

Common surgical (non orthopaedic / respiratory / bumblefoot) conditions of raptors and rehabilitation techniques

Neil A Forbes BVetMed Dip ECAMS FRCVS¹

Soft Tissue Surgery

Any avian surgeon should first be a competent small animal surgeon. The sympathetic handling of soft tissues is essential for a successful avian surgeon. Prior to commencing avian soft tissue surgery, it is essential that the clinician is correctly equipped to deal with small and challenging surgical tissues and situations.

Equipment: In order that avian soft tissue surgery is performed without undue risk of failure, the following items of equipment should always be available: -

Magnification: some form of magnification is essential for all patients under 1 Kg in size. There is a variety of equipment available, whilst bifocal surgical lens attached to a rechargeable halogen light source (and hence no trailing light cables or attachments to immobile light sources), with a variable focal distance is ideal (e.g. Surgi Tel - General Scientific Corp. Ann Arbor, MI, 800-959-0153), the cost is approx. £800. If such a price is excessive for the clinician commencing avian surgery, then they can make a very adequate start with a modified hobby loupe (MDS, Inc, Brandon, FL, 813-653-1180) at £300 including a light source (or doubling up on an endoscope light source for half the cost). The disadvantage of the latter system is that it has a fixed focal distance, and movement of the head away from the optimum distance can lead to a 'travel sickness sensation'. With practice this is easily overcome. The stronger the lenses selected, the shorter the focal distance will be, and hence the closer the clinician will be to the surgical tissues. This should be considered in relation to table and standing or sitting height. In virtually all cases of avian surgery a seated position is advantageous. It is essential that good magnification and in particular bright powerful illumination are available in order to see within the body cavities. Although modified caving lights and similar are available, it is essential that sufficient bright light is available and the latter often do not provide sufficient directional illumination.

Microsurgical instruments: these will also be required and should have the tips only miniaturised. The handles should be a normal length and preferably be counter-weighted in order to minimise finger fatigue. Prior to rushing out to buy a complete set, the clinician should be aware that counter-weighted micro instruments are very expensive. Counterweights do assist in preventing digital fatigue, but this will not be relevant to most surgeons for several years. Once purchased great care should be taken with such instruments, as if abused, they will not last long. If one is used to standard small animal theatre instruments, abuses which you could perform with them (e.g. holding pieces of wire in artery forceps), you cannot do with the new instruments, even if it is very fine wire. On the other side, relatively few instruments are required in an avian surgical kit (fine pointed scissors, needle holders, 2x artery forceps, atraumatic grasping forceps, a retractor – are the essentials). Spring loaded, locking instruments will also greatly assist in preventing finger fatigue.

Electrosurgery: (radiosurgery) employs high frequency alternating current to generate energy. There are two electrodes the active electrode should remain cool.

¹ Clockhouse Veterinary Hospital, Walbridge, Stroud, Glos. England

Training and care are required to use this equipment, but it is invaluable. Proper use of radiosurgery will not cause excessive tissue damage, and will facilitate incision in the absence of significant haemorrhage, as well as accurate control of any bleeding points (using the bipolar forceps). The control of haemorrhage is invaluable, firstly to prevent significant blood loss, but also to permit continued un-interrupted visualisation of the surgical field. The Surgitron (Ellman International) uses radio frequency current, which is received at the indifferent plate, so that direct contact between the patient and the plate is not required. This removes any risk of heat generation on the indifferent plate, which might lead to patient tissue necrosis. The bipolar forceps contain both electrodes in the forceps, so there is no need for the ground plate, these are invaluable for controlling point haemorrhage, (even in the presence of a liquid blood filled field). Cautery with the monopolar head is ineffective if the surgical field is wet with blood, whilst the bipolar electrode will still function efficiently. There is an adapter, which will allow sterile switching from monopolar to bipolar by the surgeon during surgery; this is well worth purchasing.

Correct use of radiosurgery is essential. 3.8 – 4.0 MHz is the optimum frequency for incisions. This frequency provides a precision focus of the energy in a minimal area. Excessive sparking or lateral heat should not occur, if it does the power setting is too high. If the power is too low, the electrode drags this in turn increases the lateral heat and tissue damage, which is undesirable. Any excessive tissue damage will impair post operative tissue healing. Fully filtered waveform is ideal as this minimises lateral heat. The smallest possible electrode size is required, as this also minimises the lateral heat production. The electrode should be in contact with the tissue for the minimum time possible, so as to minimise tissue damage. Once cut the operator should not return to the same tissue with a single wire within 7 seconds, or 15 seconds if it is a loop electrode.

Haemoclips: (Hemoclips, Weck, Solvay Animal Health) are essential for clamping abdominal vessels which, in view of their position, one cannot ligate. Care and practice is required in the safe and effective application of these clips.

Sterile cotton buds: are invaluable for not only applying pressure to control haemorrhage, but also for moving tissues about in an atraumatic manner.

Surgical drapes: during avian surgery a minimum area of plumage should be plucked (in order to minimise hypothermia), likewise excessive wetting of the skin should be avoided, especially with labile fluids such as alcohol (in view of heat loss due to latent heat of evaporation). The accurate visualisation of respiration is essential for monitoring depth of anaesthesia. For all these reasons the use of sterile clear plastic surgical drapes maintained on the skin with an aerosol spray adhesive, has many benefits. There are a number of purpose prepared self adhesive drapes available, alternatively sterile clear surgical drapes can be used with an aerosol surgical adhesive (which is generally much more economic).

Preparation: Prior to avian surgery the patient's condition must be assessed, any energy, nutritional, fluid or blood deficit will require addressing (Redig 1996), so will the control of intra operative and post operative hypothermia, analgesia and shock (Lawton 1996). The use of an intra cloacal temperature monitor during surgery is useful. Since the advent of isoflurane anaesthesia, many intricate avian surgical procedures can be contemplated as routine. If salpingohysterectomy is planned, if the bird is placed in reduced day light (8 hours) for 10 days, this will reduce the oviduct size and vascularity, hence reducing the risk of intra-operative haemorrhage.

Position: the surgeon should operate sitting down, with appropriate forearm support, in order to minimise tremor. The surgeon should be familiar with the following soft tissue approaches:

Ingluviotomy: for retrieval of crop, proventricular or ventricular foreign bodies, or placement of an ingluviotomy or proventriculotomy tube. The method is also used on occasions as the quickest and least traumatic manner of emptying the crop (e.g. in 'sour crop'). Similar techniques are used when crop biopsies are required, or for crop repairs following traumatic lacerations. The bird is placed in dorsal or lateral recumbency; a probe is placed into the crop via the mouth, so as to verify the position of the crop. The skin is incised; the crop wall localised and isolated, prior to incision. Closure is by two layers of continuous inversion sutures, prior to separate skin closure.

Left lateral coeliotomy: for access to the gonads, oviduct, proventriculus and ventriculus. The bird is placed in right lateral recumbency. The wings are pulled dorsally, as is the left leg. The skin web between the abdominal wall and the left leg is incised to facilitate further abduction of the left leg. Sufficient plumage is removed and the skin prepared. A bold incision is made from the level of the 6th rib to the level of the pubic bone on the left abdominal wall. The superficial medial femoral artery and vein will be visualised on the medial aspect of the coxofemoral joint, which should be cauterised with the bipolar forceps prior to transection. The 7th and 8th rib will also be transected. Prior to transection, the bipolar forceps are placed around each rib, from a caudal position, so that the points close over the anterior aspect of the rib. The intercostal blood vessels are then coagulated, prior to transecting the rib. A small retractor (e.g. Heiss) is then inserted between the cut rib ends to allow full visualisation of the abdominal cavity.

