PathCentre News

Published by the Western Australian Centre for Pathology and Medical Research
Telephone for results 13 PATH (13 7284)

Volume 9, Number 1, May 2003
www.PathCentre.health.wa.gov.au

LEAD LEVELS IN SCHOOL CHILDREN

Several authoritative studies conducted during the 1980's, including a large study on children resident in the lead smelting town of Port Pirie in South Australia, showed that for an increase in blood lead concentration from 10 to 30 µg/dL the estimated reduction in the IQ of children under seven years was in the range of 4 to 5 points, representing an approximate IQ deficit of 4 to 5 percent.

The US Centers for Disease Control [1991] and then the NHMRC in Australia [1993] reduced the level of concern for blood lead from 25 µg/dL to 10 µg/dL, and recommended that public health action should be taken if blood lead levels in children exceeded 10 µg/dL. New evidence suggests there is a measurable IQ decrease with blood lead levels between 1 and 10 µg/dL (NEJM 2003,vol 348, p 1517-26).

1993 Fremantle Lead Study

Following this recommendation, there was special urgency in reaching this level in children aged one to four years because of the adverse effects of lead exposure on intellectual development. In 1993, PathCentre conducted a survey of blood lead levels in 120 pre-school children aged up to six years who resided in the Fremantle area and the results were published in the Journal of Paediatrics and Child Health (1995, vol 31, p 326-331).

2003 Brookdale Community Lead Study

During 2002, a very high air lead level was said to have been sampled from the Forrestdale Primary School which is located approx. 29 km from the GPO and about 1 km from the Brookdale Waste Treatment Plant.

Collecting and assaying blood lead samples at PathCentre.

Concerned residents and their families were offered community wide assessment of blood lead levels to assess lead burdens. During a seven week period from early January to mid February 2003, a total of 558 residents had blood samples taken mainly at PathCentre Armadale for lead analysis at Clinical Biochemisty, PathCentre Nedlands. Children aged up to six years comprised 15% (86/558) of those sampled. The remainder comprised children aged between six and 18 years (47%) and adults aged over 18 years (38%).

Blood lead analysis at PathCentre from 1993 to 2003

During the period 1993 to 2003 blood lead analyses were performed by the same method using furnace atomic absorption spectrometry on a Varian Spectr300 instrument calibrated with porcine blood based lead standards. We are confident that a valid comparison can be made of the data obtained over this 10 year interval. PathCentre is enrolled in a national external blood lead quality assurance program in which recent feedback shows that PathCentre results are close to the program's ideal result indicating no bias for either high or low levels of blood lead.

Comparison of 1993 and 2003 children's lead levels

Table 1 shows the numbers and mean age of the children aged less than six years, mean blood lead values and the proportion who achieved or exceeded

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TABLE 1: Comparison of Traditional and Rapid Method Turn-around Times

	Number of children	Age (mean)	Blood Lead, µg/dL mean, (SD)	Percent of children 10 µg/dL and above
1993 Fremantle	120	3.3 y	7.6 (3.2)	21% (25/120)
2003 Forrestdale	86	3.7 y	3.1 (1.8)	1% (1/86)

the 10 (µg/dL level of concern in the 1993 Fremantle Lead Study and 2003 Brookdale Community Lead Study.

There are several possible reasons for the decline in blood lead levels:

- lead in petrol was progressively phased out over the 10 year period between studies and sales ceased in January 2000.
- the proportion of housing which was built pre-1970 and possibly painted with lead containing paint was higher in Fremantle than the Forrestdale area which was developed more recently.

Conclusion

The decreased lead burden in this vulnerable age group is very encouraging, particularly the decline in the proportion of children with levels greater than 10 µg/dL.

For further information please contact Dr Ric Rossi of Clinical Biochemistry on 9346 2845.

THE USE OF RAPID METHODS IN FOOD MICROBIOLOGY

The PathCentre Food Hygiene Laboratory (FHL) provides microbiology services to many clients including State, Commonwealth and Local Government departments, as well as food manufacturers. The FHL tests a wide variety of foods including dairy products, raw and processed meats, fruit and vegetables, seafood, pre-prepared meals, and animal feed. The laboratory is NATA Biological (ISO 17025) accredited and tests for hygiene indicator organisms as well as foodborne pathogens and their toxins.

Factors affecting the microbiological detection and enumeration of microorganisms in foods include:

- Batch or sample variation in the level of microbiological contamination of food.
- Low numbers of microorganisms of interest.
- Complex food structure and components may interfere with the analysis.
- The presence of sub-lethally damaged microorganisms as a result of the food preparation process; the damaged organisms may recover prior to the addition of selective pressure.

