wesig
WILDLIFE & EXOTIC SPECIAL INTEREST GROUP

MY WILDLIFE VETS

FOR WILDLIFE VETERINARIANS ▪ 7TH EDITION ▪ JUNE 2020

IN THIS ISSUE

A FEW WORDS

by Ali Anwar Ahmad

Assalamualaikum and Selamat Hari Raya Aidilfitri to everyone! Maaf zahir dan batin. Let's hope that this virus and the Conditional Movement Control Order (CMCO) does not dampen our Hari Raya mood. Even without open houses and large family gatherings, it doesn't mean we can't have a smashing Raya with our immediate family! There is a saying, only we determine how we look at things. Remember that the glass is half full and not half empty!

The last three months have been a roller coaster ride for everyone on this planet! The first half of 2020 seemed to be a total disaster for many of us. We started the year with Australia experiencing the worst bush fire it had ever seen in centuries, the death of basketball legend Kobe Bryant, a political crisis back home and now a pandemic that is tearing at the lives of countless souls in the world.

COVID-19 has brought out the best and worst of people – from the selfless sacrifice of the health care workers and security forces who brave the dangers of this highly contagious virus to provide treatment for patients and maintain order in this country, to the people in Essential Services, including veterinarians that provide services pertinent to ensure that the nation does not starve and the animals are cared for during this Movement Control Order (MCO) period.

The zoos may be closed during this period of lockdown or MCO, but the routine of zoo vets still goes on. The crisis casts a huge uncertainty on zoos worldwide, including Malaysia. During the MCO, no revenue is generated from visitors. Uncertain times and huge challenges lay ahead in the coming months for all of us, even after the MCO is lifted, as the nation has been warned to adapt to a new normal that adheres to strict social distancing.

Late in 2019, Wildlife and Exotic Special Interest Group (WESIG) planned a number of continual professional development programs for 2020 including a Rabbit medicine workshop, two clinical rounds and an anaesthesia workshop. In March (a week before MCO was announced), with safe distancing, travel declaration and on-site temperature monitoring, Dr Eve, Dr Pakee and the committee members had successfully organized the Wildlife Veterinary Clinical Rounds (WVCR) at Sunway Lagoon. A report on the WVCR will be on page 9. It appeared that we had had a good start to the year, until the pandemic got a stranglehold on the world. Following this, WESIG had announced that all activities planned for 2020 had to be cancelled, as we play our part in stopping the spread of this virus.

We have only two options in this stormy period, to stay quiet and wait to for the storm to end or brave the storm and seek new opportunities or ways to expand our vision. The vision “To Bring Communities Together to Promote Wildlife Health, Welfare and Conservation” remains steadfast. Like they say, “When one door closes, another window opens.” We have chosen to explore other means of achieving our objectives.

Adhering to MCO regulations and stay at home measures, WESIG initiated the “Zoological Anaesthesia Webinar Series”. Knowledge and experience of local and regional experts in the field of wildlife and exotic animal anaesthesia are shared among veterinarians in the comfort and safety of their homes. Please learn more on the webinar series on page 12. Thank you, Dr Reza, Dr Boon Nie, Dr Nabila and Dr Roopan who made this webinar series possible!

In this newsletter series, we have Dr Anusia sharing her experience and knowledge in Aquatic medicine. She has an exciting and highly informative article on the nitrogen cycle, a must-know for everyone who wishes to treat fish. We also have Dr Charisha Fraser sharing her experience on an exciting case in an Alligator Snapping Turtle. Not forgetting our ever resourceful and hardworking Bornean warriors, who continuously make new strides in this field. In this edition, we have a follow-up dental workarticle on the sun bears by the prestigious veterinary dentist Dr Cedric while Dr Reza shares his experience in Thermal Imaging diagnosis in a Sumatran rhino. Finally, I am sure you would have noticed that we recently have a new logo for WESIG! This is beautifully designed by Dr Suhailiza! What better way to have pangolins as the logo for WESIG? Like pangolins, we don’t just run away when we face danger. We just get ourselves in a defensive position until the danger is gone!

It is a period of uncertainty for people from all walks of life, including veterinarians. Robert H. Schuller said, “Tough times never last, but tough people do.” As a veterinarian, we are trained to overcome all kinds of situations, unparalleled among other medical professions. We are taught how to work with crazy Thoroughbred racehorses, dogs infected with parvovirus, constipated elephants and rectal pregnancy diagnosis for dairy cattle, so working in extreme conditions should be second nature for all of us. We hope all veterinarians stay above this crisis by Staying Safe and Healthy! Please enjoy our 7th edition of My Wildlife Vets!

The Water That We Breathe – The Nitrogen Cycle

by Dr Anusia Nadarajan

In the last edition, we learnt that a fish's well-being and survival heavily depends on the water quality of its environment. Just like the air we humans breathe, the water where the fish swims are directly linked to their health. Over 80% of diseases in fish are derived from poor water quality and thus checking and maintaining optimal parameters are crucial in the management of their health. Whether it is a pond, hobbyist aquarium or even large oceanarium; water quality is an important aspect of any fish kept in captivity. In the previous edition, we spoke about the importance of measuring chlorine, water temperature, dissolved oxygen, pH and water hardness. In this edition, we will talk about one of the most important water qualities that all hobbyist, aquaculturist and aquarist work with day after day. The water parameter we will focus on in this edition is the water nitrogen level. To understand about the water nitrogen level, we first need to know about the Nitrogen Cycle.

The "nitrogen cycle" is the biological process that converts ammonia into other, relatively harmless nitrogen compounds. Several species of bacteria do this conversion. In particular, the Nitrosomonas species (among others) convert ammonia (NH3) to nitrite (NO2-), while the Nitrobacter species (among others) convert nitrite to nitrate (NO3-). Thus, cycling the tank refers to the process of establishing bacterial colonies in the filter bed that convert ammonia->nitrite->nitrates.

How are they harmful?

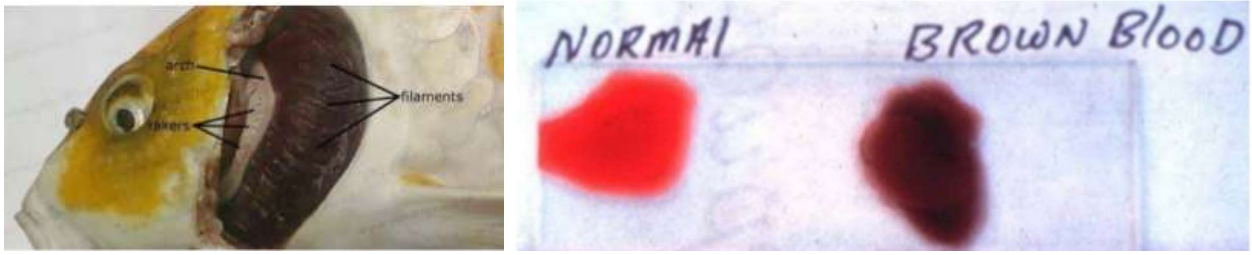
Ammonia

Ammonia is formed from the metabolism of protein and is the major waste product of fish. The majority of ammonia from fish is excreted through the gills, with relatively little being lost through urine and faeces. Ammonia is also formed as uneaten feed or other organic matter in an aquarium decomposes. High concentrations of ammonia in the water make it difficult for fish to eliminate ammonia from their bodies. This build-up of ammonia can cause stress, gill and internal organ damage, and eventually death.

