

ELEPHANT AS A VETERINARY PATIENTS. FIRYAL AND A. NAUREEN¹

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INTRODUCTION**General biological and physio-anatomical features**

Elephants are the largest land mammals and are represented by two species; *Elephas maximus* or Asian elephant and *Loxodonta africana* or African elephant (Dalling, 1966; Schmidt, 1986). Elephants typically reach puberty at 13-14 years of age. They have offsprings until they are around 50 years old. The usual life span of an elephant is 75-80 years. The female produces a single calf and in very rare cases twins. The interval between births is 2.5-4 years. An elephant's trunk (a union of the nose and upper lip) is a highly sensitive organ with over 100,000 muscle units and can get very heavy.

Elephants cry, play, have incredible memories and laugh. They are sensitive fellow animals where if a baby complains, the entire family will rumble and go over to touch it. Elephants have greeting ceremonies when a family member that has been away for some time returns to the group. They grieve at the loss of a stillborn baby, a family member, and in many cases other elephants. Elephants do not drink with their trunks, but use them as tools to drink with. This is accomplished by filling the trunk with water and then using it as a hose to pour it into the mouth (Dalling, 1966; Speakman, 2005; Anonymous, 2006).

An elephant family is ruled by a matriarch (older female), and generally consist of her female offsprings and their young ones. In Africa, a basic family unit consists of six to twelve animals, but families of 12 to 20 elephants are quite common. An elephant family will split depending on the size of the family, the amount of available food and how well they are getting along. When the matriarch dies, the oldest offspring takes her place.

The elephant has a simple stomach and its digestive system is similar to that of a horse. The kidneys are multilobed (5-7 lobes). The testes never descend; they remain abdominal throughout life. Interestingly, the Asian elephant is more closely related to the extinct mammoth than to the African elephant (Schmidt, 1986). The average estrous cycle is 16 weeks long and includes high progesterone or luteal phase that lasts for an average of 12 weeks and a low progesterone or follicular phase that lasts for an average of 4 weeks. Ovulation occurs at the end of the follicular phase

(Hess *et al.*, 1983). Asian elephant can be trained to perform tricks as well as to haul heavy loads of logs.

The Asian elephant (*Elephas maximus*) has an enormous domed head with relatively small ears, an arched back and a single finger-like protuberance located at the tip of the trunk. An Asian elephant has 5 toes on the front feet and 4 on the back. A large bull typically weighs 6 tons and is 10 feet high at the shoulder. As with gorillas, there is a tremendous degree of sexual dimorphism between males and females in Asian elephants, where adult females are about half the size of the largest males. The males have tusks (modified incisors) composed of dentine called ivory and the females have tushes, which are short second incisors that just stick out beyond the upper lip. Poachers usually hunt elephants to recover ivory which is used to manufacture very precious jewellery and ornaments. The gestation period is between 19 and 22 months.

The African elephant (*Loxodonta africana*) has a straight back, enormous ears and 2 trunk fingers. African elephants are named for the peculiar shaped ridges of their molar teeth, the ridges of an African elephant's teeth are coarser and fewer than those of the Asian elephant. The African elephant has only four toes on the front feet and three on the back. Interestingly, it has one more vertebra in the lumbar section of the spine. Both sexes have tusks, and they are also larger in size as compared to male and female of Asian elephants. Gestation period tends to be slightly longer than in the Asian elephant (Schmidt, 1986; Furley, 1997; Steenkamp, 2003; Anonymous, 2006).