Salpingohysterectomy: it is not possible to remove the avian ovary (as it is firmly attached to the dorsal abdominal wall), however in order to prevent further egg laying one may remove **all of the** oviduct and uterus. The ventral suspensory ligament (of the oviduct and uterus) is broken down. A significant blood vessel enters the infundibulum from beneath the ovary, this should be clamped off with two haemoclips, prior to transection. The dorsal suspensory ligament of the uterus should be identified extending from the dorsal abdominal wall to the uterus. In this ligament are a number of blood vessels which should be coagulated or clipped. The uterus and oviduct is then exteriorised. Care should be taken in resecting the dorsal suspensory ligament, as one approaches the dorsal abdominal wall. If resection is continued too far, there is a danger of resecting one or more urethers. The placement of a cotton bud per cloaca, will assist in delineating where the uterus should be clamped off, which is achieved by applying two clips to the uterus and transecting distal to these. All haemorrhage is controlled prior to closure of the abdominal muscle wall and then the skin each with a simple continuous suture pattern.

Orchidectomy: may also be performed via this approach. The testicles (like the ovaries are attached to the dorsal abdominal wall, adjacent to the aorta, and connected only by a short testicular artery. The left testicle is identified, the caudal pole is elevated and a haemoclip placed under the testicle. The testicle is then incised over the clip, once achieved a further clip is applied, etc.. If any testicular tissue is left, there is a possibility of regeneration. Access to the right testicle will be more difficult requiring blunt dissection through the air sac wall. A similar removal process may then be performed on this testicle.

Proventriculectomy for biopsy or access to ventriculus. The gizzard or ventriculus will be identified as a muscular organ with a white tendinous lateral aspect. All air sac and suspensory attachments to the structure should be removed. Two nylon stay sutures should be placed in the white tendinous part of the gizzard (ventriculus), and sutured to structures outside of the abdomen, so as to maintain the ventriculus firmly in the abdominal opening. The triangular portion of liver, which covers the isthmus between the proventriculus and the ventriculus, is identified. Using a sterile cotton bud, the liver is elevated, revealing the optimum incision site into the proventriculus, to facilitate biopsy or access to the ventriculus for foreign body removal. The incision is closed in two layers, and the liver is then tacked in place over the top of wound. Birds have no mesentery, so enterotomy carries a higher risk of

post operative peritonitis. The liver is utilised in this situation, in a similar manner to the mesentery, in order to provide additional protection against post closure seepage.

Ventral Midline Coeliotomy: This approach will facilitate liver biopsy collection or cloacopexy. The bird is placed in dorsal recumbency, the midline prepared and the legs pulled caudally. The skin of the abdominal wall is tented up and an initial small incision is made using the single wire radiosurgical electrode, great care is taken not to incise too deep, in which situation iatrogenic perforation of the gut could occur. The incision is then extended rostrally and caudally. The linea alba is located, and a further radiosurgical incision is made through this.

Liver Biopsy: Liver biopsy is a commonly indicated procedure in raptors as in other avian species. The liver will be identified beneath the sternum. A loupe of suture material is placed around a corner of liver, or two separate sutures are placed through a point of the liver (to form 2 sides of a triangle, the third side being the free edge of the liver. A knot is pulled up tight in the ligature, which will cheese wire through the liver parenchyma, but not the blood vessels. Alternatively two fine artery forceps may be applied so as to isolate a triangle of liver tissue. Once haemorrhage has been prevented in either manner, the segment of liver may be removed. Alternatively a monopolar loupe electrode may be used to harvest a biopsy. In such cases the power is activated prior to making contact with the tissues.

Cloacopexy : cloacal prolapse is the common indication for a Cloacopexy. The underlying cause of prolapse must be identified and controlled for surgery to be effective. Commoner causes are cloacal urolith, protozoal or bacterial infections, papilloma or other mass occupying lesions. A cotton bud is advanced into the cloaca, and used to tent up the cloaca within the abdomen, in order to confirm its position. An incision is made over the most anterior portion of the cloaca (in a horizontal fashion), being careful not to incise the thin walled cloaca. The fat pad which is present on the ventral aspect of the cloaca is removed (as it would impede adhesion formation). Two sutures are placed, one around the 8th rib on each side, then each is passed through the full thickness of the cloaca on their own side, each suture is tightened. Two further sutures are taken through the cloacal wall which are incorporated in the abdominal muscle closure, to maintain the cloaca in its new anterior position.

Abdominal Hernia Repair : these lesions occur especially in obese female psittacines, especially cockatoos, but are rarely seen in raptors. They are thought to be often related to breeding or hormonal influences.

Prior to surgery being considered at all, it is vital that the bird is weaned off a seed-based diet onto a more balanced (pelleted) diet, and a significant amount of weight is lost. In raptors if they are seen it is inevitably in obese aviary breeding birds, although atherosclerosis and per acute death is a commoner sequel to obesity in raptors compared with hernia. The hernia is not akin to the typical mammalian situation. There is no specific hernia ring, rather a thinning and gradual separation of muscle fibres. In view of this, surgery to pull the sides of the deficit together will be unsuccessful. It is generally recommended that the bird should be neutered (salpingohysterectomised – see above). Following this a tuck may be taken in the abdominal musculature. The owner should be warned that this might not be effective, and additional surgery at an additional cost might yet be required.

If such further surgery is required, a non-absorbable mesh material will need to be sutured in place. If such surgery is required, attempt to get the bird to loose weight if obese, and perform surgery before the herniation is too large.

An extensive ventral midline approach is used. Mesh is attached to each pubis, and across the ventral caudal abdominal wall in between each bone. It is further attached to each 8th rib, as well as the

sternum. These meshes are generally well tolerated although intense attention to sterility during surgery is essential. If surgery can be avoided by dietary change and weight loss this far preferable.

Tracheotomy: this procedure is most commonly indicated in the treatment of a syringeal aspergilloma or retrieval of a tracheal foreign body. The bird is placed in dorsal recumbency, with the head directed towards you. The front of the bird should be elevated at 45° to the tail, so as to facilitate full visualisation into the thorax. A skin incision is made adjacent to the thoracic inlet. The crop is identified, bluntly dissected and displaced to the right side. The interclavicular air sac is entered, and the trachea elevated. The sternotrachealis (inserted on the ventral aspect of the trachea), is transected. Stay sutures may be placed into the trachea, in order to draw it in an anterior direction. It will be impossible to completely exteriorise the syrinx. A tracheotomy may now be performed, cutting through the ligament between adjacent tracheal cartilages, around ½ of the tracheal circumference. The incision is repaired with single interrupted sutures (6/0 maxon 2-3 sutures only) placed to include two rings either side of the incision. If additional access is required, the superficial pectoral muscles may be elevated, and an osteotomy of the clavicle performed. On closure the two ends of the clavicle are left as they were. The muscle is replaced and sutured into position. The crop is carefully sutured back into place, so as to close over the entrance into the interclavicular airsac, using a continuous suture pattern and an absorbable suture material. The skin is closed using an absorbable material such as 'vicryl rapide'.

Trachectomy

In cases where a severe tracheal stenosis occurs following trauma or infection, tracheal resection and removal of the affected tissue can be performed (Clippinger & Bennett 1999). In such cases close apposition of cartilages following surgery, using a suture material which elicits minimal tissue reaction (eg Polydioxanone, Ethicon) is used in order to minimise intra-luminal granuloma formation. Certain but not all species can tolerate a shortening of the tracheal length.

Post Operative Care

As previously described, post operative care of avian surgical patients is essential. Analgesia is essential, (carprofen (Zenecarp) 4mg/kg i/m is the general drug of choice for the author, although meloxicam (metacam) 0.2 – 0.4mg/kg may be safely used orally in food).

