



JULY 2017 | PUBLISHED BY RCPA

ISSUE #071

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- Expert ironing out issues around measuring iron levels in the body
- Donor Questionnaires provide vital information to blood services
- Cats can share more than just their love around
- Breath and blood alcohol have a volatile relationship

INTERESTING FACTS

Two thirds

The proportion of the body's iron contained in red blood cells.

15%

The proportion of the body's iron contained in muscle and cellular enzymes.

Up to 400

The number of iron atoms that can be stored in an intra-cellular protein called ferritin.

Source: Common Sense Pathology

Welcome to the July 2017 edition of ePathWay

Iron deficiency (ID) is a very common problem, but it's wrong to assume the cause is always benign. Serious health problems cause ID as well. The clinical presentation of the patient should therefore be considered to ensure the most appropriate test to measure iron is used. We asked an expert to explain why.

We also check out how:

- blood services squeeze the maximum benefit out of every blood donation (as a nod to last month's World Blood Donor Day)
- cats can spread more than their love around
- alcohol can be accurately measured in the breath.

As always, check in to our [Facebook](#) page, or review the latest tweets from our CEO Dr Debra Graves ([@DebraJGraves](#)) or the College ([@PathologyRCPA](#)), to keep up to date with the RCPA and new about pathology.

Expert ironing out issues around measuring iron levels in the body

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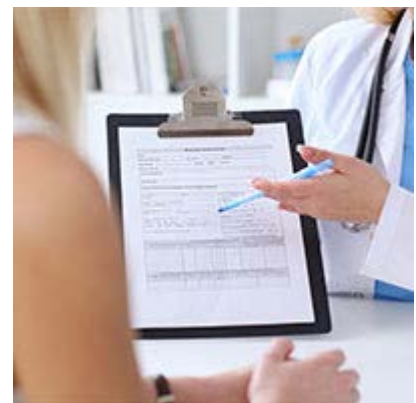


Iron deficiency (ID) is a very common problem that is often caused by a poor iron intake combined with normal blood loss. Despite this, serious health problems can also cause ID. An inherited tendency to over-absorb iron, a disorder that is potentially fatal, is fairly common as well. Iron is essential for life but it's also a potentially toxic element with a dark side, and accurately measuring the amount of it in the body is very important.

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Donor Questionnaires provide vital information to blood services

Blood donations are precious, which is why there are processes to ensure maximum benefit from every donation. Two experts from the Australian Red Cross Blood Service explained how they determine whether you can donate blood, and then control how it is used.



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Cats can share more than just their love around

You won't find any 'crazy cat lady' jokes in this article because cat zoonosis is a serious matter. It is an infection that can be transmitted to humans from domesticated cats (*Felis catus*), sometimes in the most surprising ways.



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Breath and blood alcohol have a volatile relationship

That alcohol can be measured by a blood test is generally understood. It's not so obvious that it can be measured reliably in the breath, so we asked an expert to explain the relationship between blood and breath alcohol.



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- Hypertension may be a red flag that something else is going wrong
- Kidney damage may result from sustained high blood pressure
- Hypertension was (unfortunately) here!
- Sartan side effects mimic conical disease in some

Welcome to the June 2017 edition of ePathWay

It seems we woke a sleeping giant of chronic disease by highlighting the effects of high blood pressure (hypertension) from three pathological perspectives: biochemical, anatomical and forensic. The three pathologists interviewed all called hypertension an insidious silent killer, and after reading their articles, you'll see why.

By the way, hypertension doesn't only mean very high blood pressure readings. It kicks in at 140/90, and according to observational studies of over one million adults, systolic pressures (the top number) above 115 mmHg, and diastolic blood pressures (the bottom number) above 75 mmHg are associated with increasing risk of coronary heart disease and

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Expert iron out issues around measuring iron levels in the body



Iron deficiency (ID) is a very common problem that is often caused by a poor iron intake combined with normal blood loss. Despite this, serious health problems can also cause ID. An inherited tendency to over-absorb iron, a disorder that is potentially fatal, is fairly common as well. Iron is essential for life but it's also a potentially toxic element with a dark side, and accurately measuring the amount of it in the body is very important.

“Most elements are controlled by both absorption and excretion where our body takes what it needs and excretes the excess. This doesn't happen with iron because there is no regulatory mechanism to excrete it. We therefore take what we need and store the excess in our body as a cell protein complex called ferritin,” explained Dr Michael Harrison, CEO and Managing Partner of Sullivan Nicolaides Pathology in Brisbane.

Iron has a dark side as well. Dr Harrison said it is potentially toxic and can cause cells to oxidise when it isn't bound with a protein (this is known as free iron). Think of this as creating internal rust! It is clearly not an element to mess with, and either too much or too little creates serious problems for us.