Elephant in health and disease

An elephant in good health has soft, almost black skin which is felt hard and erect at the touch. White coloured elephants are very rare and were revered in the past in some Asian countries. The mucous membranes of the mouth and tongue are bright pink without any dark patches. The eyes are bright and clear. There is slight moistness above and around the nails of feet (due to high density of sweat glands). This must not be confused with an offensive exudate which accompanies laminitis. The animal is continually in motion, either moving about or swinging its trunk and tail and flapping its ears. It eats well and sleeps from 2 to 4 hours during night (usually 11 pm to 3 am). When it

awakens, it begins to eat at once. It is to be noted that an elephant like a horse can sleep while standing. The respiration rate is about 10/min. The heart rate varies with the individual and from hour to hour and ranges from 22 to 39/min. The heart rate can be recorded only by the use of the cardiometer; the pulse is very difficult to detect, although according to some workers it can be felt in one of arteries at the base of the ear. The normal body temperature of an elephant is 97.4–99°F. Any temperature above or below this must be regarded as evidence of illness (Dalling, 1966; Schmidt, 1986; Lincoln and Ratnasooriya, 1996).

The temperature can be taken in most domesticated elephants with an ordinary clinical thermometer inserted into the rectum like in other animals. In non-cooperative elephants and also in case of Hippopotamus, the temperature of the body can be ascertained by taking the temperature of the freshly passed faecal ball and subtracting 1.3°F. The thermometer should be inserted into the bolus of droppings to the depth of two inches. The average healthy elephant defecates about once every hour, usually dropping from 4 to 11 boluses, each weighing about 1 kg (total faecal output in 24 hours is 85–137 kg). The colour of the faeces depends upon the nature of the diet and the faeces always contain some partially digested material. Frequent groaning is an indication of pain (Dalling, 1966; Schmidt, 1986).

The urination occurs about 5 times during the day and 5 or 6 times in the night. The average amount of urine discharged at a time is about 5.5 litres. The normal urine is straw-coloured and without any obnoxious or distinctive odour; its specific gravity ranges from 1.022 to 1.033. An adult elephant requires from 35 to 50 gallons of drinking water a day. Circus elephants are usually offered water at least twice a day and it is a good practice to give warm, even hot water, as very cold water is said to have a bad effect. Upon drinking cold water, they might start shivering. Circus men believe that elephants are very susceptible to cold. The elephants are very susceptible to sunstroke or heatstroke. They can tolerate cold far better than direct sunlight and heat (Dalling, 1966; Schmidt, 1986).

In hot countries, elephants delight in bathing in rivers, lakes and even small pools. When opportunities for bathing do not exist, the animal should be showered every day after which the animal should be dried and some vegetable oil rubbed especially over the head and trunk to keep them free from ticks and lice (Dalling, 1966; Schmidt, 1986).

A wide variety of fruit and vegetables, fodders, hay and sugarcane generally constitute the daily diet of the ration which is generally offered 5 times a day. At least 60 grams of common salt should be fed daily to each

animal. Vitamins and mineral supplements (180-200 grams) should be provided on daily basis (Dalling, 1966; Schmidt, 1986).

Like male camels, most elephants display a peculiar behavioural condition which might be termed as musth or rut. This is characterized by a swelling of the temporal gland which discharges an oily fluid for some weeks. The condition appears mainly in males, but may also occur rarely in females, usually at about the 15th to 20th year of age. Thereafter, it may appear regularly every year. While the glands are swollen, the animal may change in temperament and become disobedient and even aggressive. Experienced owners or attendants are always on the watch for the appearance of musth in males and at the first sign of it, tie the animal securely to a strong tree until the attack is over. The cause of the condition is not known. Unlike in male camels, it is not necessarily a sexual phenomenon; elephant in musth often attacks female elephants. Conversely, male elephants will exhibit sexual desire and will copulate without showing any sign of musth. When not in musth or suffering from a very painful complaint, the elephant is an easy animal to treat, provided it has been trained to obey orders. At the word of command, the animal will lie down on the ground and remain motionless while wounds are being dressed or injection is given (Dalling, 1966; Schmidt, 1986).