Fluid therapy, warmth, nutritional supplementation and good nursing are all as important as the surgical skills.

Further conditions with surgical implications commonly affecting raptors

Egg lethargy, is a normal physiological process which will occur to a variable extent in all egg laying females. An egg laying female extracts an immense volume of calcium from her blood which in turn is replaced by more calcium from the bone, in order to coat her precious egg with a shell. If her homeostatic mechanism is not sufficiently well tuned, when the calcium is removed from the blood, it is not replaced sufficiently quickly from the bone, leading to a dangerous reduction in blood calcium levels, which on occasions may drop seriously low, leading to lethargy, weakness, lack of muscle contractions and even on occasions fits, coma and death. The problem is caused initially by either a low calcium diet, a non functional parathyroid gland, kidney defects, lack of sun light (i.e. ultra violet light to convert vitamin D₂ in the diet to activated vitamin D₃ which is essential for calcium metabolism). The reader must appreciate that this is a complex system, which requires extremely accurate and efficient control.

Egg binding : when does egg lethargy become egg binding or worse? Typically a female will control her calcium metabolism so well that one is unaware of any changes which she is under going, except of course for the behavioural changes which accompany nest building, courtship (e.g. food passing),

copulation, and egg laying. A female should not spend undue time on the nest, and certainly should not be on the floor of the aviary and unable to stand up. It is crucial that the keeper maintains efficient visual monitoring of the female wherever she is in the aviary. Egg binding, technically is when a female is trying to lay an egg which has become stuck on its passage down the oviduct. This often occurs with hypocalcaemia in view of the prerequisite for Ca in order that muscle activity should be normal. The main factors responsible for aberrations of Ca metabolism are changes of weather, especially wet windy stormy weather, frights and shock, calcium deficiency or concurrent disease or illness.

Treatment for egg binding

Intra venous fluid therapy and calcium (preferably following blood calcium analysis)

Oral calcium and activated vitamin D₃ are also advantageous. The bird should then be left quietly in a darkened enclosed box for an hour prior to re-examination.

Following this initial hour if no egg is forth coming, further fluid therapy (and calcium if required) may be administered. Intra cloacal PGE gel may also be administered. Great care must be taken not only in respect of handling this drug, but also in the handling the egg and bird subsequently. Oxytocin is considered to be generally ineffective. Lubrication of the egg is unlikely to effective, and will inevitably render the egg non viable (should subsequent hatching be considered important).

Following the interval of a further hour, if no egg is forthcoming, invasive action is required. With the bird anaesthetised, the position of the egg within the oviduct must be assessed. Often the egg is proximate to the cloaca, it it may be considered that the egg is expendable. In such cases, the authors preferred technique is to trap the egg in a caudal position, by placing the index finger and thumb of the left hand anterior to the egg, such that the egg is pushed caudally. A blunt ended, straight metal feeding cannula is attached to a syringe, and introduced per cloaca. With the egg being gently pushed caudally, the cloco-oviductal junction will be stretched across the caudal pole of the egg. Using the cannula, with gentle manipulation the entrance to the oviduct can be located and the cannula opposed directly against the egg shell. The cannula is gently advanced through the egg shell (if the shell is thick and this is difficult, the initial hole is created using a hypodermic needle). The cannula is advanced into the egg, the contents are aspirated into the syringe, and then the cannula is gently advanced through the proximal end of the egg shell in several sites, so as to further weaken the shell. Care should be used in doing this so as not to damage the oviduct which will be immediately adjacent to the egg shell.

The cannula is then removed. With the egg contents removed, and the egg shell weakened, it is then easy with very little trauma to implode the egg shell. The collapsed shell is then generally left in situ, and voided by the hen later.

Consideration should be made to the cause of the egg binding, in particular as to whether it might have been nutritionally or managementally related. Although by the time of an egg binding, the next follicle may have already been released, a change in husbandry, reduction of day light, change of accommodation etc may assist in breaking the breeding cycle such that the internal organs have adequate time to recover from the recent trauma.

If however the egg is considered to be sufficiently valuable or the egg is halted at a more cranial portion of the oviduct, then surgical intervention may well be considered to be a preferable option. On occasions when dealing with economically or genetically valuable birds, the egg alone may be of considerable value (e.g. £2000 for black eagle egg). Furthermore, if the egg is stuck in a cranial position this may be associated with a rupture of the ventral supporting ligament of the oviduct with a torsion of the follicle containing oviduct through the ruptured ligament (Harcourt-Brown 1996). The

authors favoured approach is the standard left lateral approach as it generally facilitates good access to all of the oviduct. A direct ventral midline approach is possible but the surgical field is more likely to be complicated by the presence of intestines.

An incision is made from pubis to 8th rib or beyond in a cranial direction as is required, through the skin and lateral abdominal wall (first cauterising the medial femoral artery and vein). The oviduct is readily visible as a whiter structure (compared with the intestines) although patches of congestion and haemorrhage may also be present. A caesarian section is performed by cutting through the oviductal wall directly over lying the egg. The egg is carefully removed, and the wall closed with a single or double layered inversion pattern. Although further immediate egg laying should be discouraged, such hens will frequently recycle and lay a further successful clutch in 10-14 days. This procedure has been successfully achieved by the author with both caesarian section and subsequent eggs being viable.

In the event of an oviductal torsion, if the bird has limited or no future breeding value, the preferred option is a salpingo-hysterectomy. If future breeding is important, then following a caesarian section, ventral supporting ligament repair may be attempted.

Prolapsed oviduct – is not uncommon in breeding raptors and is most commonly associated with oviductal adhesions and other causes of dystokia. There are three treatment options (euthanasia, salpingohysterectomy, oviduct replacement, supporting ligament repair and oviduct-pecti. It is important to appreciate that simple return and cloacal purse string suture is not a treatment option.

This is a truly acute emergency, the potential future breeding ability of the bird is very poor, hence if it has not other use, euthanasia may be an option. The best option for survivability would be, stabilisation, fluids, shock control, followed by salpingohysterectomy. The option for full oviduct repair is very stressful for the bird, and the recovery rate is very poor (<5%), although it is linked to the time interval between prolapse and treatment. For a prolapse to have occurred, the supporting ligaments of the oviduct must have been ruptured and these would require surgical repair. The prolapsed oviduct is by its nature intersuscepted (a section may not be viable), and replacement of this very fragile organ often leads in further iatrogenic trauma.

Prolapsed colon – this is commonest in red tail hawks (*Buteo jamaicensis*) and also occurs as an acute condition. It may be readily differentiated from the prolapsed oviduct simply on the visual appearance (size, colour and consistency). Prolapses typically occur secondary to protozoal colonic or cloacal infections. For a prolapse to be present there must be an intersusception of the colon, typically there will be a length of non viable colon. Thankfully Red tails are very tough birds and will usually cope well with enterotomy. Following a left lateral or mid line coeliotomy, a section of colon is removed such that two healthy ends with good vascular supply can be rejoined. In view of the small diameter of the descending colon, the author favours a side to side anastomosis.

Egg peritonitis occurs when a yolk is released from the ovary, and instead of passing into the infundibulum (funnel) at the top of the oviduct it passes into the abdomen, often giving rise to an egg peritonitis. Alternatively if a yolk is already passing down the oviduct, if some shock or trauma occurs, e.g. a fright, bad weather, calcium deficiency or egg binding, then the egg which is in transit, may stop moving down and instead go into reverse, then travelling back towards the ovary. If this continues, the yolk, perhaps by this stage with albumin (egg white) added may end up back in the abdomen, leading to a severe peritonitis. A hen which has suffered egg binding very often then has egg peritonitis with the subsequent egg. Prevention is not always possible, but sensible measures are obvious.