“Iron deficiency is the most common nutritional deficiency in the world. Apart from not consuming enough iron in the diet, iron can be lost through blood loss such as during menstruation, and in pregnancy supplying the developing baby during a woman's reproductive years.”

Dr Harrison said about one third of Australian women in their reproductive years are iron deficient, and this proportion increases to 70% during the third trimester of pregnancy.

“The mother’s body supplies the foetus with iron which depletes her stores, and the risk of iron deficiency increases with every pregnancy.”

Despite these statistics, Dr Harrison said individual people should know their iron status and also the reason for it being high or low before starting any form of treatment, including taking an iron supplement.

“It’s wrong to assume that iron deficiency is always due to benign reasons such as diet or menstruation or pregnancy, because there can be other causes such as undetected bleeding in the upper gut or bowel cancer.”

Iron stores can be assessed by the serum ferritin level or with a group of interrelated tests called [iron studies](#). The skill is in knowing when to use what test.

“Serum ferritin is adequate as a screening test, such as part of routine prenatal investigations, because it is a marker of total body iron stores. But if a person has a number of conditions such as an underlying inflammatory process, liver or kidney disease, or if they are post-menopausal, a normal or elevated serum ferritin level won’t rule out iron deficiency or accurately diagnose iron overload.”

Dr Harrison said about five per cent of the Australian population of Northern European descent carry the gene for haemochromatosis. This is a disease where people absorb too much iron from their diet and store the excess their body. If it is undetected and untreated, this excess iron can cause organ or tissue damage and potentially result in premature death.

The bottom line is that iron is vital for our health but it clearly has a dark side. Measuring a person’s iron stores with the right test based on their clinical presentation is therefore important to ensure this potentially toxic element is afforded the respect it deserves.

Haemochromatosis is covered in the [August 2014](#) and [August 2011](#) editions of ePathWay. Iron studies is covered in the [June 2013](#) edition.

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Donor Questionnaires provide vital information to blood services



Blood donations are precious, which is why there are processes to ensure maximum benefit from every donation. Two experts from the Australian Red Cross Blood Service explained how they determine whether you can donate blood, and then control how it is used.

Dr Joanne Pink, Haematologist, and Chief Medical Officer/Executive Director of Clinical Services and Research at the Australian Red Cross Blood Service, said all blood donors must complete a [Donor Questionnaire](#) at every donation.

“This questionnaire asks about their medical history, medications, lifestyle behaviours and travel history. The answers are then used to determine the suitability of the person to donate blood and to establish the type of blood products that can be made safely from their donation,” she explained.

Donated blood is subjected to a series of mandatory tests to detect specific infections such as HIV, hepatitis B, hepatitis C, syphilis and a virus known as Human T-cell lymphotropic virus type 1 (HTLV1).

“These infections are known to be transfusion transmissible. We also carry out selective screening for cytomegalovirus (CMV) and malaria, both of which are infectious agents that can affect the way a donation is treated.”

Once these checks are out of the way and the blood is cleared for use, specialists at the Blood Service work out how each blood donation will be used.

“It is standard practice to separate the whole blood into its different components of red

cells, white cells, platelets and plasma. White cells are usually removed from the donated blood by filtering prior to further processing (known as leucodepletion), as they are a common cause of side effects in recipients. The other components can then be transfused separately into different recipients as medically indicated to allow maximum benefit to be derived from each blood donation,” explained Dr Pink.

How these components are used depends on the Donor Questionnaire.

“Each blood component may be variably affected by different issues identified in the Donor Questionnaire and will have a different potential to transmit specific infections. Each component needs to be assessed independently regarding its quality and safety to determine if it can be released for transfusion.”

Dr George Kotsiou, Microbiologist and National Donor and Product Safety Specialist, provided some examples of how these assessment are made. “They also illustrate why it is important to provide full and honest disclosure on the Donor Questionnaire,” he said.

Medications and platelet transfusions

“Platelet transfusions are given to patients with very low platelet counts who are at risk of severe bleeding, but they cannot be made from donors who have taken medications that interfere with platelet function such as aspirin and ibuprofen,” Dr Kotsiou explained.

He said one effect of these drugs is to cause platelets to be less sticky so they are unable to form the stable plug necessary to stop bleeding. This effect lasts approximately 7 days for aspirin and 2 days for ibuprofen.

“For this reason, we don’t take platelets from donors who have taken medicines containing these or similar drugs within these time periods. Red blood cells and plasma products can still be used from these donations, as the quality of these components is not affected by these medications.”

