CASE REPORT

OBESITY AND GASTROINTESTINAL IMPACTION IN GIANT BURROWING COCKROACHES (*MACROPANESTHIA RHINOCEROS*): A POTENTIAL EFFECT OF THE THRIFTY PHENOTYPE

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Abstract

Two 2 captive giant burrowing cockroaches (*Macropanesthia rhinoceros*) with unusual conformation developed progressive obesity followed by faecal impaction in the absence of changes in husbandry. Fluid therapy and removal of the faecal impaction under general anaesthesia was successful in the treatment of 1 case. Radiography was a useful diagnostic tool for evaluating *M. rhinoceros* whereas ultrasonography was unrewarding. The potential for obesity associated with the "thrifty" phenotype in pet cockroaches has implications for the commercial rearing of cockroaches for sale and for veterinarians approaching obesity and its complications in this and similar species. Copyright 2015 Elsevier Inc. All rights reserved.

Key words: anaesthesia; enema; giant burrowing cockroach; impaction; *Macropanesthia rhinoceros*; radiography

The giant burrowing cockroach (*Macropanesthia rhinoceros*) is a wingless, nocturnal member of the blaberid subfamily Geoscapleinae and is unique to the sandy soils of north-eastern Australia. It is best known as the world's heaviest cockroach, weighing up to 30 g and reaching 80-mm long; but is also remarkable in its lifestyle, being ovoviviparous, raising nymphs in familial groups, and creating permanent burrows up to 1 m deep in compact sandy soil.[1-3] The large size, sedentary lifestyle and limited husbandry requirements of the giant burrowing cockroach has increased the popularity of this invertebrate species as pets both in Australia and overseas.

M. rhinoceros are specialist cellulose feeders whose diet consists almost exclusively of dry, decaying eucalypt leaves, which are composted in the burrow with occasional pieces of bark and dried grass.[2,4,5] Recommendations for captive diets commonly add a variety of fruit and vegetables (e.g., banana, apple, carrot and potato) to the primary provision of dry eucalypt leaf litter.[5] Ad lib feeding allows food material to be moved into the burrow whereby dietary intake is self-regulated. Obesity has not been reported in captive *M. rhinoceros* to the author's knowledge; however, metabolic syndrome and obesity have been described in other insects maintained in an environment that restricted exercise.[6]

The "thrifty phenotype" hypothesis describes the correlation between poor nutritional conditions during early growth and increased susceptibility to metabolic syndromes as adults.[7] When exposed to limited nutrition during foetal or juvenile growth, individuals may adopt a thrifty phenotype which prioritises the storage of fat and preservation of high blood glucose levels over reproductive development to endure difficult environmental conditions. During optimal environmental conditions this phenotype lacks the plasticity to

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alter established metabolic patterns and may become "maladaptive", leading to excessive fat storage and metabolic disease.[7] As juvenile *M. rhinoceros* share the same ecological niche as adults and rely on parental care during early growth, this manner of metabolic programming may lead to obesity or metabolic disease among adults when forced lifestyle changes occur in captivity.

Veterinary guidance and medical intervention is rarely described for insect species and is lacking for the treatment of complications arising from obesity. The presented cases describe an approach to the veterinary investigation and intervention in 2 giant burrowing cockroaches with morbid obesity.

CASE STUDY

Two adult *M. rhinoceros* were presented to the Melbourne Zoo Veterinary Hospital following progressive abdominal distension. The first case developed over a period of 2 months and the second over 2 weeks. The diet of both invertebrates consisted of eucalyptus leaves that had been collected from a singular tree for the entire history of the insect collection, supplemented with occasional apple and banana pieces. The 2 female cockroaches had been housed from birth in a group with other adults until breeding age and then moved to a new empty enclosure.

The affected cockroaches demonstrated an atypical body conformation with narrow, elongated abdominal profiles compared to the wide, flat bodies of neighbouring conspecifics. Abdominal distension was sufficient to expose the pale soft tissue between the abdominal sclerites (Fig. 1). Once separated into quarantine enclosures it was clear that faecal output had ceased.

Radiographic imaging of both cockroaches revealed a large soft tissue opacity in the caudoventral coelom and marked distension of the hindgut when compared to healthy adults (Fig. 2). Ultrasonography was unrewarding due to excessive reflection from the cuticle. Marked resistance of the anal sphincter in the conscious cockroach prevented the passage of a fine rectal swab.

To allow removal of the accumulated debris within the hindgut, anaesthesia was achieved using an induction chamber filled with 8% sevoflurane. Each cockroach was then transferred to a modified anaesthetic chamber, constructed from a large syringe case and maintained at 3% sevoflurane with the anus protruding through a latex seal at the end of the chamber to allow for manipulation. A lubricated 25 gauge intravenous catheter was advanced gently through the rectum into the distal hindgut and saline slowly introduced until dry, hard faecal material was aspirated. Paraffin oil was then deposited through the catheter to act as a lubricant to further relieve faecal impaction. Both cockroaches recovered from anaesthesia within 5 minutes of transition to 100% oxygen. Fluid therapy was achieved by introducing 4 to 5 0.04 mL drops of 5% glucose saline to the mandibles using a micropipette at 24-hour intervals. The enema was repeated at weekly intervals for 3 weeks.

FIGURE 1. Dorsal view of giant burrowing cockroaches demonstrating normal (right) and elongate (left) conformation.

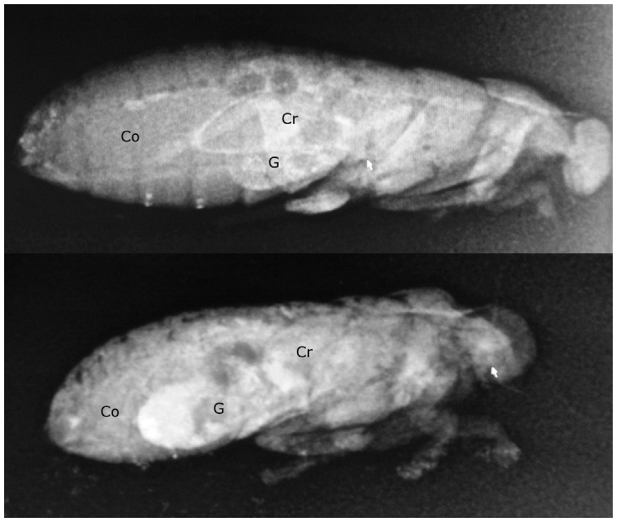

FIGURE 2. Lateral survey radiographs of an adult female giant burrowing cockroach with a 2 month history of obesity and recent faecal impaction (top) and a healthy juvenile (bottom). A distended colon occupies the entire caudal abdominal cavity of the impacted cockroach (top). Co, colon, G, Gizzard, Cr, Crop. Length of top cockroach = 75 mm.

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