Treatment needs to be quick if the bird is to be saved, this will comprise antibiotics fluid therapy and on occasions a salpingo-hysterectomy. Once a bird has had an egg peritonitis, even if it does recover, a high percentage has further gynaecological problems in the future, due to the formation of extensive adhesions. Such adhesions can be dramatically reduced if the coeliomic cavity is flushed with hyaluronidase in saline, and drainage is permitted at the time of the incident.

CARE OF THE TRAUMATISED BIRD

In most countries there is little or no control or inspection of wild life rehabilitation facilities and standards. Such a situation is often fuelled by the lack of financial involvement or funding of any such facilities. We as a profession have a great role to play in assisting all this highly committed and motivated impecunious organisations and individuals to conduct this invaluable service in an effective, safe and professional manner. When traumatised birds are presented the first priority must be towards maintenance of vital functions (see Table 1 above for schematic diagram of appropriate actions for a trauma case), (only after these have been controlled, can an accurate diagnosis and assessment of the bird's prognosis be made). Respiratory function must be assured by maintaining a patent airway, (if necessary by inserting an air sac cannula). Hypovolaemia must be corrected using intravenous crystalloid and or colloidal preparations. The exact treatment regime and assessment protocol will depend on the source and type of patient involved.

Wild injured birds should always be assessed with release back to the wild in mind. It is the author's opinion that unless the species is genuinely very rare, that if at any stage during the treatment it becomes apparent that the bird will not be releasable, that the bird should be euthanased. The clinician should be aware of any legal restraints relating to the treatment and release, or the maintenance of handicapped wild birds in captivity. The future viability of captive traumatised birds should be considered. Treatment which will leave a bird so crippled that they cannot achieve a useful, enjoyable, illness free life should not be carried out.

In cases which warrant continued treatment, the following additional factors should be considered. Any bird which has suffered significant trauma to suffer a bone fracture, may have other significant (possibly internal) injuries. The integrity of blood supply and nerve function as well as soft tissue viability is essential. Exposed soft tissues are prone to desiccation. Iatrogenic injuries and ischaemia can occur, (especially to the propatagium), if dressings are excessively tight.

Trauma cases may be subdivided according to their cause and nature, (blunt or sharp, single or multiple point). Extensive prognostic data are available for bone injuries. The nature of a fracture, the bone affected and the proximity to a joint are key factors. Thermal trauma may be subdivided into flame / electrical / ingested (ie. crop burn) / or inhaled. Water may be the cause of traumatic injuries as a consequence of submersion, soaking (especially if waterproofing is ineffective) and subsequent chilling or inhalation.

The clinician should also consider what other concurrent infections or infestations may be present. Many wild birds carry a parasitic burden. However once injured, the host-parasite balance may be upset in favour of the parasite. Myiasis can be a problem in wild injured birds, especially where there is a delay between injury and treatment. Species particularly susceptible to stress-induced infections (eg. aspergillosis in certain raptorial species), should receive prophylactic medication. The cause of the trauma should be considered so that recurrence can if possible be avoided. Wild trauma cases must be nursed with recovery and release in mind. Food should be readily utilisable and feather structure and condition must be maintained. Pain is less readily perceived in birds, but its relief improves food consumption, assists in the maintenance of body condition, speeds recovery and is a basic welfare requirement.

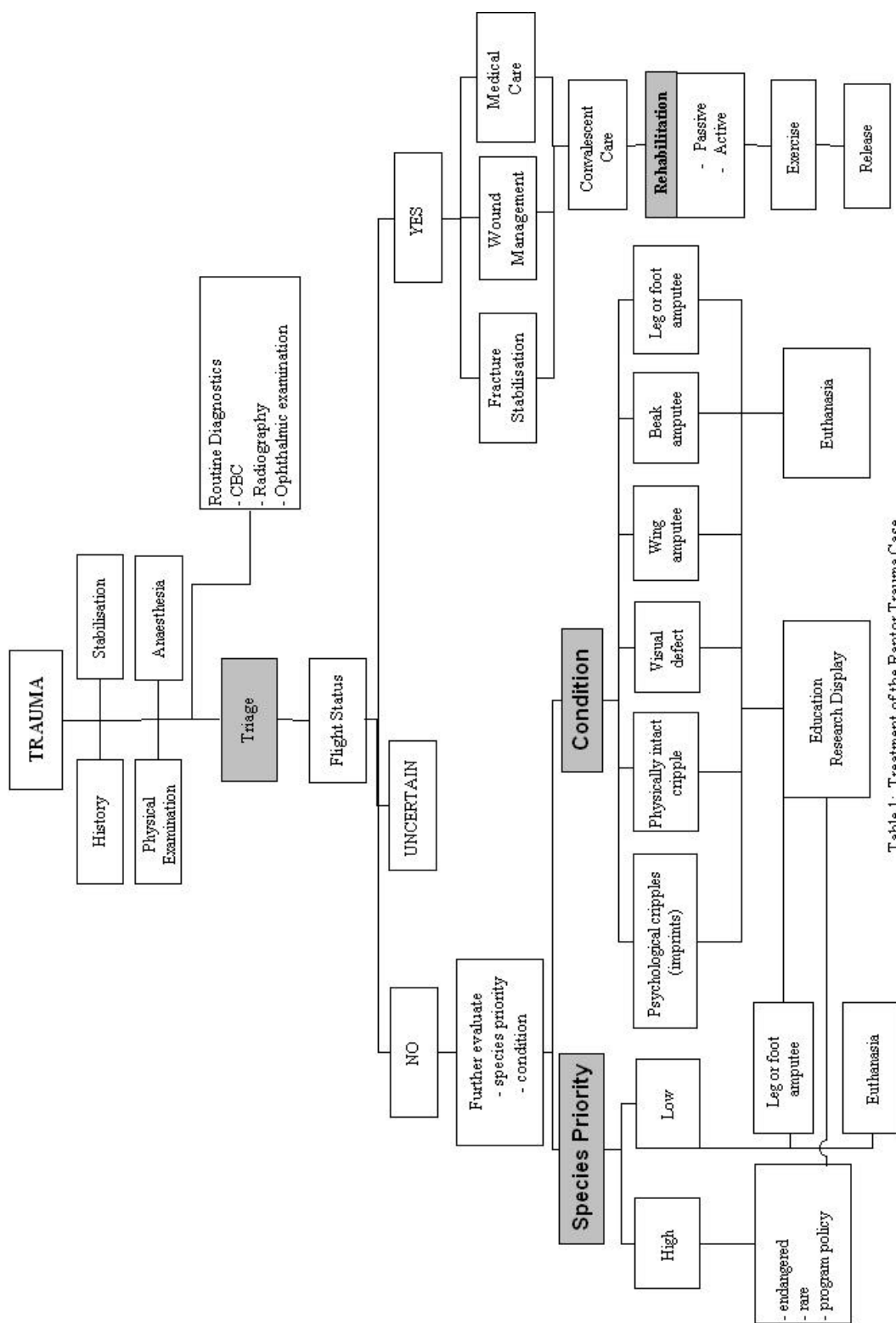


Table 1: Treatment of the Raptor Trauma Case

AVIAN CRITICAL CARE - STABILISATION AND DRUG ADMINISTRATION

Many avian patients are presented in a critical condition, in part because they mask the signs of illness but also because the rate of pathogenesis is typically rapid. The sick bird requires an approach which stabilises the acute condition of the patient whilst also facilitating the formation of an accurate diagnosis. The delicate nature of the critically ill avian patient may preclude the conduct of all diagnostic tests which one would ideally perform.

