Introduction

- Surgery of the beak
  - Congenital deformities
- Thoracic & pelvic limb surgery
  - Bandaging techniques
  - Fracture repair
  - Bumblefoot

Beak surgery

- (Functional) anatomy of the avian skull and beak
- Common procedures
  - Correction of scissors beak
    - Trans-sinus pinning
    - Ramp prosthesis
  - Correction mandibular prognathism
    - Scaffolding
    - Beak prosthesis

Form & function the beak

- Basic anatomy similar in most species
  - Species-specific differences in shape are related to the diet
- Beak
  - Upper mandible or bill
    - (Pre)maxillary, nasal bones
  - Lower mandible or bill
    - Two rostrally fused rami
  - Composed of keratin, dermis, bone
- Beak movement via prokinesis, rhynchokinesis
  - Parrots have a craniofacial hinge (synovial joint)

Congenital deformities

Mostly seen in juvenile birds, occasionally adults

- Scissors beak deformity
- Mandibular prognathism
**Scissors Beak Deformity**

- Progressive, asymmetric beak growth
  - Delayed on one side vs. other
  - Trauma, bruising of the rictal edges
- Causes may include
  - Handfeeding technique
  - Incubation flaws
  - Genetics
  - Malnutrition
  - Infections (sinusitis)
  - Trauma

**Options for intervention**

- Conservative treatment
  - Daily manual manipulation
  - Only effective if discovered in very early stages
- Surgical intervention
  - Ramp prosthesis
  - Trans-sinus pinning
  - Corrective dremmeling of overgrown keratin
  - Temporary relief, mainly in older birds

**Ramp prosthesis**

- Mainly in juvenile parrots
- Ramp exerts an opposing force to the scissors deformity
  - Fixed to the lower mandible
  - Left in place for 2-3 weeks

**Technique**

- a. Upper beak deviated to the right
  - a. Upper beak deviated to the right
  - b. Preparations for placing ramp
  - Corrective dremmeling of beak
  - Roughening of lower beak surface
Technique

a. Upper beak deviated to the right

b. Preparations for placing ramp
   - Corrective dremmeling of beak
   - Roughening of lower beak surface

c. Creation of a ramp on the right
   - Wire mesh foundation, cut and shaped to fit over the entire mandible
   - Attached with 2 cerclage wires
   - Placement of layers of acrylics or methacrylate to create a functional cap

d. End result
   - Left in place for 2-3 weeks

Trans-sinus pinning

- Tension band exerting lateral pulling force to tip of beak
  - Fixed to IM pin driven through frontal bone
  - Left in place for 2-3 months duration
- Mainly subadult parrots of larger species

Mandibular prognatism

- Upper beak is placed inside lower beak => malocclusion
- Most common in cockatoos
- Causes similar to those described for scissors beak

Upper beak extension prosthesis

- Application in young sub-adults
- Prosthesis functionally extends the upper beak
  - Prevents placement of the upper into lower beak
  - Rapidly enables normal occlusion and normalization of range of motion
Technique

- Creation of a functional cap
  - Extending distally from cere
  - Encompassing pressure bearing keratin at occlusal ledge of maxilla
  - Use acrylic/methacrylate products
  - Lower mandible must not extend out and beyond the prosthesis
  - Tomium of gnathotheca should be able of applying normal force at occlusal ledge

Scaffolding

- Primarily used in adult birds with marked deformities
- Chronic deformities present
  - Hyperflexion of the nasal-frontal hinge, caudal retraction of quadrate, hyperextended quadrate-mandibular joint
  - Muscle contraction, ↓ range of motion
- Lacking of significant lower mandibular deformities
- Not recommended as a first-step intervention

Technique

- Non-threaded IM pin placed
  - Similar to trans-sinus pinning
- Bend pins close to their exit symmetrically on both sides
- Insert second S-shaped pin at distal end of rhinotheca
- Place rubber bands around hooks of the transverse sinus pin and ventral S-pin
  - Keep traction on band with sutures

Limb surgery

- Treatment of common conditions
  - Fractures of the thoracic and pelvic limb
  - Pododermatitis or bumblefoot

Fractures

- Long bones commonly involved
  - Thin cortices, little soft tissue
- Most often trauma-related
  - Malnutrition, neoplasia, infection
- Clinical signs
  - Wing droop, inability to fly
  - Lameness, unequal weight bearing
- Note: connection to air sacs!
- Radiographic evaluation

Initial therapeutic plan

- ALWAYS stabilize the patient FIRST!!!
- Stabilize the fracture (bandaging)
- Provide analgesia
  - Carprofen 2 mg/kg q12h PO
  - Meloxicam 1.5 mg/kg q12h PO
- Antibiotics indicated for open fractures
- Adaptations to enclosure
  - Leg band removal
- Collar to prevent damage?
  - Provide distraction with tapes
Fracture repair

- Principles of fracture repair & healing
  - Prevent contamination, treat infections
  - Minimize soft tissue damage
  - Maintenance of form & function
  - Anatomic alignment
    - ≥ 50% contact between fracture ends
    - Rigid stabilization
    - ↓ disturbance of callus formation
    - Neutralization of forces

Bones heal quicker in birds compared to mammals

Methods of fracture repair

- Conservative treatment – external coaptation
- Surgical (osteosynthesis)

Fracture repair

- External coaptation
  - Bandage
  - Splint
  - Sling
- Stabilization
  - Bending forces
  - Torsional forces
  - Axial loading

