DIARRHOEA IN JOEY KANGAROOS

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Abstract

Diarrhoea is a common presentation in hand-reared marsupials such as kangaroos and possums. This talk will cover frequent causes and develop a diagnostic approach to differentiate from soft faeces normal for age, transitional diarrhoea to pathogenic reasons caused by bacteria, fungi and protozoa regardless of species. The conditions that are likely to be seen will be broken down based on the developmental pouch stage of the marsupial: a pouch-bound milk-dependent young is unlikely to acquire worms from pasture but is more at risk of developing a candida diarrhoea, for example. Basic treatment recommendations for the various conditions will be presented.

Introduction

Diarrhoea is common hand-reared marsupials for a variety of reasons that include infectious and management conditions. It is also important to remember that the ability to form a solid faecal pellet does not occur until after first pouch emergence. So, the first check is determine whether the loose faeces are simply due to immaturity rather than a more insidious condition. There remains many myths amongst wildlife carers surrounding marsupial diarrhoea, such as smell can be used for diagnosis. If only it was so easy, we could throw out our lab gear, x-ray machines and ultrasounds. However, the basic laboratory tests available in veterinary clinics can often be used patient-side to assist in achieving a correct diagnosis. Consideration for the antibiotic used in kangaroo joeys should be given as these animals are commercially harvested in several states of Australia. Fluoquinolones should not be used in food-producing species. Other antibiotic classes are more appropriate in the treatment of diarrhoea. In terms of understanding which causes are likely to be occurring, the stage of development of the joey is used as a framework to understand the likely conditions. After all, a joey cannot get worms until it has access to the ground.

STAGE OF DEVELOPMENT: IN-POUCH JOEY

The challenges facing this life stage is that once orphaned, it leaves a temperature-controlled pouch containing antimicrobial compounds and enters prematurely into a world of novel pathogens. Organs are undeveloped and the immune system does not fully develop until pouch emergence, making this animal at risk of infectious pathogens. Faecal pellets are normally not formed during this stage.

Failure of passive transfer

Marsupials, with their long pouch life continue to absorb protective immunoglobulins from the milk until pouch emergence (age factor 0.7, or expressing the age factor as 70% of the duration of pouch life). There is a small peak in immunoglobulins at vaginal birth and a much larger peak at pouch emergence (Adamski et al, 2001). Orphaning results in a loss of these protective proteins as milk substitutes do not contain these ingredients. The loss of passive

immunity from the mother in marsupial joeys appears anecdotally to decline over the first six weeks in care (McCracken, 2008). This explains why many joeys can tolerate poor husbandry (lack of heating, poor hygiene and presence of domestic pets and noisy households) for some weeks before they become unwell. Diarrhoea is a common reason for presentation. However, pneumonia, dermatitis and stunting may also be seen.

Comparison of body measurements, such as head length and weight may reveal stunting. Faecal exam may show candida diarrhoea.

Treatment involves offering supportive care, such as supplementary fluids given subcutaneously or as electrolyte feeds in between milk feeds may be indicated. Electrolytes must not be added to milk as the increase in tonicity can result in diarrhoea. Return the joey to supplementary heating. Even furred joeys need heating until an age factor of 0.8 as the heated pouch mimics the natural stimulus for pouch emergence. Wombaroo® Impact, a bovine colostrum supplement, plays a role in providing immunoglobulins and other protective proteins to boost the passive immunity.

Infectious causes of diarrhoea

Yeasts and fungal diarrhoea

This is often caused by the yeast, C*andida albicans*, found on human mouth, hands and anus. It may occur after using antibiotics. Transmission of this human yeast occurs after failure to wash hands prior to preparation and feeding of milk or failure to wash bottles and teats correctly. Most wildlife carers only give bottles a hot water rinse after use. This is insufficient to prevent *Candida* growth.

