



DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Initial treatment and care guidelines for rescued echidnas



© 2021 State of NSW and Department of Planning, Industry and Environment

With the exception of photographs, the State of NSW and Department of Planning, Industry and Environment are pleased to allow this material to be reproduced in whole or in part for educational and non-commercial use, provided the meaning is unchanged and its source, publisher and authorship are acknowledged. Specific permission is required for the reproduction of photographs.

The Department of Planning, Industry and Environment (DPIE) has compiled this report in good faith, exercising all due care and attention. No representation is made about the accuracy, completeness or suitability of the information in this publication for any particular purpose. DPIE shall not be liable for any damage which may occur to any person or organisation taking action or not on the basis of this publication. Readers should seek appropriate advice when applying the information to their specific needs.

All content in this publication is owned by DPIE and is protected by Crown Copyright, unless credited otherwise. It is licensed under the [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](#), subject to the exemptions contained in the licence. The legal code for the licence is available at [Creative Commons](#).

DPIE asserts the right to be attributed as author of the original material in the following manner: © State of New South Wales and Department of Planning, Industry and Environment 2021.

Cover photo: Short-beaked echidna (*Tachyglossus aculeatus*). Peggy Rismiller/Mike McKelvey

All other photos have been provided by Peggy Rismiller.

Acknowledgments: These guidelines have been prepared for DPIE by Dr Peggy Rismiller in consultation with Dr Gabrielle Tobias, Dr Katherine Adriaanse and Dr Aditi Sriram.

Published by:

Environment, Energy and Science
Department of Planning, Industry and Environment
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
See also www.environment.nsw.gov.au

ISBN 978-1-922672-53-7
EES 2021/0315
August 2021

Find out more about your environment at:

www.environment.nsw.gov.au

Contents

1.	Introduction	1
2.	Rescue and physical examination	1
	Personnel safety	3
	Distance examination	3
	Capture and handling	4
	Transport	8
	Restraint for physical examination	9
	Physical examination	10
	Coat condition	17
3.	Euthanasia	20
4.	Initial treatment – stabilisation	20
	Fluid rehydration	20
	Pain relief (analgesia)	20
	Wound care	21
	Managing bleeding (haemorrhage)	21
	External parasites	21
	Husbandry	23
5.	Common rescue encounters	25
	Trauma	25
	Burns	28
	Orphaned pouch and burrow young	30
6.	Quarantine and managing infectious disease	32
7.	Zoonotic disease	32
	Salmonellosis	33
8.	Record keeping	33
9.	References and further reading	34

List of tables

Table 1	Age and body weight of echidna pouch young	15
Table 2	Classification of burns	29

List of figures

Figure 1	Decision tree directing the course of action for echidna rescue encounters	2
Figure 2	A puggle in the pouch of a dead female echidna during pouch check	4
Figure 3	Placing an echidna on a cloth used for weighing and restraint during physical examination	6
Figure 4	How to safely pick up an echidna	7
Figure 5	Hessian bag and box for transporting adult echidnas	8
Figure 6	Restraint of an echidna for physical examination. Note the use of the cloth and the echidna supported against the body or on the lap of the handler to facilitate examination.	9
Figure 7	Weighing a pouch young echidna on a digital scale	11
Figure 8	Weighing an echidna in a cloth using spring scales	11
Figure 9	Spongy pad on the front foot of a healthy echidna	12
Figure 10	Temporary pouch (white arrow) of a lactating female echidna who has placed the young in a nursery burrow	13
Figure 11	Belly area of a male echidna who has contracted the stomach muscles to form what appears to be a temporary pouch	14
Figure 12	Hind foot of an echidna showing spur (white arrow) with sheath (left), and spur with shed sheath (right)	15
Figure 13	Beak of a healthy echidna showing the bulbous tip and nostrils at the apex	16
Figure 14	Sunken pad on the front foot of a dehydrated echidna	16
Figure 15	Normal nasal discharge in an echidna	18
Figure 16	Echidna scat	19
Figure 17	Angled, flat-edged forceps used to remove a female echidna tick (<i>Bothriocroton concolor</i>)	22
Figure 18	Housing for burrow young echidna	24
Figure 19	Skull of an echidna	26
Figure 20	Burrow young echidna with puncture wounds caused by a dog	28
Figure 21	Pouch young at 11 days (left) and 34 days (middle) and burrow young at 65 days of age	31

1. Introduction

The purpose of this document is to standardise the initial treatment of echidnas requiring rescue or rehabilitation, in line with the *Code of Practice for Injured, Sick and Orphaned Protected Fauna* (the 'Fauna Code') (OEH 2011).

Echidnas are monotremes with unique physiology, different from marsupials and other native wildlife. This includes low and variable body temperature and wide, unconventional responses to trauma.

Understanding that each case is different and should be assessed individually, this document aims to provide guidance for licensed wildlife rehabilitators in New South Wales on assessment and first aid treatment principles for echidnas first presenting for care.

The primary objective of rehabilitation is the successful reintegration of the individual into the wild. This determines decision-making about the care and treatment of wild echidnas.

The document provides guidance on the initial care and management of echidnas following rescue through to physical examination, initial treatment and stabilisation before presentation to a veterinarian. It provides advice on managing the more common rescue encounters in echidnas, including trauma, burns and orphaned puggles. When encountering obvious severe injuries, seek professional help immediately.

2. Rescue and physical examination

As outlined in the Fauna Code, rescuers must aim to have the echidna assessed by a veterinarian or experienced wildlife rehabilitator within 24 hours of rescue to establish an accurate diagnosis and provide the best outcomes for the patient.

The initial assessment aims to identify the severity of wounds, injuries or illness, in order to determine the best course of action.

Figure 1 provides an outline of the initial decision-making process for echidna rescue cases. It is important to keep in mind that the ultimate goal of rescue and rehabilitation is to ensure the successful reintegration of the individual back into the wild.