There is no doubt that less stress is incurred if diagnostic tests and sample collection are performed under isoflurane anaesthesia (rather than conscious), however some patients may not even withstand anaesthesia at the time of admission. Prior to the bird being handled at all, a thorough history must be collected. Knowledge of the duration of illness, disease status of the collection, entry of new birds into the collection may be of particular relevance. The bird should be observed from a distance, open mouthed breathing, tail bobbing, ruffled feathers, lack of response when approached by a stranger are all grave signs. The dilemma is that the bird which requires the most help, is least able to tolerate it. If the bird is particularly weak, the status may be improved by placing the bird in an intensive care cage (providing oxygen, heat and humidity), in the hope of improving the bird's condition prior to anaesthesia or handling. Such a cage will provide a warm, quiet, humidified and oxygenated environment. Ideally it is preferable to correct hypovolaemia prior to correction of hypothermia.

Either at the time of admission, or following a period of stabilisation, the patient should be anaesthetised, in order that a full clinical examination be performed, fluid therapy administered, blood and other samples collected, radiography, and if necessary, endoscopy carried out. Any bird presented may be assumed to be 10% dehydrated and acidotic. Warmed crystalloid or colloidal fluids should be administered by bolus via indwelling intravenous or intraosseous catheters. Body temperature (which typically falls under anaesthesia), should be maintained. Any other immediate medical therapy such as sedatives, antibiotics, vitamins, etc. should be administered whilst the bird is still asleep, by intravenous or intramuscular routes. Following these therapies the bird should be replaced into the intensive care cage, awaiting diagnostic results. Medical therapy will administered by oral, or parental routes.

More birds are saved by nursing, fluids and food than by anything else. Once stabilised, readily digestible and nutritious foods should be administered, by gavage tube. Birds have a high metabolic rate - those weighing 150g require approximately 22% of their bodyweight, whilst birds of 1Kg require approximately 9% of their bodyweight daily as food. Any fluid deficit should be replaced over 48 - 72 hours, together with the normal maintenance requirement of 50ml/kg/day. Until the bird consumes sufficient food voluntarily, it should be supplemented on a two hourly basis. The continued provision of supplementary heat will reduce the energy utilisation by the bird in maintaining body temperature.

Nursing care for the acute trauma case

The nursing requirements for birds vary from cats and dogs. The following equipment should be available.

Hospital cage: may have an oxygen rich environment at 26 - 32°C (80 - 90°F). Radiant heat should be provided, it must be easy to clean and sterilise, temperature must be adjustable. Forced air circulation can facilitate the transfer of air borne infections between subsequent patients and should be avoided.

Other disposable bird containers (eg, cardboard boxes), or readily cleanable cages or compartments for the hospitalisation of birds. A range of cages will be required to suit all species.

Weighing scales, onto which a bird will sit or may be held, for daily weight recording.

Syringes, needles and catheters (or the collection of samples and administration of medication or fluid therapy). **Blood pots, microscope slides, swabs, bandages, dressings, splints** (including tail guards).

Gavage tubes (metal & plastic), **Small clean towels**, for handling birds.

Clinical record system to record vital signs, medications administered, daily weight and food consumed.

Most birds are not accustomed to frequent handling or proximity to humans. Subdued lighting helps them relax, although periods of brighter lighting are required for feeding. Most species (except for *Galliformes* and *Anseriformes*) are happier if high up. Perches should be disposable, or cleanable. Some species of bird are unaffected by the proximity of other species, companions may help stimulate feeding. No bird should be left where it can see a predatory bird, as this will cause great stress.

High metabolic rate :- birds (especially passerines) have a higher metabolic rate than mammals. They have a higher body temperature, and use more of their daily food intake in maintaining their temperature. The smaller the bird, the higher the surface area to volume ratio, and the more it requires. Whilst a 1kg bird requires approx. 9% of its bodyweight in food daily, a 100g bird requires 25% of its weight in food daily. Birds use much of their daily food intake to maintain their body temperature. Birds whose plumage has been damaged, contaminated or simply wet, must be kept particularly warm (exposure blanket, bubble wrap or simply a towel) in order to prevent hypothermia. Sick birds maintained at 70-80°F, will use less energy to maintain their body temperature. Heat may be provided within a specialised brooder, critical care cage, or an adapted 'baby incubator', aquarium, heat pad, heat bulbs etc.. Progress is well monitored by recording the bird's weight daily.

Types of food : a food of suitable composition for the species (ie meat for raptors, cereals for waterfowl, fruit and seed for parrots) should be provided, and should be of a colour, texture, flavour, which that individual bird is accustomed to. If weight is not being maintained, feeding must be supplemented by gavage feeding, total parental nutrition or duodenal catheterisation. More birds are saved by nutritional and fluid support than by any surgery or medical therapy.

Water : most birds require 50ml/kg/day. Many birds take this fluid within their consumed food (eg. raptors). If such a bird does not eat, more importantly it has not drunk. Food and water may be refused when offered in vessels to which the bird is unfamiliar or simply if a bird is frightened, following anaesthesia, ill or in pain.

Analgesia following surgery, trauma or other inflammatory diseases is very useful.

Feather protection : birds have one set of plumage each year. Without a functional set of plumage, a bird may be unable to fly, swim or survive. The provision of a perch, and subdued lighting may assist, but the application of a tail guard (made from paper, xray film, instrument bags etc), to protect the feathers whilst in care, is a great benefit. The application of oil-based creams to the skin may damage the plumage and should be avoided.

Imprinting : the age to which young birds remain 'imprintable' is species-specific. The young bird, may grow up relating to its food, food provider or nest. A young bird, having been fed by a human, may grow up believing it is a human, thereafter it will not be able to relate safely to other members of their own species. Young birds should be reared with other members of the same species, or in a manner so it does not know who is providing the food.

Records : good records must be kept of all hospitalised birds, including reason for admission, any potential zoonosis or infectious pathogens. Medication administered, food and water consumed, daily weight, clinical pathology results etc.. Deaths should be marked and the results of post mortems attached.

Therapeutics : Methods of Administration

1. In drinking water - least reliable.
2. In food - must be mixed well and patient must be prepared to eat a soft diet. This is often a problem with psittacines as they are only prepared to eat their own normal food.
3. Gavage tube, effective, may be stressful, some owners may be reluctant to perform this themselves.
4. Parenterally:
 - a. I/m (pectoral) most reliable, renal portal system renders leg injections less reliable.
 - b. S/c poorly absorbed, no advantage in using this route.
 - c. I/v, easily achieved if venous catheter present, repeated i/v injections are not realistic.
 - d. Local infusion eg sinus flushing - can be very useful.
 - e. Intra-tracheally via oropharynx or nebulisation.
5. Topically
 - a. Creams and ointments not often suitable as liable to damage feather structure.
 - b. Drugs mixed with DMSO for per-cutaneous absorption
 - c. Eye drops, preferable to ointments for same reason as 5a.
 - d. Powders eg. ectoparasitic preparations.

Injured and debilitated birds are assumed to present with a state of dehydration, generally ranging between 5 - 10%, i.e. a deficit of 50 - 100ml/kg bird. Fluids may be given by oral, intravenous, subcutaneous or intra-osseous routes. Rapid intravenous administration is the singular most effective management for a shocked bird. In cases of extreme circulatory collapse or birds under 100g, the intra-osseous (distal ulna or proximal tibio-tarsus) route may be useful. Packed cell volume and total protein will give an indication of current hydration status, testing at this point also gives a base line for later comparison. Rehydration is achieved by calculating likely deficit (if 10% then 100ml/kg bird), then adding the maintenance requirement (50ml/kg/day). One should replace half the deficit the first day then the balance over the next 48 hours, together with each day's maintenance requirement. Lactated Ringers solution is used, this helps to correct the metabolic acidosis. In severely debilitated birds this may be mixed with 5% dextrose 1:1, this appears to facilitate fluid uptake from the intestine (Lumeij, 1987).

