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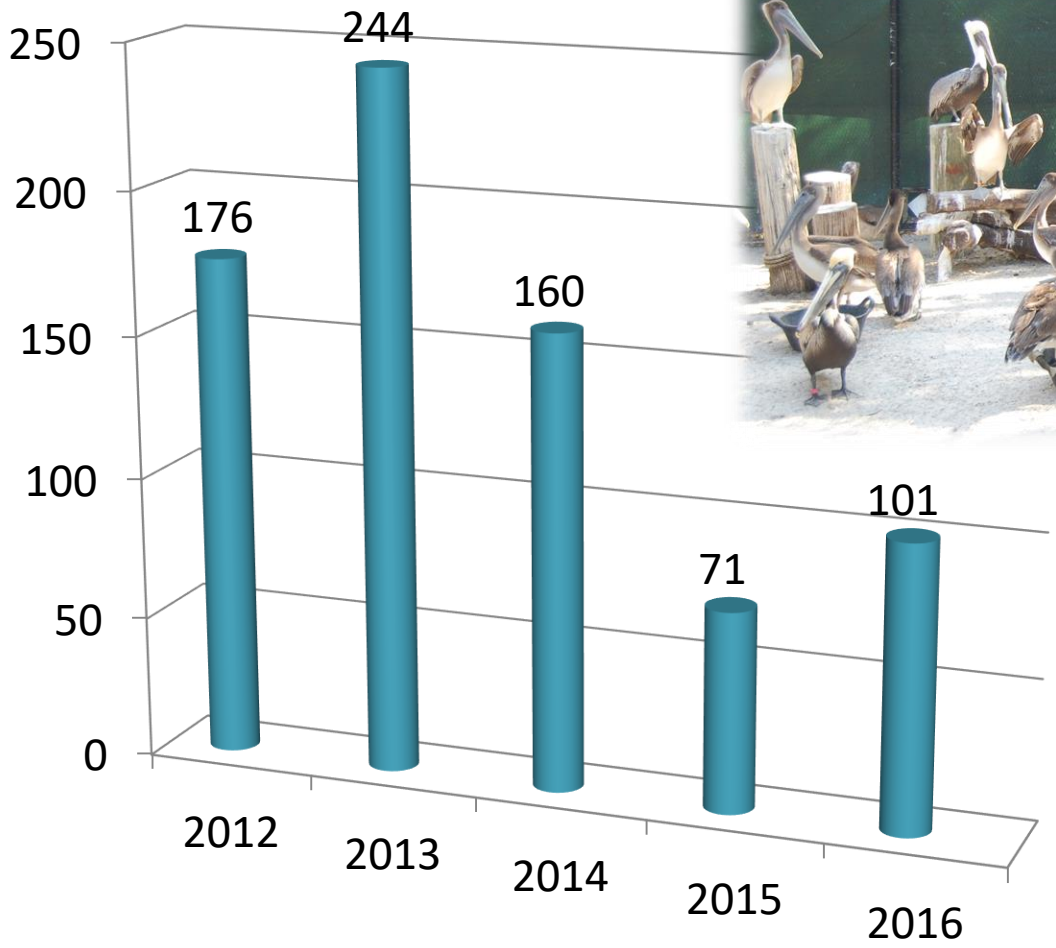
VISCERAL GOUT IN BROWN PELICANS AT THE SOUTH FLORIDAWILDLIFE CENTER