Initial treatment and care guidelines for rescued echidnas

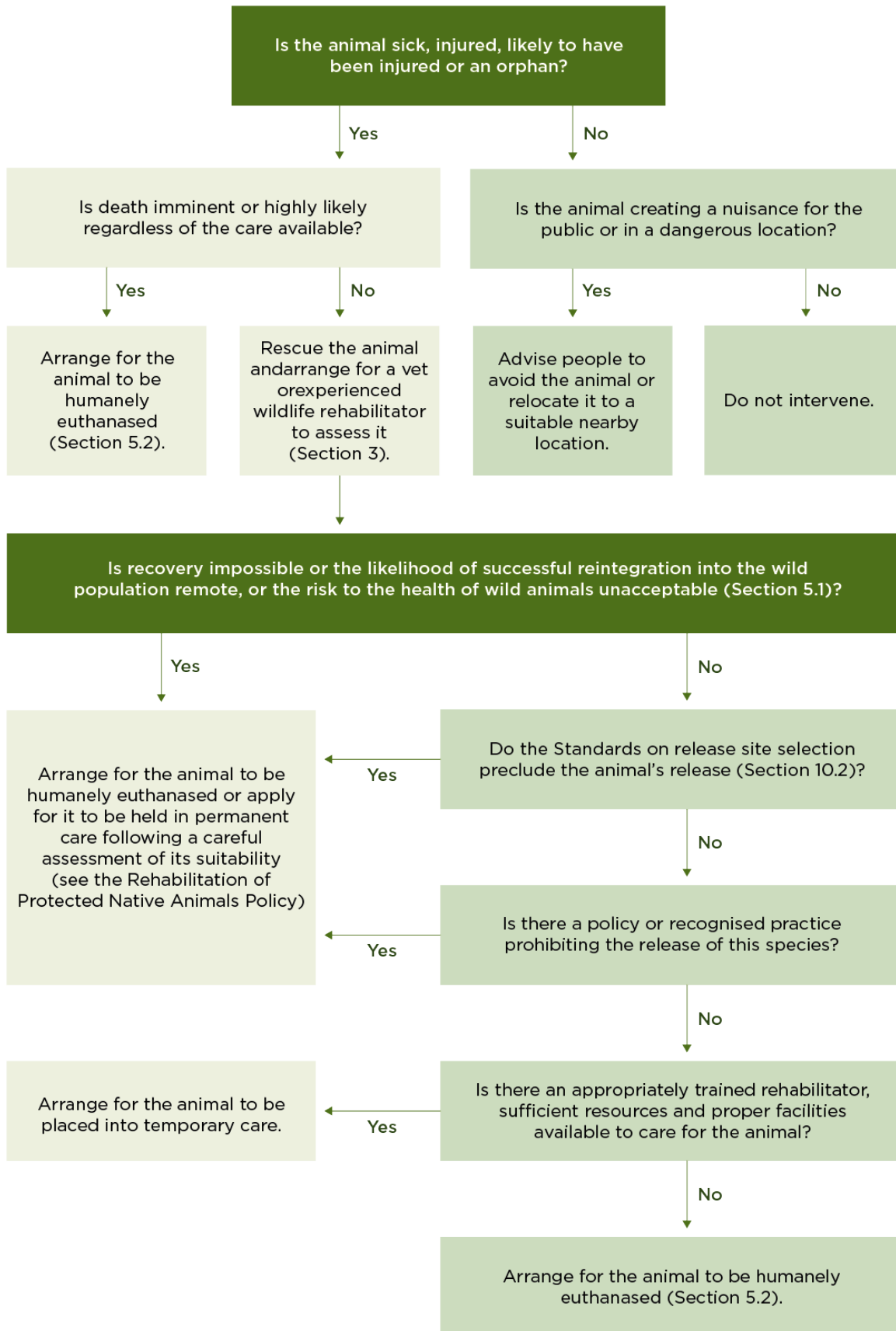


Figure 1 Decision tree directing the course of action for echidna rescue encounters (From the Fauna Code (OEH 2011). Section numbers refer to numbering used in the Code.)

Personnel safety

Before handling echidnas, rescuers should be aware of possible safety risks and take necessary precautions to minimise harm to themselves and the animal. Sick or injured wildlife can cause injury, and disease transmission is possible both to and from humans.

- Protect yourself and the animal by using appropriate personal protective equipment (PPE).
- Avoid handling wildlife if it is unnecessary or you do not feel confident and capable of doing so.
- Use PPE as a barrier where possible – wear gloves or use a towel as a barrier.
- Wear appropriate clothing – robust long sleeves, covered shoes.
- Wear a dust mask if available and particularly if the animal is showing signs of disease.
- Wash your hands before and after handling animals and removing gloves (or use alcohol-based hand sanitiser).
- If bitten or scratched, clean the injury with warm water and soap (or disinfectant) and seek medical advice. Always tell medical staff that you have been handling wildlife.

Rescuers must first be aware of their personal safety when rescuing an echidna on or beside a road. In these circumstances, it is recommended to wear a high-visibility vest and engage hazard lights on the vehicle. When rescuing in suburbia or the bush, be aware of natural obstacles and complications arising from terrain and bystanders.

Rescue should be initiated as soon as appropriate to remove both the echidna and rescuer from dangerous situations and to minimise further injury to the animal. Except for roadside or vehicle strike instances where the echidna is in imminent danger, rescues should only be performed by trained individuals. Refer to the Fauna Code for standards and guidelines about rescue.

Distance examination

Except when rescuing an echidna from the middle of a road, initial assessment begins before the animal is in hand. Some injuries, such as wounds or bleeding, can be determined by observation before capture.

If you observe severe injuries when examining an echidna on a roadside, e.g. bleeding from the beak, fractures or open wounds, arrange to have the animal taken directly to a veterinarian.

Identify if the echidna is on its back or in a curled-up or stretched-out, uncurled position. Observe its behaviour and gait, and look for the presence of external wounds or bleeding. Often, an echidna's first response to trauma, injury or danger is to dig into whatever substrate it is on. Similarly, when distressed or disturbed, an echidna will curl into a ball, even on a hard substrate. This makes it difficult to assess injuries to limbs, wounds to the belly or injuries to the beak. If an echidna does not curl up, lies stretched-out flat or is unresponsive to touch, i.e. no movement of spines, it is likely to have severe injuries.

Look for any signs of breathing. The presence of spines can make visual assessment of breathing difficult, although there are other indicators such as bubbles blowing in and out of the nostrils, movement of the flanks or, if the echidna is on its back, movement of the abdomen and the front limbs as it breathes in and out. When the beak is damaged, a gurgling or whizzing sound is often heard. Echidnas with beak injuries may have an irregular breathing pattern with one deep breath followed by a shorter one. Echidnas have a lower

respiration rate than other native mammals. When injured or distressed, it is not uncommon for an echidna to lower respiration, heart rate, body temperature and metabolism and go into torpor.

It is uncommon for echidnas to vocalise or show any obvious signs in response to pain. When cool to the touch, lethargic and unresponsive to handling, the echidna may be in torpor, but this is not necessarily due to pain, injury or illness.

Torpor is an energy-saving mechanism during which the animal lowers body temperature, respiration, heart rate and metabolism. Echidnas use daily torpor during times of rest and in response to stress or trauma. Seasonal torpor may relate to cold weather, food availability or extreme weather events such as bushfires.

When rescues occur during the pouch-young-carrying period (July – October), check the temporary pouch area for a puggle or signs of lactation (see Figure 2). The temporary pouch will appear as two 'fleshy folds' on the belly of the echidna. A very young puggle will be fully contained in the folds and not visible until the area is gently parted with fingers for examination. A larger puggle (older than 35 days) will often be partially visible between the folds of the pouch.



Figure 2 A puggle in the pouch of a dead female echidna during pouch check

Capture and handling

Capture and handling of echidnas should only be carried out by appropriately trained people. Picking up and restraining an echidna can take considerable time as the first response to disturbance by many echidnas, even injured ones, is to dig in or cling to whatever substrate they are on. Echidnas are extremely strong, and care needs to be taken to ensure the animal is not injured when being lifted up. If the echidna is in imminent danger, such as removal from the middle of a road, decisive, quick action by the rescuer is needed.

It is essential to remember to never pull, lift or hold an echidna by its hind legs or use an implement such as a shovel to dig under it.

Essential items needed for capturing and handling an echidna are:

- A sturdy square of heavy cotton, soft denim or other 'quiet', i.e. non-rustling cloth (approximately 70 x 70 centimetres), with reinforced buttonholes or loops at the corners (Figure 3, also serves as a weighing cloth). Alternatively, a tight-weave towel can be used.
- A catch bag – a large jute or hessian bag (approximately 100 x 55 centimetres).
- A transport container – a plastic domestic garbage bin is extremely useful for holding and transporting echidnas. The echidna is unable to climb out, and it is a very safe option. A towel can be used over the top for privacy. However, it must not be able to fall into the bin as the echidna may be able to use it as traction to climb out if the towel is relatively large. Alternatively, a plastic bin lid with a central hole cut out for ventilation can be used.
- Pouches (small cotton bags) for pouch young.
- Personal protective equipment. If gloves are used, it is recommended to use light-weight work or sportswear gloves. Quick, low-stress, effective retrievals are made when the rescuer can feel and respond to the echidna's movements. This is not possible when wearing heavy leather gloves.
- Patience.

Echidnas are extremely sensitive to sound, smells and movements. Before attempting rescue, ensure pets and domestic animals are secured safely away, any bystanders are quiet and a reasonable distance away and that clothing is not rustling. If photos are being taken, ensure the flash is off.



