Introduction (anesthesia)

– Indications for anesthesia
– Considerations prior to anesthesia
– Analgesia
– Injectable anesthesia
– Inhalation anesthesia
  – Airsac perfusion anesthesia
– Considerations after anesthesia

Indications for anesthesia

– Sedation for minor procedures
  – Diagnostic imaging
– Surgery
Considerations prior to anesthesia

- Health conditions
- Pre-anesthetic fasting
- Analgesia
- Monitoring
- Supportive care
  - Length of procedure
    - Short procedure => less monitoring and support necessary
    - Long procedure => more preparations have to be taken

Considerations prior to anesthesia

- Health condition
  - History and examination “from a distance” are important
  - Handling may compromise the patient prior to anesthesia
    - Handling may be more compromising than short period of anesthesia

Considerations prior to anesthesia

- Health condition
  - History and examination “from a distance” are important
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    - Handling may be more compromising than short period of anesthesia
  - PCV & blood chemistry
    - Mostly important for prolonged surgery
      - Anemia, dehydration, kidney or liver failure?
**Considerations prior to anesthesia**

- Pre-anesthetic fasting
  - Crop needs to be empty
    - Gentle aspiration may be option when fasting is impossible
  - Risk of hypoglycemia is minimal
  - Recommendations:
    - < 100 gram body weight => no fasting
    - Psittacine 400 – 1000 gram => 3 – 4 hour fast
    - Raptors => 6 – 9 hours fast (pellet needs to be produced)

- Analgesia (Treat before pain occurs!)
  - Local anesthetic
    - Lidocaine < 4 mg/kg
    - Bupivacaine < 2 mg/kg
  - SAID
  - Corticosteroids => not preferred due to immunosuppression
  - NSAID (chronic and postoperative pain)
    - Carprofen 2 – 4 mg/kg
    - Meloxicam 0.5 mg/kg
    - Ketoprofen 5 mg/kg

At least 30 minutes prior to anesthesia!
### Buprenorphine versus Butorphanol

<table>
<thead>
<tr>
<th>Buprenorphine</th>
<th>Butorphanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agonist</td>
<td>Agonist</td>
</tr>
<tr>
<td>Partial agonist</td>
<td>Antagonist</td>
</tr>
<tr>
<td>Effective for up to 8 h</td>
<td>Effective for up to 4 h</td>
</tr>
<tr>
<td>Dose in dog/cat/horse</td>
<td>Dose in dog/cat/horse</td>
</tr>
<tr>
<td>6 – 10 mg/kg</td>
<td>0.05 – 0.4 mg/kg</td>
</tr>
<tr>
<td>Reported dose in birds</td>
<td>Dose in birds</td>
</tr>
<tr>
<td>10 – 50 mg/kg</td>
<td>1 – 4 mg/kg</td>
</tr>
<tr>
<td>100 mg/kg ?</td>
<td>No analgetic response although sufficient plasma concentration</td>
</tr>
<tr>
<td>500 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

**Dose in birds**
- African Grey parrots: 1 – 2 mg/kg
- Amazon parrots: 2 – 4 mg/kg
**Buprenorphine versus butorphanol**

- Both buprenorphine and butorphanol result in
  - Respiratory suppression

- Butorphanol resulted in
  - Decreased cardiac frequency

- The administration of both opioids did NOT result in a decreased cardiac response after a noxious stimulation

**Considerations prior to anesthesia**

- Monitoring
  - A trained technician
  - Electrocardiography (ECG)
  - Capnography (intubation is necessary)
  - Temperature
Considerations prior to anesthesia

– Monitoring
  – A trained technician
  – Electrocardiography (ECG)
  – Capnography (intubation is necessary)
  – Temperature
  – Pulse Oximetry

– Thermal support
  – Loss of heat through
    – Convection
      – Airflow around animal
    – Radiation
      – Difference between temperature animal and surrounding
    – Conduction
      – Contact with “colder” surface
    – Evaporation
      – Through respiration and placement of organs outside of body

Solutions
  – Cover patient & minimize plucking
Considerations prior to anesthesia

- Thermal support
  - Loss of heat through
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Solutions
- Cover patient & minimize plucking
- Work in a warm area
- Provide heating source
- Hydrate anesthetic gasses

Considerations prior to anesthesia

- Thermal support
  - Aluminum foil (not practical)
  - Heat lamps (not practical)

Considerations prior to anesthesia

- Thermal support
  - Aluminum foil
  - Heat lamps
  - Bag with "rice" => microwave
Considerations prior to anesthesia

- Thermal support
  - Aluminum foil
  - Heat lamps
  - Bag with “rice” => microwave
  - Hot packs
  - Warm water blankets
  - Bair Hugger®
  - Cloacal temperature probe
Considerations prior to anesthesia

- Thermal support
  - Aluminum foil
  - Heat lamps
  - Bag with "rice" => microwave
  - Hot packs
  - Warm water blankets
  - Bair Hugger®
  - Gaymar Thermacare®

Injectable anesthesia

- Less controllable than inhalation anesthesia

- Suggestions:
  - Medetomidine 200 – 1000 µg/kg 400 µg/kg
  - Xylazine 10 mg/kg
  - Ketamine 30 mg/kg 50 mg/kg
  - Butorphanol 1 mg/kg 2 mg/kg
  - Carprofen 4 mg/kg
  - Meloxicam 0.5 mg/kg

Inhalation anesthesia

- Isoflurane versus sevoflurane
  - Sevoflurane is:
    - much more expensive
    - Quicker induction and recovery

- Mask induction
  - 4% isoflurane in 100 % O₂ (1 L/min)
Inhalation anesthesia

- Intubation
  - Pressure under the glottis to visualize the tracheal opening

- Maintenance
  - 2% isoflurane in 100% O₂ (1 L/min)

Respiratory ventilation

- To prevent CO₂ accumulation in the distal air sacs, assistance with ventilation is mandatory!