Standards Validation and Verification

NATA Biological accreditation guidelines requires food and water testing microbiology laboratories to use methods published by authorities such as Standards Australia, International Standards Organisation (ISO), and the American Public Health Association (APHA).

These “standard methods” rely on traditional cultural techniques that tend to be time consuming, labour intensive, and costly. Techniques commonly employed include pour plates, spread plates, multiple tube dilution techniques (Most Probable Number – MPN, Triplicate Tubes) and selective enrichment and plating.

NATA does allow for the use of newer technologies provided they have been validated against standard methods.

Rapid Methods

Over the past five years the FHL has introduced a number of new rapid methods to reduce the turn around time and cost of testing. These include spiral plating, chromogenic media, and Polymerase Chain Reaction (PCR) for the detection of bacterial pathogens (Table 2).

Spiral Plating

This technique uses a spiral plater to rotate the agar plate inoculated with a liquid sample applied at a constant rate across the plate. With a single plate, and a 1/10 dilution of a food sample, it is possible to count between 4,000 and 4,000,000 organisms per gram of food.

To produce a similar count by traditional pour plate methods, a total of four dilutions and six agar plates would be used. The FHL routinely uses this method to determine aerobic and anaerobic plate counts on food samples. Test results are reported 24 hours earlier and the price of the test is reduced.

Chromogenic Methods

Chromogenic media contains substrates which form brightly coloured compounds in the presence of specific enzymes. The FHL has introduced chromogenic media for the detection of coliforms and *E.coli* in foods. By using this agar the number of *E.coli* present in a food sample can now be enumerated in 24 hours and coliforms in 48 hours.

PCR detection of Pathogens

The FHL has introduced a number of PCR protocols for the Detection of pathogens including, *Salmonella, Listeria monocytogenes, E.coli*O157:H7 and Shiga-like toxin producing *E.coli* (SLTEC).

Whilst the testing of foods by PCR is a little more costly than traditional methods, approximately 20% more, PCR methods reduce the turn around times for the detection of pathogens by 50 to 90%.

Summary

With the often competing pressures of increased food safety and the need for food manufacturers to reduce holding times prior to release, the continued introduction (and acceptance) of rapid methods in food microbiology is assured. Whilst PCR and chromogenic media are now in use, research is being carried out now which will see DNA microarrays and biosensors further revolutionising food microbiology in the future.

The PathCentre Food Hygiene Laboratory will continue to develop new methods for rapid food microbiology testing.

Further information please contact Mr Steve Munyard or Dr Tim Inglis from Clinical Microbiology on 9346 2137 or 9346 3461.

TABLE 2: Comparison of Traditional and Rapid Method Turn-around Times

Test	Traditional Methods	Turn-around Time	Rapid Method	Turn-around Time
Aerobic Plate Count	Pour Plate	3 days	Spiral Plate	2 days
Coliforms	MPN	3 days	Chromogenic	2 days
E.coli (Count)	MPN	6 days	Chromogenic	1 day
Salmonella	Enrichment	4 - 7 days	PCR	1 day
Listeria monocytogenes	Enrichment	5 - 7 days	PCR	2 days
E.coli O157:H7	Enrichment	5 - 7 days	PCR	1 day
SLTEC	Enrichment	7 - 10 days	PCR	3 days

Profile

DR PETER HOLLINGSWORTH

Dr Peter Hollingsworth heads the Section of Autoimmunity and Immunopathology at PathCentre and is Head of The Department of Clinical Immunology at Sir Charles Gairdner Hospital. He is a Clinical Senior Lecturer in Pathology at the University of Western Australia and a former Examiner in Immunopathology for the Royal College of Pathologists of Australasia.

After graduating from the University of Western Australia he was appointed Medical Officer in the Nuffield Department of Medicine in Oxford where he gained a Doctorate in Immunology. He subsequently specialised in Rheumatology, Immunology and Immunopathology.

He retains a strong commitment to integrating clinical and laboratory services and to teaching and research in public medicine. His clinical practice is

Dr Peter Hollingsworth

focused on systemic autoimmunue diseases including SLE, vasculitis, allergy, immune deficiency and he maintains an interest and practice in HIV infection.

He is responsible for autoantibody testing at PathCentre including provision of the service to Royal Perth Hospital.

He is committed to refining the predictive and prognostic value of autoantibodies and to research in autoimmune disease. Dr Hollingsworth is keen to discuss diagnostic problems and immunological test selection with clinicians or to see patients in consultation. He can be contacted on 9346 2833 or 0417 977 468.

SUMMER FORENSIC SYMPOSIUM 2003

The Summer Forensic Symposium 2003 convened by PathCentre was held at the Nedlands campus 6th - 10th January 2003.