Figure 3 Placing an echidna on a cloth used for weighing and restraint during physical examination

Note the reinforced buttonhole for connecting to scales.

Methods of capture

For echidnas digging into soil

Kneel as close behind the echidna as possible (Figure 4). Slip one or both hands (palms up) under the shoulders and front legs. When the echidna relaxes, move decisively and confidently, pushing further under the shoulders until the soft underside is felt. When you have a firm hold, lift steadily and quietly towards you (Rismiller 2008). The echidna's natural reaction is to move forward and curl around the hands, giving you a firm grip while protecting the animal from spiking itself.

Note: the echidna's body can move freely within its coat of spines. They can squirm and turn making it hard to keep a grip. If this happens, hold the animal gently against your body or immediately place it on a fabric cloth.

Alternatively, attempt to lift the echidna up by sliding a hand underneath one side between the forelimbs and hindlimbs, tipping the echidna as you go. As soon as there is enough space to allow purchase, place the other hand on the other side and scoop up the echidna. As above, the echidna will naturally curl forward therefore lift the echidna so that its underside is draped over your forearm with its quills against your body. A towel can be placed over the echidna's back to offer some protection. Lifting an echidna from soil can be very difficult given their strength and ability to dig vertically. The rescuer may have to use their hands to dig from the side in an effort to tilt the echidna in a sideways direction to be able to slide a hand underneath.

For echidnas on a hard surface

On hard surfaces, e.g. roads, it is often impossible to slip a hand under the animal to pick it up. The rubber mat from the car, an old coat or flat cardboard can help. Slip the mat, coat or whatever you have as far under the echidna as possible. This usually moves the animal enough that it is possible to gently roll the echidna onto your flexible surface or a thick towel. It can then be carried off the road safely and placed into a bag, if necessary, for rescue.

For echidnas walking

Approach the animal from behind, and without hesitation place both hands with fingers open in front of the legs and under the shoulders. With fingers firmly against the chest, scoop and lift. Place the animal into a catch bag or transport container as soon as possible.



Figure 4 **How to safely pick up an echidna**

The handler kneels directly behind the echidna and places their hands under the front legs and shoulders. Light-weight work or sportswear gloves can be worn for protection.

Transport

The echidna's strength, ability to climb and intelligence make them a significant escape risk. This must be kept front of mind when considering transport and containment. Consideration must also be given to potential causes of beak damage. Echidnas will poke their beak into all nooks and crannies and potential escape routes, which can result in damage and potentially render it unsuitable for release.

A catch bag or towel wrapped around the echidna can be used for carrying and for short-distance transport. If further transportation in a vehicle is necessary, the echidna must be placed in a solid, ventilated wood or plastic transport container with a secure lid (Figure 5). A plastic garbage bin with a clip lid can also be used. Cardboard or Styrofoam boxes are not suitable as they are easily destroyed, and pet carriers with plastic or metal slits can cause further injuries to feet and the beak.



Figure 5 Hessian bag and box for transporting adult echidnas

The box in the photo is a polyurethane fish transport box which has smooth interior walls, a clip and screw-down lid, and is easily cleaned and disinfected.

Always avoid placing a transported echidna in direct sun or a heated vehicle. Echidnas should be kept cool at temperatures less than 25°C and in a quiet environment during transport.

Echidnas are much more prone to heat stress than cold stress (Middleton 2008). Echidnas do not sweat or pant to aid heat loss. They have a relatively low active body temperature range, between 31–33°C (Griffiths 1978, 1989), and their preferred temperature range is 20–30°C (Holz 2015).

Restraint for physical examination

An initial examination can be performed on rescued echidnas with appropriate physical restraint. Sedation or anaesthesia, administered by a veterinarian, may be required to reduce stress associated with handling, and is necessary for a thorough physical examination.

While restraining an animal, the aim is to perform a thorough examination with minimal stress to the animal. The restraint method employed should be tailored to each individual based on its health status and temperament.

Following rescue, when the echidna is in hand, place it on the square cloth and take up all four corners. If the echidna is very active, place it on its back to prevent it from turning quickly. Once secured in the cloth it is possible to examine the head and beak. Holding the echidna under the front legs and against your body, it is often possible to examine the belly. Placing the echidna on your lap supports the animal. In this position, it is possible to feel natural movement and check for broken bones, puncture wounds or bleeding (see Figure 6). Using a fabric square that allows the handler to feel the animal's movements is the preferred restraint technique. This is also the least stressful for the echidna, and if the handler is relaxed the echidna will generally stop struggling and remain quiet.

When working with a restrained echidna, it is important to support and not grip the animal. The lighter the touch, the more relaxed and responsive the echidna.

If the echidna continues to struggle, place it in a catch bag or a secure container in a cool, dark, quiet location. Contact an experienced wildlife rehabilitator or veterinarian to advise on the management of the echidna. Sedation prescribed by a veterinarian can facilitate examination in stressed echidnas or those not tolerant to handling and restraint.

Following mild sedation, echidnas can be placed on their back to examine their underside, legs and beak. Echidnas should be placed in a lap, on a towel or on a non-resonating surface. Examinations should be conducted in a cool, quiet place.



Figure 6 Restraint of an echidna for physical examination. Note the use of the cloth and the echidna supported against the body or on the lap of the handler to facilitate examination.

Signs of stress

Signs of stress in echidnas are difficult to assess. Digging in or curling into a ball are normal reactions to loud sounds, unexpected movements or touch, but can also be viewed as signs of stress. Stressed echidnas will make vigorous attempts to escape if injuries allow. Increased respiration rate cannot be easily assessed in a struggling echidna, and heart rates even less so. Stressed echidnas will often urinate and sometimes defaecate.

As outlined in the Fauna Code, following initial assessment and stabilisation, rescuers must aim to have the echidna assessed by a veterinarian or an experienced wildlife rehabilitator within 24 hours of rescue.

In situations where it is not logistically possible to have the animal physically assessed, contact a veterinarian or an experienced wildlife rehabilitator for advice on continued care, until the echidna can be transported.

Physical examination

A detailed examination of the echidna, including the parameters described below, provides an overall health assessment which is necessary to determine treatment needs and prognosis. Ensure to make notes and keep records of findings (see Section 8 'Record keeping'). In many cases, sedation or anaesthesia is required to allow a thorough physical examination of an echidna.

When performing a physical examination, prioritise the animal's wellbeing. If severe injuries such as broken bones are noted, continued handling and restraint can result in increased pain, stress and further injury. Discontinue the physical examination, and seek urgent veterinary assistance.

Body weight

Body weight can be an important indicator of health. Recording an initial weight, soon after rescue, will provide a baseline for each individual animal. Continued monitoring of weight at regular intervals throughout the rehabilitation process will provide valuable information on the health and development of the echidna.

Body weight is not a reliable indicator of age in echidnas as there is significant variation in adult weights between individuals in a population. There is also no consistent weight difference between males and females (Rismiller & Grutzner 2019).

Adult or burrow young echidnas can be weighed directly in a square restraining cloth with a spring scale (see Figure 7). The cloth should be marked with the weight or the spring scale tared to get the accurate weight. One, five and 10-kilogram Salter spring scales have weight increments of 5, 25 and 50 grams, respectively. If the scale was not tared, the echidna weight can be calculated by subtracting the weight of the bag or container from the total weight of the echidna and the bag or container.

If the echidna is to be weighed on a table balance or other scale with a metal tray, ensure a towel or other soft and noiseless cloth surrounds the animal to avoid excess noise leading to stress.



Figure 7 Weighing a pouch young echidna on a digital scale

Pouch young generally weigh less than 200 grams and can be weighed in a small cloth bag with an appropriate spring scale (available from 10 to 200 grams) or placed directly on a digital scale used specifically for small exact measurements (see Figure 8).