Total ammonia is comprised of two components: un-ionized ammonia (NH3) and ionized ammonia (NH4+). Un-ionized ammonia is extremely toxic to fish whereas ionized ammonia is not. The proportion of un-ionized to ionized ammonia shifts in relation to pH and water temperature. As pH or temperature increases, more of the ammonia shifts to the un-ionized, toxic form. Un-ionized ammonia begin causing gill damage at approximately 0.05 mg/L and death at approximately 2.0 mg/L. Keep in mind that most test kits measure total ammonia and not un-ionized ammonia.

Nitrite

Nitrite is formed by the conversion of ammonia by nitrifying bacteria. Nitrite is toxic to fish because it binds with the haemoglobin in fish's blood to form methaemoglobin. Haemoglobin carries oxygen through the body while methaemoglobin does not, so fish in high nitrite waters may suffocate even if sufficient oxygen is present. If enough methaemoglobin is present in a fish's blood, it will cause the blood to appear brown instead of red. Consequently, nitrite toxicity is often called "brown blood disease."



Picture showing brown gills and the blood colour with methaemoglobin problem. (Picture from Abisha.S.J MFT160085)

Nitrate

Nitrate is formed from the breakdown of nitrite by nitrifying bacteria. Except in very high concentrations, nitrate is not toxic to most freshwater fish. Nitrate can be absorbed by plants or removed from the water through periodic water changes. In natural systems and some aquarium systems, nitrate is converted to nitrogen gas by denitrifying bacteria.

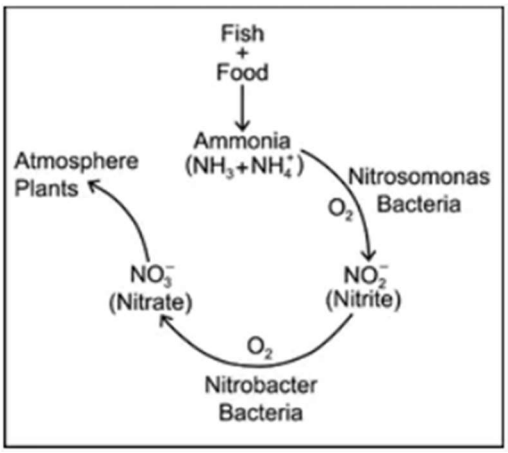
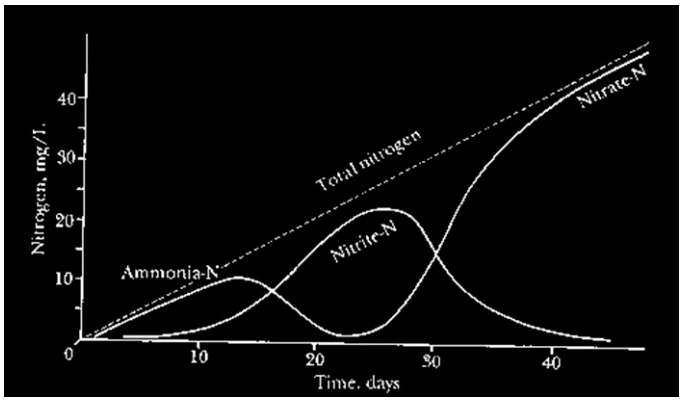


Figure 1: This cascade describes how natural wastes in the water get processed in natural ecosystems. And even in a closed aquarium, this cascade must be established and fostered. Ammonia, nitrite, and nitrate are the main biological toxins that occur in an aquarium, so the nitrogen "cycle" must work effectively to convert and remove all of these waste by-products. (Ammonia. (2020, May 12).
Retrieved from https://thefishsite.com/articles/ammonia)

So, how do we cycle our tank?

In aquaculture systems, all these processes take place in the surface of the mud and soil, but in tanks or closed system aquaria, we need to provide places/substrates for the bacteria to flourish. This is called biological filter/biofilter. A newly set up tank is not instantly ready to support life. The process of tank maturation, better known as “cycling”, is crucial as we prepare the necessary volume and concentration of beneficial bacteria to grow and be functional for the nitrogen cycle. One thing worth mentioning about these bacteria is that they take time to establish and depends on the pH, temperature, salinity and other water parameters to grow. For example, a typical tropical water aquarium biofilter will takes 3-4 weeks to be established, while cold-water system take 6-7 weeks.



(n.d.). Retrieved from https://users.cs.duke.edu/~narten/faq/cycling.html

During the cycling process, ammonia levels will go up and then suddenly plummet as the nitrite-forming bacterias take hold. Because nitrate-forming bacterias don't even begin to appear until nitrite is present in significant quantities, nitrite levels skyrocket (as the built-up ammonia is converted), continuing to rise as the continually-produced ammonia is converted to nitrite. Once the nitrate-forming bacterias take hold, nitrite levels fall, nitrate levels rise, and the tank is fully cycled.

There's two ways of doing cycling in tank, with and without fish presence

Cycling with fish

Options 1 is not the preferred way to get the nitrogen cycle started because the fish are exposed to ammonia and nitrites during this process. Many fish cannot and will not make it through the cycling process. Often times the fish becomes stressed and fish disease starts to break out.

Cycling without fish

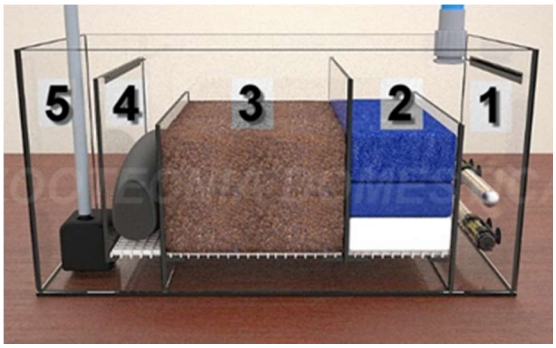
A better way to achieve this tank maturation is by 'fishless' maturation. By this, it means that prepare your tank as per normal, let it run and feed the system with small amounts of fish feed/ ammonium chloride, to let the system and bacteria start growing and feeding on the ammonia. Therefore, once you have an ammonia source in your tank, it's only a matter of time before the desired bacteria establishes a colony in your filter bed!

Housing for the beneficial bacteria

For these beneficial bacteria to be more functional in an intensive system or an aquarium tank, we need a lot of them. Thus, we need to provide proper housing for them to grow. Biological filtration media are like condominiums for bacteria. There are several types including ceramic rings, sponges, pads, bio balls and bio stars, sand, and gravel. These porous objects have high surface areas while still allowing the passage of water and light to flow through them; they make excellent homes for bacteria. This topic is a big topic as well which can be discussed in more detail next time.

Picture showing the normal compartmentalisation of filter sump for aquarium.

1- ***UV, temperature equipment.***
2- ***Mechanical filtration.***
3- ***Biological filtration, the substrates.***
4- ***Buffering compartment (mostly useful in marine aquarium).***
5- ***Returning submersible pump. (Source :http://www.zootecniadomestica.com/filtro-humedo/)***



Sharing my experience

I have encountered numerous cases from fish owners complaining about their fish's health deteriorating and mortality rate increasing in their aquarium or pond. When obtaining history, 80% did not know the basic concept of the Nitrogen cycle and this led to bad living environments. Secondly, the animal succumbs to the stress in the environment and this leads to disease outbreak. Treatment with medication is only a temporary solution. Educating the owners is much more crucial for a long-term solution.

