New Equipment and Diagnostic Aids in Pet Avian Medicine and Surgery

Alex Rosenwax BVSc. (Hons), MACVSc (Avian Health)

Bird and Exotics Veterinarian, Green Square, Waterloo, Sydney, NSW 2017

There are common standard equipment and instruments found in most avian practices. These usually concentrate on the specifics of avian medicine and surgery; being smaller equipment suited to avian patients who, in most cases, are also flighted. In recent years, clients' expectations of outcomes, diagnostics tests and prognostics at their avian veterinarian have risen. Many clients demand to see their pet birds tested, treated and operated on in a similar fashion to dog and cat veterinary patients. This has lead to an increase in the diagnostic aids and equipment utilised by avian veterinarians.

While there are new instruments and equipment available, many of the newer advances in avian diagnostics adapt already available small animal technology to suit the avian patient. The introduction of this newer technology and approaches must be approached with caution. This is because some advances and adaptations from other veterinary fields can initially seem useful but may not necessarily give accurate results once peer-reviewed published documents become available. This paper discusses and reviews several newer technologies and ideas in avian veterinary practice.

Anaesthetic Monitoring Equipment

a ***Pulse Oximeter***

Initial reports suggested that accurate readings were possible. Subsequent studies were unable to gain accurate results on pulse oximeters. Anecdotal discussions suggest that a trend or pattern can be seen on a pulse oximeter. At this stage, their use of pulse oximeters is limited.

b ***Doppler Flow Probe***

Several Dopplers are available to acoustically enhance the measurements of heart and pulse rate**.** It is important to find a small flat paediatric probe able to fit on the available blood vessels for monitoring. In most cases, this involves probes small enough to sit on the medial wing veins. Care must taken when attaching the probe to avoid occluding the small blood vessel, which could lead to a failed reading. The use of Doppler is also becoming more common as micro-ventilators are decreasing the previous ability to monitor anaesthetics primarily by relying on respiration rates and depth.

c ***Electrocardiograms (ECG)***

ECG was investigated widely in the 1980s as a tool for cardiac monitoring and diagnosis of pathological cardiac conditions (Rembert). Its use has fallen into disfavour due to the difficulties of maintaining the connections on smaller birds during surgery. However, there is renewed interest in cardiac pathology in the ageing medium to large pet bird population. This renewed interest is combined with the growing use of Doppler and ultrasound to detect cardiac conditions. Wireless systems also make placing and maintaining the ECG clamps on the body less cumbersome. It should also be noted that the avian ECG is different to that of the mammalian.

Anaesthetic Equipment

a ***Micro-ventilators***

Intermittent positive pressure ventilation (IPPV), either manual or with a ventilator, seems to decrease the risk of anaesthetic complications in longer, more complicated avian surgeries. The reason for this has not been completely ascertained. There are suggestions that IPPV reduces mucous build-up in the trachea, reduces the deflation of the airsacs in longer surgeries, and lessens the chances of apnoea due to high oxygen levels over longer periods (as birds rely on decreased oxygen levels, not increased carbon dioxide levels for inspiration). IPPV micro-ventilators are becoming popular. However, the limitation is that the commonly available micro-ventilator, Vetronics micro-ventilator (Vetronics Services UK), needs a tight endotracheal tube in the trachea and needs to fully inflate the airsacs to gain enough pressure change for it to work. The tight fit on the closed tracheal rings may lead to tracheal inflammation from the endotracheal tube. The high oxygen flow rates to keep the airsacs at full pressure (up to 1-2 litres/minute absolute oxygen flow rates) could over inflate the airsacs. These micro-ventilators are unlikely to work well when the abdomen is open as they rely on a change in pressure to reactivate the sensor for inspiration. Further work on micro-ventilators needs to be performed on timed IPPV not related to pressure change.

b ***Anaesthetic Machines***

Sevofluorane is becoming more available. It was previously expensive but is now readily available for avian clinics that are considering upgrading. Suggestions of possible improvement with sevofluorane exist but studies are not conclusive for a significantly noticeable improvements in clinical practice on small birds.