Figure 8 Weighing an echidna in a cloth using spring scales

Body condition

Body condition score is a subjective measurement and is generally graded on a scale of one (emaciated) to five (over-conditioned). During the initial examination, the intention of body score is to identify if the echidna is emaciated or in poor condition. Assessing body condition is very difficult and requires practical experience gained through handling large numbers of echidnas. Pronounced protrusion of the sternum (breastbone), felt by holding a restrained or unrestrained echidna, can indicate the animal is in poor condition.

Body condition score is normally used to assess muscle or fat accumulation at key body locations in a species. This is difficult and not practical in echidnas. Examining resilience on the pads of the front feet (should feel spongy, not flat), although subjective, can give an indication of the animal's health (Figure 9).



Figure 9 Spongy pad on the front foot of a healthy echidna

Identification

In areas where field research is being conducted, it is important to look for signs of identification on rescued echidnas, including microchips and colour codes. In areas where community or rehabilitators monitor rescued echidnas after release, external colour codes that last for a few years may be present.

Microchips

Microchips are inserted subcutaneously (under the skin) on the dorsal midline (along the back) at the level of the shoulders or on the ventral (under) side at the interface between spines and belly hair. If available, use a microchip scanner to identify whether a microchip is

present. As microchips can be difficult to read with a scanner when the echidna curls into a ball, they are best scanned when the echidna is resting flat in a container or bag.

Colour codes

Coloured plastic tubing, fitted over individual spines, is sometimes used to identify individuals. With this method, generally a cluster of three spines are tagged on a specific body part to avoid tag loss when spines are periodically shed. Identification of this type can last for a number of years, but is not permanent. If an echidna with colour codes is rescued, record the colour code by taking a photo and ensure to note down the colour code in the animal's record sheet. Documentation of colour code should be forwarded to the relevant authority to pass on to the registered researcher.

Sex and age

External examination cannot be used to determine sex in echidnas as there are no external genitals. Body weight and size of an animal is also not an indication of sex or age. Echidnas do not have a permanent pouch. Both males and females can pull the stomach muscles together to form what appears to be a small pouch (see Figure 11). Only lactating females form a temporary pouch which is often only obvious to experienced wildlife rehabilitators, especially once the young is placed in a nursery burrow (see Figure 10).

The temporary pouch of the female is created by the swelling of the mammary glands forming a fleshy area surrounding the milk patches.



Figure 10 Temporary pouch of a lactating female echidna who has placed the young in a nursery burrow



Figure 11 Belly area of a male echidna who has contracted the stomach muscles to form what appears to be a temporary pouch

The presence or absence of spurs on the inner side of the hind feet is also not a definitive way of determining sex. All young echidnas (less than four years of age) have spurs. In adults, both males and females may have one, both or no spurs. This is different to the platypus where only the males retain spurs in adult life.

The sex of reproductively mature echidnas can often be determined by gently palpating for the penis, however, this requires experience in technique and handling. During the breeding season, the penis often protrudes from the cloaca during palpation. It is difficult to feel the penis in subadult male echidnas as it is not fully developed until sexually mature.

In conscious adult echidnas, restraint to determine sex can distress the animal and may only be possible with sedation or anaesthesia, administered by a veterinarian. Sex determination is important during the breeding season to assess the presence of egg, pouch young or lactation so the mother can be released quickly and exactly where she was found in order to return to a burrow young. Outside this period, the determination of sex does not affect the treatment of sick or injured echidnas.

The penis of the echidna is only used for reproduction, not urination. Urine flows directly from the urogenital sinus (organ system that includes the reproductive and urinary organs) out through the cloaca.

The age of pouch young echidnas up to 50 days old can be fairly well estimated by body mass (Table 1). Age of echidnas can also be estimated by the presence of spur and sheath. In subadults, the spur is covered by a sheath. Spur sheaths are completely lost when an animal is 24 to 48 months old (see Figure 12). Time of sheath shedding is not related to sexual maturity, however,.



Figure 12 Hind foot of an echidna showing spur (white arrow) with sheath (left), and spur with shed sheath (right)

Table 1 Age and body weight of echidna pouch young

Adapted from Rismiller and McKelvey (2003)

Age (days)	Mean body mass (grams)	Min. – max. range (grams)	Body mass change (grams/day)
1	0.303	0.231–0.371	
5	3.5	2.8–4.0	0.8
10	8.6	4.4–11.0	1.0
15	25.3	20.3–30.0	3.3
20–25	48.3	40.0–55.0	2.3
30–35	105.5	83.0–165.0	5.7
40–45	148.7	120.0–205.0	4.3
50–55	215.6	180.0–270.0	6.7

Hydration status

Hydration status is not easily assessed in echidnas. Even emaciated echidnas often show moderate to good hydration. In well-hydrated echidnas, the top end of the beak will be

bulbous and not flat (see Figure 13). Dehydrated echidnas may have sunken eyes, reduced skin turgor on limbs, and dry wrinkles on the beak. Pads on the front feet should be firm and resilient, i.e. spongy (see Figure 9). Flat, empty feeling pads can indicate dehydration or poor body condition (see Figure 14).



Figure 13 Beak of a healthy echidna showing the bulbous tip and nostrils at the apex



Figure 14 Sunken pad on the front foot of a dehydrated echidna

Coat condition

Spines should be smooth and uniform. Colour variation within the spines is normal. Variation in the surface texture of the spines, e.g. rippled or bumpy, can indicate nutritional deficiencies earlier in life.

- A patch of broken spines can indicate impact area, such as from a vehicle.
- Animals with melted spines or patches of exposed skin are often a result of burn injuries.
- Combination of loss of hair between spines and crusty skin can indicate mange. Mange in echidnas has been reported in areas where they share habitat with mange-infected wombats, foxes and domestic animals.
- Ticks are often present on normal, healthy echidnas. Very heavy tick burdens (numerous visible ticks) may indicate poor health. A thorough search for ticks between the spines, around the ears and on the chest can be stressful and should be performed after more critical issues are addressed or when the animal is sedated or anaesthetised.
- Identify wet patches or blood on the spines to check for deeper wounds. Deep wounds are painful and should only be explored under sedation or anaesthesia administered by a veterinarian.

Heart rate

Heart rate of a resting adult echidna is 50–68 beats per minute (bpm). During capture or handling, it may be as high as 145 bpm. When in torpor, heart rates may be as low as 4 bpm (Augee et al. 2006). Using a stethoscope to accurately assess heart rates in echidnas can be difficult due to the handling and positioning required and should be performed by a veterinarian.

Eyes, beak, nostrils and ears

The eyes are small and difficult to examine when the animal curls into a ball. It is normal that the face and eyelids of an animal that has been digging are covered with soil.

Check the beak for symmetry, protruding bones, wounds or damage to the skin. Check for bleeding or blood-tinged discharge from the nostrils. Echidnas normally produce large amounts of mucus. This can present as bubbling, clear fluid from the nostrils and is a normal observation (see Figure 15).

It is normal for an echidna to 'blow bubbles' through the nostrils during normal breathing when being handled. The nasal discharge is usually clear white to colourless.

The ear slits should be checked for wounds or bleeding. Ticks are commonly found in the short spines and hairs surrounding the ears slits.

If there are any signs of blood, exposed bone or wounds to the eyes, beak or ears, immediately place the echidna in a secure container and seek urgent veterinary attention. These animals require a thorough veterinary assessment to identify concurrent injuries (e.g. radiographs and ultrasound).



Figure 15 Normal nasal discharge in an echidna

Ventrum (underside)

The ventral or belly side of an echidna is soft to touch, smooth and may or may not be hairy. Examination of the ventrum of an echidna may not be possible in all animals, due to their temperament and stress resulting from handling. If possible, check for presence of a temporary pouch that may or may not contain a puggle (see Figures 2 and 10).