Although cell life of heterologous blood transfusions may be less than 24 hours (Murray 1994), the most recent work (Degernes 1997), showed that erythrocyte survival was for 9 - 11 days in homologous and 2 - 3 days in heterologous transfusions. Survival of erythrocytes was reduced to 24 and 12 hours in the heterologous group after sequential transfusions. Any bird with a PCV of less than 20 should receive a transfusion.

Methodology is simple, withdraw blood, from a fit donor (10ml/kg bird), via a needle or catheter into a heparinised syringe. The blood removed from the donor may be replaced with saline. The blood is then administered via a catheter by slow intravenous infusion to the recipient. In the absence of whole blood, colloidal preparations are preferable to crystalloids.

Total parental nutrition (TPN) is little used, there are no specific solutions for use in birds and almost continuous infusion would be required. Enteral nutrition, (via duodenal catheterisation), though

invasive, provides a manageable route for administering nutrition, at least in larger species (Goring 1986).

Accommodation for Convalescing Birds.

As stated previously, there are serious legal implications in keeping birds in accommodation which is not sufficiently large for them to stretch their wings out properly, unless under the care of a vet or during transport.

When treating injured raptors, there is a whole range of different sized accommodation required at different stages of treatment. For example a bird with a fractured ulna but intact radius, may well be best treated by simply confining it to a small night quarter. However this is only legal when carried out under veterinary supervision. As time progresses the size of the accommodation will be increased to allow increased exercise.

As previously stated, the initial accommodation for an injured bird is likely to be small, dark and warm. Different birds with different ailments and species with different temperaments will require separate consideration.

With injured wild birds one prime concern is that generally speaking the bird should be kept as remote from human contact as possible. As with all golden rules there are of course exceptions.

A young bird (often even up to 60 days of age), should be prevented from even seeing humans if possible, in order that imprinting can be avoided. Puppet feeding and crèche or foster-rearing should be used.

For older birds, who may need to be trained in order that one can be sure that they are fit to kill, and hence survive back in the wild, may in fact benefit from some gradual humanisation, prior to manning and training.

When considering accommodation one should always consider the ease of cleaning the accommodation, the prevention of injury to the bird (e.g.. not able to cut his cere or head on the aviary roof) and the provision for proper observation. Heat will need to be given to all birds which are still in an acute phase of any illness or injury. Heat may be provided by heated pads or heat lamps. Whatever method is used be sure that the bird is adequately warmed but not cooked !

Housing

Once a bird has been stabilised and requires no extensive handling for medical treatment, it should be placed into a rehabilitation aviary. Materials available for building aviaries are numerous, in view of the limited budget of most rehabilitators cheap or second hand materials may often be successfully utilised. As long as the aviaries are safe and durable then this is acceptable. There are of course a number of other very important parameters which do need to be considered. Chain link fencing or similar can be used for the side walls of the aviary, although this should be plastic coated, as uncovered (ferrous) wire will tend to rust in time leading to an extremely rough and abrasive surface. It should also be coated on the inside with netlon, or other soft nylon netting. This acts not as an inner softer protective lining but more as a visual warning to the bird. With such a liner in use the bird will see it and turn before scalping itself on the wire mesh itself. Alternatively wooden or plastic doweling rods can be placed from the ground to the ceiling at suitable distances apart from each other (dependent on species and size) (plastic electrician's conduit tubing is the easiest and cheapest material). The aviary itself should also be designed with the most frequently rehabilitated species in mind. As stated

previously it is important that convalescing birds are not startled or harassed by humans. It is often preferable to employ an adaptation of the sky-light seclusion aviary. The main advantage of this successful design is that it is advantageous if the bird is able to get up high and look out from a suitable vantage point, without at the same time feeling threatened.

Doors

It is essential that a double safety door is used, equally it is sensible to make it large enough to get in and out comfortably, especially bearing in mind that one may be carrying an injured bird and a net at the same time.

Perches

It is important that the perches offered suit the individual occupant at that time. If the bird is at all handicapped in its manoeuvrability then do not clutter up the centre of the aviary unduly. If it has difficulty gaining height, ensure that you have graduated perches, which act as a form of ladder, so that it can gain height by climbing rather than being forced to fly. The highest perch should be shielded in order to give security. Often it will help (especially with owls and young birds) to house a number of birds in the same aviary. This is good and helps with socialisation, as long as there is no inter species aggression. It is often a good idea to offer some form of cover for a bird (e.g.. male sparrowhawk), being chased by a larger (possibly female) bird to seek refuge in. Perches should vary in size and texture, as many as possible should receive regular sunlight, as this will help control residual bacterial contamination. Suitable perches should also be available under cover in order that birds are not compelled to sit in either a prevailing wind, or the rain.

Feeding

Needless to say a good varied diet is essential for a recuperating bird. Do not forget that such a bird will have a greater food requirement than a normal fit and healthy bird. Bare in mind that an injured wild bird will not be familiar with some readily available commercial food sources. So do not assume he is eating the chicks. It is often necessary to force feed injured wild birds for the first few days. Food should be introduced via a chute, or removable tray. The latter is a particularly good system as any uneaten food (unless cached) remains in the draw, and hence at the time of the next feed if less has been taken then the situation can be investigated. The latter may be indicative of either a sick/dead bird or simply that you are giving too much food. It is vital that the food is good quality, balanced and varied, and fresh. Needless to say it is imperative that the bird does not see the supplier of its daily food. Once the food has entered the aviary it should not be situated in direct sun light as in summer months this will speed up putrefaction. A bathing/drinking bowl should be present, this is best filled by a hose pipe which hangs permanently over it, remotely controlled from outside.

Floor Material

Over the years many alternative floor coverings have been used, some good some not so good. Perhaps the ideal structure is an initial concrete floor set with an adequate fall so that it drains, (but not into an adjacent aviary). Over the top of this pea gravel is added. As mentioned previously plants can be advantageous, and these can take up temporary residence in large pots or other containers, sunk into the gravel. The advantages of this system are that the gravel can be washed, if necessary it can be removed and sterilised, it also drains well. The disadvantage is that it is expensive, and in direct sunlight the gravel can become extremely hot. Whatever is used it is important that it can be adequately cleaned, in case it is found retrospectively to have harboured a bird suffering from an infectious disease.

Siting of the Aviary

When deciding on the site of an aviary, the following points should be considered:- Noise
nuisance / Privacy from other birds or humans
Protection from inclement weather (cold or hot)

Security

Drainage

Of all elements perhaps the most important is the provision of adequate observation holes, so that where ever the bird is in the aviary at any one time, that you will be able to visualise him and check that he is fit and well. This point cannot be over emphasised.

Hygiene Control in the Rehabilitator's Facilities

Wild injured raptors are typically infected with a range of organisms, these may comprise :-

Parasites (endo - eg. worms, coccidia, or ecto- eg flat flies, lice, Cryptosporidia etc)

Bacteria (eg *Salmonella* spp. , *Mycobacterium* spp- *Campylobacter* spp etc.)

Viruses (eg Paramyxovirus 1 - ie Newcastle Disease, Falcon Herpes virus, Avian Pox etc)

Mycoplasma

Chlamydiosis

Food supplies for feeding to raptors may be contaminated eg *Salmonella* spp, *E coli*. Collection, storage, preparation and feeding of food should be carefully controlled, as well as detailed attention to personal hygiene. Gloves, hoods, jessies etc should not be held or pulled with the mouth.

