

Early Detection of Subclinical Diphtheritic Myocarditis by Serum Glutamic Oxaloacetic Transaminase (SGOT) Estimation

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Abstracts

Background & objectives: Diphtheria is endemic in India. Almost 50 - 60% of diphtheria deaths are due to myocarditis. Incidence of subclinical myocarditis is 68%. Serum Glutamic Oxaloacetic Transaminase (SGOT) level can be used as marker of extent of myocardial damage during the course of diphtheria³⁻⁷. We therefore conducted study to detect early myocarditis due to diphtheria by measuring SGOT level. **Methods:** This is a prospective study of 55 patients admitted over a 6 months period in a tertiary care hospital. Patients, from which *Corynebacterium diphtheria* was isolated in throat swab culture, were enrolled in study. The clinical parameters, ECG and SGOT level were estimated on admission. All data were collected and statistical analyzed. **Results:** The SGOT level was high in 65.5% (36/55) of patients. The clinical myocarditis was found in 25.8 % (6/55) patients. In 91.6% (33/36) cases of myocarditis, ECG did not reveal any abnormality, but definite elevations of the enzyme levels were noticed. The mean \pm SD age of children in our study was 6.6 yr \pm 3 SD (range 1-13) years. SGOT level was high in 36 cases out of them 30 cases (83.3%) having duration of illness less than 7 days. Out of 6 expire cases 4 patient (66.7%) having raised SGOT level. We noticed 83.3% (5/6) cases expired due to diphtheritic myocarditis had abnormal leukocyte count (p 0.01). **Interpretation & Conclusion:** We concluded elevated SGOT levels had high sensitivity and a negative predictive value to detect subclinical diphtheritic myocarditis. Abnormal (high or low) total leukocyte count had poor prognostic value.

Key Words: Diphtheritic Myocarditis, Leukocyte count, Serum Glutamic Oxaloacetic Transaminase

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Introduction: Diphtheria is endemic in India. Fatality rate is 5-10%^{1,2}. Almost 50 - 60% of diphtheria deaths are due to myocarditis. Incidence of subclinical myocarditis is 68%. SGOT level can be used as marker of extent of myocardial damage during the course of diphtheria³⁻⁷. In our country especially in our region diphtheria is still major health problem like other developing countries instead of good government DPT vaccination program. We therefore conducted study at tertiary level health set up to detect early myocarditis due to diphtheria by measuring SGOT level.

Material and Methods: This is a prospective study of 55 patients admitted over a 6 months period in a tertiary care hospital. Patients, from which *Corynebacterium diphtheria* was isolated in throat swab culture, were enrolled in study. The ECG and SGOT level were estimated on admission. Parents of each patient gave their written informed consent. The detailed history and examination of enrolled patient were done. The patient with culture negative suspected diphtheria, myocarditis due to other causes or due to congenital anomalies was excluded. All data were collected and statistical analysis was performed using Epi Info 2002. Chi-square test & Fisher's exact test were used for comparing categorical variables. A probability of less than 0.05 was considered statistically significant.

Descriptive statistics (frequency, median, mean & SD) were used for data presentation.

Results: There were confirmed 55 cases of diphtheria hospitalized in paediatric isolation ward. The SGOT level was high in 65.5% (36/55) of patients. It suggests myocardial damage due to diphtheria. On this basis we consider 36 patients of diphtheritic myocarditis in our study. The distribution of SGOT level in present series with mean \pm SD mg/dl was 59.2 \pm 46.1 mg/dl. The clinical myocarditis was found in 25.8 % (6/55) patients. In 91.6% (33/36) cases of myocarditis, ECG did not reveal any abnormality, but definite elevations of the enzyme levels were noticed.

In 36 cases of myocarditis we noticed 11.1% (4/36) had abnormal pulse rate, 2.7% (1/36) had low blood pressure, 11.1% (4/36) had irregular pulse rhythm, and 61% (22/36) had abnormal total leukocyte count.