The joey may be presented for several reasons. Mouth and cloacal lesions - redness, white plaques (Booth, 2002) are reported, but not commonly seen; diarrhoea may be green and smelly. A poor weight gain for age is noted. The animal may not take the teat well due to a sore mouth. Death is uncommon.

A diagnosis by the veterinarian is reached by performing a Diff-Quik stain of mouth lesions and diarrhoea. Differential diagnosis includes Macropod Herpesvirus which produces ulcers on the mouth and cloaca. Bacterial causes may also be present at the same time.

Treatment for fungal diarrhoea involves nystatin (Nilstat®**,** Aspen Pharma) 10 000 IU/kg three times a day for 5 days (Booth, 2002). This should improve the diarrhoea in 48 h of starting treatment. If no response after this time, consider another cause as the inciting agent, or that a higher dose of up to 100 000IU/kg may be needed. Give one hour prior to a meal as nystatin works by contacting the surface of the gut. Ketoconazole has been recommended, but considering the hepatotoxic effects of this drug, unknown dose rate and metabolism in an infant animal, this drug should be avoided. It is now no longer readily available due to its toxicity.

Prevention of fungal diarrhoea involves good hand-washing before each feed and wiping spilt milk away from the mouth. Hot water, soap, rinsing and disinfection are required to adequately clean bottles, teats and other equipment used to make up foods.

Bacterial diarrhoea
Joeys acquire bacteria from fur, pouch or milk/equipment. Bacteria such as haemolytic *E. coli, Yersinia, Campylobacter and Klebsiella* have been reported in the literature These are present in faeces of humans and other animals. *Salmonella, Streptococcus* and *E. coli* are part of the normal gut flora of kangaroos making it difficult to determine that a particular bacterium is the cause of the diarrhoea.

The joey may be quiet, and have a change in colour of faeces, or faeces looser than expected for Age Factor. Haemolytic *E coli* produces a liquid faeces (Booth, 2002).

Diagnosis by the veterinarian involves performing a Gram stain of faeces to show a preponderance of gram negatives. Faecal culture by the laboratory is used to exclude *Salmonella*, *Yersinia* and *Campylobacter*, all of which are zoonotic. The confirmation of a joey with a zoonotic cause raises the question of the risk this animal poses to others and the human handler when a positive result returns. There have been reports of multiple deaths in facilities from one infected joey transferring the disease to others.

Suitable antibiotics include penicillin, trimethoprim/sulfonamides as good first choices. These drugs are ideally, in these herbivores, given parenterally, rather than by mouth, just as in livestock species. Herbivores have a competent liver able to detoxify plant-produced anti-nutrients. Nystatin may also be needed to stop overgrowth of yeast. Prevention of bacterial causes is aimed at improving hygiene. Bovine colostrum (e.g. Wombaroo® Impact) may also assist in treatment (Pandey, 2011) due to presence of lysozyme and lactoperoxidase which have anti-bacterial properties.

Cryptosporidiosis
Cryptosporidium is a small protozoa. Various species are found in macropods (Power, 2005). The macropod species known to be affected include; red kangaroo, eastern and western grey kangaroo, red-neck wallaby, swamp wallaby, and red-necked pademelons. A watery diarrhoea is seen in joeys. It is asymptomatic in adults (Power, 2005).

Specific stains performed by external laboratories are needed. This cause should be considered if the joey fails to respond to other therapy. No antiprotozoal has been demonstrated to be efficacious against this organism. Bovine colostrum (i.e. Wombaroo® Impact) has been used in other species as it contains immunoglobulins to cryptosporidiosis as it affects calves (Pandey, 2011). In terms of prognosis, some will recover, others may die. It is possible that this is a zoonotic condition but this has not yet been documented in the literature.

STAGE OF DEVELOPMENT: EMERGING JOEYS
This is a stage of natural wastage. The joey leaves the protection of the pouch and needs to develop its immune system at a time of life where the nutritional demands of fur growth, skeletal growth and increased activity are occurring.

