predictive value was 95.33% ranging from 82.3% to 100% with a standard deviation of 5.89%. The results were tabulated in Table 1.

Tabel-1: Sensitivity, Specificity, PPV and NPV

	Number of patients	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Average	333.56	95.94	76.17	67.05	95.33
Minimum	42	87	28.7	33.6	82.3
Maximum	1695	100	100	100	100
Standard deviation	443.3	20.54	24.52	24.52	5.89

DISCUSSION

Kulkarni *et al*. [1] studied the prevalence of beta thalassemia using NESTROFT as screening test and showed that the cost which was incurred in conducting the NESTROFT was only rupees 1.5 INR per subject, which showed that this was a simple and low cost screening test which can be used for the identification of the carrier status of beta thalassemia in screening large populations, particularly in developing countries at the primary health care centres where laboratory facilities are not available. The average sensitivity of 95.94% and a NPV of 95.33 % indicate NESTROFT is a good screening tool for the beta thalassemia.

CONCLUSION

Hemoglobinopathies are suspected based on hematological parameters like reduced MCH, reduced MCV and elevated RBC count disproportionate to hemoglobin level. NESTROF test is reliable, cost effective and better screening test for carrier detection. Screening positive cases can be confirmed by HPLC for HbA2 estimation. It can be used in hemoglobinopathies screening programmes.

Table-2: The results of previous studies

Sl no	Author	Year	Journal	No of cases	Sensitivity	Specificity	PPV	NPV
1	Mehta *et al.* [2]	1988	Indian Journal of Haematology		95%	82.1%	73.1%	97%
2	Thomas S *et al*. [3]	1996	Indian Journal of Medical Research	137	98.7%	66.6%	87%	96.5%
3	Thool AA *et al.* [4]	1998	Indian Journal of Pathology and Microbiology	42	95.2%	100%	100%	83.3%
4	Bobhate SK *et al.* [5]	2002	Indian Journal of Pathology and Microbiology	110	97.1%	100%	100%	98%
5	Manglani M *et al*. [6]	1997	Indian Pediatrics	1695	94.4%	64.2%	35.3%	97.6%
6	Chow J *et al*. [7]	2005	American Journal of Hematology	85	95%	86%	94%	88%
7	Raghavan K *et al*. [8]	1991	Indian Pediatrics	110	95.5%	87%	70.5%	98.3%
8	Sirichotiyakul S *et al.* [9]	2004	International Journal of Gynaecology and Obstetrics	446	97.6	72.9	33.6	99.5
9	Tongprasert F *et al*. [10]	2010	Gynaecologic and Obstetric Investigation	477	100%	73%	35%	100%
10	El-Beshlawy A *et al*. [11]	2007	Eastern Mediterranean Health Journal	412	87%	34.1%	47.2%	82.3%
11	Singh SP *et al*. [12]	2008	Singapore Medical Journal	124	97.7	83.3%	95.5%	90.9%
12	Sinha M *et al.* [13]	2006	Indian Journal of Pathology and Microbiology	120	100%	28.7%		
13	Sharma G K *et al.* [14]	2013	International Journal of Pediatric Research	121	93.22%	88.7%	88.7%	93.22%
14	Piplani S *et al*. [15]	2013	Journal of Clinical and Diagnostic Research	100	100	85.47%	66%	100
15	Maheshwari M *et al*. [16]	1999	Indian Pediatrics	1048	91%	95%	55%	99%
16	Suri V *et al.* [17]	2001	Indian Journal of Hematology & Blood Transfusion	100	97.7%	71.7%	51.9%	99%
17	Chakraborthy *et al*. [18]	2012	Iranian Journal of Pathology	500	95%	95.8%	41.02	99.78