Limbs

The front legs of an echidna are short, stout and powerful. Hind limbs are rotated backwards, and the hind feet point backwards at rest. Echidnas are strong and when conscious can be difficult to adequately restrain to examine the limbs. Where possible, gait should be assessed before capture of the echidna. If the echidna shows any signs of lameness or wounds indicative of trauma, a thorough veterinary assessment with sedation or anaesthesia is required.

Feet, nails and pads

Echidnas have five nails on the front feet, with the two on either side shorter than the three in the middle. In younger animals these nails are concave. As the echidna ages, and depending on the terrain where they have been foraging, the nails become more solid and rounded. There are five claws on the hind feet. Depending on the subspecies, the second, third and sometimes fourth claw is elongated; these are termed grooming claws.

Pouch and early burrow young echidna have increased flexibility in the feet, allowing them to close and tightly grip the hairs in the mother's temporary pouch when being carried and in the early stages of burrow life. As the echidna ages and grows closer to weaning, the palms fill out into pads, which no longer exhibit the same flexibility in adult animals.

Assess the digits and nails for symmetry and wounds. Although deformities in the position and shape of nails (e.g. nails curling upwards) have not been shown to affect quality of life in echidnas, any abnormalities should be assessed by an experienced wildlife rehabilitator or veterinarian to identify severity and any concurrent injury or illness.

Body temperature

Compared with other mammals, echidnas have a low core body temperature of 31–33°C. They are capable of regulating body temperature in different ways compared to many native mammals. Echidnas use torpor, the physiological process of lowering body temperature and slowing other body functions, at any time of the year and in many situations. Torpor is an energy-saving mechanism that may relate to stress in a rescue situation or food availability in the wild. Echidnas allow their body temperature to passively drop during times of rest and have been known to lower body temperature to only a few degrees above ambient temperature.

Assessment of core body temperature in echidnas can be difficult due to their small body size, required restraint and cloacal anatomy. Rectal temperature is assessed by inserting a lubricated thermometer into the cloaca and into the rectum (opening closest to the tail). This should only be performed by experienced persons.

When assessing the body temperature of an echidna, the time of year, environmental conditions and physiological condition of the animal should be considered as this may affect the body temperature.

Faecal production

Normal, healthy echidna scats are solid and cylindrical, consisting primarily of soil, often containing parts of undigested invertebrate exoskeleton (see Figure 16). Colour and density of scats varies depending on soil types in the area where the animal has been foraging. Due to their low metabolic rate, an echidna may defecate only once every 48 hours.



Figure 16 Echidna scat

3. Euthanasia

As stated in the Fauna Code, an echidna must be euthanased where recovery is not possible, the animal is suffering from an incurable disease that poses a risk to wild animals, death is imminent, the animal is suffering from chronic unrelievable pain, or its ability to consume food is permanently impaired due to a missing or injured jaw or beak. The Fauna Code, including the decision-making tree (Figure 1) provides further standards and guidelines on euthanasia.

Euthanasia should be performed by a veterinarian where available.

Intravenous barbiturate overdose, administered by a veterinarian, is the recommended method of euthanasia for echidnas in care. Echidnas can be difficult to restrain, and physical restraint can cause considerable stress to the animal. The echidna should be anaesthetised before euthanasia as this provides a better opportunity for venous access and reduces the stress associated with restraint.

4. Initial treatment – stabilisation

Fluid rehydration

Echidnas have the ability to produce concentrated urine and this, along with their low metabolism, allows echidnas to thrive in the extremes of our Australian environments (Middleton 2008). Most rescued echidnas tend to be adequately hydrated, hence fluid therapy may not be immediately necessary. If there is an indication of dehydration (see Section 2 'Hydration status'), fluids can be offered orally or administered via subcutaneous (SC) or intravenous (IV) routes. Administration of IV fluids requires a qualified and experienced veterinarian, sterile techniques and appropriate equipment. Due to echidnas' spines and unusual anatomy, it is recommended that SC fluids also be administered under veterinary supervision.

Oral fluids can be offered to echidnas that are bright, alert and able to drink. Return the animal to its container and provide access to a shallow, sturdy, heavy water bowl and seek veterinary advice.

Pain relief (analgesia)

It is very difficult to assess pain in an echidna as they may not demonstrate external signs that differ from normal behaviour.

In the majority of rescue cases, especially with signs of trauma (e.g. fractured beak, predation), pain relief is crucial for the welfare of the animal. The provision of pain relief must be a priority and must be based on veterinary advice.

Depending on the assessment of injuries, and in consultation with a veterinarian, appropriate drugs can be administered to alleviate pain. Echidnas have a lower than average body temperature and metabolic rate. Medications commonly used in other native wildlife may not be appropriate for echidnas. Therefore, once initially assessed, consultation with a veterinarian regarding the most appropriate drug and route of delivery is imperative.

Wound care

Echidnas with wounds should be assessed by a veterinarian to assess and treat the wounds appropriately. Depending on the severity of wounds, further investigation (e.g. radiographs or ultrasound), surgery or medical (antibiotic) therapy may be required.

Before veterinary assessment, superficial contaminated wounds can be flushed with lukewarm saline or sterile water. Use a syringe and 18-gauge needle to create pressure and direct the flushing.

The benefits of flushing or irrigating wounds cannot be underestimated, as it helps clear debris, decreases potential for infection, hydrates tissues and optimises wound healing.

Bandaging

If wounds between the spines continue oozing after flushing, use a non-adherent, absorbent dressing (e.g. 'Melolin') or gauze pad to wick exudate away from the wound until oozing stops. It is not possible to apply a bandage to wounds between the spines, but non-adherent dressings can be placed over the wounds to help prevent desiccation, flystrike and further contamination. If this is not possible, ensure the echidna is housed in a fly-proof area to prevent flystrike.

Applying and maintaining bandaging on the limbs is also extremely difficult in a conscious animal due to their anatomy. Wounds on the feet can be bandaged temporarily using layers of non-adherent dressing, wound care padding and a cohesive bandaging (e.g. 'VetWrap') material to stabilise the bandage. Ensure bandages are not constricting as this can disrupt blood supply and healing.

Bandages should be maintained clean and dry and should be changed if there is 'strike-through' – fluid from the wound wicking through to external bandaging layers.

Managing bleeding (haemorrhage)

Bleeding wounds on limbs can be managed in the short term with bandaging or by applying digital pressure. Apply pressure using gauze swabs, and bandage with wound padding and cohesive bandaging (e.g. 'VetWrap') to apply even pressure. Ensure the bandage is applying pressure but is not constricting, as this can impede blood supply and damage tissue below the bandaged area. If you can still pass a finger between the skin and the bandage, that is adequate pressure.

For wounds that are in a location that cannot be bandaged, such as between the spines, apply pressure with fingers using gauze swabs or cotton tips and hold the pressure for a minimum of three to five minutes. Seek veterinary attention as soon as possible.

If there is profuse blood loss from a wound or the source of bleeding is from deeper tissues (e.g. muscle rather than superficial skin wounds), apply a bandage where practical and contact a veterinarian as soon as possible for advice.

External parasites

Ticks are the most significant external parasite found on echidnas. Heaviest tick loads are generally found during the wetter months of the year. Healthy, fit adult echidnas generally do

not have heavy tick loads. High tick burdens are most often found on young animals that may be in poor condition or have underlying health issues. Where high tick burdens are identified, a thorough veterinary assessment is required to investigate underlying illness or injury.

Manual removal of ticks on the face and chest is the best management approach. A flat-edged, angled forceps is the most practical instrument (Figure 17).