Transitional diarrhoea
Although it is generally appreciated that marsupial milk changes through the course of lactation to meet the various needs of skeletal growth, hair growth and activity, little

consideration is given to the effects on the gut of these changes. Mother's milk matches the requirements of the joey. However, in captivity, an arbitrary and often incorrect assessment of the developmental stage of the joey is made by carers and veterinarians, which results in an incorrectly staged milk being offered. Marsupial milk changes from a milk containing high sugar levels of 13% in mid-lactation (age factor 0.4 – 0.6) to decline rapidly to less than 1% for the rest of lactation (Green, 1988) as preparation for a herbivorous diet (Janssens & Messer, 1988). Unfortunately, low lactose cow's milk, which is high in glucose, is still used in marsupials and the sugar levels also contribute to this condition. Joeys that have an age factor of greater than 0.7 being fed a high carbohydrate milk are affected. This is a fully furred, eyes open joey, which only lacks fur on the midline of the abdomen. So, diarrhoea is seen in association with this transition in milk constituents. Do not assume the joey has been aged correctly by another carer. Often recent orphaning creates a desire by carers to place the joey on an earlier stage milk due to perception that later stage milks will be 'too harsh/rich'. The joey presents with loose faeces that have failed to respond to home remedies. A diagnosis is reached based on assessment of age factor and history of milk used. Often the joey is becoming stunted as a consequence of lower protein levels of mid-stage or cow's milk.

Change from the current milk to milk required by age factor 0.7 joeys. This milk is low in carbohydrates, high in protein and fat, similar to mother's milk at this stage. Expect that diarrhoea will take at least this time to resolve. Secondary bacterial infections are possible as the abnormal high sugar environment in the gut may favour the growth of more pathogenic bacteria or yeast.

Clostridial enteritis

A bacterium, *Clostridium perfringens,* found in the soil is the cause. Young kangaroos at pouch emergence are at higher risk as they may access this bacterium from the soil for the first time. High starch foods such as grains and domestic animal pellets may promote the growth of these bacteria in the gut. Kangaroos and wombats need a high fibre diet based on hays and a minimum of pellets offered daily.

Clinical signs include lethargy, off food, and bloody diarrhoea (Ladds, 2009).
Treatment using injectable penicillins and metronidazole can be used to attempt to treat this condition but the success rate is often low. Supportive care includes continued milk feeds, additional fluids and warmth. However, the prognosis is poor: the most common presentation is sudden death. Vaccination using a 5-in-1 livestock clostridial vaccine (Ultravac® 5in1, Zoetis) at pouch emergence and one month later is used for prevention. Use of Wombaroo® Impact in the milk may also provide some protection at 1 g/100 ml.

STAGE OF DEVELOPMENT: WEANED JOEYS

The weaning process can be prolonged in some of the larger macropods. During this stage, the joey is attempting to meet ongoing needs for skeletal growth and activity from a plant-based diet. A 10 kg eastern grey kangaroo has the same energy requirement as its 25 kg mother. At this stage, the impact of the pasture quality and quantity on the health of these animals becomes paramount.

Coccidiosis

Coccidia are host-specific protozoa – over 40 species are found in the intestine of macropod species. (Beveridge, 1978). The brushtail possum (*Trichosurus vulpecula*) hosts a coccidium as does the common (bare-nosed) wombat (*Vomatus ursinus*). *Eimeria kogoni* and *Eimeria cunnamullensis* cause disease in macropods. Eastern grey kangaroos are at risk when grazing contaminated pasture (Beveridge, 1978). Other stressors may permit this disease to occur: translocation, cold weather and overcrowding. It has been documented in eastern and western grey kangaroos, red kangaroo as well as tammar, whip-tail, red-necked and parma wallabies. The ages at greatest risk are emerging from the pouch (4.5 – 5 kg) and weaning (6.5 – 8 kg) in eastern grey kangaroos. The coccidia are acquired by ingestion of oocysts in the soil that has been contaminated with faeces. Infective oocysts remain in the soil for at least two years.