CMV infection

Dr Kotsiou said approximately 60% of healthy Australians have had CMV infection in the past, although most of them won’t recall the mild illness associated with it.

“It often occurs in infancy and may be completely without symptoms. Infected individuals will then carry CMV for the remainder of their lives, generally without ill effect. The organism may subsequently be found in their blood, especially the white cells, despite the donor feeling completely well.”

In some rare groups of blood recipients, such as premature babies or severely immune suppressed individuals, CMV infection can cause a very severe, even a life-threatening, illness.

“This is why the Blood Service tests some donations for CMV antibodies, and keeps a separate inventory of blood products from donors who have tested negative for CMV antibodies. Whilst leucodepleted blood is widely considered to be CMV-safe, CMV antibody testing may provide further reassurance for the highest risk recipient groups such as babies still in the womb.”

Malaria

Malaria is a parasite that predominantly infects the red blood cells. Travellers to regions where malaria is present are at risk of becoming infected. This risk can be reduced but is not entirely eliminated by taking anti-malaria drugs or using mosquito avoidance measures. This is why donors who have returned from risk countries are routinely tested for malaria antibodies.

“Donors who present to donate within 120 days after travelling to a country at risk of malaria are initially only eligible to donate plasma. The plasma is then manufactured into various plasma-derived products rather than used fresh. The additional processing steps used in the manufacturing process are able to kill any malarial parasites, and many other germs as well if they are present, which makes the product safe.”

Dr Kotsiou says red cells and platelets cannot be used from people who have a history

of travel to a destination with a known malaria risk, but those people are able to resume donating red cells and platelets when they have been cleared by malaria antibody testing.

Other infections

“The Blood Service is only able to actively test each donation for a relatively small number of infections. Often the Donor Questionnaire will identify a possible exposure to an infectious disease that is not screened for by the Blood Service, commonly as a result of travel to a risk area,” explained Dr Kotsiou.

He said these infections include dengue, chikungunya and West Nile (which are all viruses acquired through mosquitoes) that can sometimes cause minimal symptoms, or only cause illness to the donor after a donation has been given. This means asking donors for a history of illness prior to donation may not always identify an infection.

“For this reason, red cells and platelets are not used from donations from donors who have travelled to a country with a risk for these infections. Instead plasma donations can be sent for further processing and manufactured into plasma-derived products.”

Articles about blood and blood donations are also in the [December 2016](#), [October 2013](#), [November 2011](#) and [July 2011](#) editions of ePathWay.

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Cats can share more than just their love around



You won't find any 'crazy cat lady' jokes in this article because cat zoonosis is a serious matter. It is an infection that can be transmitted to humans from domesticated cats (*Felis catus*), sometimes in the most surprising ways.

"The most commonly known viral zoonosis is **rabies**," advises Dr Sasha Jaksic, Medical Microbiologist at Dorevitch Pathology in Melbourne. While Australia and New Zealand are declared rabies free countries, it's important for travellers to realise it's not just a 'dog's disease'. "Both wild and domestic animals, including cats, can carry this infectious virus that is transmitted through animal bites and scratches, usually via saliva."

There are also bacterial zoonoses. The bacterium *Pasteurella multocida* lives in the upper respiratory tracts of various livestock, poultry and domestic pet species, especially cats and dogs. It is most commonly passed on to humans from cats through a cat bite, although Dr Jaksic was involved in one unusual case.

"The patient had a recurrent sore throat and we couldn't initially find the cause, but from one throat swab specimen we isolated *P. multocida*. When we asked the patient to monitor her cat's activities, she discovered it was licking her toothbrush and passing *P. multocida* bacteria to her via infected saliva left on the toothbrush."

Another bacterial zoonosis is **cat scratch disease** caused by *Bartonella henselae*. It is spread through bites and scratches from an infected cat that will almost always appear healthy.

Q Fever is caused by a bacterium called *Coxiella burnetii*. It is mainly spread from animals to humans via inhalation of infected particles in the air, but infection can occur from contact with infected animal products such as birth products (placenta), milk, urine

and faeces. Usually thought of as a rural disease, urban cases do occur, such as the infamous outbreak of poker players' pneumonia in Nova Scotia in 1987.

Dr Jaksic said a cat infected with *C. burnetii* was giving birth in the corner of a room where a dozen men were playing poker. The birth created a mist of infected particles that was breathed in by the card players. All became ill with Q Fever, and one player (who had underlying heart disease and a simultaneous bacterial blood infection) died.

Cats can also carry **salmonella** bacteria and excrete them in their faeces. "Salmonella infections are more common in cats that are fed raw food or that eat wild birds and animals. This is why it's advisable to feed cats cooked or commercially processed food and to keep them inside," says Dr Jaksic.

