

Issue #005

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Interesting Facts

32,396

The number of people notified with HIV in Australia and New Zealand since 1985

11,446

The number of people diagnosed with AIDS in Australia and New Zealand since 1985

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Welcome to the July edition of ePathWay

This month's articles include a look at HIV and AIDS 30 years on, why blood must be crossmatched before a transfusion, the painstaking work of forensic pathologists, and the difficulties of diagnosis without a laboratory to back it up.

Professor Peter McMinn, who is interviewed in this edition, is in Timor-Leste grappling with the problem of working with limited laboratory facilities, and looking for solutions. He is part of the unsung army of pathologists whose skill and quiet dedication make a difference to many lives both here and abroad.

We welcome your feedback about the stories covered in ePathWay, and hope you find it an invaluable way of being kept up to date about pathology in Australasia.

HIV and AIDS: 30 years on it's still a work in progress



33 million

The number of people globally living with HIV/AIDS at present

Important Message



has an important message for you. Click to see the message! It's been 30 years since HIV and AIDS burst into our lives and embedded themselves into our society. Amid the hysteria and anxiety that followed, teams of health professionals - including pathologists - quietly stepped up to the challenge of finding ways to diagnose, treat and hopefully control this new threat to public health. And 30 years on it's still a work in progress.

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The perfect crossmatch

Anyone who works in a blood bank has probably heard a vampire joke or two. But blood transfusions are serious business. All blood may look the same but it actually contains components that vary according to a person's genetics. This means that not every blood group gets along with each other and their 'arguments' can be fatal. That's why blood compatibility must be determined before every blood transfusion.



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What a difference a laboratory makes



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Solving puzzles all in a day's work for forensic pathologists

The job description for forensic pathologists should include 'must like solving complex puzzles'. But these puzzles are not for the faint hearted. Part of their role involves using a process called Disaster Victim Identification (DVI) to positively identify people who have lost their lives, often in traumatic circumstances, and there is little room for error.



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HIV and AIDS: 30 years on it's still a work in progress



It's been 30 years since HIV and AIDS burst into our lives and embedded themselves into our society. Amid the hysteria and anxiety that followed, teams of health professionals - including pathologists - quietly stepped up to the challenge of finding ways to diagnose, treat and hopefully control this new threat to public health. And 30 years on it's still a work in progress.

Before we go much further let's get the terminology right. HIV stands for 'human immunodeficiency virus', and AIDS stands for 'acquired immune deficiency syndrome'. You don't actually 'get' AIDS. You become infected with HIV which might develop into AIDS. This happens when HIV has weakened the body's immune system and other viruses, parasites, fungi and bacteria that don't usually cause problems start making the person very sick. According to Dr Roger Garsia, an immunopathologist and Head of the HIV service and Division of Medicine at Sydney's RPAH, if left untreated HIV leads to AIDS in more than 95 percent of cases.

"Some people are able to control the HIV better than others," says Dr Garsia. "But you need to

ePathWay - Monitoring diabetic health: it's more than a daily fingerprick

remember changes in the presence of other co-infections means it is not a static field. Changes in the virus and the response to it are happening all the time."

Dr Garsia says there has been a dramatic impact from treatments and interventions developed over the past 30 years. For example, in 1987 there was one pill, now there are 20 pills from which to construct combination regimens, and quiet breakthroughs are happening all the time. These include increasing scientific knowledge about HIV, tweaking combination antiretroviral therapy (cART) to increase life expectancy and quality of life, advances in clinical research and practice, and educating the population about preventative measures to avoid infection.

"Pathologists also play a key role in managing HIV through serology, virology and immunology tests," says Dr Garsia. "At the research end there is a huge amount being done by pathologists looking at the virus, the way it is changing and the effect of strategies to control it."

While reliable blood tests to detect HIV have been available since 1985, new generation blood tests can now start to detect HIV as early as two weeks after infection (reduced from three months), while other tests provide essential guidance about managing its progress. These tests measure how quickly the virus is multiplying and keep track of the immune system's health. This year's Federal Budget also included reimbursement for the HIV drug resistance genotype test, which detects antiviral drug resistance, as a funded Medicare item.