Hobbles and chains are used for controlling elephants of uncertain temperament and males thought to be coming in musth. Chains are also essential for administering veterinary care. However, chaining may lead to degenerative joint disease due to restricted movement of the animal. Xylazine hydrochloride (e.g., Inj. Rompun^R-Bayer, Germany; Inj. Xylaz^R-Fatro, Holland) can be used for chemical restraint and as a sedative, analgesic and muscle-relaxant. The usual dose of xylazine in elephants is 0.08 mg/kg IM. Excited elephants may require higher doses (upto 0.15 mg/kg) which may induce recumbency. Institution of atropine (4-5 mg/100 kg body weight) to an elephant that lies down after administration of xylazine is essential to prevent hypostatic congestion and adverse cardio-depressant effects. Perphenazine is commonly used tranquilizer, that has been given to calm the aggressive African and Asian elephants under captivity, during transportation (where confinement is to be continued at the destination) and in musth at usual dose of 1 mg/9kg and calming effect lasts for about 2 weeks. However, the optimal dose rate of perphenazine has not yet been firmly established (Schmidt, 1975; Raath, 1993; Coatsee, 1996; du Toit, 2001).

Elephants should not be forced to stand on ground or cement soiled by their urine; whenever possible, dry

straw should be provided as bedding. The feet should be examined regularly for any sign of inflammation of the sensitive tissue under the sole and nails, for any necrosis of the horny layer and for any excess exudate above the nails. When foot-rot or foot canker occurs, it should be treated with 10% formaldehyde (formalin) dip and parental antibiotics administered preferably into large veins of the ear.

Drug dosages and routes of administration

Elephant requires the same doses of antibiotics per kg of body weight as those given to horses and cattle to achieve the same effective serum levels. Therefore, it can be logically assumed that all drugs given to elephants should be administered in the same recommended doses per kg of body weight as those used in horses and cattle. Considerations for the veterinarian who is trying to determine the proper drug dosage include age, physical condition and known or estimated body weight of the elephant and potential toxic side effects of the drug (Schmidt, 1986).

The drugs can be administered by several routes including oral, intramuscular, intravenous and subcutaneous. For oral administration, the drugs can be mixed with molasses, sugar, fruits, fruit juices and bread etc. One can also pass a stomach tube in a handleable elephant by restraining the animal and placing a gag in its mouth between the molars. The tube must pass dorsally to the larynx through the sphincter at the posterior of the pharyngeal pouch. This sphincter is quite strong, and gentle probing may be required before it relaxes enough to allow the tube to pass. One should exercise caution (as also in all other animal species) to be certain that the tube is in the oesophagus and stomach and not in the trachea (Schmidt, 1986).

The intramuscular route is the most common parenteral route used in elephants. The skin of the elephant is thinnest over the forequarters and thickest over the hindquarters; therefore, the best site of the intramuscular injection with the typically used disposable 4-cm (1 ½-inch) needle is the large triceps area (i.e., hind quarter). Longer needles will be preferable or necessary for the intramuscular injections into the hindquarters of adult elephants. For unhandleable elephants, intramuscular administration of drugs may be very difficult. Pole syringes are useful, but standard models may be inadequate for dangerous animals. Special long pole syringes can be constructed from conduit to allow safe remote injection. One may also chain an elephant securely and keep it chained for the course of treatment if the elephant objects to necessary repeated injections. When possible, no more than 10 to 20 ml of drug should be injected intramuscularly into one site in an adult elephant. Doses

as large as 30 to 50 ml have been given to elephants in one site, but this may produce tremendous inflammation and swelling (postinjection cellulitis). Such swelling can be reduced by the application of dimethyl sulfoxide (DMSO) at the site (Schmidt, 1986).

Intramuscular injections can also be made with a capture dart. Because elephants have a tendency to develop abscesses readily in the wake of parental administration, one should make every effort to use sterile syringes and needles and deposit the drug deep in the muscles.

The veins on the posterior aspect of the ear are readily accessible for intravenous administration of drugs. Great care should be exercised when irritant drugs are injected into ear veins because perivascular irritation and sloughing can occur. The large veins on the proximal foreleg and distomedial rear leg can also be used for intravenous administration of drugs. A tranquilizer or sedative (e.g. xylazine @ 0.08 mg/kg) may be required for the restraint of elephants that do not allow intravenous administration of drugs. In young elephants, the large superficial vein running up the medial aspect of the rear leg is a good site for a venous cutdown when intravenous drug or fluid therapy is imperative (Schmidt, 1986).