Antonia Gardner, DVM

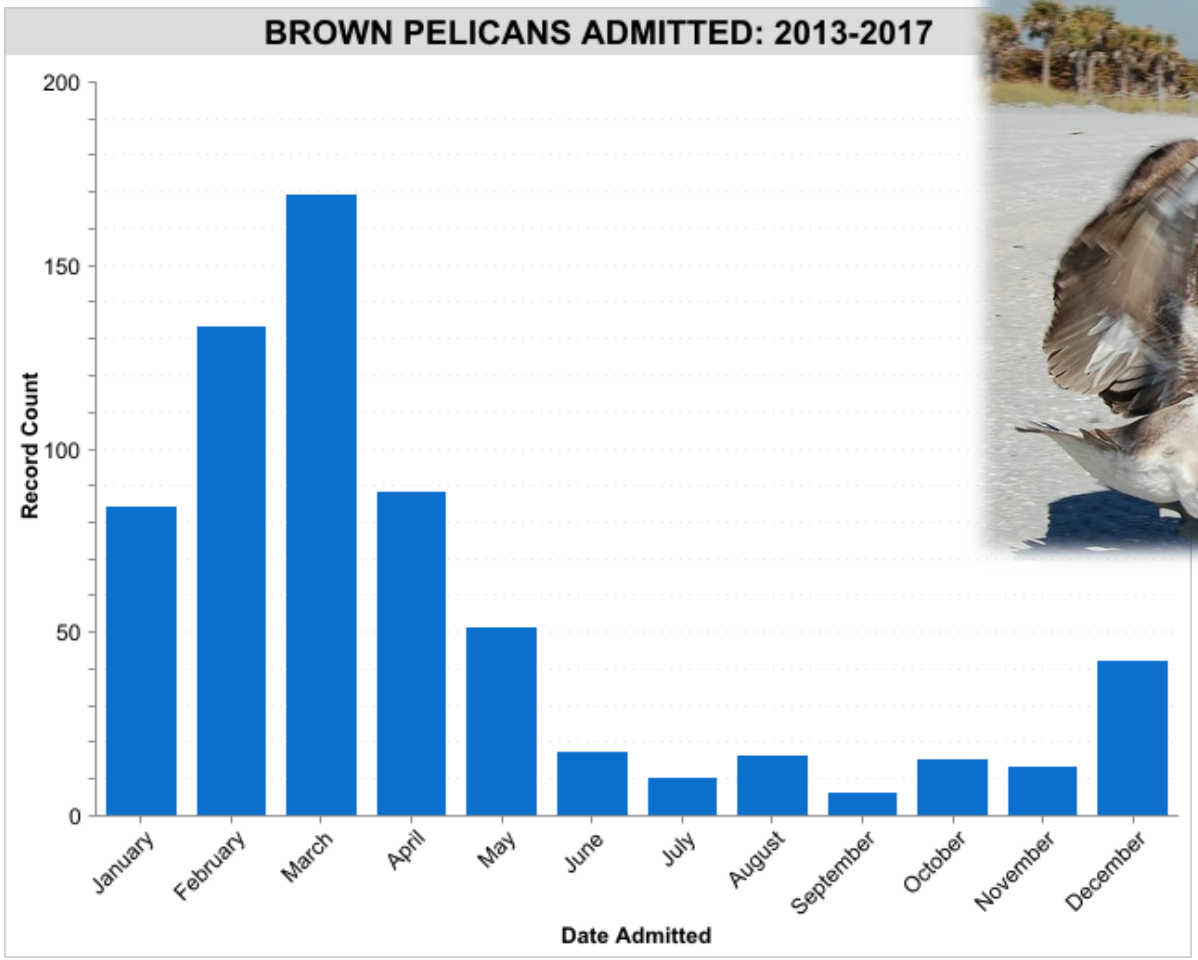
Medical Director

South Florida Wildlife Center, Ft. Lauderdale, FL

BROWN PELICANS



BROWN PELICANS



BROWN PELICANS – Reasons for admission

Trauma:

Hook a

ingestion

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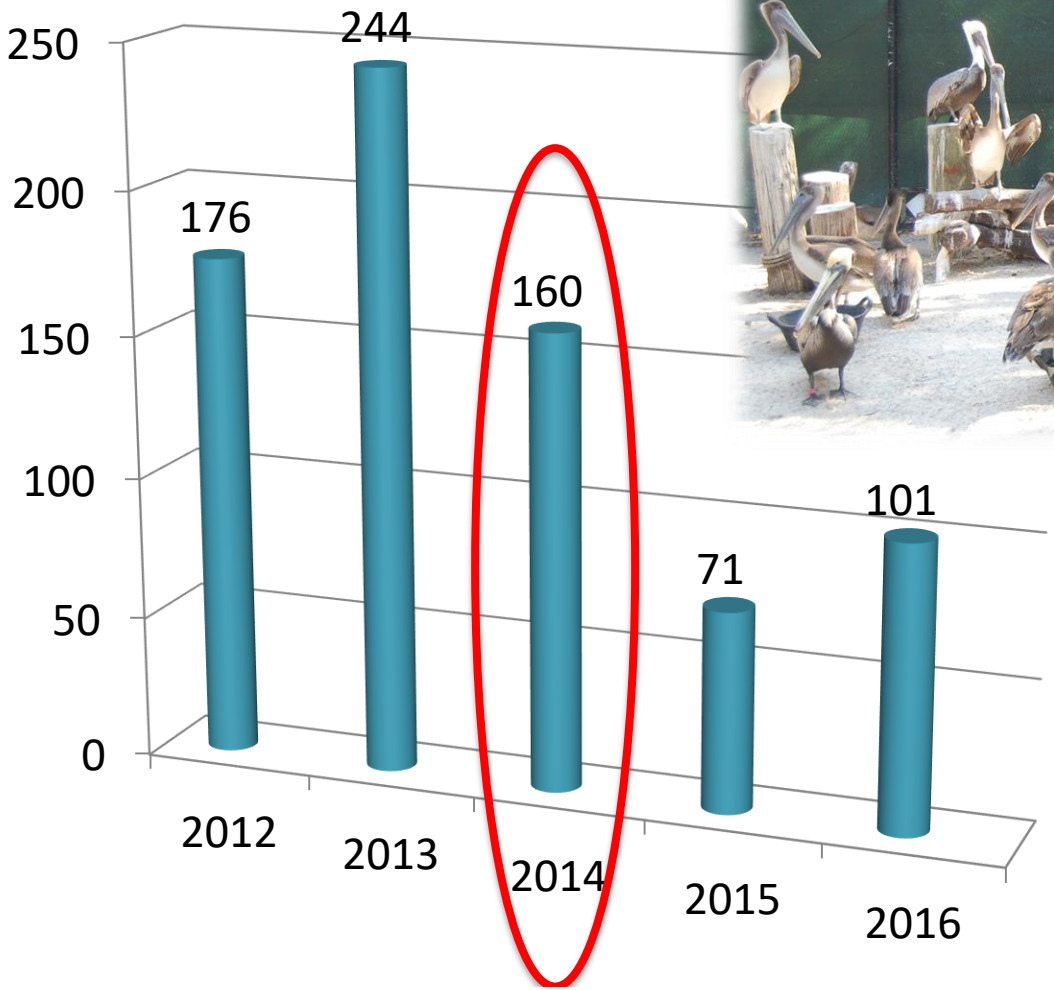
BROWN PELICANS



Pelicans Admitted to SFWC Annually

Brown Pelicans

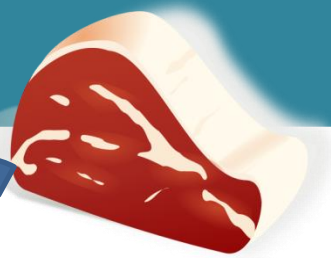
Date	Case Number	Histological findings
01/17/14	14011709	Urate stasis in kidney, urate deposition multiple organs
01/24/14	14012404	Salt gland adenitis, kidney mineralization
03/01/14		ne;
03/26/14		
04/03/14		dium,
04/19/14		
04/20/14	14042013	GROSS - White deposition on air sacs and pericardium
07/14/14	14071408	Urate tophi on liver, heart; enteritis