Newer masks with minimal dead space are also being developed. These usually have the in-flowing oxygen/isofluorane tube entering the distal third rather than the proximal end of the mask.

In-house Biochemistry Analyser

The ease of use, small blood volumes and quick results have lead to many avian veterinarians investing in in-house biochemistry machines. This is in contrast to some external laboratories' slow turn around time for results and their inability to deal with small avian blood volumes. This is especially the case if the avian clinic is outside a major capital city. Most in-house machines utilise dry chemistry for analyses.

a ***Vetscan (Abaxis)***

Vetscan is a popular, relatively newer machine based on a fixed rotor. It is seemingly accurate, easily calibrated and uses only a small volumes of whole blood. The rotor also has bile acids for liver function. However, the fixed rotor does not allow the monitoring of gldh, amylase and cholesterol. All these three, in the author's opinion, are considered useful on a pet Australian parrot biochemical profile to assess liver function and pancreatic problems. Bile acid levels alone are generally not useful in the diagnosis and monitoring of fatty and/or fibrotic livers in pet birds as a single screening test (Cray 2008).

b ***Reflotron (Roche Diagnostics)***

The Reflotron is easy to use with smaller blood volumes. The concern is the lack of bile acids and gldh analytes. Another problem is the poor ease of use for multiple high volume through put blood testing as each analyte is individually run.

c ***Vettest Dry Biochemistry Machine (IDEXX)***

The Vettest is commonly utilised in small animals. The probe has large dead space leading to the need for large volumes of blood. If only small volumes of blood are available then the machine needs extremely accurate dilutions with a micropipette. This, combined with lack of bile acids and

gldh, has limited its use in smaller pet birds.

d ***Future In-house Biochemistry Mahines***

Wet chemistry on easily calibrated machines should be the future for more complex benchtop biochemical analysis. At present, reconditioned machines can be bought relatively inexpensively, such as the Hitachi 911 (Boehringer). These machines can give very accurate (Greenacre 2007) results. They are limited by the time taken for daily calibration on semi-automatic machines and/or expensive calibration and high water usage in automatic machines. Several newer machines, such as the Randox RX Monza and the Easy RA (Medica USA), are currently being developed in the United States and may in the next 2-10 years become common benchtop units in veterinary clinics worldwide.

e ***External Laboratories***

A well-trained veterinary laboratory can give accurate quick results on small samples without tying up valuable internal veterinary staff. The major negative to external laboratories is the poor turn around time in evenings and on weekends, which is magnified outside major capital cities.

Diagnostic Imaging

a ***Digital and Computer Radiography***

Digital and computer radiography is an excellent method to improve radiographic diagnosis in the avian patient. The digital technique needs a 50% less exposure time setting on the radiography machine for the same image as compared to analogue radiography. This leads to lower radiation exposure to staff. It also means there is a less blurring effect from movement on the image from the fast respiration of birds. This greatly improves the final image. Large viewing screens with high numbers of pixels using powerful computers allow magnification and reversal of images, leading to easier investigation of bones and other tissues. The images are also interactive which allow greater client and veterinary education. Higher quality digital and computer radiography machines must be used as lower quality, cheaper digital and computer radiography machines and LCD screens may negatively affect the image quality compared to older analogue images (Nemetz 2006).

b ***Ultrasound***

Ultrasound is not as commonly utilised in avian patients as it is in other small exotics. It may become more popular as further investigation into cardiac problems in some avian species is made available. One major problem is the small area on the abdomen of birds to place the ultrasound probe due to the large pectoral bone. Newer machines are becoming available with smaller probes, which will allow more uses in birds. The use of 7.5MHz and up to 12.5MHz probes allows higher detail in a smaller area at decreased depths of penetration (Krautwald-Junghanns et al. 2005). There are newer probes with internal gyroscopes being developed with a contact area of only 2-3 cm. The second major limitation in birds concerns the abdominal airsacs as ultrasound cannot penetrate usefully through the air inside. However, the use of ultrasound is being expanded for imaging enlarged livers, including ultrasound guided needle biopsy of the liver. Future use may be in cases of abdominal ascites to investigate ovarian/oviductal cysts and tumours as well as other intra-abdominal organs and lesions (Krautwald-Junghanns et al. 2005).