Diseases of the elephant

Elephants are susceptible to a wide variety of infectious and non-infectious disease conditions. Infectious and parasitic diseases include anthrax, tuberculosis, tetanus, pasteurellosis, salmonellosis, streptococcosis, staphylococcosis, bacillary necrosis, foot-and-mouth disease, rabies, pox, herpes virus infection, mycosis, surra, piroplasmiasis, 'bots', toxoplasmosis, helminthiasis and ectoparasitism (Windsor and Ashford, 1972; Burkhardt *et al.*, 1999; Wimalaratne and Kodikara, 1999; Mikota *et al.*, 2000; du Toit, 2001; Tuntasuvan *et al.*, 2001; Lewerin *et al.*, 2005). It is definitely known that elephants are not susceptible to rinderpest, and there is probably no record of blackquarter, botulism, glanders, pleuropneumonia, brucellosis, Johne's disease, actinobacillosis, nocardiosis, listeriosis and leptospirosis. Some elephant-specific diseases are described as under:

Viral encephalo-myocarditis

This is a viral disease that usually occurs in adult elephant bulls. The affected elephant dies from cardiac failure. Virus can be isolated from heart muscles in fresh carcasses. Rodents are carrier of the virus and contaminate the food and water through urination. Control of rodent in the food storage facilities is, therefore, of the utmost importance for the prevention

of an outbreak of the disease in elephants in captivity (Gaskin *et al.*, 1980; du Toit, 2001).

Herpesvirus infection

Herpesvirus infection (HVI) is a fatal disease of young Asian and African elephants, caused by two distinct Elephant Endotheliotropic Herpesviruses (EEHV). African elephants are thought to be the reservoir of the herpesviruses. Signs of HVI are edema of the head, neck and thoracic limbs, cyanosis of the tongue, lymphopenia and thrombocytopenia. African elephants carrying EEHV have typical herpetic lesions on the skin and vulva. Postmortem lesions include pericardial effusion with widespread petechial to ecchymotic hemorrhages primarily involving the heart, liver, intestine and tongue. Oral, laryngeal and intestinal ulcerations often occur. Transmission is thought to be through intimate contact. However, direct proof of transmission has not yet been established. Nonetheless, it is currently recommended that Asian and African elephants be housed separately. The infection confuses with encephalomyocarditis virus, orbivirus, salmonellosis or other bacterial septicemia and vitamin-E deficiency (Ossent *et al.*, 1990; Richman *et al.*, 2000; Richman and Montali, 2001)

Elephant pox

Elephant pox is highly fatal disease, probably caused by some strain of cow pox virus and most often, spread to elephants from rodents. Typical pox lesions appear on head and trunk accompanied by conjunctivitis and discharge from the temporal glands (Mayer, 1973; Vinogradov *et al.*, 2006).

Coryza-like syndrome

An unidentified virus or viruses are thought to be responsible for a coryza-like syndrome in elephants. The syndrome is similar to the common cold in humans. Signs associated with this disease include excessive serous nasal discharge, watering from eyes (epiphora), mild loss of appetite, reduced activity and listlessness. Healthy elephants should be able to recover from this disease without treatment. Supportive care and antibiotic therapy may be indicated for debilitated elephants, because secondary pneumonia is one of the potential sequelae to this syndrome (Schmidt, 1986).

Enterotoxaemia

Clostridial enterotoxaemia has been reported as the cause of death in a number of young elephants. Food contamination is usually considered a source of infection. Signs of the disease include listlessness, loss of appetite, diarrhoea and death. Diagnosis of enterotoxaemia is reached by culture of the etiologic

bacterium and identification of toxins in the gut contents. Treatment consists of administration of antitoxin and high doses of antibiotics (penicillin) in addition to supportive care. Prognosis is guarded to poor. Elephant facilities that have problems with clostridial infection should consider a vaccination programme for the disease (Schmidt, 1986).

