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Restraint and Anesthesia of Possums (Diprotodontia: Burramyidae, Pseudocheiridae, Petauridae, Tarsipedidae, Acrobatidae) (12-Nov-2002)

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Introduction

The possums are characterized by having one pair of lower incisors, three pairs of upper incisors, and no lower canines. A pair of sectorial premolars is present in mountain pygmy possums. Most possums are arboreal and can oppose the first two digits of the forefoot against the other three. The first toe on the hindfoot is opposable and lacks a claw. The second and third toes are fused together except at the tip (syndactyly) where a pair of slender claws protrude for grooming purposes. The number of teats ranges from two to six.

Possums are categorized into four superfamilies: the Phalangeroidea (cuscuses, brushtail possums and the scaly-tailed possum), the Burramyoidea (pygmy-possums) all with prehensile tails, the Petauroidea (ringtail possums, Leadbeater's possum, striped possums, wrist-winged gliders and the greater glider) all with a prominent dorsal stripe and prehensile tail, and the Tarsipedoidea (honey possums and feathertail gliders). Table 1 lists all the possums with their weights.

Manual Restraint

Wild animals perceive handling as a major stressor usually associated with being killed. Consequently, manual restraint is only used for minor procedures or prior to induction of general anaesthesia. Any attempt at physical restraint will result in considerable panic and struggling on the part of the animal that will activate the "fight or flight response". This will lead to a release of catecholamines that may result in untoward effects such as hyperthermia or ventricular fibrillation.

As well as attempting to escape the animal will attempt to defend itself. Many possums can scratch and the larger ones will deliver painful bites. They are often presented in boxes or other containers that make restraint difficult. A towel should be used to disorient them. Thick gloves can be worn but large possums are able to bite through these and they markedly decrease sensitivity. Once under the towel the possum is grasped firmly behind the head. Brushtail possums (*Trichosurus* spp.), in particular, are stronger than they appear and will pull back out of a grasp that is too lax. You are more likely to be bitten than strangle the possum, so be firm. It is also necessary to grasp the base of the tail with the other hand (Fig. 1). Otherwise the possum will swing the hindlegs forward in an attempt to scratch. If the possum is then stretched out it can be examined or anaesthetised. Alternatively, it can be placed firmly on a table giving it purchase for its claws, decreasing the likelihood of being scratched.

It is preferable to transport the animal in a bag or pillowcase as this will disorient it, calm it down and give you the edge in any contest. The animal's head can then be grasped through the pillowcase, the material rolled back and the face placed in an anaesthetic mask for induction.

Figure 1. Manual restraint of a brushtail possum. Please note that this possum has been anaesthetised with isoflurane. - To view this image in full size go to the IVIS website at www.ivis.org . -

Chemical Restraint - Inhalation Anaesthesia
Inhalation anaesthesia is the immobilization technique of choice. If the animal can be manually restrained the safest way to induce general anaesthesia is via a non-rebreathing circuit (e.g., Ayre's T-piece), and a mask. Masks can be custom made using variably sized plastic bottles. The bottom is cut off and a piece of rubber glove is stretched over the opening. A hole is then made in the glove to accommodate the animal's face. For animals in bags, anaesthesia can be induced either through the bag, or by extracting the head and placing it in the mask.

Induction involves exposure to 5% isoflurane delivered at an oxygen flow rate of 200 ml/kg/min with a minimum of 1 L/min. Maintenance of anaesthesia generally requires 2% isoflurane, but this varies between species and individuals.

If isoflurane is unavailable halothane is an acceptable substitute, but is not as safe and requires close monitoring.

Chemical Restraint - Injectable Anaesthesia
If the animal cannot be restrained to induce gaseous anaesthesia it will require an injectable induction. Sedation suitable for transport will occur five to twenty minutes after 1 - 2 mg/kg diazepam is injected intramuscularly. Duration of effect is approximately one to two hours.