URIC ACID DEPOSITION

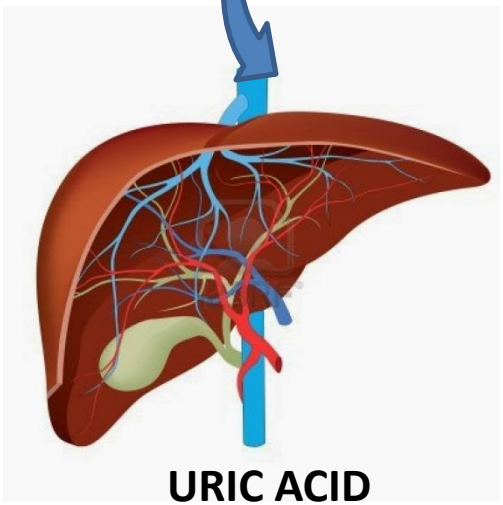
AKA

VISCERAL GOUT

AVIAN URIC ACID EXCRETION

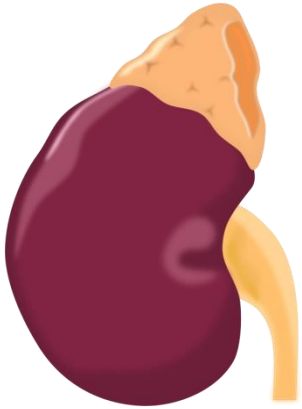


PROTEIN METABOLISM



URIC ACID

SODIUM URATE IN BLOOD



URETERS

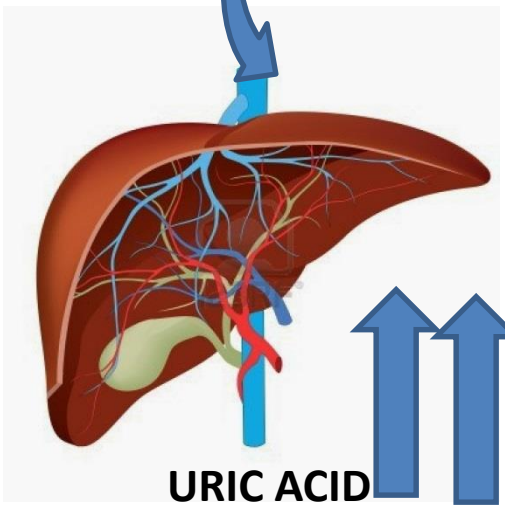
URODEUM

PROTEIN METABOLISM

URIC ACID PRECIPITATES

URODEUM

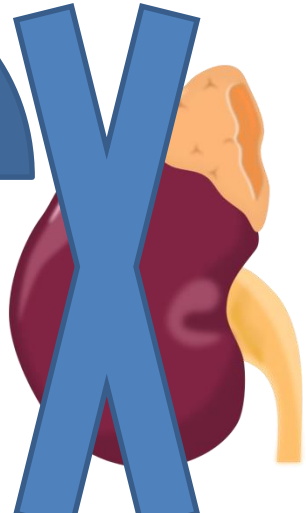
AVIAN URIC ACID EXCRETION



URIC ACID

URETERS

SODIUM URATE IN BLOOD



Visceral Gout

Uric acid excretion is reduced or production is increased

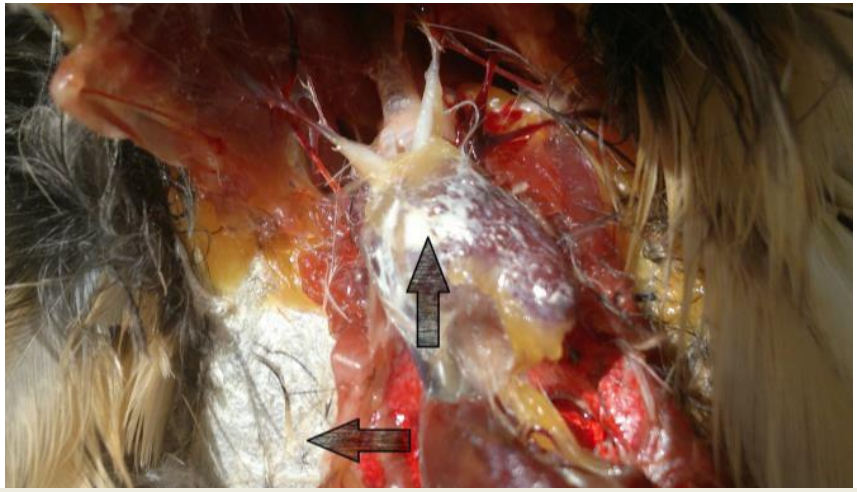
This leads to ↑↑ blood levels of uric acid