I am very honoured to be involved in a public aquarium opening process, which means I was involved in the tank preparation, bio maturation process, fish establishment and acclimatization process. Each stage and process are extremely crucial in preparing the best conditions for the fish, even before they come into the tank. The bio maturation process started 1-2 months before the fishes came in, to ensure that the tank was cycling perfectly. Our method was to add ammonium chloride into the system, while ensuring the other parameters are constant. For the first two weeks, we maintained the ammonia at 1ppm and slowly increased it to 3ppm for the following weeks. Testing the parameters of ammonia, nitrite and nitrate had been a routine task so that we can monitor the cycling process. We stopped dosing 2-3 days before the fishes were to be introduced, so that ammonia levels can be brought down to a safe level.

In conclusion, understanding the nitrogen cycle and how it works in an aquatic environment is crucial and basic to every living aquatic environment set up. These aquatic lives can have less stress and environmental related diseases, only with optimal living environments.

Reference: https://users.cs.duke.edu/~narten/faq/cycling.html
https://thefishsite.com/articles/ammonia

BITE WOUND MANAGEMENT IN AN ALLIGATOR SNAPPING TURTLE (MACROCHELYS TEMMINCKII)

by Dr Charisha Fraser

Introduction

The Alligator Snapping Turtle (AST) is the largest species of freshwater turtle in the United States of America (USA). They can reach up to 80 kilograms and can sometimes exceed 100 kilograms. This species is fully aquatic, and are known to be able to stay submerged for a period of up to 50 minutes. Only females come on land to lay her eggs. This particular species can be found mostly in rivers, lakes and wetlands. ASTs reaches reproductive maturity at the age of 11 to 13 years and tends to live a solitary life. ASTs use chemosensory cues to locate prey and use their throat to draw water in and out to test for chemicals that have been released by prey. Once their prey are located, ASTs use their unique hunting method of luring their prey with their pink worm-like flesh (a) in their mouth. Once the prey comes within striking distance, close to its mouth, it will attack and grab hold of its prey.

Worm-like flesh

History

Cassie is an adult female AST estimated to be between 12-15 years of age with body weight of 15.2kg. She is kept with another larger female AST in the exhibit. During feeding time, the larger female bit Cassie on the right forelimb. Cassie was presented with an infected open wound and reported to be inappetent.

On presentation, Cassie's Body Condition Score (BCS) was 7/9 which is slightly overweight. The patient was bright, alert and responsive (BAR). Physical examination revealed a unilateral inflammation on the right forelimb with the tendon and muscle exposed. Necrotic tissue was seen on the wound site. Manual manipulation of the right forelimb was performed and no significant neurological or musculoskeletal dysfunction was noticed.

Based on the physical examination, it was diagnosed as an avulsion wound. The prognosis of the case was fausta, which means that it is curable and would be able to heal with a proper treatment regime.

The treatment plan for Cassie is listed in Table 1 and the methods used to conduct regular wound treatment are described in figure 1 and 2.

Figure 1. Methods of Restraining: A vase was used as a pedestal to provide an easier and safer method of restraint. AST and other chelonian species will naturally extend their limbs when securely balanced and the base (plastron) of the animal is supported.

Figure 2: DIY wooden plank to block the head as AST have very strong jaws and cause bad bites. It is always important to make sure both people and animals are safe when dealing with wildlife.

Table 1: Treatment Plan for Open Wound Management

No	Treatments	Medications
1.	Systemic antibiotics	Enrofloxacin 6 mg/kg IM q48h for 7 times (diluted with 0.9 % NaCl, 1:1)
2.	Pain Management	Ketoprofen 2 mg/kg SC q48h for 3 times
3.	Debridement	Superficial flushing with chlorhexidine q48h for 15 times
4.	Topical antimicrobial cream	Himax Cream
5.	Water Treatment	S1 anti-bacterial solution and anti-chlorine
6.	Semi Dry Dock	1 hr

Discussion

Healing is affected by two main factors. The first factor is the patient's individual or intrinsic factors such as the animal's appetite, nutritional status, type of wound, stress level, immunity level and animal's circulation. In Cassie's case, treating necrotic tissue wounds normally warrant dry docking, but this could impair her blood circulation and stress her leading to a compromised immune system. Cassie was managed with appropriate diet, stress management and vitamin supplementation. The second factor affecting healing, are the environment or extrinsic factors which includes water quality, enclosure design and enclosure mate. Cassie was constantly exposed to fresh water that can damage exposed tissue so this had to be treated carefully.

Wound healing has three phases; inflammation, proliferation and maturation. Typically, wound healing begins with the inflammation phase. In this phase, the wound goes through active bleeding which could last for a couple of minutes to a couple of days. Once the bleeding has stopped, inflammatory cells move into the wound area and this is categorized with production of exudate, malodor, necrotic tissue and yellowish scab-like material at the wound site. Proliferation phase is the second phase, usually taking weeks to complete and this phase ends with vascularization of scar tissue. The hallmark of this phase is the presence of granulation tissue. The last phase; the maturation phase can last for months at a time, as the tissue undergoes remodeling to form scar tissues that are more organized with low vascularity. The lack of vascular structure gives scar tissue the pale or pigmented appearance. At maturation phase, no bleeding, exudate, infection or odor is observed at the wound site.

Conclusion

Early wound detection in chelonians is important as the goal is to prevent infections from setting in. Aggressive treatment will reduce and even prevent the occurrence of septicemia, especially when the treatment plan is followed carefully. Dry docking is important in turtles for wound management but this has to be done with caution as it may result in the impairment of the animal's circulation. Treatment of extrinsic factors such as improving the husbandry, is equally important in reptile medicine.

Wildlife and Exotic Medicine Continual Professional Development in Times of Global Pandemic

COVID-19 wreaked havoc in Hubei Province, China in late 2019. Nobody foresaw that this virus would, in a matter of weeks, change the lives of every single human in this world in one way or another. It disrupted almost everything it laid its hands (or receptors, to be more precise) on; global travel, global economy, health care system and events. Be it a Taylor Swift concert or a wildlife conference, all were deemed as hotspots for viral spread. Hence, countless events, such as concerts, charity events, meetings and conferences around the globe had to be cancelled.

The hard work of planning and organizing these events were flushed down the drain in a blink of an eye. Nevertheless, a number of enterprising individuals chose to change the status quo. Rather than just sitting down on the couch, watching Netflix, a number of organizers turned to the online platforms. Encouragingly, we Malaysians were not far behind in utilizing the power of the internet to replace these cancelled events.

In this article, we talked about two events that WESIG had organized during this pandemic. The first event, the Wildlife Veterinary Clinical Round (WVCR) was organized a week before the Restriction of Movement Order and the Zoological Anaesthesia Series was organized during the MCO period.