People can become infected after contact with an infected cat's faeces such as when emptying a litter tray or inadvertently being exposed to it in the environment. "For example, cats love to go to the toilet in sandpits, and children can become infected when they play with sand where a cat has been to the toilet," says Dr Jaksic.

A protozoan parasite can be a cat zoonosis too. **Toxoplasmosis**, for example, is caused by *Toxoplasma gondii*, and while cats aren't the only way to become infected, they play an important role in spreading this parasite.

"The parasite is passed out in an infected cat's faeces as oocysts, and these are not infectious for the first one to three days. This is why it's important to clean a cat's litter tray daily," advises Dr Jaksic. If the cat is allowed outside it can contaminate the soil and water in the environment as well.

Dr Jaksic says toxoplasmosis can be very serious in people with compromised immune systems, and for babies born to an infected mother. "A pregnant woman can pass the infection to her unborn children, and while the mother may be asymptomatic, the baby can be born with congenital birth abnormalities," she explained.

Another type of cat zoonosis is **ringworm**, although the name is misleading. "Ringworm is a fungal infection of the skin, hair and nails caused by cats infected with either *Microsporium canis* or *Trichophyton species*. A cat infected by these species of fungi will have lost fur, resulting in patches of bare, red skin," says Dr Jaksic.

The spores from the fungus live on the cat's fur, and are transferred to a person when they have contact with an infected cat's fur (by patting or cuddling it), or with an object or surface (think food bowl, bedding, carpet etc.) that has spores on it from the cat.

"Cats provide many benefits including companionship and helping to decrease stress and anxiety, but to enjoy only their benefits it's important to manage the risks of infection," explains Dr Jaksic.

"This means good hand washing after touching a cat or handling their faeces or litter trays, feeding them cooked or commercially prepared cat food, keeping your environment clean, regular veterinary care, and not being too intimate with your cat. That way, they will only share their love around, and not some of the nasties that can come with them."

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Breath and blood alcohol have a volatile relationship



That alcohol can be measured by a blood test is generally understood. It's not so obvious that it can be measured reliably in the breath, so we asked an expert to explain the relationship between blood and breath alcohol.

Associate Professor Anthony Moynham, Forensic Physician at the Sydney Forensic Medicine & Science Network and a Fellow of the RCPA's Faculty of Clinical Forensic Medicine, says a key part in understanding this relationship is realising that alcohol is a very small and volatile molecule.

"Volatile in this context means it has the capacity to vaporise, and because the molecule is very small it can go straight through tiny pores in the walls of all of the body's cells."

The basic principle of being able to measure alcohol in the breath is that alcohol travels via the circulation within the lungs where it easily evaporates from the circulating blood into the air in the lungs each time we take a breath. We then exhale that air which contains the vaporised alcohol.

A/Prof Moynham says the reason other types of drugs such as cannabis can't be measured in the breath is because they are not made up of very small molecules, and they are not volatile. This means they can't partake in this gaseous exchange in the lungs. Alcohol is also rapidly absorbed and readily distributed throughout the body because of its small size.

"It doesn't need an active transport medium. It basically drives itself around the body, including being able to cross the thin permeable membrane between the circulating

blood and the alveoli in lungs,” explains A/Prof Moynham.

If we attached a GoPro to an alcohol molecule it would record an epic journey. Once ingested, it travels through walls of the digestive system (especially the stomach and upper part of the small intestine) into the blood, and then goes through the liver before returning to the heart. It is then pumped through the lungs and heart (again) before making its way around the rest of the body including the brain.

Alcohol is removed from the bloodstream by a combination of metabolism, excretion and evaporation. A/Prof Moynham says most alcohol is metabolised by the liver, about 5% is excreted via the urinary system, a tiny amount is sweated out, and about 1% is evaporated then expired through the lungs. This is the alcohol measured by a breath alcohol test.

“The breath that is deep in the lungs is the most accurate measure of breath alcohol because that is the air that has the closest relationship with the blood. Most breath tests require about one litre of expired air to ensure this deep lung air is captured,” explains A/Prof Moynham.

The effects of alcohol (which is a depressant drug) on the body are well known, and A/Prof Moynham says being able to measure breath alcohol concentration through roadside tests has markedly reduced motor vehicle fatalities.

“Breath testing is also more user friendly than pulling people over and requesting a blood sample,” he explains. We certainly can’t argue with that, but it doesn’t completely replace a blood test.

“The evidential breath analysis carried out by the police is considered very accurate, however if there are any doubts the option of a blood test can be taken up as a blood analysis for alcohol is the final accurate test.”

The effects of drink driving are covered in the [December 2015](#) edition of ePathWay.

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