c ***Access to Computer Tomography***

Many university and some larger referral hospitals now have Computer Tomography (CT). It is very useful for imaging skulls and sinuses of birds as air allows easy recognition of the different complicated cranial components. CT will most likely replace skull radiographs in near future. CT is useful for imaging the abdominal cavity of birds as the organs are often surrounded by air, allowing easier definition of the different organs. It is not as useful for intracranial tumours when compared to MRI, although CT may show some tumours with the assistance of intravenous dyes. Its use is

limited in smaller birds by the size of the “slices”, which are approximately 2 mm (Rosenwax and Stewart 2005).

d ***Fluoroscopes***
Fluoroscopes are available at some universities and larger veterinary and referral hospitals. Although not as detailed as radiography, it does allow motion studies (Ford 2006). Fluoroscopy's most common use has been as an aid to diagnose cases of proventricular dilation syndrome (PDS) and other gastrointestinal motility issues. PDS is still uncommon in Australia.

Surgical Equipment and Adjuncts

a ***Small Surgical Equipment***
The use of smaller ophthalmic surgical equipment is well-reported and utilised. The major problem is that commonly, especially if lower quality, the scissors and other equipment are easily blunted on avian tissue compared to ophthalmic tissue. This can lead to a relatively high turnover of instruments. Metal haemostatic clips for blood vessels are useful for abdominal surgery. Their applicators may come with a bent distal end allowing easier application of the metal clips distal to some abdominal organs that may not be easily elevated in the avian patient.

b *Rigid Endoscopes with Biopsy Cutting/crushing Forceps*
Most avian clinics will have a rigid 30 degree angle 2.7 mm width endoscope. Endoscopes were an invaluable tool during the 1990s for surgical sexing. Since DNA blood-sexing became more accepted, this invaluable tool has been underutilised in avian veterinary practice, as less surgical sexing has been demanded. Endoscopic sheaths with cutting/crushing biopsy forceps and scissors are useful for sample collection in the abdomen, cloaca and oral cavity. They may also become useful in routine juvenile salpingectomy in the future (Hernandez-Divers 2007).

c ***Dremel® Hand Drill***
Many clinics have used Dremels™ for many years. They are useful for nail and beak filing and, in some cases, used for leg ring removal.

d ***Surgical Electrocautery***
Bipolar electrocautery has been well-reported for many years to be a useful tool for cutting and cauterising during avian surgery.

e ***Miniature Bolt Cutters***
Double-hinged smaller hand-held bolt cutters are useful for removing rings from larger parrots. This avoids using large bolt cutters that are hard to manoeuvre around birds’ legs.

f ***Operating Microscope and Bifocal Eye Magnification***
Available for many years for use by ophthalmologists. The use of operating microscopes is a useful adjunct for surgery in the avian clinic. The microscope standard is 12.5X eyepieces and a 200 mm objective with various internal zoom capabilities leading to a zoom range of 3X to 16X (Ford 2006). Magnification using simple bifocal eye magnification adjusted head loups is already in common use in many avian clinics. Stereoscopic vision by the operator is necessary to utilise this equipment.

g ***Surgical and Preparation Table***
Smaller surgical table for ease of use on avian patients. There are smaller consult electric “back saver” tables that can cheaply be converted for use with birds. The most common problem is that all tables are stainless steel which, while very easy to clean and sterilise, often end up covered with towels, hot water bottles and other heating devices. Further investigation is needed into treatment tables using polycarbons or other nanotechnologies that are easily cleaned but are not made of cold steel.