Pasteurellosis (Haemorrhagic septicemia)

Pasteurellosis was first reported in 1910 in Asian elephants. It is extremely acute and fatal disease (death occurs within 12 hours of onset of illness) with signs fairly similar to those of anthrax (Ferrier, 1947).

Abscessation

Elephants have a thick skin and penetrating wounds (thorns, darts, mahouts, etc.) can cause abscesses by bacteria, e.g. *Staphylococcus* and *Corynebacterium*. When an abscess cannot break through the skin, it spreads laterally and must be drained surgically. Culturing the organisms and making an antibiogram are important for treating an abscess successfully. When an abscess is drained, the pus must be collected on cotton-wool and burnt to prevent the accumulation of bacteria in the facilities (du Toit, 2001).

Dermatitis

Dermatitis is a common problem in captive elephants and is usually associated with improper daily skin care. The animals should be bathed or hosed daily, followed by an application of mineral oil. They should have an access to an abrasive wall or logs to rub their bodies and vegetable oil should be added to the diets (Schmidt, 1986).

Tusk conditions

Tusks are modified incisors composed of dentine surrounding a pulp canal. Traumatic impact of the tusks when elephants push against solid objects causes a purulent infection of the tusk sulcus (Schmidt, 1986). Healing usually takes place when the animals settle down in the bomas.

Blind tusk is a severe inflammatory condition which develops on failure of incisors to erupt through the skin. The elephant pushes its head against objects and shows signs of discomfort. A surgical incision can be made through the skin. Surgical gauze dipped in wound ointment can be placed as a plug to prevent myiasis of the wound.

Fractured tusks with the exposure of the root canal to bacteria can lead to a fistulous tract with purulent exudate. The fistula should be flushed twice daily with a 1:10 dilution of povidone-iodine.

An antibiogram is important for the successful treatment of the wound. A dental filling is important to keep the wound clean.

Choking

Choking occurs when elephants compete for fruit or vegetables. Whole oranges can be too big to be swallowed and may cause obstruction of the oesophagus. The symptoms include inability to drink water, resulting in dehydration. Muscle relaxants can be given as a part of conservative treatment, but usually the foreign body must be removed surgically or by passing stomach tube. The wound must be treated as an open wound to prevent stricture of the oesophagus. For prevention of the problem, fruit and vegetables should be chopped (Schmidt, 1986; du Toit, 2001).

Colic

As in horses, two types of colic viz., spasmodic and obstructive have been described in elephants (Schmidt, 1986; du Toit, 2001). Spasmodic colic is usually caused by mouldy fodder. The signs of abdominal pain are shown intermittently. The condition can be treated by parenteral administration of spasmolytic drugs e.g. Flunixin Meglumine (Inj. Loxin^R-Sellmore Pharma, Pakistan) and also by copious, soapy water enemas (repeated until relief). Obstructive colic is seen when the excessive intake of clay and high-fibre food forms hard faecal balls that pass with difficulty through the gastro-intestinal tract. The condition can be treated by parenteral administration of muscle relaxants, such as Diazepam and Inj. Valium^R (Roche, Switzerland).

Trunk injuries and paralysis

The trunk of the elephant is subject to different types of injuries, such as crushing, laceration, penetration by foreign bodies and damage to motor nerves. The specialized functions of the trunk dictate that every effort be made to ensure healing with minimal loss of function. The blood supply to the trunk is massive and a deep incised wound or laceration high up on the trunk can produce shock and death. If such a serious wound occurs, one may need to immobilize the excited animal with etorphine in order to get a pressure wrap around the cut portion of the trunk. Trunk paralysis can occur as a result of parasite migration in the area of the motor nerves, bacterial infection from wounds near the motor nerves, a crushing injury that causes massive damage to the trunk, or tumors that exert pressure on the motor nerves. It can also be caused by tetanus or rabies. Diagnosis involves a composite of neurological examination of trunk functions, history, complete blood count, serum

chemistry, physical examination and faecal examination for parasite ova. Treatment of trunk paralysis in which motor nerve damage from parasitic or bacterial infection is suspected entails usage of high doses of steroids, and broad-spectrum antibiotics (Schmidt, 1986).