Dr Garsia says Australia is a world leader in HIV research and treatment. In fact, life expectancy after an HIV diagnosis has increased from less than two years to an almost normal lifespan if it is detected early. In countries such as Sub-Saharan Africa the news is not as bright. About two-thirds of the 33 million people worldwide infected with HIV live there and controlling the virus is challenging due to a lack of drugs, services and information, and the shortage of testing facilities. This is probably the reason why even minor breakthroughs in the quest to developing a vaccine are greeted with such fanfare. As yet, no effective vaccine has been found.

Despite the excitement in the media of 'huge' breakthroughs in HIV and AIDS research that happen from time to time, Dr Garsia says it is the quiet day-to-day work, building on years of clinical trials of new therapies and combinations of drugs, that is making the difference in controlling HIV developing to AIDS. In the background is the unsung army of pathologists and scientists who are keeping tabs on this infamous virus on a daily basis.

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The perfect crossmatch



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"Pre-transfusion testing involves a group of blood tests including a physical or electronic crossmatch to check if the donor and recipient's blood are compatible," explains Dr Erica Wood, haematologist and transfusion specialist, and President of the Australian and New Zealand Society of Blood Transfusion. "These include a group and screen to determine the patient's blood group, and to also identify any possible red cell antibodies in the patient that might react with transfused red blood cells."

The antibodies develop in response to antigens (found on the surface of red blood cells) initiating an immune response. These antigens also determine a person's blood group. There are about 30 blood group systems, and hundreds more antigens also described but not included in these systems, but the most significant in transfusion practice are the ABO and Rhesus (Rh) blood systems.

Austrian scientist Professor Karl Landsteiner identified the ABO blood system in 1901. He discovered that reactions between red cell antigens and antibodies cause the red cells to clump together resulting in adverse reactions in transfusion recipients. Professor Landsteiner also found four blood groups based on the presence (or absence) of two specific antigens known as A and B. This discovery led to the system of grouping blood called the ABO system.

The Rhesus factor was discovered in 1939 from research involving the rhesus monkey. The Rh system has multiple antigens, but the most important is RhD. This discovery meant that, regardless of the ABO blood groups, people with a specific D antigen on the surface of their red blood cells were grouped as Rh positive, and those without the D antigen were grouped as Rh negative. This is where the '+' or '-' symbols came from. The Rhesus factor is particularly important during childbirth as the baby is at risk of haemolytic disease of the newborn (HDN) if an Rh-negative mother and an Rh-positive father conceive an Rh-positive baby.

"HDN can result in jaundice and even more serious complications and used to be a major cause of illness, and even death, for babies of Rh-negative mothers," says Dr Wood. "It is largely preventable these days due to the routine use of RhD immunoglobulin during pregnancy which is a precious therapy made from donated blood."

Dr Wood says that everyone has a particular blood type which is inherited from their parents, and this combination of genes determine which antigens are on the surface of the person's red blood cells.

"The red blood cell membrane is very sophisticated and complex," she says. "We know what some functions of these blood group antigens are, but there is still a lot of research to do."

While research into this complex field is continuing, it's important to note that checking blood compatibility before a blood transfusion is serious business. And it's comforting to know that this process is overseen by pathologists who are skilled at finding the perfect crossmatch.

Why is donating blood important?

"Donating blood is a life saving gift," says Dr Wood. "There are no blood substitutes available for routine use so we rely on members of the community giving up their time to donate blood."

Dr Wood says that donations are needed all year round because blood products have a 'use by' date.

"While some blood components can be frozen for long-term storage, other specialised products like platelets have a shelf life of just five days, and red cells can only be stored for up to 42 days," she says. "It is not something that can be donated once and kept forever. It's a living blood bank."

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What a difference a laboratory makes



It can be as basic as finding out why a child has diarrhoea. In Australia and New Zealand it's simple. Collect a specimen, send it to the local laboratory, and within days the offending pathogen is identified by pathologists and the course of treatment mapped out thanks to the pathology report. But if you live in a country with limited or no laboratory facilities, this course of action is often not available. What happens next?

"In this situation doctors are forced to make clinical diagnoses which are often inaccurate," explains Professor Peter McMinn, clinical microbiologist at the Royal Prince Alfred Hospital. "The only way to determine the correct course of action is by laboratory testing to confirm the cause of diarrhoea."