Bird Identification

a ***Microchip***

While not new technology, it is becoming more common to both microchip pet birds and to scan all stray birds that enter the avian veterinary hospital. In small animal practice, it would be considered poor practice not to do so with cats and dogs. Similarly, immediate scanning of birds is now becoming the norm in avian veterinary practice.

b ***DNA Identification***

Microchips can theoretically be removed and possibly migrate. Newer technology for DNA identification is available and is not especially expensive when utilised on single pet birds or rarer birds. It does necessitate the accurate and reliable storage of samples of each bird's DNA sample for future use if identification is required. Parentage testing is also now becoming available.

Ancillary Equipment and Adjuncts

a ***Microscope***

Not a new technology but it is important to be a high quality bifocal microscope. It is very useful to have one in each consult room connected to a television screen to allow clients, students and associate vets and lay staff to learn and appreciate its use. Newer digital connection will allow direct connections to computers to save and enhance images.

b ***Small Digital Scales***

While not a new item, small 1 gram scales that accurately read up to 5 kg and paediatric scales are old technology but are a must for avian veterinary clinics.

c ***Digital Cameras***

Digital cameras with a super macro setting for close-up pictures are useful for interesting cases. These often have a 1-3 cm focal distance. They can take photos of eyes as well as other areas such as feathers and then magnify them for closer investigation. Most importantly, these cheap short focal distance cameras can take photos and videos down the microscope eyepiece. Digital photos of birds are also becoming more common as an identification method to place into client records.

d ***Nebuliser***

Were very popular in the 1990s. Still used in the Northern Hemisphere but are used less often in Australia in pet parrots, possibly as fungal airsac and lung lesions are less common in Australian medium to larger pet birds. Nebulisers are intended to deliver medication to areas of the respiratory tract that often considered to have poorer blood supply, such as air sacs and sinuses. It is important the nebuliser releases particles in a small enough diameter to enter the avian respiratory system

E ***Compounded Pharmaceuticals***

Unlike some larger human hospitals, compounding chemists are not found in the larger veterinary hospitals. Compounding chemists can make pharmaceuticals into shapes and forms suitable for the avian patient. This may be making compounds into a soluble rather than a tablet form or increasing the palatability of common pharmaceuticals. Their use is very common in native animal wildlife work and aquaculture but only now are compounded pharmaceuticals being utilised in avian practice for pet birds and aviculture.

Information

a ***Client Sheets***

Although not a diagnostic test, the giving of fact sheets prior to clients entering the consult room

which discuss the available diagnostic tests for the originating complaint are an invaluable assistance in client compliance. Similarly, client reminders for health checks that list the possible diagnostic procedures assist with client compliance.

b ***Internet and Websites***

Many veterinarians raise concerns about the general public accessing poor information from websites. This may be due to the dearth of higher quality avian information sites and chat groups open to the general public. The use of fact sheets on avian chat groups and avian veterinarian websites can save hours on the phone explaining information to clients. For veterinarians, the access to particular chat groups and abstracts online is also invaluable. Reliable sites for native wild birds are also available in order to assist with identification and husbandry.

Hospital Room and Equipment

a ***Hospital Room***

A separate heated room for keeping hospital cases warm. Can use a simple electric oil heater with a thermostat or more complex heat and ventilation systems. The problem is deciding on heating large rooms versus smaller rooms with unwell, possibly infectious, birds in close proximity. In some cases, smaller rooms and even consult rooms can use a mobile electric oil heater to heat birds at night that should no longer be kept awake with a direct heat lamp/light.

One-way ventilation of hospital rooms is also becoming increasingly important as many more seriously debilitated birds are hospitalised. These birds may have infectious diseases that are passed by aerosol transmission. Newer avian veterinary clinics should build easily heated rooms with one-way ventilation flow to avoid the spread of infectious agents.

b ***New Cages and Enclosures***

Cages should be enclosed on 5 out of 6 sides with cage doors of wire that do not allow birds to push their head through. Preferably, the cage will have a smaller access door in the centre for bird retrieval. Stainless steel, while easy to clean and maintain, is not necessarily as easy to keep heated. Birds also do not seem as comfortable in these steel cages compared to the white plastic container cages.