To induce general anaesthesia Zoletil (Telazol) can be injected at 10 mg/kg intramuscularly. Zoletil is a combination of tiletamine and zolazepam [7]. The advantage of Zoletil is its low volume and rapid effect. However, relaxation is variable and deaths occurred in three squirrel gliders induced at this dose rate [1]. Alternatively, xylazine / ketamine combinations can be used. Dose rates are 6 mg/kg xylazine combined with 30 mg/kg ketamine injected intramuscularly.

Venepuncture Sites
Ventral coccygeal vein - Insert the needle in the ventral midline, perpendicular to the tail, and push it in until the vertebrae are reached (Fig. 2). Withdraw the needle slightly and blood should enter the needle hub. This vein is useful for all possums down to the smallest.

Figure 2. Ventral coccygeal vein in a mountain pygmy possum. - To view this image in full size go to the IVIS website at www.ivis.org . -

Femoral vein/artery - Direct the needle at the pulse felt in the inguinal region. Arterial blood is often obtained and digital pressure is required to prevent haematoma formation.
Medial metatarsal vein - This is a small vein running along the medial aspect of the hindleg (Fig. 3).

Figure 3. Medial metatarsal vein in a common ringtail possum. - To view this image in full size go to the IVIS website at www.ivis.org . -

Cephalic vein - This vein is present on the dorsal surface of either foreleg and can be used in larger possums.
Jugular vein - This vein can be used but is difficult to access due to the short neck of possums.

Table 1. Possum Weights [4].			
Common Name	**Scientific Name**	**Weight - Male**	**Weight - Female**
Mountain Pygmy-possum	*Burramys parvus*	30 - 54 g	30 - 82 g
Long-tailed Pygmy-possum	*Cercartetus caudatus*	25 - 40 g	25 - 40 g
Western Pygmy-possum	*Cercartetus concinnus*	8 - 20 g	8 - 20 g
Little Pygmy-possum	*Cercartetus lepidus*	6 - 9 g	6 - 9 g
Eastern Pygmy-possum	*Cercartetus nanus*	15 - 43 g	15 - 43 g
Striped Possum	*Dactylopsila trivirgata*	246 - 528 g	246 - 528 g
Leadbeater's Possum	*Gymnobelideus leadbeateri*	100 - 166 g	100 - 166 g
Yellow-bellied Glider	*Petaurus australis*	450 - 700 g	450 - 700 g
Sugar Glider	*Petaurus breviceps*	115 - 160 g	95 - 135 g
Mahogany Glider	*Petaurus gracilis*	330 - 410 g	255 - 407 g
Squirrel Glider	*Petaurus norfolcensis*	190 - 300 g	190 - 300 g
Lemuroid Ringtail Possum	*Hemibelideus lemuroides*	810 - 1060 g	750-1140 g
Greater Glider	*Petauroides volans*	900 - 1700 g	900 - 1700 g
Rock Ringtail Possum	*Petropseudes dahli*	1280 - 2000 g	1280 - 2000 g
Green Ringtail Possum	*Pseudochirops archeri*	880 - 1190 g	670 - 1350 g
Daintree River Ringtail Possum	*Pseudochirulus cinereus*	830 - 1450 g	700 - 1200 g
Herbert River Ringtail Possum	*Pseudochirulus herbertensis*	810 - 1530 g	800 - 1230 g
Western Ringtail Possum	*Pseudocheirus occidentalis*	900 - 1100 g	900 - 1100 g
Common Ringtail Possum	*Pseudocheirus peregrinus*	700 - 1100 g	700 - 1100 g
Honey Possum	*Tarsipes rostratus*	7 - 12 g	7 - 12 g
Feathertail Glider	*Acrobates pygmaeus*	10 - 14 g	10 - 14 g
Common Spotted Cuscus	*Spilocuscus maculatus*	1.5 - 4.9 kg	1.5 - 4.9 kg
Southern Common Cuscus	*Phalanger intercastellanus*	1.5 - 2.2 kg	1.5 - 2.2 kg
Mountain Brushtail Possum	*Trichosurus caninus*	2.5 - 4.5 kg	2.5 - 4.5 kg
Common Brushtail Possum	*Trichosurus vulpecula*	1.3 - 4.5 kg	1.2 - 3.5 kg
Scaly - tailed Possum	*Wyulda squamicaudata*	1350 - 2000 g	1350 - 2000 g