Professor McMinn says when there is no laboratory available to test for infectious diseases, doctors work out the most likely causes of the infection and then prescribe a broad spectrum antibiotic that will target two or three likely pathogens.

"Laboratory testing provides accurate information on the cause of the infection and the most appropriate antibiotic treatment, allowing treatment to be narrowed to focus on the actual cause and avoids exposure of the patient, and pathogens, to unnecessary antibiotics," says Professor McMinn. "This, in turn, reduces the likelihood of antibiotic resistance developing which is becoming a major ePathWay - Earthquake leaves one pathology lab standing in Christchurch

public health issue globally as pathogens develop resistance to many antibiotics."

If there is a laboratory available then collection and storage issues are common. For example, if a specimen is collected in a small community health clinic or by the patient, it can take several days to reach the laboratory, and the specimen might not have been stored correctly along the way. By the time it gets to the lab it's often in a less than optimal condition for testing. This is where pathologists such as Professor McMinn are stepping in to help find alternative solutions.

"With the development of simple test kits that can be used by staff with limited training, testing is increasingly being done at the point of patient contact including quite remote settings," says Professor McMinn. "Although these tests frequently do not perform as well as tests performed in laboratories, they are a compromise to ensure that accurate diagnoses, and therefore treatment, can be provided at the point of patient contact. This is important because it can often prove difficult to find the patient again when a test result is returned from a laboratory."

Complicated testing procedures that require a high level of expertise are often not available in resource-limited countries. In these cases, doctors have to rely on clinical judgment and a diagnosis is much more difficult to make. In some instances specimens are sent overseas for testing, but this inevitably leads to delays in diagnosis.

Doctors in resource-limited countries know that making a diagnosis without supporting laboratory tests is very difficult. According to Professor McMinn, laboratory medicine costs approximately five percent of the total health budget but is essential in seventy-five percent of diagnoses (based on UK data). When there isn't a pathology report to point to the right treatment path, it comes down to making empirical decisions and hoping they are right. That's the difference a laboratory can make.

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Solving puzzles all in a day's work for forensic pathologists



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"It is really important to have people properly identified and it is easy to make a mistake," explains Dr Chris Lawrence, Director of Statewide Forensic Medical Services at the Royal Hobart Hospital. "Sometimes the DVI process takes time."

Dr Lawrence says the DVI process is a team effort usually led by the police. Other team members include forensic pathologists, dentists, technicians, photographers and data entry operators. Their job, as Dr Lawrence points out, is to clean up after the live people have been rescued. But where do they start?

"The main identifiers for DVI are dental records, DNA and fingerprints," says Dr Lawrence. "We also use secondary sources such as scars from previous operations, the person's likely age and stature, jewellery, clothing and other personal items."

Dr Lawrence says dental records are quick to match and can also help determine a person's age. Fingerprints are also straightforward to process, while DNA matching takes about 24 hours and can be a tricky process.

"We often go to where people lived and get finger prints and DNA samples, but we need to be careful," explains Dr Lawrence. "Family members often have the same DNA so this can be difficult if people from the same family are being identified."

Dr Lawrence says the recent Victorian bushfires and previous terrorist bombing disasters have highlighted the need for forensic anthropologists in the teams. This is particularly important when dealing with badly burned or fragmented remains to help identify suicide bombers or distinguish between human and animal remains.

While Australia's forensic teams can handle most domestic situations such as homicides and bushfires, large-scale natural disasters require an internationally coordinated effort. This is because there are more people to be identified, and most countries don't have enough forensic pathologists to handle this work on their own.

"After the 2004 Boxing Day tsunami in Thailand, it took about a year to identify the victims, and the work in these cases is also challenging because we are working amid damaged infrastructure," explains Dr Lawrence. "We have also changed the way we do things with DVI and suicide bombers. We used to deal with the intact bodies first then move on to the body parts. However, we now recognise that the small body parts of the suicide bomber are central to working out what happened."

The DVI process is certainly not for the faint hearted and is often carried out amid chaos and grief. It can be painstakingly slow and involve many complexities, but positively identifying victims is an essential process that provides closure for grieving relatives.

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