Removal of ticks should only be performed following initial examination and stabilisation, and where this can be achieved with minimal stress to the echidna. Prolonged handling of wild echidnas to facilitate tick removal can be stressful for the animal. Where there is a high tick burden between the spines, manual removal with appropriate forceps can be performed if required and providing the animal does not appear overly stressed. Use vegetable oil administered with a pipette or syringe for hard to reach or small ticks between spines. Place a drop directly on the tick and surrounding skin. Anti-parasitic medication, prescribed by a veterinarian, can also be used for animals with heavy tick burdens.



Figure 17 Angled, flat-edged forceps used to remove a female echidna tick (*Bothriocroton concolor*)

The smaller male tick is visible in front of the forceps.

Husbandry

Husbandry requirements for echidnas in the initial period after rescue differ to requirements for echidnas in longer term care and should be adapted to each individual depending on the individual's condition, injuries and health status.

Following initial assessment and necessary first aid treatment, echidnas should be left in a quiet, dark, secure container until assessment by an experienced wildlife rehabilitator or veterinarian.

Housing

Echidnas are solitary and must be housed individually until each animal's disease status can be determined by a veterinarian or experienced wildlife rehabilitator (Fauna Code). Housing should be sheltered from direct heat and in a quiet environment free from stressors, including loud sounds, vibrations, domestic animals, people and pungent smells.

Adult

Following initial stabilisation, and before veterinary assessment, an adult can be housed in a large, smooth-walled container, with shredded paper or soft towels which can be changed easily. If the container is less than 100 centimetres in height, it must have a secure closing lid that can be screwed or bolted down (e.g. with a wing nut) and a series of small air holes near the top (approximately 15-millimetre, to avoid beak damage) on opposite walls for ventilation.

Even injured echidnas can be 'escape artists', climbing out of enclosures more than twice their stretched-out height. All lid closures must be tight as further injuries to beak or feet can occur if the animal can push or pry it slightly ajar.

Ensure the echidna container is located in a cool area away from direct heat. Ambient temperatures should be monitored regularly and maintained between 17–25°C.

Burrow young

Following initial stabilisation and before veterinary assessment, make an artificial burrow in a large (60 x 40 x 40 centimetre) smooth-walled container with small air holes near the top and on opposite walls of the box. As the young are underground in a nursery burrow, with no daylight, an artificial hollow can be formed using half a terracotta pot, wooden box or similar dark hide (see Figure 18). The floor of this burrow can be covered with dry leaf litter to mimic the nursery burrow. Keep the burrow in a cool (15–21°C) dark area or with a lid to avoid direct daylight.

Never place an adult, burrow or pouch young echidna directly on a hot water bottle or heating pad.

Pouch young

Pouch young are placed in small cotton pouches which are then folded over, providing a closed, secure environment. This can then be placed in an open, appropriately sized round-

bottomed bowl, mimicking the temporary pouch of the female. Ambient temperature should not exceed 28°C, and where artificial heat sources are used, ensure they are not in direct contact with the animal and they are regularly monitored or controlled by a thermostat.

In the wild, pouch young are exposed to variable temperatures – the female’s body temperature will decrease during inactive periods, and the temporary pouch does not fully enclose the young and is therefore exposed to ambient temperatures.



Figure 18 Housing for burrow young echidna

A broken terracotta pot on leaf litter substrate provides a cool burrow with good ventilation.

Nutrition

Adult

It is not unusual for echidnas that are in care for a week or less not to eat. Echidnas have low metabolic rates and can survive as healthy animals without food for extended periods of time (two or more weeks), especially when in torpor and allowed to lower their body temperature close to ambient (up to three months).

For adult echidnas in longer care periods, a number of specialised diets have been developed and used.

Contact an experienced wildlife rehabilitator before offering any diet to a rescued echidna. The appropriate type, volume, method and frequency of feeding will depend on the age and health status of each individual echidna.

Pouch young

It is unknown how often a pouch young suckles while in the mother's pouch. Rescued pouch young should be transferred to an experienced wildlife rehabilitator as soon as possible.

Burrow young

In the wild, burrow young are suckled by their mother once every five days. It is therefore not urgent to offer burrow young food in the immediate period following rescue. Burrow young may not have fed for more than five days at rescue, and hydration should be assessed before feeding. When burrow young are rescued, an experienced wildlife rehabilitator should be contacted to discuss the specialised husbandry and care requirements.

5. Common rescue encounters

Trauma

Trauma is the most frequent cause of mortality in echidnas rescued in New South Wales. Trauma can be related to a range of incidents such as vehicle strikes or dog or fox attacks.

Follow the basic principles for initial stabilisation (as set out above). Following an initial assessment, it is best to allow the echidna to rest in a dark, cool, quiet location while preparing for treatment. It is not uncommon for an echidna to go into torpor (lower body temperature, respiration and heart rate) as a result of trauma. If there are severe injuries requiring immediate medical attention, treatment should not be delayed, and the animal referred for veterinary care as soon as possible.

Never artificially warm an injured echidna in torpor as this may cause further deterioration.

Motor vehicle accidents

Beak trauma

Any injury to the beak of an echidna should be considered serious due to the specialised function of the beak. Care should be taken when handling these patients as this injury can affect the animal's ability to breathe. Signs relating to beak trauma include:

- blood or bloody mucus from the nostrils
- wheezing or gurgling sounds when breathing
- abnormal position or angle of beak
- exposed bone, wounds or discolouration of the beak.

Animals with beak trauma require immediate veterinary attention for pain relief and a thorough assessment of the beak and concurrent injuries.

Jaw fracture

A jaw misalignment on the underside of the beak and bleeding from the mouth are common presentations of jaw fracture. Radiographs or more advanced imaging techniques are required to accurately assess fractures of the lower jaw (mandible) and beak.

Echidnas with suspected jaw fractures should be immediately transferred to a veterinarian.

The echidna beak is part of the skeletal skull structure, as in a bird. Echidnas have no teeth and the lower jaw consists of two fine bones (mandibles) (see Figure 19).



Figure 19 Skull of an echidna

The lower jaw consists of two bones.

Haemorrhage

Check for signs of external or internal haemorrhage:

- blood in saliva or mucus from the nostrils can indicate internal haemorrhage
- bruising of the skin (most frequently seen in pouch young) indicates trauma and possible internal haemorrhage.

Abdominal trauma

Abdominal trauma and internal injury is not uncommon in cases of motor vehicle strike where the animal was rolled or directly hit. It is difficult to assess internal trauma. Any

echidna suspected to have suffered abdominal trauma should be assessed by a veterinarian as soon as possible.

Limb fractures and dislocations

Fractures of the limbs are uncommon when compared to beak fractures due to the muscular body shape of echidnas (Middleton 2008). Where there are injuries to the limbs, further trauma is likely to be present, and these animals should be presented to a veterinarian as soon as possible for thorough assessment.

When assessing the limbs, note that the hind limbs of the echidna are naturally rotated backwards, and the alignment of front limbs to the shoulder girdle is unique.

Injuries to the limbs can present as lameness or areas of swelling. Immobilising a fracture is vital to reduce pain and tissue trauma.

- Immobilising the echidna in a soft cloth or towel and confining it in a small carrier can reduce pain and additional trauma. The patient should be assessed by a veterinarian as soon as possible and kept confined with minimal handling.
- Open fractures (where the fractured bone is exposed) are at increased risk of infection and carry an extremely poor prognosis. Animals with open fractures should be taken to a veterinarian for assessment as soon as possible. In the interim, again, ensure the patient's mobility is restricted.
- Spinal fractures can result in compromised neurological functions. The echidna may not be capable of curling into a ball or may show loss of motor function. Veterinary assessment and where indicated, radiographs, are needed to adequately diagnose spinal injuries.