WVCR was annually organized by the Department of Wildlife and National Parks (Perhilitan) to promote experience and knowledge sharing among wildlife and exotic veterinarians. In 2019, WESIG was invited by Perhilitan to organize two WVCR session for 2020. Dr Pakeeyaraj and Dr Eve Foong from Wildlife Park, Sunway Lagoon led the organizing committee for the first WVCR held at Sunway Lagoon on 12th of March 2020.

event was held during the early phase 2 wave of COVID-19, in which daily new cases were slowly rising among our population. Knowing the need to avoid community spread of the virus, several precautionary measures were taken during the event. Participants were required to fill up a travel declaration form and their contacts were collected for contact tracing. On registration, all participants had to undergo temperature screening and assessment of their health, to ensure that those with symptoms of flu or fever were refrained from attending the event. The Sunway Pyramid team also provided hand sanitizer for all participants.

Figure 1: Opening remarks by Mr Ramesh from Sunway Lagoon

Figure 2: Dr Yeoh Boon Nie presenting on sun bear dental condition

The case sharing session began a bit behind schedule due to some technical difficulties that led to a change in venue. After some minor delay, WVCR kicked off with a welcoming speech by both Sunway Management team Mr Ramesh and WESIG team Dr Ali Anwar. The session commenced with Dr Ali Anwar imparting some useful knowledge on a “Beginner’s Guide to Aquatic Veterinary Medicine”. This was followed by Dr Vishwanee Veloo, who shared her master project on “Reproductive Profiling in Critically Endangered Painted Terrapin”.

Her groundbreaking work shed some insights on this littleknown species. Dr Navaneetha Roopan then shared an interesting case report of “Successful Rehabilitation and Affordable Clinical Management of Depressed-Comminuted Skull Fracture in a Rescued Green Sea Turtle (Chelonia mydas). The talk shares how vets and conservationist improvised on the usage of materials such as brassiere hooks, to fix a skull fracture in a remote area in Malaysia, far away from nearest veterinary facilities.

After a short but scrumptious teabreak prepared by the Sunway Team, the session resumed with Dr Nyanavelan sharing his experience on a case of abortion in a giraffe in Melaka. Dr Yeoh Boon Nie then shared on “Dental Extraction & Root Canal Therapy in a Bornean Sun Bear” and Dr Pakeeyaraj presented on Chronic Vomiting and Diarrhea in a White Gibbon. Beneficial and meaningful discussions were brought forth by the audience after each case-sharing session. Probably the nice warm food and drinks served as an informal ice-breaking session and everyone became more familiar with each other. Or simply, some caffeine and good food were all that was needed to get the mood going for Malaysians! Whatever the case, it was a really fruitful and interactive session, limited only by lunch break and a tight schedule.

Figure 3: Souvenir courtesy of Sunway Lagoon given out to Dr Donny Yawah

After a wonderful lunch at Sunway Lagoon, the afternoon session began with Dr Donny Yawah from Perhilitan sharing on the Breeding Pattern of Malayan Tapir in Semi Wild Conditions in Malaysia. For the first time in Malaysia, we were privileged to witness several wonderful and amazing videos of Malayan Tapir birth. Thank you Dr Donny for this wonderful opportunity. Our final session was by Dr Charisha Fraser whose presentation was titled Captive Breeding Case Study on Spectacled Caiman. The success story of breeding these majestic creatures is another successful captive breeding story in Malaysian Zoological facilities. Dr Fraser’s presentation was the icing on the cake for such a wonderful case and knowledge sharing day.

Figure 4: Group photo at the end of the WIldlife Park Sunway Lagoon tour.

A tour of Sunway Lagoon Wildlife Park ensued, after souvenirs were presented and closing remarks were given by Dr Ali Anwar. The day ended with our customary photo session at the end of the tour. Kudos to Dr Pakeeyaraj, Dr Eve Foong, Dr Suhailiza, Dr Bryan Lazarus and Dr Nyanavelan for organizing this wonderful event!

What appeared to be a good start for WESIG came to a major roadblock when Prime Minister Tan Sri Muhyiddin Yassin announced a nationwide lockdown following the escalating situation surrounding the second wave of COVID 19. WESIG programme plans for 2020 has fallen into jeopardy as social distancing measures began, and global economic recession is expected to follow suite after the lockdown. With a heavy heart, members from WESIG had unanimously agree to cancel all programs for 2020. Months of planning for the second WVCR, Reptile Medicine Seminar, Wildlife Anaesthesia in Taiping Zoo, Basic Wildlife and Exotic Anaesthesia talk in UPM and UMK, all have to be cancelled due to this pandemic.

Abiding to MCO regulations and utilizing the technological advancement of digital technologies, our Bornean Warriors again stepped up to the challenge and organized the Zoological Anaesthesia Webinar Series. This series was spearheaded by Dr Reza Tarmizi, Dr Nabila Sakawi, Dr Roopan and Dr Boon Nie. The five webinars are as follows:

1. Fish Anaesthesia by Dr Ali Anwar
2. Gas Anaesthesia by Dr Chen Hui Cheng
3. Avian Anaesthesia by Dr Jalila
4. Companion Exotic Anaesthesia by Dr Serena Oh
5. Reptile Anaesthesia by Dr Paolo

The webinar began with Fish Anaesthesia during the 1st phase of MCO in April and Gas Anaesthesia in May. WESIG plans to conduct the series monthly with Dr Paolo's webinar to be held in August.

For the two webinars previously organized, we received tremendous support with more than 80 participants. We apologize that we have limited the number to 100 participants as we are limited by our technical expertise to handle more than 100 participants. As veterinarians, we are not as techno-savvy and we are dealing with trial and error. We received a number of feedback on some of the technical issues that were encountered and we are sorry if it affected your experience. We strive to get better one webinar at a time with both experience and constructive feedback.

We are extremely grateful to Miss Sophia Peh and the team at Medical Plus for their generous sponsorship of the Zoom Webinar Platform subscription. It would have been virtually impossible for us to conduct the webinar series without their support!

What lies ahead for the next six months for all of us, is rather hazy. No crystal ball or palm reading can predict the challenges each of us will face, and we don't need a feng shui master to tell us there will be rough waters for months and even years to come. Whether you are a creationist or evolutionist, we are aware that the species that thrives in harsh conditions are the ones that can adapt to any form of environmental or ecological challenges. Hence, we need to adapt to the new normal for the months to come and also adapt to the challenges in providing for continual professional development. With the waves of uncertainty pounding against us, we have our vision "To Bring Communities Together to Provide Wildlife and Exotic Animal's Healthcare, Welfare and Conservation" to steer ourselves out of troubled waters.

