The army laboratory response

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At the request of the Indonesian government, the 1st Health Support Battalion was given the task of providing immediate medical support as part of the Australian government program of humanitarian relief following the tsunami that devastated areas of the Indonesian island of Sumatra on 26 December 2004.

In the tsunami devastated provincial capital of Banda Aceh, the laboratory team personnel set up a medical laboratory at a field hospital operated jointly by medical personnel of the Australian defence force and the New Zealand defence force. It was known as the ANZAC field hospital.

The laboratory team provided operational level clinical pathology testing and advice to clinicians and medical specialists of the ANZAC field hospital and all surrounding areas of Banda Aceh. The team offered clinical testing and advice in biochemistry, haematology, serology, bacteriology, parasitology and immunohaematology. The volume of tests requested was consistently high, in support of 3700 medical treatments offered by the ANZAC hospital. The laboratory team performed its final operation on 20 February 2005 before handover of its function to the Indonesian civilian management supported by the Australian Agency for International Development.

This article will describe the concepts of mobile laboratory services and highlight the important role of field medical laboratory science in the Banda Aceh humanitarian relief operation.

Following the 2004 Boxing Day tsunami, the laboratory team proved to be an important part of ANZAC field hospital's humanitarian relief effort to Indonesia. Initially, the team aimed to provide additional diagnostic services capability for at least 30 days. The laboratory was manned by two staff instead of the normal three; one medical scientist and one medical technician. During this operation, the laboratory team of the hospital was prepared to perform:

- Basic biochemistry analysis, including emergency blood gases.
- Haematology analysis.
- Qualitative serology analysis, including Dengue virus serology.
- All aspects of routine bacteriology.
- Parasitology, including malariology.
- Immunohaematology, including emergency donor collection for local patients.

It was quite fortunate that all the laboratory staff deployed to Banda Aceh had previously undertaken 6 months of deployment experience in the Solomon Islands. There, the laboratory team provided diagnostic services to personnel from five troop-contributing nations. The experience and lessons learnt had a major input into the Banda Aceh deployment. Most of the test kits were thereafter adjusted to reflect the challenging nature of current humanitarian land-based operations.

It was assumed from the start that most of the buildings had been destroyed, either by earthquake or flooding. Therefore, the team deployed with self-contained mobile accommodation with all weather-capability integrated with air-conditioning. The shelter only required four persons to set up (within 2 hours) and accommodated all the laboratory equipment. Fortunately, the shelter was not used, since it was decided to set up the hospital inside the existing medical facilities.

Equipment, specifically for deployments, is maintained ready at the 1st Health Support Battalion in Sydney. It has been subjected to safety tests. All analysers have been well maintained and enrolled in specific external quality assurance programs to monitor the quality of results.

One of the most common questions that the laboratory team was asked was the appropriateness of the selection of test kits. The selection was based on previous deployment experience, mainly from the Solomon Islands. During the capacity planning and control phase, it was determined that food-borne and water-borne diseases would be the main issues of concern. It was decided that the order quantity of the relevant disease test kits would only be limited by the storage space available. It was noted that some of these demands exceeded the supplier's inventory.

The overall capacity planning, control phase and inventory demand phase was achieved in less than 3 hours. The following sections will highlight some of the key aspects behind the planning process and a list of the suppliers is available for reference (Table 1).

Aerial view of teaching hospital RSUVA in Banda Aceh (photo Norbert Ryan).

Table 1. Test kits and suppliers.

	Serial & Test kit	Supplier
1	Determine™ HIV	Abbott Diagnostics Division www.abbottlabs.com.au
2	Determine™ HBsAg	Abbott Diagnostics Division www.abbottlabs.com.au
3	NOW® Filariasis	Laboratory Diagnostics Tel: 1800 023 623
4	Dryspot™ E. coli O157	Oxoid Australia www.oxoid.com.au
5	Dryspot™ Seroscreen E. coli non-O157	Oxoid Australia www.oxoid.com.au
6	Dryspot™ Campylobacter Test	Oxoid Australia www.oxoid.com.au
7	Dryspot™ Pneumo	Oxoid Australia www.oxoid.com.au
8	Dryspot™ Streptococcal Grouping Kit	Oxoid Australia www.oxoid.com.au
9	Dryspot™ Staphytech Plus	Oxoid Australia www.oxoid.com.au
10	Para-Pak® EcoStain	Oxoid Australia www.oxoid.com.au
11	C Difficile Toxin A Test	Oxoid Australia www.oxoid.com.au
12	Xpect™ Giardia and Cryptosporidium Test Kit	Oxoid Australia www.oxoid.com.au
13	VIKIA® Rota-Adeno	bioMérieux Australia www.biomerieux.com
14	TROP T Sensitive	Roche Diagnostics Australia www.rochediagnostics.com.au
15	HCV-SPOT	Diagnostic Technology www.diagnostictechnology.com.au
16	RIDASCREEN® Norwalk-Like Virus	Laboratory Diagnostics Tel: 1800 023 623
17	Serodia® HTLV-I	Bayer Australia www.bayer.com.au
18	Dengue Virus Duo Cassette	Panbio www.panbio.com
19	Pastorex® Meningitis	Bio-Rad Laboratories www.bio-rad.com

Key aspects

Biochemistry

The laboratory team deployed the Reflotron® biochemistry analyser (Roche Diagnostics Australia). The main advantage of this analyser is the stability of the dry chemistry reagents which do not require refrigeration.