Air sac perfusion anesthesia

More extensive information is provided during surgery part of this lecture
**Location air sac tube**

![Image of air sac tube location]

**Recovery of your patient**

- Anesthesia is NOT done once the surgery is over!
- Post operative monitoring of your patients is mandatory
  - Keep warm
  - Keep hydrated
  - Provide food as soon as possible
  - Maintain analgesia for a couple of days

**Introduction (surgery)**

- Preparation & instrument use
- Ingluviotomy
  - Cockatoo with crop lesion
- Placement of an air sac tube
- Ventral laparotomy
- Post-operative care
Preparation

Demarcate surgery area with tape

Prevent heat loss: use betadine instead of alcohol

Birds are plucked and no eye ointment is necessary

Prevent heat loss: Supply external heat (see anesthesia)

Instrumentation

Drape patients with light materials

Use hygienic measures just as in mammals

Use fine instrumentation

Instrumentation

- Electro-surgery
  - Surgitron (Eilmann)

- Use magnification
Ingluviotomy

- Indications
  - Removal of foreign body
  - Obtaining crop biopsy for diagnosis of PDD
    - Proventricular Dilatation Disease
  - Repair of damage due to trauma
    - Barb wire in pigeons and raptors
    - Burnt crop wall due to overheated handfeeding formula

Pluck feathers just cranial to sternum
Tape feathers out of surgery field
Use betadine to sterilize surgery field

Insert cotton swab into crop to facilitate localization of the crop
Ingluviotomy

Cover patient with sterile paper drape & cut opening in drape
Carefully cut skin with scissors until cotton swab is visible
Notice how thin the crop wall is

Ingluviotomy

Place stay-sutures (Monocryl 4-0)
Cut crop wall with scissors to open crop
Crop biopsy for diagnosis of PDD should include blood vessel!

Ingluviotomy

Close crop wall and skin in two separate layers using Monocryl 4-0 in a continuous pattern
PDS results in less tissue reaction compared to Vicryl
Monocryl was not tested
Cockatoo with crop lesion
- Blue eyed cockatoo
- 12 weeks-old female bird
- Thick lesion on ventral surface crop since a couple of days
- Anorexia
- Vomiting
- Bird is still being handfed with formula

Cockatoo with crop lesion
- At inspection a massive lesion with necrosis was visible on the skin surface.
- The skin was torn proximally and the crop mucosa was necrotic along a large portion of the crop wall
- Due to the severe loss of viable crop mucosa it was decided to let the crop heal by second intent

Cockatoo with crop lesion
- Placement of an esophageal feeding tube
– One week later
– The crop mucosa is starting to heal nicely
– There is still a huge inflammatory lesion at the distal area of the crop
– It was decided to continue with supportive care

– Another 2 weeks later
– The large necrotic area had disappeared
– The crop had heal for a large part by second intent

– Another 2 weeks later
– The large necrotic area had disappeared
– The crop had heal for a large part by second intent
– The crop mucosa was closed in a simple interrupted layer
– Duoderm® was applied to cover the wound
**Cockatoo with crop lesion**

**Conclusion**
- Surgery may be postponed by placing an esophageal tube
- The crop heals well by second intent
- In some birds it may be wise to use a collar to prevent chewing on the tube

(www.aviancollar.com)

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**Placement of airsac tube**

**- Indications**
  - Emergency treatment for tracheal obstruction
    - Compare with tracheostomy in mammals
  - Airsac perfusion anesthesia
    - To facilitate tracheal surgery / endoscopy
    - To provide more room during surgery on the head / eye

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**Placement of airsac tube**

Place bird in right lateral recumbency
Tape wings together
Tape left leg to neck

Pluck feathers distal to leg
Tape feathers out of surgery field
Disinfect surgery area & drape patient

Placement of airsac tube

Cut skin with scissors at junction of both lines

Caudal border of sternum

Ventral border of M. flexor cruris medialis

Placement of airsac tube

Place bent mosquito with concave side towards sternum

Push mosquito through abdominal wall in cranial direction

Insert endotracheal tube (3 mm ID) into caudal thoracic airsac

Placement of airsac tube

Either place a suture through the skin, abdominal muscle, endotracheal tube and skin
or use the Chinese finger locking loupe to keep the tube in place

Placement of airsac tube

Airsac tube can also be placed cranial to the leg

The left leg is pulled in caudal direction. A skin incision is made halfway the femur. If the tube is left in place the tube will move within the abdominal cavity during movement of the leg.

Ventral laparotomy

- Indications
  - Liver biopsy
  - Intestinal surgery
    - Proventriculus is approached from left side
  - Removal of egg
    - Removal of oviduct and testis via lateral approach
  - Attachment of cloaca to ribs and abdominal wall
    - In case of cloacal prolaps
Feathers originating on sternum can be bent in cranial direction.

Tape feathers out of surgery field.

Incision may need to be expanded in lateral direction to allow for more abdominal access.

Make skin incision with scissors.

A lone star retractor is a light weight instrument which can keep your operating wound open.

Expand incision in lateral direction.

A better overview of the abdomen is now achieved.
The liver can be approached by opening the ventral hepatic peritoneal cavity just dorsal of the sternum.

The liver is difficult to see when not enlarged. Endoscopy is advised in those cases.

For closure of the wound FIRST bring the corners of the incisions together.

The abdominal wall and skin are then closed in two separate layers using Monocryl 4-0 in a continuous pattern.

Post operative care

- In general
  - Keep warm
  - Keep hydrated
  - Provide food as soon as possible
  - Maintain analgesia for a couple of days
Any questions?

Thanks for flying me in!