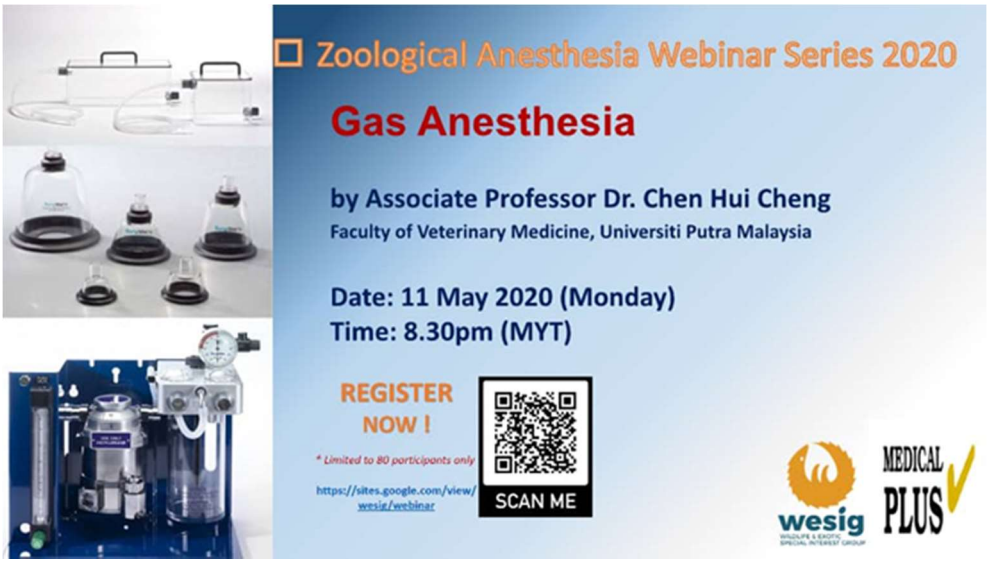


Figure 5: Gas anaesthesia series by Dr Chen Hui Cheng

ENDODONTIC TREATMENT IN CAPTIVE BORNEAN SUN BEAR

by Dr Yeoh Boon Nie

Introduction

Endodontic treatment refers to the treatment of disease or injuries to the dental pulp. Dental caries or crown fractures can cause pulp exposure, leading to resulting infection. As the pulp comprises of neurovascular bundles, pulp exposure or infection is an extremely painful medical condition that impairs the well-being of the affected animal.

A crown fracture refers to the fracture of the enamel or dentine. The fracture condition with pulp exposure would be referred to as a complicated crown fracture. In case of a non-complicated crown fracture, if left untreated, the pulp may eventually be exposed due to continual attrition or caries formation, and infection will quickly set in.

Based on the recent dental examination conducted at Bornean Sun Bear Conservation Centre (BSBCC) and also numerous reports by zoo and rescue

Figure 1: Complicated crown fracture of canine tooth in a sun bear at BSBCC

centres, crown fractures of the canine tooth are a common manifestation of dental disease in captive sun bears (Figure 1).

Conventional management of a complicated crown fracture in veterinary medicine is dental extraction. This exodontic salvage procedure is commonly chosen over endodontic treatment (commonly practiced in human dentistry), because

veterinary dentistry services are not commonly available in many areas especially in Asia.

Yet, is dental extraction good for the long-term dental health of the affected animals? Dental extraction comes with a variety of complication such as suture dehiscence, jaw fracture and total loss of function of the extracted tooth. This is especially significant for wildlife such as sun bears, where the canine tooth is used to rip and tear hard food and also for the animal's defence. Hence, extraction will result in the alteration of its behaviour and reduces its capability to survive.

Globalization, advancement of mass communication systems and more affordable global travelling, have been a game changer for all industries, including the veterinary industry. What seemed to be many leagues between a specialist and a patient are no longer an issue and has fuelled a growing interest in veterinary endodontic treatment in both domestic and captive wild animals. What about its application in Malaysian captive wildlife? Are we left behind in terms of providing optimal health care for our iconic wildlife?

Material and Methods

In BSBCC, endodontic dental treatment was arranged for three sun bears that had previous records of one or multiple canine tooth fractures.

The bears were sedated with a combination of Ketamine 4mg/kg, Medetomidine 0.04mg/kg and Butorphanol 0.05mg/kg via a projectile dart. Isoflurane was used as to maintain anesthesia once the bears were intubated.

Dental radiography was the initial step to assess the diseased tooth condition. The veterinary dentist then decided on a treatment option, the method and materials to be used.

Plate 1 illustrates the simplified root canal therapy procedure of a canine tooth in a sun bear in BSBCC. The affected male bear, aged 15 years old, weighed 45kg, and suffered from complicated crown fractures for all four canine teeth. Dental extraction of the right lower canine tooth was attempted two years ago, but the attempt failed. In this treatment session, the dentist removed the right lower canine tooth that was complicated by periodontal disease, and the other three canine teeth were salvaged by root canal therapy.

The above procedure shared is merely an introduction, and not a guideline for root canal therapy in all cases. As the saying goes, no two veterinary surgeries nor procedures are the same. Each case has to be assessed individually by a dentist and he/she will decide on the treatment regime based on the condition of the tooth, as well as his/her experience. Post treatment therapy and management is varied based on the case assessment too.

Discussion

In BSBCC, we grouped our bears into different age categories. The juvenile group are bears younger than 5 years old. The adult group, with ages from 5 to 10 years old, are deemed as the best age group for release and reintroduction back into the wild. Bear release candidates are chosen from this age group because they are sexually mature, independent and have already mastered suitable forest skills. Bears with ages more than 10 years old are considered geriatric and will be cared for in captivity for research and education purpose. Note that the life span of a Bornean sun bear is about 12 to 15 years in the wild; and up to 30 years in captivity.

In BSBCC, approximately 21% of our captive bears have either one or multiple canine teeth fractures. Up to 36.4% of bears in the last age group were affected. The youngest age of the affected bears is 9 years old. It is worth noting that regular dental examination only started two years ago at BSBCC. Hence, there is a lack of information which indicates the age when the bears start developing tooth fractures or other dental diseases.

Age (years)	Total bear	Affected bear	% (based on age group)
< 5	8	0	0
5 - 10	13	1	7.7
> 10	22	8	36.4
Total	43	9	20.9

Table 1 Total number of bears and affected bears with canine tooth fractures in BSBCC.

The causative factor contributing to this problem, is mechanical trauma such as seen in cage biting. This is usually a stereotypic behaviour developed in a cub kept as a pet and is locked in a small cage. Some bears tend to bite and destroy the hard structures or furniture in the cage due to boredom and to seek attention. This condition is common among the bears in BSBCC as a number of bears are rescued from homes that kept these animals in deplorable conditions.

The conventional management of a fractured tooth is dental extraction. This method is preferred because the tools and equipment required are easily available to veterinarians. Nevertheless, open extraction of a canine tooth in a bear is invasive, takes a long procedural time, and may lead to many complications.

In the past, we encountered several failures from the attempts to extract diseased canine teeth of sun bears by either inexperienced veterinarians or human dentists. Failures are caused by lack of skills and experiences, in addition to inappropriate tools and equipment. A sun bear's canine tooth can measure up to 9cm (Figure 2); and in humans, tooth roots do not go beyond 2centimeters. Retained tooth roots occurred in three cases as dental radiography was not available to assess before and after the extraction procedures. Oronasal fistulas occurred in two cases due to either breakdown of suture material along the mucoperiosteal flap created or an iatrogenic fistula was created when attempts to extract the diseased tooth was carried out.

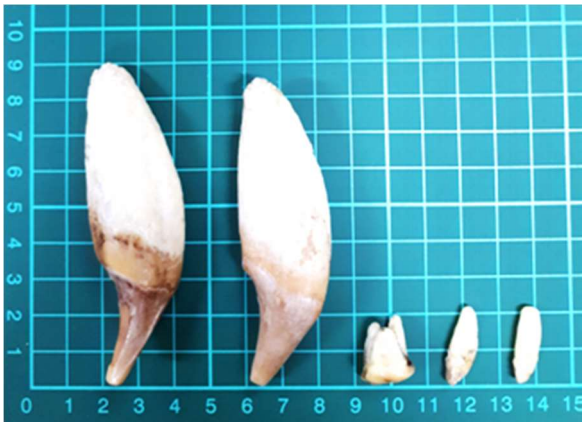


Figure 2: Tooth measurement from a sun bear. Tooth 104, 204, 108, 402, 403 (From left to right) according to Triadan System.