The symposium was specifically designed for professionals in the fields of forensic medicine and science and involved many aspects of forensic investigation.

The participants were from a diverse range of organisations including the Western Australian Police Services, the Department of Public Prosecutions, the Coronial Investigation Services, the Sexual Assault Referral Centre, the Ministry of Justice, the Chemistry Centre of Western Australia and Forensic Biology and Pathology Services at PathCentre.

The five-day symposium attended by 54 registrants comprised a comprehensive series of relevant lectures and interactive workshops presented by experts from within and outside PathCentre.

Most importantly, the Convenor of the Symposium, Dr Clive Cooke, Chief Forensic Pathologist at PathCentre,

succeeded in designing a programme containing applicable knowledge which was enhanced by reviews of actual cases. The programme contained topics on time of death estimation, injury interpretation, ballistics, bloodstain evidence interpretation, forensic biology and DNA profiling, forensic anthropology, forensic odontology, forensic analytical chemistry and disaster victim identification. The coronial system of death investigation was highlighted in individual sessions for deaths resulting from asphyxia, blunt and sharp force injuries, fatal fire, drowning, electrocution and alcohol and drug abuse.

Summer Forensic Symposium 2003

The symposium provided an ideal forum for interaction between members of the law enforcement and legal disciplines with medical and scientific forensic professionals thereby increasing the awareness of the complex nature of forensic analyses and investigations.

NORMAL SERUM FREE THYROXINE AND SUPPRESSED TSH

The causes of normal serum free thyroxine (FT4) and a suppressed TSH are:

- Excessive thyroid hormone treatment for hypothyroidism
- Anti-thyroid treatment for hyperthyroidism
- First trimester of pregnancy
- High dose glucocorticoids and dopamine
- Non-thyroidal illness
- T3 thyrotoxicosis
- Subclinical or mild hyperthyroidism

The usual result in a patient with hyperthyroidism is a high FT4 and suppressed TSH. However a normal FT4 and suppressed TSH is not an unusual finding. By far the most common cause of such a result is the hypothyroid patient being treated with an excessive dose of thyroxine. Conventionally, a serum TSH concentration in the reference range is taken to indicate adequate thyroxine replacement.

Some patients appear to benefit symptomatically if the dose of thyroxine is titrated so that TSH is in the lower half of the reference interval; others appear to need to take a slightly excessive dose of thyroxine (which results in suppressed TSH) in order to feel well. In the latter case, the symptomatic benefit must be traded off against a potential increased risk of osteoporosis and heart disease with long term treatment. In all cases, thyroid function tests should be done at least 6 - 8 weeks after initiating or changing treatment.

In the initial period of treatment of hyperthyroidism, the patient may be clinically euthyroid and FT4 and FT3 (triiodothyronine) may be normal despite the TSH being suppressed. The thyrotrope secretion of TSH may take months to recover from the preceding prolonged inhibition due to high circulating thyroid hormones. In the early phase the biochemical monitoring of anti-thyroid treatment is by measurement of FT4 and FT3. Only later, when the thyrotropes have recovered from suppresssion, may TSH be used to monitor anti-thyroid treatment.

In the first trimester of pregnancy some individuals may have a suppressed TSH and normal FT4 and are clinically euthyroid. A probable explanation for this is that the high circulating levels of human chorionic gonadotropin, which has TSH-like activity, stimulates the thyroid to secrete thyroid hormones and this inhibits TSH secretion from the pituitary gland.

Other causes of normal FT4 and suppressed TSH include treatment with high dose glucocorticoids or dopamine and non-thyroidal illness such as in severe disease states. This is usually in hospitalised patients.

If the above causes have been excluded, the most likely diagnoses are T3 thyrotoxicosis (elevated FT3, normal FT4, suppressed TSH) or subclinical/mild hyperthyroidism. The term “subclinical hyperthyroidism” has traditionally been applied to patients with normal FT4, normal FT3 and suppressed TSH, but may be inappropriate, as some patients have hyperthyroid symptoms, and there is an increased risk of atrial fibrillation, cardiovascular events and osteoporosis.

The most common cause is an underlying toxic multinodular goitre. It is controversial whether such patients are best served by treatment or simply observation and repeat thyroid function tests in 6-12 months.

In all cases, clinical details are absolutely essential for correct interpretation of the results, so be sure to supply the history and clinical details whenever thyroid function tests are ordered.

For further information contact Dr Chotoo Bhagat, Clinical Director, Clinical Biochemistry, PathCentre on 9346 2670 or Dr John Walsh, Endocrinologist, SCGH on 9346 3333.

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