Infection may be introduced into the facility by feral birds, rodents, arthropods which are attracted to the site by the presence of surplus food. Such feral animals and birds should be controlled or discouraged.

You the keeper, wild injured birds, resident birds, or the wild life population following release may all become infected by such infections.

Prevention:

Quarantine - new birds admitted should be kept in isolation for a minimum period of 35 days, prior to mixing with any other birds. Casualty birds should be maintained in isolation anyway. However action must be taken to prevent passage of infection from one bird to another. Such transfer is most likely to occur as a consequence of passage on fomites (inanimate objects - such as gloves, clothing, shoes), or by contamination of the accommodation which fails to be adequately cleaned following the birds removal to alternative accommodation or release.

Action: when birds are initially admitted keep them in disposable containers (eg cardboard boxes), or in containers with impervious walls, which can be readily and thoroughly cleaned prior to reoccupation. Many keepers rely on powerful disinfectants (eg Virkon S or chlorhexidine). Although these are both powerful agents, they are of course only effective in the absence of organic material, a point often ignored by well meaning rehabilitators.

One should have a flow-through system, so that it is acknowledged that birds come in dirty and hopefully go out clean, new (dirty) birds do not mix with birds ready for release (clean).

Approximately 65% of wild raptors will carry some form of parasitic burden. They have been living quite happily with these parasites for a period of time, without any ill effect. However once the bird becomes sick or injured, the parasite infestation may well gain the upper hand. It is better to assume that all incoming birds are infested and treat them accordingly, with a standard round worm therapy, eg

Panacur or Ivomec. Although one must appreciate that this does not cover all parasites, if the bird does not improve in clinical condition then one would advise that a faecal sample be tested by a veterinary surgeon. To the uninitiated the use of an anthelmintic can create a false sense of confidence that all possible infestations are controlled.

The presence of ectoparasites is usually just an indication of the bird's poor condition, however these should be treated with a safe and effective treatment (eg Frontline Spray – Fipronil. Merial).

If a bird appears unwell, its faeces (mutes) are abnormal, then the bird should be examined by a veterinarian and the faeces tested for bacterial infections. Such samples should be analysed for all enteric parasites, *Salmonella* spp and *Campylobacter* spp as well as other pathogens. All such samples must be very fresh and in appropriate transport media.

If any bird dies, it should be post mortemed. It should be impressed upon carers that although this is an additional expense for a dead bird, it must be conducted so that one can be certain that the dead bird has not left a legacy of infection behind in their facility.

Some infections may not cause obvious illness in a bird until months or years after infection has occurred (eg tuberculosis), so maintaining a good record of all birds in, their ailments, which accommodation they were kept in, their treatment, identification and release is invaluable. All birds released should where ever possible be rung, so that post-release survival rates can be monitored long-term.

Aviary Design: it is inevitable that at times over the years that your longer term or outside accommodation will become infected or contaminated. Aviaries should be designed to facilitate a thorough clean on a regular basis. It is preferable if the floor of the aviary is concrete, or at least covered with a thick plastic sheet. Over the top of this one may place soil or gravel. In this way all the ground surface material may be removed periodically, washed, sterilised and replaced or renewed. If conversely the ground is a soil base, then you can never adequately clean it. Aviaries are better designed with a solid roof and one open side, so that feral birds flying over cannot contaminate the aviary. The aviary water supply should be protected from faecal contamination by wild birds. The bases of the aviary walls should also be solid to reduce the risk of arthropods gaining access to the aviary as these are often act as intermediate hosts for raptor parasites.

Dilemma's: there are occasions when you may feel it is important to mix newly taken in casualties. In particular this is relevant with 'orphaned' birds, where the risk of spreading infection is less than the risk of imprinting.

Assessment of the Viability of the Injured **Bird**.

There are three important aspects that should be considered before a bird is released. These are the health and condition of the individual bird, its relationship with man, and the locality in which it is going to be released. We will consider each of these in turn.

In order for a bird to be considered fit for release it must have the physical ability to fly, see, grasp and kill prey adequately such that it can survive independently in the wild. The mental or psychological ability to happily and peacefully coexist with members of the same species.

Health of the Bird

Only approximately 30% of all rehabilitated birds survive following even the most carefully planned release process.

In view of this one must be particularly careful that the bird is as fit as possible in order to give it every possible chance.

There are certain key handicaps which mean that a bird should never be released:-

Loss of any limb

Loss of an eye/sight

Loss of a hind talon

Permanent loss of any part of the beak

Inability to waterproof the plumage

The above criteria are based on the necessity for a released wild bird to be able to fly, hunt, kill and eat in any weather. There are also a number of other points which all have to be assessed on an individual basis. For example if there is permanent loss of, or loss of function of any primaries or deck (tail) feathers, the bird may or may not be able to cope. There is no doubt that the bird will have to be able to hunt and kill. The effect of the handicap must be assessed either following traditional falconry training and flight, or in a wind tunnel. Some species such as the buzzard, which feed predominantly on carrion, do not require great acrobatic skills. Short wings (ie accipters e.g. sparrowhawk, goshawk etc) require greater flying abilities, but kill from an observation position, by waiting for prey and making a short flight. Conversely the falcons do require almost perfect flight for high-speed chases, in order to kill and survive. So not only does the injury need to be assessed but also an estimation of what effect this deficit will have on the bird's ability.

The bird must be fit in feather and posture. Although a fractured humerus may have mended, is there any residual droop or twist to the wing.

To quote the old cliché 'the proof of the pudding is in the eating' with reference to this situation of the proof of recovery is in the ability to catch and kill quarry. It is for this reason that it is very much part of a rehabilitators function to retrain a bird to fly and kill, prior to release, where ever possible.

Any bird must be free of parasites and diseases at the time of release and must not present a risk to the endogenous wildlife population in the locality in which it is to be released. This can be a problem as it can be difficult if not impossible to assess. An example may be that a carnivorous ex wild raptor may be fed in captivity on day old cockerels. These cockerels may be infected with an adenovirus which is not pathogenic to them. One should recall that most adenoviruses (of which there are hundreds) are pathogenic to just one or two species of birds. However whether the virus is pathogenic to the infected bird or not, the infected bird is likely to become a carrier. Once released, the bird which is carrying the virus may well infect some other susceptible and possibly endangered spp with that virus. These are real and significant risks of rehabilitation of any wild birds. One can at the same time question whether the release of any post injured wild bird, serves any conservational function at all. Research, training, education and publicity may be invaluable benefits. The maintenance of a captive bred population, in particular of endangered species, in captivity is useful, but reintroduction must be considered very carefully and critically.

If it is decided that the bird is not fit for release, what then?

There are very many different schools of thought on this subject. The author's opinion is that unless the bird is extremely rare, (eagles, red kite, merlin, harrier) then an invalid (ex wild) bird should not be confined in an aviary simply so that it can be used for breeding. If this is its only possible function then the correct answer almost certainly is for the bird to be put down.

