

Evaluation of Albustix and Dextrostix for the Estimation of Protein and Glucose in Cerebro-Spinal Fluid

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Summary

Prosser, Robert. (1975). *Nigerian Journal of Paediatrics*, 2 (1), 25. **Evaluation of Albustix and Dextrostix for the Estimation of Protein and Glucose in Cerebro-Spinal Fluid.** The chemical examination of cerebro-spinal fluid using Albustix and Dextrostix is described. The protein and glucose values obtained in cases of meningitis compare favourably with those obtained using routine laboratory techniques. It is therefore recommended that where facilities are not available for routine laboratory estimation of protein and glucose in suspected cases of meningitis, Albustix and Dextrostix may be used.

IN clinical practice, lumbar puncture is routinely performed to confirm or exclude a clinical diagnosis of meningitis or encephalitis. Naked-eye examination of the cerebro-spinal fluid (CSF) may indicate increased cell content, but this method of assessment is often unreliable. Microscopic examination of CSF is, on the other hand, absolutely essential, and this should be carried out as soon after collection of the fluid as possible, to determine the number and type of cells. Depending on the microscopic findings, a gram-stain, bacteriological culture and determination of protein and glucose levels in the fluid are normally requested. It does, however, require conscientiousness and close supervision of the technician to ensure that the microscopy, gram-stain and culture are carried out reliably and in good time.

Sometimes, however, the quantity of CSF available is limited, or where laboratory facilities

are not immediately available, as often happens in most rural hospitals in developing countries, a simple ward test for protein and glucose levels should provide useful information on the correct diagnosis and enable treatment to proceed pending confirmatory evidence at a later stage. The purpose of the present study was to evaluate *Albustix and †Dextrostix (Ames Company) for the estimation of protein and glucose in cerebro-spinal fluid.

Materials and Methods

The study was carried out in the Department of Paediatrics, Ahmadu Bello University, Zaria. Seventy-four specimens of CSF were examined after they had first been handled by the routine chemical pathological laboratory, but without any foreknowledge of the protein and glucose

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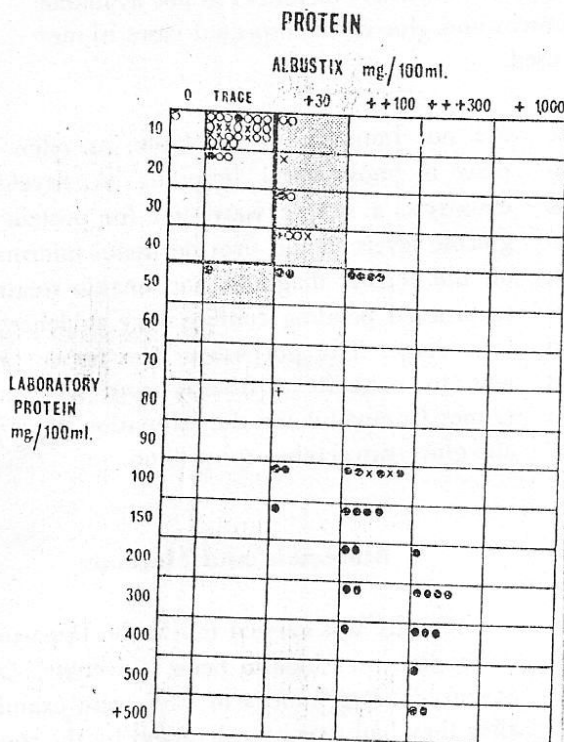
* Albustix (Tetrabromophenol) for protein estimation.

† Dextrostix (glucose oxidase, peroxidase and chromogen indicator) for glucose estimation.

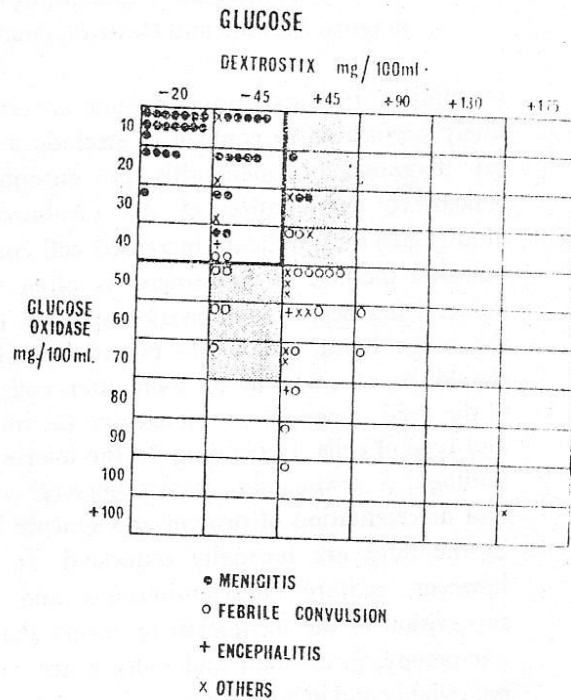
values obtained. A drop of CSF was placed on the sensitive area of the Albustix and Dextrostix strips and read as directed by the manufacturer, i.e., immediately for Albustix, and at exactly one minute for Dextrostix. If no colour change was recorded with Dextrostix, this was read as less than 20 mg/100 ml. of glucose. A combination of any two of the following laboratory findings in the CSF was accepted as confirmation of a clinical diagnosis of meningitis: Glucose < 45 mg/100 ml. (glucose oxidase: normal range 45-80 mg/100 ml.) Protein > 40 mg/100 ml. (Turbimetric—Gallenkamp normal range 10-40 mg/100 ml), white blood cells > 7 cells/mm³; a positive gram stain and culture.