Bandaging materials

- Primary layer (dressing) = in contact with wound
  - Non adherent - Adherent - Occlusive dressings

Bandaging materials

- Secondary layer = support and/or absorption
  - Artiflex

Bandaging materials

- Splints = provide extra stability
  - Articast - Cellacast - Vet-lite
Bandaging materials

- Tertiary layer = outer covering layer
  - Vetrap - Elastikon

Figure-of-eight bandage & Body-wrap

Wing bandaging techniques

Leg bandages

- Femur – difficult!
  - Schroeder Thomas splint
  - Spica splint

Leg bandages

- Tibiotarsus - difficult
  - Robert Jones bandage

Leg bandages

- Tarsometatarsus
  - Metatarsal bandage
  - Tape splint
    - Useful in smaller birds

Metatarsal bandage & Ball bandage

A ball bandage is used to stabilize the toes
Ball bandage

The different layers of a ball bandage

Fracture repair

- Surgical (osteosynthesis)
  - Internal fixation
  - External fixation
- Stabilization
  - Bending forces
  - Torsional forces
    - IM Pin
    - KE & Plates
  - Axial loading
    - IM Pin
    - KE & Plates
- Very good stabilization
- Depending on the type of fixation:
  - Poor stabilization
  - Very good stabilization

Fracture repair

- Surgical (osteosynthesis)
  - Intramedullary pins
  - Bone plating
  - External fixation
    - Type I, II, III
  - Combination IM-EF (Tie-in)

Osteosynthesis

- Intramedullary (IM) pins
  - Kirschner Pin
  - "Shuttle" Pin

Cerclage wire can be used
The combination with a Type-1 KE-Fixator ("Tie-in") is also possible

Osteosynthesis

- Intramedullary (IM) pins
  - Kirschner Pin
  - "Shuttle" Pin

A wire is threaded through the polypropylene pin
This pin is then inserted into the bone shaft
The pin can be inserted into the other shaft by pulling on the wire

It is possible to place an external fixator through the "Shuttle" Pin
**Osteosynthesis**

- Intramedullary (IM) pins
  - Kirschner Pin
  - „Shuttle“ Pin
- Plate osteosynthesis

- External fixator
  - Type-I
  - Type-II

**Osteosynthesis**

- Intramedullary (IM) pins
- Plate osteosynthesis
- External fixator
  - Type-I

**Osteosynthesis**

- Intramedullary (IM) pins
- Plate osteosynthesis
- External fixator
  - Type-I
  - Type-II
  - Type-III

**Osteosynthesis**

- Fractures
  - Wing
    - Humerus
    - Radius & ulna

**Osteosynthesis**

- Fractures
  - Femur

**Uncertain if this technique is used in birds**
Osteosynthesis

- Fractures
  - Femur
  - Tibiotarsus

Not enough room for a Type-II K-E
A Type-I K-E or tie-in are possible
When the bone is big enough, a plate osteosynthesis gives the best results

Osteosynthesis

- Fractures
  - Femur
  - Tibiotarsus

A Type-I K-E is possible, but is not as stable as a Type-II KE
When using a Type-I KE it is recommended to use threaded pins

Osteosynthesis

- Fractures
  - Femur
  - Tibiotarsus

A Type-II KE results in a good outcome and may be used simultaneously on two legs
The KE-osteosynthesis can be combined with an IM pin

Type-2 KE Osteosynthesis

Example case
- Hawk
  - Female
  - 1.5 years old
- Fractured left tibiotarsus due to trauma

Anterior-Posterior  Lateral

A closed reduction was performed in this bird
Two Kirschner pins were placed in the proximal fragment and three Kirschner pins were placed in the distal fragment
The pins are bent parallel to the limb

"ESF Putty" (Epoxy resin) is placed around the pins

The pins on the other side are bent in a similar fashion

"ESF Putty" from Veterinary Instrumentation

"ESF-Putty" is also applied on the other side
A pressure bandage is applied between the leg and the fixator.

Post operative radiographs were made a day later.

### Type-2 KE Osteosynthesis

- Condition comparable to a bedsore
- Etiology
  - Obesity
  - Lack of exercise
  - Contact with rough surfaces
  - Too smooth perches

#### Five stages

- **Stage I**: Hyperemia and slight sloughing of the skin
- **Stage II**: Inflammation with crusts and slight thickening
- **Stage III**: Abscess with obvious inflammation, including thickening and pain

### Bumblefoot

- Five stages

- **Stage I**: Hyperemia and slight sloughing of the skin
- **Stage II**: Inflammation with crusts and slight thickening
- **Stage III**: Abscess with obvious inflammation, including thickening and pain
Bumblefoot

**Five stages**

- **Stage I**
  - Hyperemia and slight sloughing
- **Stage II**
  - Inflammation with crusts and slight thickening
- **Stage III**
  - Abscess with obvious inflammation, including thickening and pain
- **Stage IV**
  - Deeper structures involved, but foot function retained
- **Stage V**
  - Involvement of deeper structures, loss of function

**Treatment**

- **Bandage to decrease pressure**
  - A "doughnut" bandage
- **Antibiotics** (often associated with *Staphylococcus aureus*):
  - Amoxicillin with clavulanic acid
    - TID 100 mg/kg oral, or
    - BID 125 mg/kg oral
- Surgery required in severe cases

- Promote circulation
- Provide perches with variable diameters
Questions???

Thank you for your attention!