

# All Wales Clinical Biochemistry Audit Group

## Trace Element Analyses and Monitoring of Total Parenteral Nutrition

### INTRODUCTION

Trace element measurements are required for detecting suspected deficiencies of essential elements and for the demonstration of suspected toxicity. Uses of these measurements include:

- monitoring patients maintained on total parenteral nutrition (TPN);
- investigation of suspected deficiencies due to malabsorption or excessive losses;
- investigation of certain inborn errors of metabolism, e.g. Wilson's disease;
- monitoring of serum aluminium concentrations in patients with renal failure;
- industrial monitoring for workers exposed to toxic elements, e.g. lead;
- investigation of accidental or intentional poisoning.

As these elements are present in trace amounts, potential sample contamination is a significant problem and great care needs to be taken with sample collection and handling. Sensitive analytical techniques (usually atomic absorption) requiring technical expertise are also needed.

A survey of trace element analyses in Wales was presented at an audit meeting in Jan. 1998. The following standards are recommended in the light of the presentations and discussion at this meeting.

### STANDARDS

#### **1. Sample Collection**

Laboratories should ensure the use of appropriate sample handling procedures and collection containers, which have been shown to be "trace element free" either "in house" or by a specialist laboratory. Laboratories should take particular care with samples for analyses of the following elements: aluminium, chromium, manganese, mercury, nickel and zinc.

#### **2. Reference Ranges and Interpretation**

- a) Laboratories should ensure that valid reference ranges are quoted on reports.
- b) The ranges used should be those of the external laboratory to which samples are referred, if they are not assayed "in house".
- c) Age-related ranges should be used where there are significant differences, in particular for copper, manganese and selenium in children. Laboratories should also be aware of changes in pregnancy, e.g. for copper.
- d) Adequate interpretation and advice should be available on site for tests assayed "in house". Laboratories providing assays for other hospitals should provide an interpretative as well as an analytical service.

### **3. Analytical Requirements for "in House" Assays**

- a) Annual workload for each assay should be sufficient to maintain assay quality and the provision of interpretative expertise and to ensure that the maximum turn round time does not exceed 1 week, except for technically difficult assays. Laboratories with an annual workload of less than 100 requests for a trace element assay should consider referring requests for that analyte to a specialist external laboratory.
- b) The analytical method chosen should be capable of producing accurate and precise results.
- c) Laboratories should ensure that appropriate internal quality control procedures are in place for each assay and choose internal quality control materials which can assess precision at key "clinical decision" levels; precision should not significantly exceed 5% at these levels.
- d) Laboratories should participate in appropriate external quality assurance schemes for each assay and achieve acceptable performance. Participation in the UKEQAS for blood lead (with acceptable performance) and Employment Medical Advisory Service registration is compulsory for laboratories measuring blood lead for occupational health monitoring.
- e) Laboratories should have arrangements in place for back-up via another laboratory in case of instrument or staffing problems necessitating the temporary suspension of service.

### **4. Trace Element Monitoring of Total Parenteral Nutrition (TPN)**

- a) Protocols for regular trace element monitoring of TPN should be established in each hospital where TPN is used, in full consultation with appropriate local clinicians. A separate protocol should be established for children in those hospitals where TPN is used by paediatricians.
- b) The exact pattern of trace element monitoring of TPN is a matter for local agreement, but the minimum recommendations are as follows:
  - plasma zinc before TPN started if deficiency is likely;
  - plasma copper, selenium and zinc at 10-14 days after starting TPN, fortnightly until concentrations are stable and then monthly;
  - blood manganese monthly, but more frequently if cholestasis develops; and
  - serum aluminium monthly in patients with chronic renal failure.
- c) In order that TPN composition can be adjusted without undue delay, it is recommended that laboratories ensure that the maximum turn-round time for provision of plasma copper and zinc results does not exceed 5 days.

### **REFERENCE**

Taylor A. Detection and monitoring of disorders of essential trace elements. Ann Clin Biochem 1996; **33**: 486-510.

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