In 19/55 cases both SGOT & ECG were normal. In 16/55 cases both SGOT & pulse were normal. In 19/55 cases SGOT, blood pressure and pulse rhythm were normal. In 15/55 cases both SGOT & Total Leukocyte Count were normal. The mean \pm SD age of children in our study was 6.6 yr \pm 3 SD (range 1-13) years. There were 40% (22/55) female and 60 % (33/55) male child. SGOT level was

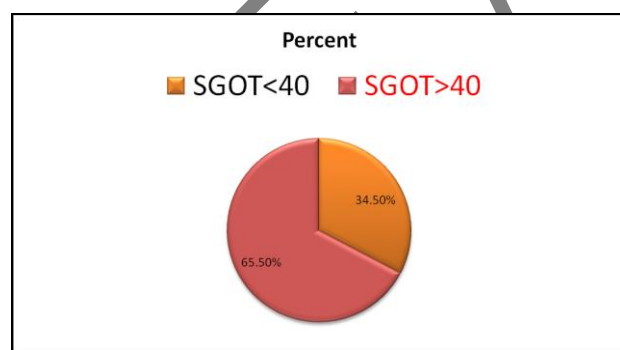
high in 36 cases out of them 30 cases (83.3%) having duration of illness less than 7 days.

All children who died were under 5 year age. Out of 6 expire cases 4 patient (66.7%) having raised SGOT level. There was statistically significant relation of abnormal leukocyte count with mortality due to diphtheritic myocarditis. We noticed 83.3% (5/6) cases expired due to diphtheritic myocarditis had abnormal leukocyte count (p 0.01).

Table 1: Relation of Leukocyte count (TLC) & Mortality in diphtheria.

		Expired	Discharged	P value
TLC	Abnormal	5	13	< 0.01
	Normal	1	36	

Graph 1: SGOT level in present series



Discussion: The SGOT level was high in 65.5% (36/55) of patients of diphtheria in our series. The SGOT is normally present in human serum, skeletal muscle, brain, liver, kidney, testis, and lung. Its highest concentration,

however, is in cardiac muscle. The abnormally high levels are associated with cardiac cellular necrosis. Myocardial impairment in diphtheria develops very early, but is diagnosed in different time depending on the diagnostic technique. Early signs of myocardial involvement are activation of cardiospecific enzymes⁵.

Several investigators noticed that of the cardiac enzyme levels measured, an elevated SGOT level was the best predictor & the presence of troponin T identified additional children with subclinical cardiac damage^{6,7}. We measured SGOT level in our cases. It is low cost marker to detect subclinical myocarditis in developing world. In our series 65.5% patients had subclinical diphtheritic myocarditis. Similarly Boyer et al found subclinical myocarditis in 84%. Series of 100 cases by Kole AK et al noticed myocarditis is most common complication seen in 70 patients and majority of patients (60) were asymptomatic. The distribution of SGOT level in present series with mean \pm SD mg/dl was 59.2 ± 46.1 . The clinical myocarditis was found in 25.8 % (6/55) patients. Similarly various author found clinical myocarditis between 14 to 25%^{2,6,10,11}. The early detection & management diphtheritic myocarditis is corner stone to prevent mortality as most of the

investigators found that the myocarditis was immediate cause of death in diphtheria²⁻⁶.

Serial S.G.O.T. estimations with daily electrocardiograms were carried out by E. Chesler in six cases of severe diphtheria. He observed the transient slight elevation of the S.G.O.T. levels in 2 cases may be due to minimal myocardial damage insufficient to produce clinical and cardiographic abnormalities. Lumio JT et al found cardiac involvement in 25 (28%) of 88 evaluable patients, with a median time from symptom onset to an abnormal ECG of 9 days. Tahernia AC et al found 10 patients had myocarditis with ECG evidence of disturbances in conduction. SGOT levels were considerably higher in that group of patients. Similarly we noticed 91.6% (33/36) cases of myocarditis, ECG did not reveal any abnormality, but definite elevations of the enzyme levels were noticed. This finding could be a pointer to the exercise of caution in the early ambulation and discharge of such patients.

The vital parameters like pulse rate, rhythm, blood pressure as well as total leukocyte counts alone were not good predictor of diphtheritic myocarditis. However normal vital parameters, ECG, and total leukocyte counts all together with normal SGOT level had high negative predictive value as noticed in present series.

The mean \pm SD age of children in our study was 6.6 yr \pm 3 SD (range 1-13) years. There were 40% (22/55) female and 60 % (33/55) male child. In diphtheria, clinical and cardiographic evidence of myocarditis is commonly observed during the second week of the disease^{3,4}. In our series SGOT level was high in 36 cases out of them 30 cases (83.3%) having duration of illness less than 7 days. So it suggests subclinical myocardial involvement in first week. The time course of recovery from diphtheritic myocarditis is longer than has been appreciated previously¹⁵.

