Back to Basics – Insects and arachnids

Invertebrates are an incredibly diverse group of animals encompasing the smallest single cell protozoa through to the more complex metazoa (multicellulared animals) such as arthropods. This article's focuses on the terrestrial insects and arachnids.

Even for a dedicated exotic animal clinician invertebrates are unlikely to make up a high percentage of the annual caseload – however in our clinic the invertebrate caseload has steadily increased over the years with dedicated and committed owners expecting a high level service for their fascinating and sometimes very valuable pets. Some species of invertebrates are long lived (for example tarantula's) and owners can form strong emotional attachment to their pets. It is easy for a clinician to feel out of their depth treating species that differs so greatly in anatomy and physiology from traditional companion species. With little or no curriculum time at university dedicated to invertebrates it is hardly surprising that few vets feel comfortable treating them. It is the author's opinion that standards of husbandry and veterinary care for invertebrate species should be equal to that of vertebrate species.

Basic Husbandry Considerations:

The husbandry of invertebrates varies with the species being kept. Some are terrestrial and others arboreal. Species may be from arid, temperate or tropical environments. A close examination of the species natural history will give useful clues as to their likely husbandry. Temperature, humidity, substrate and diet are all important factors that need to be considered. In clinical cases husbandry should always be fully evaluated and critiqued. Owners should be encouraged to take and record temperature, relative humidity, food consumption and shed dates on a regular basis. It is important to use dechlorinated, reverse-osmosis water or distilled water with invertebrates.

While captive breeding of invertebrates is now common many species are still wild caught and imported. These specimens may carry parasitic diseases and are more susceptible to stress and may not adapt to captivity well.

Handling and restraint of invertebrates should always be performed with due care to prevent injury to either the specimen or the handler. Invertebrates can be fragile and iatrogenic injury can occur if due care isn't provided. It is important to recognize that restraint does not necessarily involve physical contact between clinician and patient. Transparent containers and bags can be used to temporarily house invertebrates for examination. Hypothermia (cooling patient to 4-5C) can facilitate handling and restraint, although provides no analgesia and should not be used for invasive or potentially painful procedures. Some invertebrates are venomous ie spiders and scorpions. Certain spiders (including many commonly kept 'tarantula' species) have urticating satae (hairs) on their abdomen which can be irritate skin, eyes and mucous membranes. Gloves and protective goggles can be warn to prevent contact with the satae. When

threatened arachnids will kick the hairs in the direction of the potential attacker. Arachnids can sometimes present for suspected 'alopecia' – this is generally a result of stress causing the tarantula to flick large numbers of satae. Husbandry improvement to resolve stress prevent progression and the satae will return following the subsequent moult.

Good husbandry practices are important at preventing common diseases. Good management, affective hygiene, quarantine of new animals and prompt isolation of sick subjects is important.

Clinical symptoms of disease:

Common signs of disease whether non-infectious or infectious include:

- Weight loss
- Anorexia
- Lethargy
- Changes in integument
- Discharges
- Dysecdysis
- Behaviour changes – neurological signs, incoordination

History and Clinical examination:

The clinical history can be based around that used for traditional companion vertebrates. Invertebrate specific questions should include:

- Animals origin (wild caught, captive bread)
- Length of time in captivity/collection
- Communal housed or single
    - Is the animal part of a group where a 'flock medicine' concept is required or treated as an 'individual pet'.
- A full husbandry examination should be conducted – photos or even direct examination of the housing can be beneficial.

Diagnostic procedures:

Many clinical cases will require some diagnostic procedures to formulate a diagnosis and allow affective treatment. Post-mortem examination of dead animals, shed skin examination, cytological examination of swabs and scrapings as well as fungal/bacterial culture and sensitivity are all commonly performed. The majority of invertebrates are ectotherms with lower body temperature then mammals. The standard bacterial incubation temperature of 37C may not be optimum when culturing invertebrate samples.

Due to the small size of many invertebrate patients magnification is a great advantage when examining specimens. Magnification loops are very useful, but

even a basic hand held magnifier can be benefit. Good lighting is also very important.