REFERENCES

1. Kulkarni, P., Masthi, N. R., Niveditha, S. R., & Suvarna, R. (2013). The Prevalence of the Beta Thalassemia Trait among the Pregnant Women who attended the ANC Clinic in a PHC, by using the NESTROF Test in Bangalore, Karnataka. *Journal of clinical and diagnostic research: JCDR*, *7*(7), 1414.
2. Mehta, B. C., Gandhi, S., Mehta, J. B., & Kamath, P. (1988). Naked eye single tube red cell osmotic fragility test for beta-thalassaemia: population survey. *Indian J Haematol*, *6*, 187-90.
3. Thomas, S., Srivastava, A., Jeyaseelan, L., Dennison, D., & Chandy, M. (1996). NESTROFT as a screening test for the detection of thalassaemia & common haemoglobinopathies--an evaluation against a high performance liquid chromatographic method. *The Indian journal of medical research*, *104*, 194-197.
4. Thool, A. A., Walde, M. S., Shrikhande, A. V., & Talib, V. H. (1998). A simple screening test for the detection of heterozygous beta thalassemia. *Indian journal of pathology & microbiology*, *41*(4), 423-426.
5. Bobhate, S. K., Gaikwad, S. T., & Bhaledrao, T. (2002). NESTROFF as a screening test for detection of Beta-thalassemia trait. *Indian journal of pathology & microbiology*, *45*(3), 265-267.

6. Manglani, M., Lokeshwar, M. R., Vani, V. G., Bhatia, N., & Mhaskar, V. (1997). 'NESTROFT'--an effective screening test for beta thalassemia trait. *Indian pediatrics*, *34*(8), 702-707.
7. Chow, J., Phelan, L., & Bain, B. J. (2005). Evaluation of single- tube osmotic fragility as a screening test for thalassemia. *American journal of hematology*, *79*(3), 198-201.
8. Raghavan, K., Lokeshwar, M. R., Birewar, N., Nigam, V., Manglani, M. V., & Raju, N. B. (1991). Evaluation of naked eye single tube red cell osmotic fragility test in detecting beta-thalassemia trait. *Indian pediatrics*, *28*(5), 469-472.
9. Sirichotiyakul, S., Tantipalakorn, C., Sanguansermsri, T., Wanapirak, C., & Tongsong, T. (2004). Erythrocyte osmotic fragility test for screening of alpha- thalassemia- 1 and beta-thalassemia trait in pregnancy. *International Journal of Gynecology & Obstetrics*, *86*(3), 347-350.
10. Tongprasert, F., Sirichotiyakul, S., Piyamongkol, W., & Tongsong, T. (2010). Sensitivity and specificity of simple erythrocyte osmotic fragility test for screening of alpha-thalassemia-1 and beta-thalassemia trait in pregnant women. *Gynecologic and obstetric investigation*, *69*(4), 217-220.
11. El Beshlawy, A., Kaddah, N., Moustafa, A., Mouktar, G., & Youssry, I. (2007). Screening for beta-thalassaemia carriers in Egypt: significance of the osmotic fragility test. *EMHJ-Eastern Mediterranean Health Journal, 13 (4), 780-786, 2007*.
12. Singh, S. P., & Gupta, S. C. (2008). Effectiveness of red cell osmotic fragility test with varying degrees of saline concentration in detecting beta-thalassaemia trait. *Singapore medical journal*, *49*(10), 823.
13. Sinha, M., Panigrahi, I., Shukla, J., Khanna, A., & Saxena, R. (2006). Spectrum of anemia in pregnant Indian women and importance of antenatal screening. *Indian journal of pathology & microbiology*, *49*(3), 373-375.
14. Sharma, G.K., Sharma, D., Gulati, R.K.(2016). Use of NESTROFT as a screening test for the carriers of thalassemia major. *Int J Pediatr Res. 3*(7):502-6.
15. Piplani, S., Manan, R., Lalit, M., Manjari, M., Bhasin, T., & Bawa, J. (2013). NESTROFT-A Valuable, Cost Effective Screening Test for Beta Thalassemia Trait in North Indian Punjabi Population. *Journal of clinical and diagnostic research: JCDR*, *7*(12), 2784.
16. Maheshwari, M., Arora, S., Kabra, M., & Menon, P. S. N. (1999). Carrier Screening and Prenatal Diagnosis of b-Thalassemia. *Indian Pediatr*, *36*, 1119-25.
17. Suri, V., Sidhu, P., Kanwal, S., Chopra, B.(2001). Evaluation of Naked Eye Single Tube Red Cell Osmotic Fragility Test NESTROFT as a screening test in detection of beta-thalassemia trait. Int J Hematology and Blood transfusion,19: 6-7.
18. Chakrabarti, I., Sinha, S. K., Ghosh, N., & Goswami, B. K. (2012). Beta-Thalassemia Carrier Detection by NESTROFT: An Answer in Rural Scenario?