The joey presents with a history of being quiet, hunched, bruxism. It may take a bottle in the morning but not that evening. Diarrhoea begins as green and watery and may progress to blood being present. Death within 24 – 48 hours of clinical signs in per-acute cases. Chronic coccidiosis causes ongoing weight loss and failure to thrive.

Coccidiosis is diagnosed by performing a faecal floatation which may show oocysts, except in fulminant cases. Coccidia are a normal part of gut flora – it is normal to see in faeces but high numbers are suggestive of a problem.

Treatment involves supportive care including the provision of vital warmth and fluids. Ideally joeys are placed on intravenous fluids and receive colloids (Voluven®, Fresenius Kabi). Aggressive fluid therapy may be needed to counter losses of protein through the gut wall. Dubbo Zoo pioneered plasma transfers – blood products from a healthy kangaroo are given to a joey. These joeys are also at risk of becoming septic – monitor blood glucose levels and treat with intravenous antibiotics.

Antiparasitic therapy involves the use of Toltrazuril (Baycox® Piglet, Bayer*)* at 25 mg/kg once, and then repeat treatment 5 days later. This works against 7/8 stages. It is not effective against the stage on the ground! In mammals, as different to birds, it remains in the body for a longer time, so repeated doses are not indicated. Studies in mammals show that this drug may remain active in the body for up to a week. More frequent dosing than once every five days is strongly not recommended.
Maintain adequate nutrition – continue milk feeds and add in Wombaroo Impact at 5 g/100 ml milk. Consider Critical care (Oxbow®) as a supplementary source of grass. Antibiotics that are effective against gut bacteria that may translocate into the bloodstream are indicated. A combination of penicillin IV, SC q 12 – 24 h, 5 d and metronidazole at 10 mg/kg IV q12h 5 d. Trimethoprim/sulphas are active only against the schizont stage of the protozoa and only play a role in mild cases.

Prevention is aimed at treatment of all new arrivals onto the property with toltrazuril. This is especially required before entering the pre-release stage. Intermittent treatment with single doses of toltrazuril at intervals (fortnightly if wet to monthly) to keep the number of oocysts low in the pasture.

Pasture management involves the daily removal of faeces from the paddock to break the cycle. Compliance by carers with this simple but effective management tool is challenging. Pastures should be rested: ideally a kangaroo or wombat paddock contains grass and not bare earth. Food should not be offered on the ground but out of hayracks. Although coccidiostats are recommended, there is no evidence that they are effective, or that the dose rate is correct. Amprolium was recommended by zoo veterinarians in the 1970's. No further work on an effective dose rate has been done. As it blocks vitamin B synthesis, prolonged use results in bloody diarrhoea. Wombaroo® Impact is likely to contain antibodies to coccidia as this is a parasite that affects young calves as well. Use at 1 g/100 ml of milk is anecdotally shown to reduce the severity of the disease.

Gastrointestinal nematodes

Nematodes may play a role in the fermentation of bacteria and the breakdown of grass fibre in herbivores. Herbivores require nematodes to break down the fibre in the grass. So, it is critical for health that indiscriminate worming does not occur. However, one nematode worm that sucks blood, *Globocephaloides trifidospicularis*, has been shown to cause disease. Although this has been seen in wild joeys, it has not been documented in hand-reared joeys, despite overcrowding and poor nutrition.

Death – not diarrhoea, was the presenting sign in wild kangaroos. Examination of faeces by smear or floatation for the eggs. This nematode can be treated using fenbendazole at livestock dose rates. Prevention is aimed at reducing the egg burden in the enclosure. Pick up faeces daily, rotate pasture twice yearly, avoid overcrowding and ensure good nutrition, just as for any herbivorous livestock.

Conclusion

Both infectious and developmental reasons for diarrhoea occur in hand-raised marsupials. The stage of development from in pouch, emerging to weaning can be used as a guide to direct the diagnostic approach by the veterinarian.

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