Assessment of Eye Sight

As mentioned above normal eyesight is essential for release to the wild, however the accurate assessment of functional eyesight is not easy. Previous studies have shown that many injured raptors & owls suffer from defective vision. (30% of raptor trauma cases have eye defects, 70% of which only affect the posterior chamber, ie 21% of injured wild raptors have a sight defect which is not readily apparent when viewed by a rehabilitator with the naked eye). The cause of such a handicap is varied, either the bird suffered detachment of the retina, ocular haemorrhage or cere damage at the time of the injury, or possibly it had the injury because its eyesight was already impaired. Many birds which are admitted to a rehabilitation centre in a thin starving state may in fact be like this because of ocular defects preventing them from catching prey efficiently. Birds with defective vision will appear outwardly normal, as the site of the defect is most frequently the retina. The reason for such a high level of retinal damage is because of the anatomy of the pecten and its susceptibility to contra coupe injuries, as well as *Toxoplasma* related retinal damage. Preferably all birds destined for release should be examined by an experienced veterinarian with an ophthalmoscope. Whether a vet examines the bird or not, prior to release the bird's behaviour in the aviary must be carefully assessed. The carer must ensure that the bird appears to see well on both sides, and reacts normally to movements in all areas of the aviary. If possible and legitimate, it is far preferable to release any injured raptor using traditional falconry training techniques, such that the rehabilitator can be certain that the bird can fly, see, catch and kill sufficiently to survive.

Relationship with Man

Imprinting can occur very easily, at best it is an embarrassment, at worse simply dangerous. An imprinted bird is unlikely to breed in the wild, but may well occupy a nest site, thereby depriving a further potentially fertile pair from using it. A complete imprint may look for and even attack (fly at) a human, in the hope of finding a suitable mate once they reach sexual maturity. This is particularly dangerous with the larger species such as buzzards, goshawks and eagles. Any imprinted bird must not be released and every step should be taken to prevent imprinting from occurring in the first place. The authorities should be aware of the possibility for knowledgeable careers to actively imprint a wild chick such that they are unable to release it.

Not only may a bird become imprinted upon man, but also on an unsuitable prey/food, species or habitat. It is not easy for an artificially reared merlin to find day old chicks in the middle of a grouse moor in Scotland. Likewise it would not help a released Golden Eagle if it was used to flying and being fed in a suburb of London. So a young raptor should whenever possible be reared in a suitable nest site, in the presence of its own species and be fed on a suitable food source prior to an successful release.

Rehabilitation Techniques

The Site for Release

The site encompasses not only the geographical position, but also the vegetation type, prey species availability, weather and time of year. With respect to weather, it is important that birds are not released in any extremes of weather, either droughts or storms. It is well worthwhile checking the long-term forecast before actually releasing a bird.

As far as time of year is concerned, this applies particularly to migratory birds who should not be released immediately prior to a potential migration time. The time of year for release should be also be considered in relation to the availability of suitable food. Times of year when their own prey species are actively rearing are often successful as easy prey is available. Rehabilitation birds should not be released directly into other birds territories, or where there is a particularly high density of the species already present. Rehabilitators releasing numbers of birds over a period of years, may well have to vary the sites they use to prevent over population or increased stress on released birds. For any

species, both suitable nest sites and a readily available supply of the natural food species must be available.

Habitat Assessment

The area which is chosen for release must be natural terrain for that species. It is also advisable to consider other avian species which may already inhabit this area. Species which one should be particularly aware of are rooks, crows, magpies, as well as woodpeckers, tits and some other song birds. Such species will tend to constantly mob the released bird. As a result the bird will be kept constantly on the move, allowing little time to rest or hunt, in the mean while burning up precious energy by staying on the wing for long periods.

Food availability is all-important, as previously stated it is preferable for the bird to be trained and seen to kill proficiently prior to release. However in the period immediately after release, food should be made available for the bird so that its wild-caught dinner can be augmented.

Ordinance survey maps and BTO (and other) references of established breeding pairs may be useful, in order that a given species is released within its normal population range, in a suitable habitat, but importantly not too close to others of the same species. The territory size of given pairs will vary depending on the food availability. Generally speaking the better the food supply, the smaller a territory each pair needs. Their food supply needs to be not only sufficient to survive but also hopefully enough to successfully rear a clutch of young.

Timing of Release

The longer a bird is kept in captivity, the more troublesome the release is likely to become. If a bird is fit for release within 14 days of the initial injury, then it should go back to its initial territory. If however release has been delayed, then the bird is usually better released in another area.

As previously stated weather and ambient temperatures should be considered. Winter is not an easy time of year to release birds, as their metabolic rates will be higher, (on account of the cold weather), and hence food requirements greater. During winter the quarry base tends to be lower with few insects, small mammals and reptiles available.

The summer months are ideal for release, the days are long, the breeding season is over and food is more plentiful.

For non migratory species the autumn can also be good, as ground cover is diminishing, making hunting easier, whilst quarry is still relatively plentiful.

Time of day is also important for a release, diurnal birds should be released early in the day whilst owls should be released shortly before sunset.

Methods of Release

Each method has its own inherent advantages and disadvantages, each has its place and different ones will be most suitable on different occasions. Release subjects can be divided into one of three categories:-

- a. Adult birds. Experienced hunters. 4-6 weeks hospitalisation. Good condition.
- b. Adult birds. Experienced hunters. >8 weeks in captivity. Fair condition.
- c. Young birds. Inexperienced at flying and hunting. <6 weeks in captivity. Good condition.

As birds regain fitness, intra-abdominal fat is utilised and muscle tone through out the body is developed and strengthened. Manoeuvrability and stamina will increase daily, as long as the bird is given the opportunity to fly.

Variations of the traditional hack and falconry techniques are often appropriate and adequate. Birds can be flown to the fist or the lure to achieve this fitness. Where possible this fitness training should be carried out in the area into which they are to be released.

The falconer's definition of 'hack' is a period of liberty offered to a young inexperienced bird to enable it to naturally develop the necessary skills required in flying and hunting. In our situation the young inexperienced bird is replaced by the 'convalescent bird'. There are several techniques used. A few of them will be discussed briefly below.

In both methods described below, if the bird can be trained and hunted prior to release a lower release failure rate will be encountered.

A Feeding Board or Hack Board

A platform is secured in a tree or other secure site, which offers the bird a good view of the surrounding countryside. Food is secured to the hack board. The bird is carried on the fist, unhooded to the hack board. This is done to familiarise the bird with its new surroundings. The bird is then tethered to the board and allowed to feed. Initially the hawk is only left on the board for 10 minutes, after the end of feeding. This is repeated daily until the bird attempts to fly to the board as you approach it in order to reach its food. During this process the bird is only offered food on the board.

It is worthwhile observing the bird's posture whilst on the hack board. Initially he will crouch or lie down if mobbed by other birds or if other raptors are in the area. However as his confidence increases, he will stand prominently and defiantly irrespective of who else is in the vicinity.

The day you decide to release the bird, only give him half the normal food. As he is still hungry he is more likely to remain in the vicinity of the hack board. The rehabilitator will also now have to cut off the birds jessies. This negative stimulus will help break the falconer : patient bond.

From then on food is continually placed out on the board and tied to it, at a regular time each day. One should continue to leave food out for a considerable period after the bird is last seen.

Hack Flight

The principle involved here is similar to that previously mentioned, except that it involves far less human contact. The technique makes use of a hack aviary rather than a platform. Hack flights are usually simple aviaries, built along similar lines to the previously mentioned recuperation aviary. They are however best kept simple and preferably collapsible and transportable so that different hack sites may be utilised.

Food is tied in a similar fashion to a platform inside the flight. When the birds are feeding well the flight is opened, to allow the birds to venture out and investigate the surrounding countryside. Again the birds must be kept fairly hungry in order to discourage them from departing, before they are fully fit and ready. Birds released in this way do not acquire the same degree of territoriality as those hacked using the platform. For this reason they must not be frightened or disturbed during the delicate procedure.

There is no point in struggling to put a bird back together after an injury and get it fit, if the 'hacking' process is not adequately planned and carried out.

It is hoped that all participants have found this day's lectures informative and useful. If you have friends or colleagues who you feel would benefit from this type of information, please ask them to contact the lecturer at the address as shown on the front cover.

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