Dog or fox attack

Internal injuries are often more severe than they appear to be externally. All echidnas presenting due to animal attack should be assessed by a veterinarian. Often the only noticeable external signs will be broken spines. On more thorough assessment, bleeding from puncture wounds or grazes may be identified in areas of broken spines. Superficial injuries might appear minimal, however, injury to deeper structures such as muscle, bone, joints or organs may be severe. In animals with wounds around the chest or abdomen, internal injuries must be assessed. This requires anaesthesia and imaging (e.g. radiographs or ultrasound). Severe dog or fox attack injuries require antibiotic treatment prescribed by a veterinarian.

- Ensure an initial assessment has been performed once the animal is stabilised, and check between spines and on the belly for puncture wounds.
- Dog and fox bite wounds are contaminated wounds and require antibiotic treatment. Antibiotics need to be prescribed by a veterinarian and the choice of medication and duration of treatment will depend on the severity and extent of injuries.
- Flush and treat external wounds as described in 'Wound care' in Section 4.



Figure 20 Burrow young echidna with puncture wounds caused by a dog

Due to their small size and lack of protective spines, dog, fox or goanna attacks on burrow young can result in much more severe injuries than attacks on adult echidnas (see Figure 20).

Burns

In any rescue situation, rescuer safety is vital. Information about rescues on fire grounds is outside the scope of this document. Only qualified personnel with appropriate training should attend to rescues on fire grounds.

Echidnas have a very different response to fire than other native mammalian wildlife. In the event of controlled burns or wildfires, echidnas may retreat to known burrows such as a cave, tree root or self-dug burrow, or they dig into the ground. Depending on the soil and substrate composition, an echidna may be able to completely bury itself, moving spines to incorporate soil next to the skin for further insulation, lower respiration, heart rate, metabolism (go into torpor) and wait out the fire.

While a fire ground is still smoking, it is not unusual to find echidnas out foraging and displaying normal behaviour. Some have melted or absent spines and singed hair over small or extensive parts of their dorsal surface. 'Semi-bald' echidnas have been sighted a year or more after a fire.

Spines are modified hairs. The roots of the spines extend into the *panniculus carnosus*, a muscle layer unique to the echidna. Spines, like hairs, are shed and replaced naturally. In case of fire-damaged spines, complete replacement may take years, but is not detrimental to the health or normal activities of the animal.

As in other mammals, burn injuries should be classified based on their severity, location and extent. This is an important indicator of prognosis and will direct treatment. In addition to a burns assessment, an overall physical examination should be performed by a veterinarian to check vital signs and identify any concurrent injuries.

Keep welfare in mind when triaging burn cases. Burn injuries are severely painful, and the experience in itself is traumatic. Assessment and provision of pain relief by a veterinarian should be sought as soon as possible.

Depth of burns

There is limited information about burns and burn assessments in echidnas. Due to their unique anatomy, the ability to examine and classify the depth of burns may be limited. Assessing depth of burns can be subjective depending on the experience of the person assessing the patient. Table 2 provides some guidance on classifying burns as superficial, partial or full-thickness burns.

Table 2 Classification of burns

	Superficial	Partial thickness	Full-thickness (3rd degree)
Pathology	Epidermis and upper dermis, most adnexal structures intact*	Epidermis and part of the dermis. Superficial adnexal structures affected	Epidermis, dermis and cell adnexal structures destroyed
Appearance	Red, pale pink	Dark pink to red	Dry, leathery, white, black (charred) or yellow. Eschar (dead tissue) may be present
Blisters	Large within hours	May be present	None
Sensation	Very painful	Less painful	Absent

Adapted from T Duratovic (2016)

*Epidermis: outermost layer of skin

*Dermis: layer of skin below the epidermis

*Adnexal structures: skin associated structures such as hairs, spines, nails

*Eschar: dry, dark scab or falling away of dead skin.

Extent and location of burns

Veterinary consultation is necessary to determine prognosis based on the extent and location of burn injury in echidnas.

- Significant burns to the face, feet and genitals carry a poor prognosis and euthanasia must be considered.

- Full-thickness burns to echidna feet, especially where exposure of the bone of the nail has occurred, carry grave prognosis and euthanasia is indicated.
- Burns to the feet can result in injury to deeper structures, including tendons and bones. It is difficult to immobilise the feet to allow healing and this must be considered when assessing burn injuries. Scarring and deformity can lead to permanent dysfunction and the deeper tissues, including bone, may become progressively devitalised.
- When full-thickness burns damage the *panniculus carnosus* (which permits movement of the spines) to the extent the echidna cannot curl, euthanasia is required.

Both front and hind feet are important for digging and foraging. Pads on the feet contain mechanoreceptors (sense organs that respond to mechanical stimuli) that are important for finding food and receiving other vibrational information.

Stabilising the patient

Following classification of the burn injury, a veterinarian or experienced wildlife rehabilitator should be contacted to discuss how best to stabilise the animal before transfer to a veterinary facility. General guidelines for stabilising an echidna with burn injuries are:

- If the burns are 'fresh', there is a high likelihood there is remnant heat in the wounds, therefore flush the wounds with lukewarm saline flushes or cover the wounds with saline-soaked gauze swabs.
- For burns to the face, flush with tepid saline and seek prompt veterinary advice.
- Fluid therapy is vital as animals can develop shock from severe dehydration. IV fluid administered by a veterinarian is the recommended route of rehydration in the case of burns. If not possible, provide oral fluid replacement.

Treating burn wounds

- All burn injuries require assessment by a veterinarian. Treatment for the burn wounds should be undertaken only once the patient is stabilised. This may be 24 hours after initial presentation. Sedation and pain relief are primary considerations in echidnas with burns injuries.
- Wear surgical gloves when handling burn injuries to reduce the risk of wound contamination.
- Flush burns with lukewarm saline to remove debris and gently pat dry. Following veterinary advice, apply topical treatments such as 'Solosite', 'Acticoat' or 'Flamazine' (silver sulfadiazine) to wounds and cover them to protect the wounds from further trauma, prevent desiccation and relieve pain from exposed nerve endings. Ensure bandages are not too tight or constricting, and when bandaging weight-bearing surfaces (feet) ensure bandages are well-padded.
- Burns are extremely painful, and in most cases, sedation or anaesthesia is required to perform bandage changes. Therefore, following initial stabilisation, transfer to a veterinary facility is advised. A veterinarian can determine the severity of burns and determine the requirement for sedation or anaesthesia and frequency of bandage changes (which may be as frequent as once every two to three days).

Orphaned pouch and burrow young

Clinical assessment and decision-making regarding the treatment of orphaned pouch and burrow young echidnas largely depends on their age. Pouch young under 30 days of age

and under 100 grams have a poor prognosis for survival. Burrow young, generally above 200 grams, are ideal candidates for hand rearing and rehabilitation (see Figure 21). Echidnas are weaned at 200 to 210 days. At this time the burrow young weigh between 800 and 1800 grams, depending on the mother's size.

Housing for rescued pouch and burrow young is described in 'Husbandry' in Section 4.



Figure 21 Pouch young at 11 days (left) and 34 days (middle) and burrow young at 65 days of age (right)

Following initial rescue, long-term care of pouch or burrow young should be undertaken only by (or under the supervision of) experienced wildlife rehabilitators as it is an intensive process requiring experience and time commitment (in some cases many months). Aim to contact an experienced wildlife rehabilitator as soon as possible for advice on husbandry and care of the echidna until the animal can be transferred.

Feeding

There is no need to immediately feed a rescued pouch or burrow young echidna. Although it is unknown how often a pouch young suckles, experience shows they can easily survive 24+ hours without food. Feeding a pouch young should be undertaken only by an experienced wildlife rehabilitator. Do not attempt to force feed or insert any device into the mouth as the mouth is still developing and this can result in damage to the delicate beak structure.