Trauma

Small injuries of trunk and legs are common, especially in young elephants. Fighting and bullying inflict wounds that can lead to abscessation. Infarction and sloughing of the ear occur when irritant drugs like phenylbutazone are administered perivascularly. Young elephants can panic easily and may run into veld fires in the absence of a matriarch (older female leading a basic elephant family unit). Severe burn wounds may be incurred under such conditions. Breaking of tusks occurs when newly-caught elephants charge people during the boma-training period (du Toit, 2001).

Sunburn and heat stroke

Elephants exposed to strong direct sunlight for several hours can develop sunburn, usually occurring on the top of the head and forehead. Diagnosis can be made by observation of typical erythematous peeling skin associated with sunburn. Treatment can include application of ice to the affected areas and one of the many soothing, protective ointments recommended for burns in human. One can prevent sunburn of an elephant by providing the animal with shade, by applying clay or dirt to the top of the head and forehead, or by providing a sun pad, which rests on top of the elephant's head.

Elephants are fairly susceptible to heatstroke when exposed to high ambient temperatures and direct sunlight. The condition usually terminates fatally. To treat heatstroke in an elephant, one should roll the animal onto its side if it is in sternal recumbency and erect shade over it, administer copious repeated cold-water enemas, apply crushed ice to the front and top of the skull, spray/splash/hose the surface of the elephant with cold water, and administer massive intravenous doses of steroids such as prednisolone sodium succinate (1 mg/3 kg body weight) or dexamethazone (1 mg/5 kg body weight) (Schmidt, 1986).

Subcutaneous edema

Large edematous pockets can develop in any of the dependent areas of the elephant's body. Causes of the ventral edema appear to be varied but are most often associated with general debility, anxiety or stress (Schmidt, 1986). Specific ventral edema is usually manifested overnight. Edema of umbilical area can lead to necrosis and sloughing. Affected animals can be

treated successfully with hot and cold pressure bandages (du Toit, 2001).

Degenerative joint disease

Degenerative joint disease is apparently more common in captive than in wild elephants. Debate concerning the causes of degenerative joint disease in captive elephants has centred on husbandry. Some researchers believe that elephants forced to spend their lives on hard surfaces such as bare concrete (which produces a damp, cold environment) most often develop degenerative joint disease. Another view is that both the uniform surface of hard, cold floors and the fact that many elephants are chained for most of the day in positions that restrict movement are responsible for the degenerative joint lesions seen in captive elephants. Infectious agents are also strongly suspected as causes of degenerative joint disease in elephants; of these, *Mycoplasma* is of foremost concern (Clark *et al.*, 1980). Treatment of degenerative joint disease can include warm-water hosing of the affected joints or application of rubefacient liniments to promote circulation, aspirin given in a dosage of 6.50-13gm/500 kg body weight two or three times per day, and anti-inflammatory drugs (e.g. steroids, orgotein, meclofenamic acid and flunixin meglumine). Dosages of anti-inflammatory drugs for elephants can be reduced to 0.5-0.75 unit/kg body weight, as recommended for equids. In addition, tylosin @ 12 mg/kg IM once a day for 5 days is indicated (Schmidt, 1986).

Foot problems

Foot problems are common in captive elephants, resulting from poor hygiene and inadequate exercise. Common foot problems include cracked sole, cracked heels, over-worn sole, overgrown sole, overgrown nails, split nails, ingrown nails, overgrowth of cuticle and abscesses. These conditions can be prevented by proper hygiene, regular examination and a timely treatment of problem foot (Schmidt, 1986; du Toit, 2001; Olivet-Courtois *et al.*, 2003). Feet should be examined regularly and excessive nail and sole material should be removed with hoof knives, rasps, grinders, or any other tool that can be used skilfully.

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