Table 2. Hematology [2,3,5,6].				
	Common Ringtail Possum	**Common Brushtail Possum**	**Greater Glider**	**Mountain Brushtail Possum**
Hb (g/L)	134 - 150	139 +/- 0.4	108 - 135	105 - 141
PCV (%)	40 - 48	42 +/- 1	33 - 41	30 - 42
RBC (10^{12}/L)	4.5 - 6.6	6.38 +/- 0.16	4.59 - 6.21	3.99 - 5.92
MCV (fl)	68 - 89	66 +/- 1	59 - 73	68.1 - 80.0
MCH (pg)	22.3 - 29.8	21.7 +/- 0.2	21 - 24	23.2 - 26.7
MCHC (g/L)	31.2 - 33.5	32.8 +/- 0.2	319 - 369	320 - 350
WBC (10^9/L)	4.0 - 9.6	8.2 +/- 0.5	1.3 - 6.6	2.1 - 6.8
Neutrophils (10^9/L)	0.7 - 2.7	2.6 +/- 0.3	0.4 - 2.0	0.5 - 4.8
Lymphocyte (10^9/L)	1.5 - 6.6	4.9 +/- 0.5	0.4 - 5.5	0.6 - 3.4
Monocytes (10^9/L)	0.2 - 1.0	0.4 +/- 0.1	0 - 0.3	0 - 0.5
Eosinophils (10^9/L)	0.2 - 0.6	0.2 +/- 0.1	0 - 0.1	0 - 0.5
Basophils (10^9/L)	0	0.02 +/- 0.1	-	0

Table 3. Biochemistry.				
	Common Ringtail Possum	**Common Brushtail Possum**	**Greater Glider**	**Mountain Brushtail Possum**
Urea (mmol/L)	2.8 - 3.2	5.0 +/- 0.5	1.3 - 8.4	5.8 - 15.8
Creatinine (umol/L)	-	-	40 - 60	50 - 100
Phosphate (mmol/L)	1.4 - 2.4	2.2 +/- 0.3	0.8 - 2.69	0.8 - 2.2
Calcium (mmol/L)	1.7 - 3.6	2.9 +/- 0.1	1.78 - 2.50	2.12 - 2.53
Glucose (mmol/L)	5.6 - 8.0	8.7 +/- 1.6	-	5.7 - 9.0
Total Protein (g/L)	43 - 67	63 +/- 2.0	62 - 72	55 - 64
Albumin (g/L)	24 - 49	35 +/- 2.0	34 - 50	34 - 42
Globulin (g/L)	14 - 33	25 +/- 2	22 - 30	19 - 29
Sodium (mmol/L)	136 - 146	152 +/- 2.6	-	141 - 148
Potassium (mmol/L)	2.8 - 3.6	4.0 +/- 0.2	-	2.7 - 4.9
Chloride (mmol/L)	95 - 103	102 +/- 3.2	-	94 - 108
Magnesium (mmol/L)	2.8 - 3.2	2.4 +/- 0.2	-	-
CK (U/L)	-	-	-	103 - 1676
ALP (U/L)	-	-	252 - 664	838 - 2977
ALT (U/L)	25 - 65	36 +/- 6	36 - 140	13 - 73
AST (U/L)	48 - 77	76 +/- 16	-	79 - 240
Cholesterol (mmol/L)	-	-	-	1.52 - 3.64
Bilirubin (umol/L)	-	-	< 5	2 - 18

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