Moreover, with the removal of a canine tooth, bears have a reduced ability to cut, tear and rip hard fruits. In a captive situation, we can easily condition the bears to eat a soft diet, such as rice porridge and cooked vegetables. Bears feeding on soft and sweet diets are prone to having dental calculus as there will not be any hard food material

to physically remove the calculus that developed. Subsequently, periodontal disease occurs. Thus, it seems to be a vicious cycle with more periodontal health issues arising on the remaining teeth following a change in diet after dental extraction. Training the bears to have their teeth brushed daily will help to prevent periodontal disease. Alternatively, endodontic treatment can preserve the tooth integrity and subsequently reduce the unfavorable complications mentioned. In comparison to dental extractions, endodontic procedures are faster, less invasive and yield a quicker recovery. Our bears who received this treatment recovered almost immediately without having their appetites affected.

Specialized endodontic tools, materials and dental radiography are essential. The procedure itself is complicated and requires specialized training in order to be able to perform it. Hence veterinary endodontic procedures in most cases are usually performed by a veterinary dental specialist. Lack of commonness and available expertise are the main deterrents in providing optimal dental care in many Malaysian zoos.

Fortunately, with today's advancement in technology and telecommunication, it is now feasible to get in touch and engage with a specialist of a certain field. But are we, or the management willing to go all out to spend money in providing such health care to our animals?

Conclusion

Canine tooth fracture is common in captive old bears. Complications following dental extractions occur often when we try to manage a case in a sub-optimal manner. These failures and complications affect the animal's welfare greatly as it brings more pain and discomfort. Engaging a veterinary dental specialist for specialized dental treatment in captive wildlife is feasible in this era. Endodontic treatment provides an alternative to save the diseased canine tooth structure. Seeing the bears recover after the procedure, with their usual voracious appetite for food, is the best outcome we can hope for.

Acknowledgement

In BSBCC, the sun bears were very fortunate to have the attention of a great veterinary dentist, Dr Cedric Tutt, who was assisted by Dr Serena Oh from Wildlife Asia Veterinary Services on 28th and 29th February 2020. Both Dr's Tutt and Oh are from The Veterinary Dentist. Several Malaysian wildlife veterinarians (Dr Reza, Dr Kavitha, Dr Zahidah, Dr Eve Foong) and Dr Pattarawan from Thailand were invited to join this treatment session with the specialist. The precious experience with Dr Cedric no doubt was an eye opener for most of us.

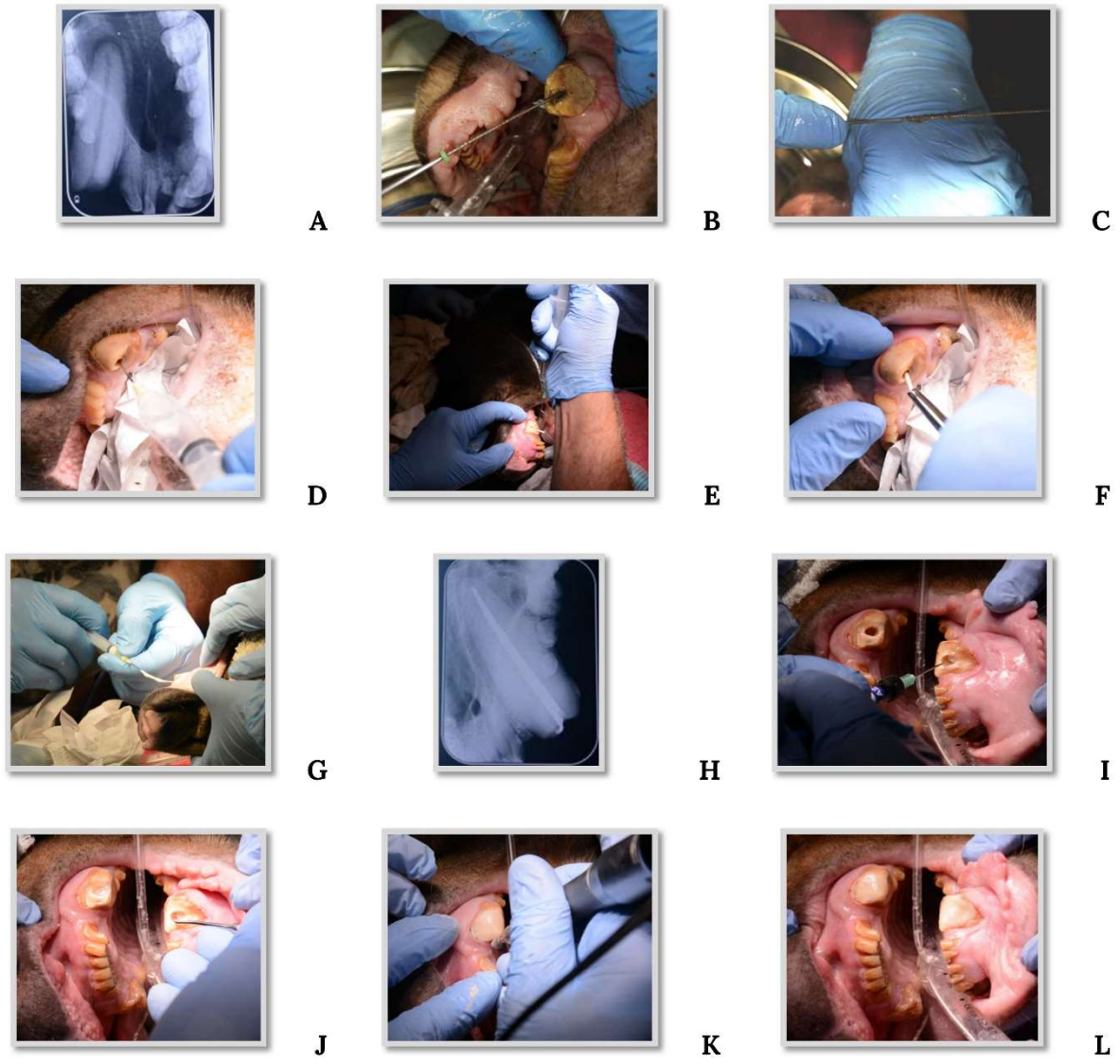


Plate 1.

A. Periapical radioluscency indicates inflammation and infection of the canine tooth in dental radiograph. Root canal therapy was decided to salvage this diseased tooth.
B. Place the endodontic file to evaluate the canal length.
C. Repeat filing of the canal with successively larger files and remove organic matter from the canal.
D. Clean and disinfect the canal with 5% sodium hypochlorite (household bleach).
E. Air blow to facilitate drying using 20ml syringe.
F. Dry the canal with appropriate paper point.
G. Place the root canal sealer (Polymeric calcium hydroxide). This formulation produces rapid healing and hard tissue formation.
H. Radiograph to ensure entire canal filled with the material.
I. Place etching gel (37% Phosphoric acid) to promote adhesion of bonding agent to tooth structure.
J. Obturate the access site with Smart Dentine Replacement (SDR), a resin composite restorative material.
K. Restore the access site. Contour and shaping with round burr.
L. Appearance of canine tooth after root canal therapy.
(Photo courtesy of BSBCC)

Seeing The Unseen, Thermal Imaging In Zoological Medicine

by Dr Mohamed Reza Tarmizi

Have you ever wondered how cameras (Thermal cameras) in airports especially during these SARS-Cov-2 pandemic event could detect a person with fever? Or how vipers or pythons detect their prey in pitch darkness? All thanks to a radiation wave length called infrared. Vipers, pythons and boas have holes on their faces called pit organs, that detects infrared radiation from warm bodies of prey mammals. At night, the pit organs allow snakes to 'see' an image of their prey. This same concept had been adapted into the modern thermal camera.