Once the young has been placed in the burrow, a female returns to suckle the young only for around two hours every five days. As a female has no teat or nipple, a bottle cannot be used for supplementary feeding of orphaned young. It is necessary to teach the young to suckle from a shallow silicone cup or similar. Suckling directly from the palm of the rehabilitator's hand is not recommended as bacteria living on human skin are very different to those which live on the skin of the echidna pouch, and ingestion may have detrimental effects for the animal. Feeding burrow young should be undertaken only by an experienced wildlife rehabilitator.

Offering food to rescued pouch or burrow young increases stress. They should be kept in a dark and quiet situation until transferred to an experienced wildlife rehabilitator.

6. Quarantine and managing infectious disease

Quarantine practices are vital in controlling and preventing infectious diseases being transmitted between animals in care. Personal hygiene of the rescuer is essential.

Treat all echidnas as potentially infectious and take precautions to minimise disease transmission between animals, to humans and from humans.

- House animals separately until disease status is determined by a veterinarian or experienced echidna rehabilitator.
- If an animal shows signs of disease (skin lesions, sneezing, coughing, diarrhoea, unusual behaviour), it must be quarantined and managed as potentially infectious until assessed by a veterinarian.
- Animals in quarantine must have their own cleaning equipment, feeding equipment and pouches which are not to be shared with other animals.
- Thoroughly clean all enclosures, food and water bowls and equipment between animals. Cleaning feeding dishes, water bowls, and other cage furniture is best done by removing organic material by cleaning in a sink with detergent, followed by additional cleaning and sanitising by running them through a dishwasher on a hot cycle.
- Ensure pouches, towels etc., in enclosures are thoroughly cleaned before and after use.
- Ensure biological materials such as leaves, soil etc., are disposed of after use to prevent contamination between animals.
- Wash hands thoroughly before, after and between treating and handling individual animals.
- Use PPE as required: disposable gloves, covered clothing, alcohol-based hand sanitiser, dust mask, eye protection (see 'Personnel safety' in Section 2).
- There are a range of available disinfectants with varying levels of efficacy against different pathogens. Follow manufacturers' instructions when using disinfectants as contact time and dilution rates vary across products. Only surfaces that are impervious to water and completely free of organic material can be disinfected. Before disinfection, ensure surfaces are cleaned to remove organic debris.

If an unusual disease or mortality event is suspected, the wildlife rehabilitator must immediately contact their species coordinator to notify the Department of Primary Industries (DPI) Emergency Animal Disease Watch Hotline (24 hours) on 1800 675 888 for immediate assessment of emerging health threats.

7. Zoonotic disease

Zoonotic diseases are diseases transmissible from animals to humans. As a group, wildlife rehabilitators are at increased risk of zoonotic disease due to regular and close contact with wildlife (Hulst 2019). Knowledge of the disease, appropriate personal protective equipment (PPE), hygiene practices and vaccination where available are vital in reducing the risk of disease transmission. Zoonotic infections associated with echidnas are rare and listed

below. Further information on zoonotic diseases can be found on the Department of Primary Industries website: [Zoonoses – animal diseases that can infect people](#).

Salmonellosis

Transmission: The bacteria is shed in faeces and can be contracted through direct contact or indirect contact through fomites (inanimate object that can transfer infectious pathogens).

Symptoms in echidnas: Most animals that shed salmonella are asymptomatic.

Symptoms in people: Can include nausea, vomiting, diarrhoea, fever and abdominal pain and cramps.

Prevention: Hygiene and PPE are vital in protecting against salmonellosis, including hand washing, regular disinfection of equipment, and isolation of affected animals.

8. Record keeping

Accurate records must be maintained to track the progress and outcomes for echidnas in care. If the echidna is referred for treatment at a wildlife hospital, these records provide vital clinical information useful in determining continued treatment and outcomes. They are also a useful resource for research and government organisations.

Records to be maintained include:

- encounter details – date, circumstances, location, name and details of people involved
- individual identification of echidna – sex (if determined), estimated age, identification (microchip or colour code) if present
- initial physical examination findings
- daily notes – including treatments provided, progression or development of symptoms, weight, food intake, faecal output etc.; maintain record sheets while the echidna is in care
- outcome – record the outcome for each individual coming into care (for example, whether the animal was transferred to a wildlife rehabilitator or veterinarian, if the animal was euthanased, if the animal died while in care, or if it was released, including release location).

9. References and further reading

- Augee ML, Gooden B & Musser A 2006, *Echidna. Extraordinary egg-laying mammal*. CSIRO Publishing, Collingwood VIC, Australia.
- Brett S 2007, Complementary Therapies for Wildlife, in Proceedings of the National Wildlife Rehabilitation Conference.
- Duratovic T 2016, First Aid for Fires, in Proceedings of the Australian Wildlife Rehabilitation Conference.
- Griffiths M 1978, *The Biology of the Monotremes*, Academic Press, London, UK.
- Griffiths M 1989, Tachyglossidae, in *Fauna of Australia* Vol 1B Mammalia, DW Waktib and BJ Richardson (eds), pp.407–435, Australian Government Publishing Service, Canberra, Australia.
- Holz P 2015, Monotremes, in *Zoo and Wild Animal Medicine*. 7th edition, ME Miller and RE Fowler (eds), pp. 517–521, Elsevier Saunders, St Louis.
- Hulst F 2019, Zoonoses, in Current Therapy in Medicine of Australian Mammals (Eds L Vogelnest, T Portas), pp. 267–283, CSIRO Publishing, Melbourne.
- Middleton D 2008, Echidnas, in Medicine of Australian mammals, L Vogelnest and R Woods (eds) pp. 77–101, CSIRO Publishing, Melbourne.
- Nicol S, Andersen NA & Mesch U 1992, Metabolic rate and ventilatory pattern in the echidna during hibernation and arousal, in *Platypus and echidnas*, ML Augee (ed), pp.150–159, Royal Zoological Society of New South Wales, Sydney, New South Wales, Australia.
- Nicol S & Andersen NA 2003, Control of breathing in the echidna (*Tachyglossus aculeatus*) during hibernation, *Comparative Biochemistry and Physiology A* 136, pp. 917–925.
- OEH 2011, Code of Practice for Injured, Sick and Orphaned Protected Fauna, Office of Environment and Heritage, Sydney NSW, Australia.
- Rismiller PD 1999, *The Echidna, Australia's Enigma*, Lauter Levin Associates, Connecticut.
- Rismiller PD 2008, *Biology Rescue and Rehab of Short-beaked Echidnas*, updated edition 2019, ISBN 978 0 9805672 0 5, pp. 1–51.
- Rismiller PD 2014, Tachyglossus: survival strategies for successful rescue and hand rearing, in *Proceedings of the National Wildlife Rehabilitation Conference*.
- Rismiller PD 2018, Monotreme Genesis: wildlife care challenges, in *Proceedings of the National Wildlife Rehabilitation Conference*.
- Rismiller PD & Grutzner F 2019, *Tachyglossus aculeatus* (Monotremata: Tachyglossidae), *Mammalian Species* 51 (980), pp. 1–17.
- Rismiller PD & McKelvey MW 2003, Body mass, age and sexual maturity in short-beaked echidnas, *Tachyglossus acculeatus*, *Comparative Biochemistry and Physiology* 139A, pp. 851–866.
- Singh O, Khanam Z, Misra N & Srivastava MK 2011, Chamomile (*Matricaria chamomilla* L.): An overview, *Pharmacogn Rev* 5(9), pp. 82–95.
- Tobias G 2019, Short-beaked Echidna, in *Current Therapy in Medicine of Australian Mammals*, L Vogelnest and T Portas (eds), pp. 405–424, CSIRO Publishing, Victoria.
- Waugh CA, Grigg GC, Booth DT & Beard LA 2006, Respiration by buried echidnas *Tachyglossus acculeatus*, *The Journal of Experimental Biology* 209, pp. 938–944.