Ancillary Diagnostic Test Devices

a ***Access to PCR (Polymerase Chain Reaction) Laboratory for Diagnostic Tests***

PCR machines are not currently an in-house test or instrument, but with the recent research into the manufacture of a “in the field” PCR test, they may be soon available to veterinary clinics. Already some university veterinary schools have direct access to PCR. One major problem both with in-house PCR and collection for external laboratories is sample contamination. The second problem with external laboratories is confidence in their methodology in obtaining, storing and recording their PCR results. In the past few years, many newer non-IATA accredited laboratories have been set up and are processing samples for psittacine circovirus, polyoma and chlamydophila. The results have been available directly to the general public with neither a veterinarian on the staff nor a consulting veterinarian having submitted the samples. This will most likely have the effect of decreasing general public confidence in PCRs.

b ***In-house Chlamydophila Tests Immunocomb***

The immunocomb test (Biogal Israel) is an Elisa antibody test on one drop of whole blood. It allows an understanding of exposure to *chlamydophila psittaci* (Phalen 2006). Is useful as, unlike PCR, it can also be used despite recent doxycycline medication. The limitation is that it only shows exposure and does not indicate active excretion or length of exposure (as it is an IgG test without IgM). Other problems include limited peer-reviewed articles on the accuracy of the test or clear

information on which part or parts of the chlamydophila antigen is assessed. The test relies on viewing a control compared to the exposure test spot. This comparison between the two grey spots (control and test result) on the test is open to subjective interpretation by the human test reader and thus is open to a wide range of interpretations. The results of low to moderate titres or, in other cases, continually high antibody titres despite treatment over many years is still being debated in avian veterinary clinical discussions.

c ***In-house Glucometers***

Transient diabetes and occasional chronic diabetes mellitus is not uncommon in birds such as cockatiels. Glucometers allow simple small blood volume sampling. Although they are assumed to be accurate, there are multiple different makes and models available and it is not necessarily known which are accurate in avian species. A high blood glucose on a glucometer generally warrants a full blood profile to accurately diagnose diabetes mellitus and its possible underlying causes. No diagnosis of diabetes mellitus should be made on the basis of one single glucose reading on an in-house glucometer.

d ***In-house Blood Lead Machine***

Leadcare II blood lead machine (ESA USA). It allows easy, quick and seemingly accurate in-house results taking three minutes utilising 1 drop of whole blood. This newer model has less "pieces" and is a very compact unit. However, the results are not in standard international units. The older model has been used in several field blood lead trials (Youl 2006) in birds but, although assumed to be accurate, there are no peer-reviewed studies to show that this newer model is accurate on avian blood. Most useful in pet bird practice to rule out lead poisoning in order to minimise overuse of calcium EDTA chelation in suspected cases of lead poisoning. Leadcare II is also useful when no radiodense particles are seen on radiographs when the birds live in an area of high lead incidence such as older inner city suburbs or mining towns. These birds often have chronic exposure with increased blood lead levels with no radiodense fragments. Indications for use in these cases may include a uricaemia and/or increased kidney size on radiographs as well as clinical signs as diverse as feather picking, vomiting or polyuria.

e ***Haematology***

Unopette method and the indirect blood smear counts are still the most commonly used methods. Future technology to deal with the nucleated red blood cells is still not fully developed but eventually will simplify haematological counts using laser flow cytometry (Samour 2006). These may eventually be available for benchtop use.

Avian Veterinary Instruments and Equipment Already in Common Use

- crop tubes
- dropper bottles
- liquid medications
- small boxes for weighing
- small ophthalmic sized surgical kits
- heat lamps and heaters
- incubators or heated cages
- insulin needles and syringes
- small scales
- microscope
- Gram stain and cytology stains
- isofluorane anaesthetic
- small anaesthetic masks and uncuffed small endotracheal tubes
- ring removers
- cotton tips

- small scales
- electrocautery
- bird cages and perches
- in consult perches

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