Hungarian physicist Kálmán Tihanyi was the first to invent thermal imaging or “night vision” for British anti-aircraft defense following World War I. Thermal cameras did not reach the consumer level until the late 20th century. Due to its noninvasive application, it is now popular in the field of medicine.

So... what is an infrared? Infrared (IR) is an electromagnetic radiation (EMR) with wavelengths beyond that of visible light radiation (0.7um - 1000um) (Figure 1). This IR spectrum can further be divided into near- (0.8 - 1.2um) and far-IR (3 – 14um). All EMR are emitted or absorbed by molecules. Night-vision devices (e.g. camera trap) uses near-IR illumination emitted by IR electronic LED’s to detect animals. Thermal camera uses far-IR to observe asymmetries in peripheral skin temperatures.

Thermal camera functions by collecting IR radiation data which will then be converted by a rendering software program. This process will make IR appear as visible light. In modern commercial thermal cameras, all of these processes happen in real time. These rendered visible light output will be shown in thermal palettes (grayscale, color wheel, rainbow, ironbow, lava, etc.).

In veterinary medicine IR thermography has been used on farm and companion animals since the late 1950s. The most advanced field is that of equine medicine. Eulenberger and Kämpfer first recommended the use of IR thermography in zoo and wild animal medicine (Hilsberg 2008) and IR thermography has been used extensively with modern equipment in zoo medicine by Sabine Hilsberg. Application in zoo animals are currently limited, and are used more in musculoskeletal inflammation detection and pregnancy diagnosis in mega vertebrates such as elephants and rhinos.

Some examples of clinical applications that have been reported are pregnancy diagnosis in a Black rhino (Hilsberg 1998) (Figure 2), heat-stress detection in Takin (Uhlemann 2003), shoulder injury, hip injury, carpal joint injury, pododermatitis in Asian elephant (Hilsberg 2002), lameness evaluation in Black rhino (Hilsberg 2002) polyarthritis in Giraffe (Hilsberg 2002), evidence of anal sac in Sun bear (Schneider 2011) (Figure 3).

Unfortunately, thermal imaging is not a point and shoot camera with instant results for interpretation. The user/veterinarian will need to be familiar with thermoregulation patterns of the species at work. Each species differs from one another in thermoregulation based on their anatomical features (skin thickness, ear size, hair length, hair distribution, gland location, horns, antlers and leg shape) which will lead to the determination of 'thermal windows'. Thermal windows which are obligatory in mammals are the eyes, oral cavity, heart region, rectal and vaginal opening, and erected penis.

In late November 2018, a female Sumatran rhino "Iman" was reported to have a slight lameness in the right hind leg. The rhino was kept in Borneo Rhino Sanctuary (BRS), Tabin Wildlife Reserve Sabah. She was kept in a semi-wild enclosure with attached night-stall, isolated from another male rhino. At that initial moment, the rhino foot was checked for wounds and cleaned daily with no wound or swelling observed. After a week from the initial report, the lameness did not resolve and by this time, the affected hind leg was swollen. Visually, the swelling had extended to the lower thigh and mammary gland and muscle atrophy on the right pelvis had started to take place (Figure 4). This made the hind limbs uneven and the animal was unable to flex the effected limb when moving. Lameness caused weight bearing on the right hind leg which was painful and warm to the touch. Metal nail leftovers from the construction of BRS was also found by the animal keepers in the animal paddock causing suspicion of nail puncture injury. (It should be pointed out that prior to the rhino's translocation to the BRS facility, almost 300 kilograms of metal parts from nails, metal pipes and construction debris left by contractors were removed from the enclosures). Anti-tetanus toxoid, antibiotic and anti-inflammatory drugs were given.

On 3rd December 2018, a radiograph was taken on the right foot which was very tricky but luck was on our side. No metal object was seen on the radiographic image. A non-medical thermal camera (Scout TK, FLIR Systems, USA) which I had on-hand, was utilized to narrow down the location of inflammation. Fortunately, thermal imaging did show distinct heat radiation (hot spot) at the proximal hip area when the image was compared with the opposite hind limb (Figure 5). Antibiotic and anti-inflammatory drugs were continued and warm compression was applied to the identified area of inflammation. On 18th December 2018, an ultrasound examination was conducted by BRS manager and resident veterinarian, Dr Zainal Zainuddin while the animal was restrained in a chute. By this time, abscess points had appeared and ultrasound exams confirmed the presence of the abscess. Three days later, the abscess point was lanced by Dr Zainal and left to drain (Figure 6). After a week, the swelling had resolved and the limb and pelvic appearance was back to normal. By this time, the lameness had resolved.

This attempt to narrow down the area of inflammation in a rhino has proven that thermal imaging has its uses in zoological species. I am not properly trained in veterinary thermal imaging nor have access to a medical grade thermal camera. This article is not a promotion for veterinarians to purchase any thermal cameras available in the market, but to show my personal experience on

the possible application of this tool as a supplementary tool for other conventional forms of veterinary diagnostic imaging. There is a big opportunity for local veterinarians to pursue this field of IR thermography as I am not aware of any veterinary practice that provides this service locally. Proper training and equipment is needed for veterinarians to use thermal imaging in veterinary diagnosis, and any thermal camera at hand will always be useful for a veterinarian working with mega vertebrates.

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Photos

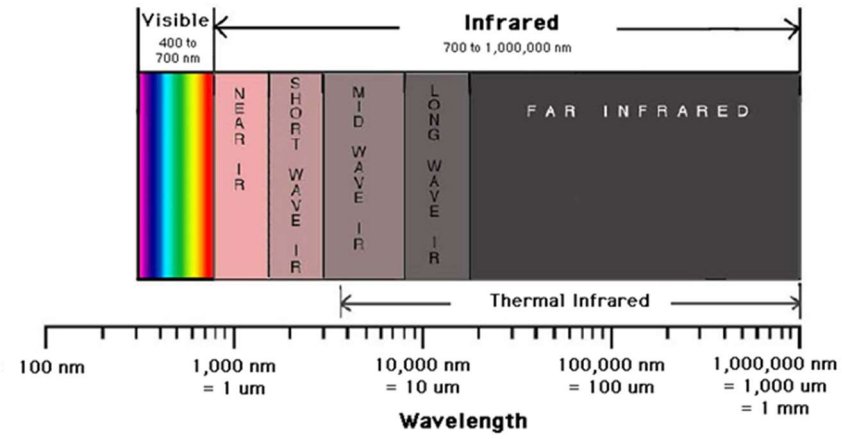


Figure 1: Chart showing wavelength of visible light compared to IR. (Photo taken from EM Spectrum: Near IR - Digital Earth Watch, 2020)