Results

Of the 74 specimens of CSF examined 37 were cases of meningitis; the remaining specimens were obtained from patients with febrile convulsion (25), encephalitis (2) and others (10). The CSF protein and glucose values (Fig.) obtained by the above simple methods compared closely with those obtained from the routine laboratory methods. It will be seen (shaded areas in Fig.) that there is a small disparity (12 glucose and 10 protein values) between the laboratory and the Dextrostix and Albustix values. Considering the 37 cases of pyogenic meningitis, the laboratory protein and Albustix results show a disparity in only two cases, both of which had borderline protein levels.



C. S. F.



- MENINGITIS
- FEBRILE CONVULSION
- + ENCEPHALITIS
- x OTHERS

The Dextrostix colour* change at 45 mg/100 ml was more difficult to assess than was Albustix colour change at 30 mg but again the discrepancy between the glucose oxidase laboratory method and Dextrostix values is small, and concerns three cases in the meningitis group. In one case of pyogenic meningitis the values of protein and glucose by routine laboratory methods were 50 and 19 mg/100 ml respectively, while normal values were obtained for Albustix (trace) and Dextrostix (>45 mg/100 ml). In the present study a high protein (>40 mg/100 ml) and a low glucose level (<45 mg/100 ml) which are characteristic of pyogenic meningitis, were obtained in all but one case using laboratory methods, and in all but 3 cases using the simple methods as described above. A combination of a low glucose and high protein values, using both laboratory and simple ward methods was found in each of three patients with encephalitis, trypanosomiasis and cerebral malaria infection respectively.

Discussion

The use of Albustix for the estimation of CSF protein for clinical purposes has been recommended by several investigators (Beck and Rainier-Pope, 1966; McAlhany, 1966; Kutter 1964; Jacobs, 1959). Kutter (1964) has stated that CSF is even better suited than urine for Albustix test analysis, since the fluid is colourless and its properties are comparatively constant, especially the pH, whereas urine pH and density, as well as the ascorbic acid, uric acid and glutathion contents vary within large limits and may affect phases of the dye reactions. Although the validity of Albustix estimation of protein in CSF has been questioned by Watson (1964), it must be pointed out that his study involved adults with multiple sclerosis and cerebrospinal syphilis, disorders in which a high globulin rather than albumin would normally be expected. Since the results of the present

investigation have substantiated the usefulness of this simple test in paediatric clinical practice, it is suggested that a protein value of 30 gm/100 ml or more obtained by this test should be regarded as abnormal.

Except the report of Ma, *et al.*, (1965) there has been no published work on the use of Dextrostix for CSF glucose estimation. The manufacturers of Dextrostix do not recommend its use for glucose estimation in CSF for the following reasons:

1. CSF has a different rate of penetration through the semi-permeable membrane of Dextrostix compared with blood.
2. It is easy to overwash the strip in the absence of erythrocytes and leach out the colour.
3. The calibration is intended to estimate the reaction in terms of whole blood and so is inapplicable to CSF.

The results of the present study contradict these reservations. In the present study, overwashing of the strip was avoided by simply shaking off the remains of the CSF from the Dextrostix, and reading the result immediately at the end of exactly one minute. McAlhany (1966) found Combistix to yield clinically dependable results in estimating glucose, whilst Beck and Rainier-Pope, (1966) found it unreliable in the presence of a raised protein. Kutter (1964) found Test Tape readings dependable at levels below 20mg/100ml only.

Although the need for CSF glucose estimation has been questioned, there can be no doubt that it is of value either alone or in combination with protein in the diagnosis of meningitis. This applies especially in those few cases without pleocytosis and negative smears (Hall, 1966), in cases of meningitis partially treated prior to hospitalization, and in aseptic meningitis with a high cell count and a predominance of polymorphonuclear cells (Perkins, 1966; Merrell, 1966). None of these conditions were encountered in the present series.

* Since this work was done the Dextrostix scale has been improved in the lower range.

Conclusion

The estimation of CSF protein and glucose in the ward using Albustix and Dextrostix respectively is recommended as a useful aid to the diagnosis of meningitis. If either test alone is abnormal (Albustix 30mg/100ml or higher, and Dextrostix below 45mg/100ml) meningitis is probable, and is certain if both tests are abnormal.

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