All children who died were under 5 year age. Out of 6 expire cases 4 patient (66.7%) having raised SGOT level. We also noticed 83.3% (5/6) cases expired due to diphtheritic myocarditis had abnormal leukocyte count (p 0.01). A total leukocyte count more than 25,000/cumm had a high specificity and positive predictive value while SGOT levels of more than 80 IU/l had high sensitivity and a negative predictive value for fatal outcome in diphtheritic myocarditis¹⁰. An elevated renal and liver function test probably denotes an advanced stage of illness and was seen in all the patients who died thus serving as markers of poor prognosis¹⁶. Treatment of such severe diphtheritic myocarditis cases by temporary insertion of a cardiac pacemaker was only hopeful modality to decrease mortality^{7,17}.

Conclusion: We concluded elevated SGOT levels had high sensitivity and a negative predictive value to detect subclinical diphtheritic myocarditis. That is why we can use it for screening purpose to detect myocarditis. SGOT may prove to be particularly useful cost effective test to detect carditis along with other clinical parameters like Pulse, Blood pressure, Abnormal rhythm and some lab studies like total leukocyte count & ECG. Abnormal (high or low) total leukocyte count had poor prognostic value. Early detection & monitoring cases of Subclinical Diphtheritic myocarditis might reduce morbidity & mortality. For early ambulation decision, SGOT level required further studies.

References:

1. Singh J, Harit AK, Jain DC, Panda RC, Tewari KN, Bhatia R, *et al.* Diphtheria is declining, but continues to kill many children: Analysis of data from a sentinel center in Delhi, 1997. *Epidemiol Infect* 1999;123:209-15.
2. Jayashree M, Shruthi N, Singhi S. Predictors of outcome in patients with diphtheria receiving intensive care. *Indian Pediatr* 2006;43:155-60.
3. Stephen E, Diphtheria. In: Kliegman RM editors. *Nelson textbook of Pediatrics*. 18th ed. Vol 1, New Delhi: Elsevier; 2008, 1155.
4. Khubchandani RP, Diphtheria. In Siddharth NS editor. *API textbook of Medicine*. 7th ed. Mumbai: the association of physicians of India; 2003, 38.
5. N D Iushchuk, P G Filippov. Myocardial involvement in diphtheria patients. *Duodecim*. 1985;101 (21):2056-68
6. Kneen R, Nguyen MD, Solomon T, et al. Clinical features and predictors of diphtheritic cardiomyopathy in Vietnamese children. *Clin Infect Dis* 2004;39:1591-8.
7. Dung N, Kneen R, Kiem N, Bethell DB, Phu NH, Solomon T, et al. Treatment of severe diphtheritic myocarditis by temporary insertion of a cardiac pacemaker. *Clin Infect Dis*. 2002;35:1425-9.
8. Boyer NH, Weinstein L. Diphtheritic myocarditis. *N Engl J Med* 1948;239:913-9.
9. Kole AK, Roy R, Kar SS. Cardiac involvement in diphtheria: Study from a tertiary referral infectious disease hospital. *Ann Trop Med Public Health* 2012;5:302-6.
10. Havaladar, PV; Sankpal MN, Doddannavar RP. (2000). "Diphtheritic myocarditis: clinical and laboratory parameters of prognosis and fatal outcome.". *Annals of Tropical Paediatrics* 20 (3): 209-15.

11. Edward G.S., Diphtheritic myocarditis with permanent heart damage case reports. *Ann Intern med.* 1958; 48(1):146-157.
12. E. Chesler. Serum glutamic oxalacetic transaminase levels in diphtheritic myocarditis: *Br Heart J.* 1958 April; 20(2): 244–248.
13. Lumio JT, Groundstroem KW, Melnick OB, et al. Electrocardiographic abnormalities in patients with diphtheria: a prospective study. *Am J Med* 2004;116:78–83.
14. Tahernia AC. Electrocardiographic abnormalities and serum transaminase levels in diphtheritic myocarditis. *The Journal of Pediatrics.*1969; 75: 1008-14.
15. Bethell DB, Dung NM, Loan HT, Le Minh TN, Dung NQ, Day NP, et al. Prognostic value of electrocardiographic monitoring of patients with severe diphtheria. *Clin Infect Dis.* 1995;20:1259–65.
16. Mithun J Varghese, Sivasubramanian Ramakrishnan, Shyam S Kothari, Akhil Parashar, Rajnish Juneja, and Anita Saxena. Complete heart block due to diphtheritic myocarditis in the present era *Ann Pediatr Cardiol.* 2013 Jan-Jun; 6(1): 34–38.
17. Matisonn RE, Mitha AS, Chesler E. Successful electrical pacing for complete heart block complicating diphtheritic myocarditis. *Br Heart J.* 1976 Apr;38(4):423-6.