Specific Techniques:

Haemolymph collection:

One can safely sample up to 10% of the patients body weight in most invertebrates. In arthropods haemolymph can be sampled using a 27gauge needle from either the cardia, haemocoel, or limbs.

Cutaneous diagnostic sampling:

Modified mammalian techniques can be used in arthropod. Due to their fragile exoskeleton care is required while sampling. Impression smears, skin scrapes. Biopsies can be taken for histopathology.

Common infectious disease problems:

Fungal infections: Often seen as lesions on the integument. Mycelium may be visible to naked eye or under magnification. Internal lesions may be seen on post-mortem specimens. Animals may be ill-thrifty and mortality is often seen. Disease is very commonly associated with husbandry derangements; in particular temperature, relative humidity and hygiene.

Bacterial infection: As with fungal disease integument changes are commonly seen. Liquafaction of the skin may occur. Animals may be anorexic, have faecal changes or regurgitate. Mortality may be seen. Haemolymph should be sampled and examined for evidence of bacteraemia. Haemocytes can be examined for poikilocytosis and vacuolization which may suggest reactive changes to infection. The normal bacterial flora of skin and GI tract is not known and the significance of findings is often a subject for debate. Bacteria in the haemolymph however should always be considered significant.

Parasitic infection: More common in imported specimens. Most commonly nematode spp. Oral nematodes can be diagnosed following cytological examination of swabs. Panagrolaimidae spp of nematodes are a possible zoonosis and euthanasia should be considered on human health grounds. Stress and poor husbandry can exacerbate asymptomatic infection. Treatment with benzimidazole anthelmintic is generally not affective and potentially toxic. Mites are also commonly seen in arachnid enclosure's. Small numbers are often considered non-pathogenic however large burdens are thought to cause irritation, stress and potentially respiratory compromise at the book lungs. Predatory mites are a good non-chemical method of control. Manual removal from the arachnid under anaesthesia can also be attempted.

Hymenopterous and dipterous larvae infection: Weight loss and often death. You can visualize lavae or emerging adult insects directly on the patient. Infestation is prevented with good hygiene and insect proof housing.

Common Non-infectious disease problems:

Dehydration: Can lead to weight loss, desiccation and dysecdysis. Can be associated with high temperature or low relative humidity. Dehydrated individuals will often be lethargic, anorexic or have a shriveled opisthosoma or abdomen. Fluids can be administered by injection parenterally into the haemocoel or heart. Lactated ringers or saline are both suitable fluid choices for parenteral administration. As a general rule10% dehydration equates to approximately 2-4% of body weight of fluid in most commonly kept arachnids. Increasing environmental humidity can help. Encouraging weak arachnids to drink is possible by submerging their mouths in a shallow water dish. You cannot rely on dehydrated tarantulas to find water, as they are reliant on sufficient haemolymph pressure for movement. Hypovolaemia due to dehydration results in a drop in pressure and inability to move. Care is required not to submerge the book lungs.

Dysecdysis:

Common cause for presentation of pet arthropods. To be able to recognize dysecdysis it is important the clinician is familiar with normal moulting in arachnids. Prior to moulting a tarantula will be found in dorsal recumbency for 12-24 hours. To allow the exoskeleton to slough it splits in two on the dorsal surface of the abdomen. The prognosis following dysecdysis is poor. Causes are varied; husbandry, infections, lethargy, trauma & injury can all cause shedding dificulty. The underlying exoskeleton is soft and easily injured leading to complications when removing the stuck shed. Atraumatic forceps (harris ring-tip), cotton buds and careful dissection of the stuck shed with fine scissors can help release the patient. If skin softeners are to applied topically (glycerin) then care must be taken not to cover the book lugs or spiracles which could affect respiration. In cases where shed is only stuck to limbs amputation may be performed. Retained shed can eventually cause a constriction damaging the exoskeleton leading to haemorrhage. If infection is suspected then topical treatment may be required based on cytology and culture results.

Nutritional deficiencies: Weight loss, ill-thrift, susceptibility to secondary infections. A varied diet should be fed. Gut-loading feeder insects if required. Mollusks require calcium supplementation in most situations.