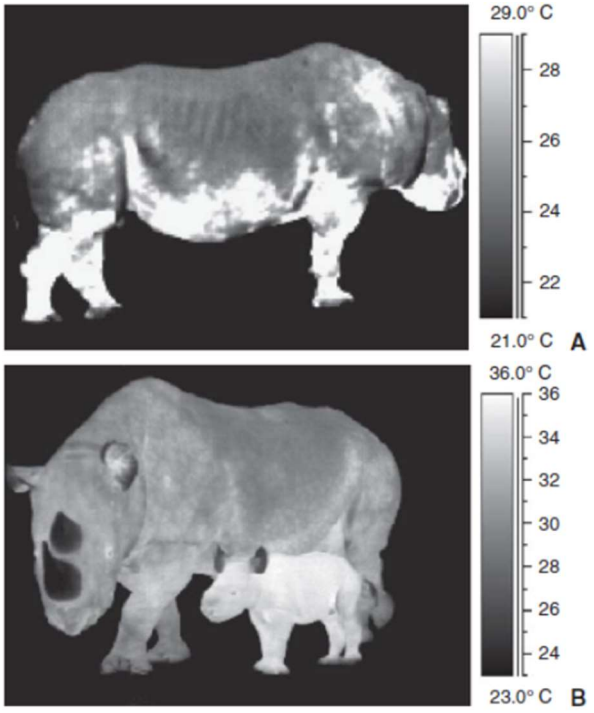
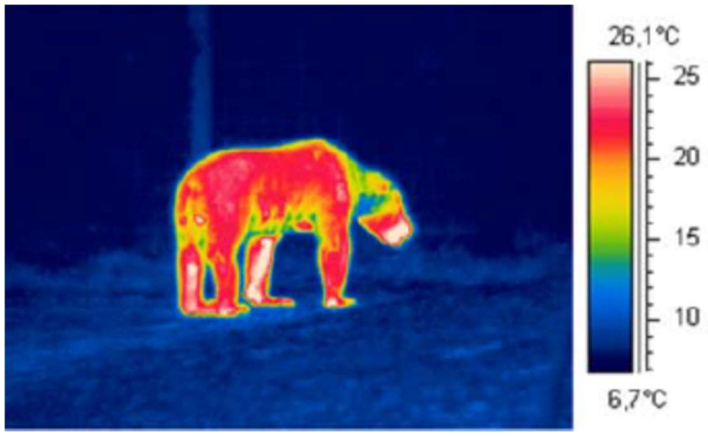


Figure 2: A, Reproductive evaluation in a black rhinoceros. Late pregnancy with increased heat radiation from the abdomen and legs. B, After the calf was born, the increased radiation disappeared in the mother but was shown by the newborn calf. (Photo taken from Hilsberg 2008)

Figure 3: Thermal image revealed distinct hot spots located on either side of the anus in the perineal region in Malayan sun bear in a study on thermoregulation. (Photo taken from Schneider 2011)



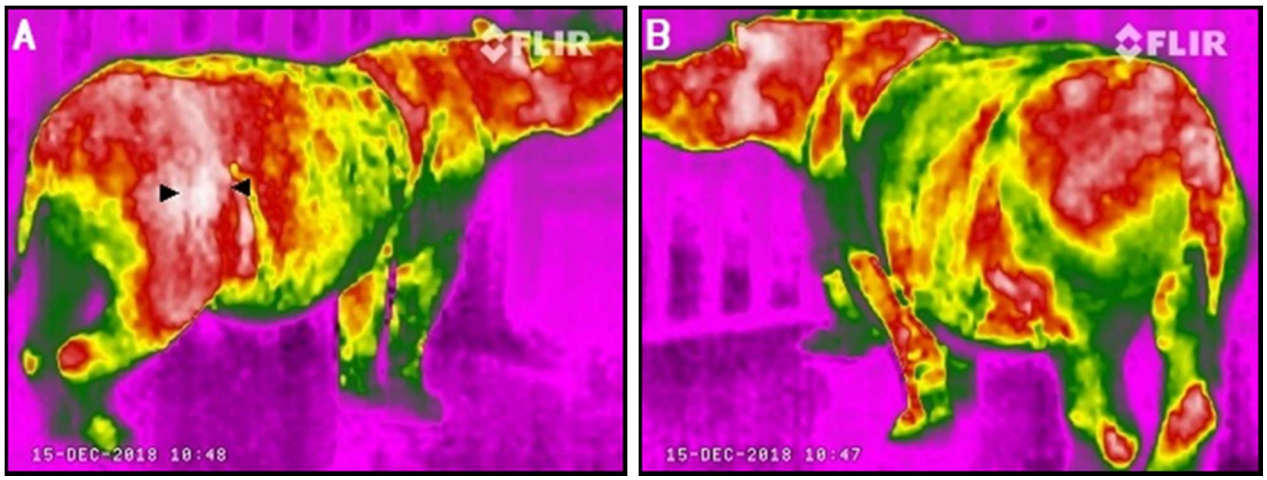


Figure 5: A, Thermal image revealing hot spot (white) at the right proximal hip area (black arrow heads). B, Absence of hot spot on the left hip area.

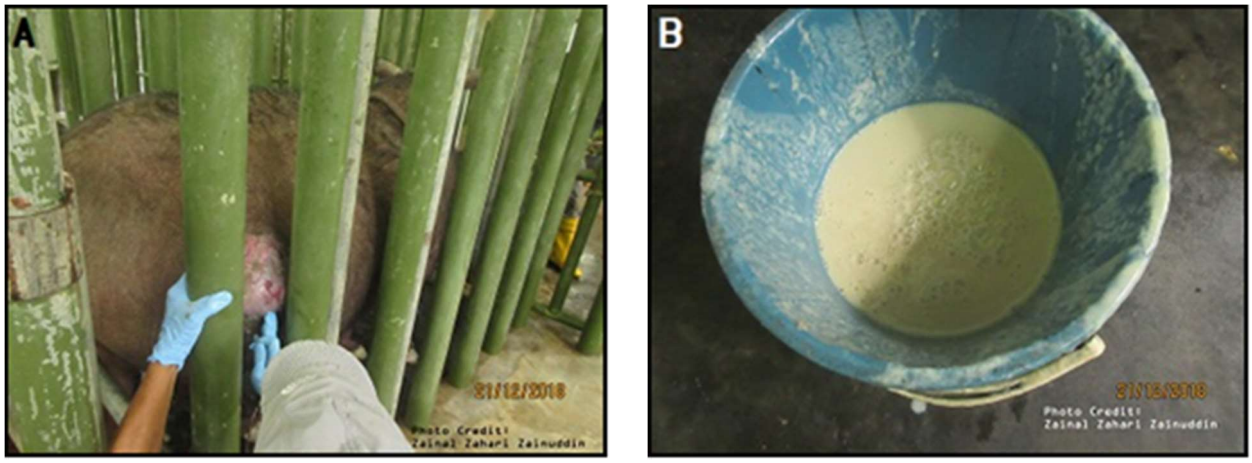


Figure 6: A, Abscess point was lanced and allowed to drain. B, Amount of abscess collected from lancing in a bucket. Photo credits- Zainal Zainuddin

"A ship in a harbor is safe – but is not what ships are built for."
John A. Shedd

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