An i-STAT® portable clinical analyser was used to provide biochemistry and blood gases analysis. The advantage of the i-STAT® system is the short turnaround time for analysis. The TROP T Sensitive was used for acute myocardiac infarction assessment.

Haematology

A MICROS 60 haematology analyser (In Vitro Technologies) was deployed. The analyser itself is a compact module and able to provide reliable haemoglobin measurement, thrombocyte count and leucocyte count.

Serology

Test kits of human immunodeficiency virus (Type 1 and 2) (Determine™ HIV), hepatitis B virus (Determine™ HBsAg) and hepatitis C virus (HCV-SPOT) were selected for two purposes. Firstly, for the status of local patients and, secondly, for potential needle-stick injuries for our unit members and other humanitarian aid workers.

Dengue virus screening cassettes were requested. These newly released cassettes had been selected from the Panbio because of the benefits of room temperature storage.

The NOW® Filariasis, an immunodiagnostic test for the detection of *Wuchereria bancrofti* antigen, was ordered. The cards can be stored at room temperature.

The Rapid TB, an immunochromatographic test for the detection of immunoglobulin to *Mycobacterium tuberculosis* was requested. Unfortunately, these newly released test kits did not reach us in time to be of use.

The SERODIA® HTLV-I, a passive particle-agglutination test for detection of immunoglobulin to human T-lymphotropic virus type I, was requested to meet the Australian guidelines for testing of donor blood.

Mobile laboratory supplies.

Bacteriology

We had limited information on the likely demand for bacteriological investigations. However, we had prepared ourselves for the majority of food-borne and water-borne illness investigations. It is known that more morbidity and mortality can occur from these causes than tuberculosis or malaria in a disaster area. Therefore, we had extra reagents to cater for food-borne disease outbreaks. Extra loads of agar plates were ordered for the detection of Campylobacter, Salmonella, Shigella, Vibrio and *Yersinia enterocolitica*. Fortunately, a major outbreak did not occur, therefore most of the thiosulfate citrate bile salt sucrose (TCBS) medium expired, unused.

The Pastorex® Meningitis, an agglutination test for the detection of the main meningitis causative organism, was especially selected due to the ease of use and a wide detection range.

Virology

Gastroenteritis viruses are important human pathogens. In particular, the Caliciviruses (Norwalk-like viruses), were a major concern because of potential rapid spread around refugee camps. It is known that Caliciviruses have an impact on military operations and are associated with contaminated drinking water. The RIDASCREEN® Norwalk-walk Virus was selected for the detection of this virus. This particular test kit is the only kit which can be read visually; therefore this test forms part of the all stool specimens routine testing.

The VIKIA® Rota-Adeno test kit was selected because of the benefits of room temperature storage and short turn-around time for results. This test forms part of the all stool specimens routine testing.

The C Difficile Toxin A Test, a rapid immunoassay for the direct qualitative detection of *Clostridium difficile* toxin A, was selected due to the simple filtration process and method of interpretation.

Parasitology

The Para-Pak® EcoStain was stain selected for the operation. The stain is composed of environmentally-friendly components; therefore this stain can be deposited safely with other liquid waste.

Immunohaematology

The DiaMed System was used for all immunohaematology procedures. This method has the advantages of ease of use and easy interpretation of results.

Local support

The initial support provided by the laboratory team could not have been provided by local agencies. However, the team had difficulties in providing adequate diagnostics support to the paediatric population. Firstly, the staff had had limited clinical experience with paediatric patients and, secondly, limited paediatric collection devices were available from the defence inventory, hence great difficulties in blood collection were encountered.

At the final phase of this operation, the laboratory team staff worked diplomatically with medical staff at the local hospital in rebuilding and retraining. The laboratory team staff was tasked to support the training of the local haematology staff in performing basic microbiology; all microbiology staff had become casualties on the day of the tsunami.

Conclusion

The value of the laboratory team's assistance in Indonesia has four important elements which contributed to the success. The first was the rapid deployment of the team. The second was the selection of seasoned and competent staff. The third was the availability of functional field equipment and the fourth was the sensitivity in identifying the correct time to handover.

In the total 2 months of operation, more tests were performed than in the 6 months of deployment to the Solomon Islands and the workload output exceeded that experienced when the unit was deployed in East Timor in 2000. This was partly because of a different pattern of casualty load; however, it serves to emphasise how effective this small team had been.

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