Toxins/Poisoning: Captive invertebrates are commonly susceptible to the same toxins and poisons used to control pest invertebrate species. Use of insecticides and pesticides in the house can lead to large losses. Flea medications can be particularly toxic. Reptiles and invertebrates are often kept in same room. Accidental death in invertebrates when treating mite infections in reptiles is reported. In cases where exposure has not caused death treatment is supportive – nutritional support, fluids therapy, decontaminating environment.

Trauma: Results in physical damage to the exoskeleton, crushing, loss of appendages and wounds resulting in haemolymph haemorrhage. Freshly shed

specimens are particularly susceptible to damage following trauma due to their soft exoskeleton. Trauma can occur from moving cage furnishings, handling or as a result of dysecdysis. In the case of limb injuries amputations can be performed and integument repaired with tissue adhesive. In arthropods it is often possible to induce autotomy. In young animals still actively shedding limbs will often regrow. Most invertebrates have a relatively open circulatory system – meaning haemorrhage is potentially very serious. Most inverts feature a haemoceol (single cavity containing visceral organ which is continuous with the circulatory system). The heart is contractile that directs flow of hemolymph through the hemocoel and body. Where minor injuries occur particularly in freshly molted specimens placing them in a dark container with no cage furnishing undisturbed for 12-24hours allows the exoskeleton to harden. In some cases adding a thin layer of damp paper towel helps increase the relative humidity reducing the rate of evaporation of fluid from the animal. If active haemorrhage of haemolymph is occurring pressure can be applied using cotton swabs or cottonbuds. Cyanoacrylate tissue glue can be used to repair the defect. Supportive care including fluid therapy may be required depending on level of haemolymph loss.

Anaesthesia:

It is not acceptable to perform invasive procedure in invertebrates without anaesthesia. Hypothermia is not a suitable or ethical alternative to anaesthesia. Anaesthesia can also be used to facilitate safe examination in potentially dangerous or delicate specimens.

Terrestrial invertebrates can be anesthetized using halogenated ethers commonly available in companion animal practice. It is important to consider the respiratory physiology – the respiratory openings in arthropds are located on the body rather then the head. Appropriately sized induction chambers to allow the whole specimen to be exposed to the anaesthetic agent are required. Either isoflurane or sevoflurane can be used by inhalation. Carbon dioxide, ether or methoxyflurane have also been used successfully but are unlikely to be readily available. The authors preference with the majority of athropods is to induce anaesthesia with 5% isoflurane, following induction the concentration can be titrated down to affect.

Anaesthetic monitoring is challenging. Asystole is a common result of anaesthesia but is usually temporary resolving after removal from the anaesthetic chamber. In the majority of invertebrates respiration occurs passively so respiratory movements cannot be monitored.

Euthanasia:

In terrestrial invertebrates anaesthesia should always precede euthanasia. Anaesthesia should be induced as above. Following induction of anaesthesia the author's preferred technique is to inject penobarbital either intracardiac or into

the haemocoel. Immersion in ethanol or freezing following anaesthesia are also reported techniques. If post-mortem examination is required then immersion in ethanol preserves tissues for examination without inhibiting histopathology.

Medication Routes:

Oral medications – it is possible to apply oral medication to the mouth-piece or invertebrates using either a syringe or dropper. Ensuring complete ingestion is difficult so dosing compliance can be problematic.

Careful injection of medications either directly into the haemocoel or heart can be performed. Small insulin syringes with 27guage needles can be used to prevent creating large defects in the exoskeleton leading to haemolymph haemorrhage.
Injection Sites

- Pericardial/Cardial – Introduce needle on the dorsal midline of the opisthosoma at a 45deg angle from vertical. Anaesthesia is required to reduce the risk of cardiac laceration should the patient move.
- Intracoelomic – Injection is administered along the transverse plane in the lateral opisthosoma.
- Ventral joint membrane of the limbs – only very small volumes of fluid can be administered by this route. Risk limb damage and autotomy. Does not require anaesthesia.

Topical medications: topical antimicrobials and antifungal ointments can be used. If used care should be taken not to cover the book lungs or spiracles.

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