Uric acid precipitates out of the blood

Uric acid precipitates form on and in visceral organs

Visceral Gout

- Grossly apparent
- Chalky-white deposition on surface of organs
- Can appear on heart, liver, mesentery, and airsacs, and within kidney tubules



Arrows depict urate deposit on the heart and thoracic air sacs of a little bittern with visceral urate deposition

Causes of Visceral Gout

- Nutritional – water deprivation, high-calcium diets, high-protein diets, hypovitaminosis A
- Nephrotoxic agents – mycotoxins, heavy metals
- Nephrotoxic drugs – NSAIDs, certain antibiotics
- Viral nephritis – avian nephritis virus, polyomavirus, nephropathogenic bronchitis virus
- Bacterial nephritis – *Brachyspira alvinipulli, Pasteurella multocida*
- Parasitic disease – renal cryptosporidiosis

Brown Pelicans

Date	Case Number	Histological findings
01/17/14	14011709	Urate stasis in kidney, urate deposition multiple organs
01/24/14	14012404	Salt gland adenitis, kidney mineralization
03/01/14	14030112	Urate deposition in trachea, air sac, heart, intestine; renal tubular necrosis and mineralization
03/26/14	14032624	Urate tophi in spleen and kidney; urate stasis
04/03/14	14040333	GROSS - White deposition on air sacs and pericardium, mottled kidneys
04/19/14	14040933	Urate tophi in kidney, ureteral trematodes
04/20/14	14042013	GROSS - White deposition on air sacs and pericardium
07/14/14	14071408	Urate tophi on liver, heart; enteritis

Brown Pelicans

Case Number	Histological findings	Medication
14011709	Visceral gout - kidneys	Meloxicam 1 mg/kg SID x 11 days
14012404	Salt gland adenitis, kidney mineralization	Meloxicam 1 mg/kg SID x 8 days, Amikacin x 13 days
14030112	Visceral gout - trachea, air sac, heart, intestine, kidneys; renal tubular necrosis	Meloxicam 1 mg/kg SID x 3 days
14032624	Visceral gout - spleen and kidney; urate stasis	Meloxicam 0.5 mg/kg BID x 9 days
14040333	Visceral gout – pericardium and kidneys	Meloxicam 1 mg/kg SID x 8 days
14040933	Visceral gout - kidney, ureteral trematodes	Meloxicam 0.5 mg/kg BID x 5 days
14042013	Visceral gout - air sacs and pericardium	Meloxicam 0.5 mg/kg SID x 5 days
14071408	Visceral gout - liver, heart; enteritis	Meloxicam 1 mg/kg SID x 5 days, then 0.5 mg/kg SID x 5 days

NSAID Toxicity in Birds

- Diclofenac residues in cattle carcasses caused population collapse of vultures in Indian subcontinent
- Population decreases up to 95% in 3 *Gyps* species, all Old World vultures decimated

Courtesy: Scientific American

Courtesy: Birdlife International

NSAID Toxicity in Birds

- Primary finding in bird carcasses was acute renal necrosis and visceral gout
- Diclofenac also caused visceral gout experimentally in Gyps vultures, broiler chicks and pigeons

Research Note

Suspected flunixin poisoning o
Eurasian
Griffon Vulture from Spain

Irene Zorrilla,‡ Rosa Martinez,‡ Mark A. Taggart,† § and Ngaio
‡Environmental and Water Agency of Andalusia, Division of Integrated Environme
Diagnosis of
Wildlife – CAD, Avda. Lope de Vega, 9, M´alaga 29010, Spain
†Environmental Research Institute, University of the Highlands and Islands, Castle
United Kingdom
‡Working Dogs for Conservation, 52 Eustis Road, Three Forks, MT 59752, U.S.A

Biol Lett. 2010 Jun 23; 6(3): 339–341.
Published online 2009 Dec 9. doi: 10.1098/rsbl.2009.0818
PMCID: PMC2880042
PMID: 20007163

Toxicity of non-steroidal anti-inflammatory drugs to *Gyps* vultures: a new threat from ketoprofen

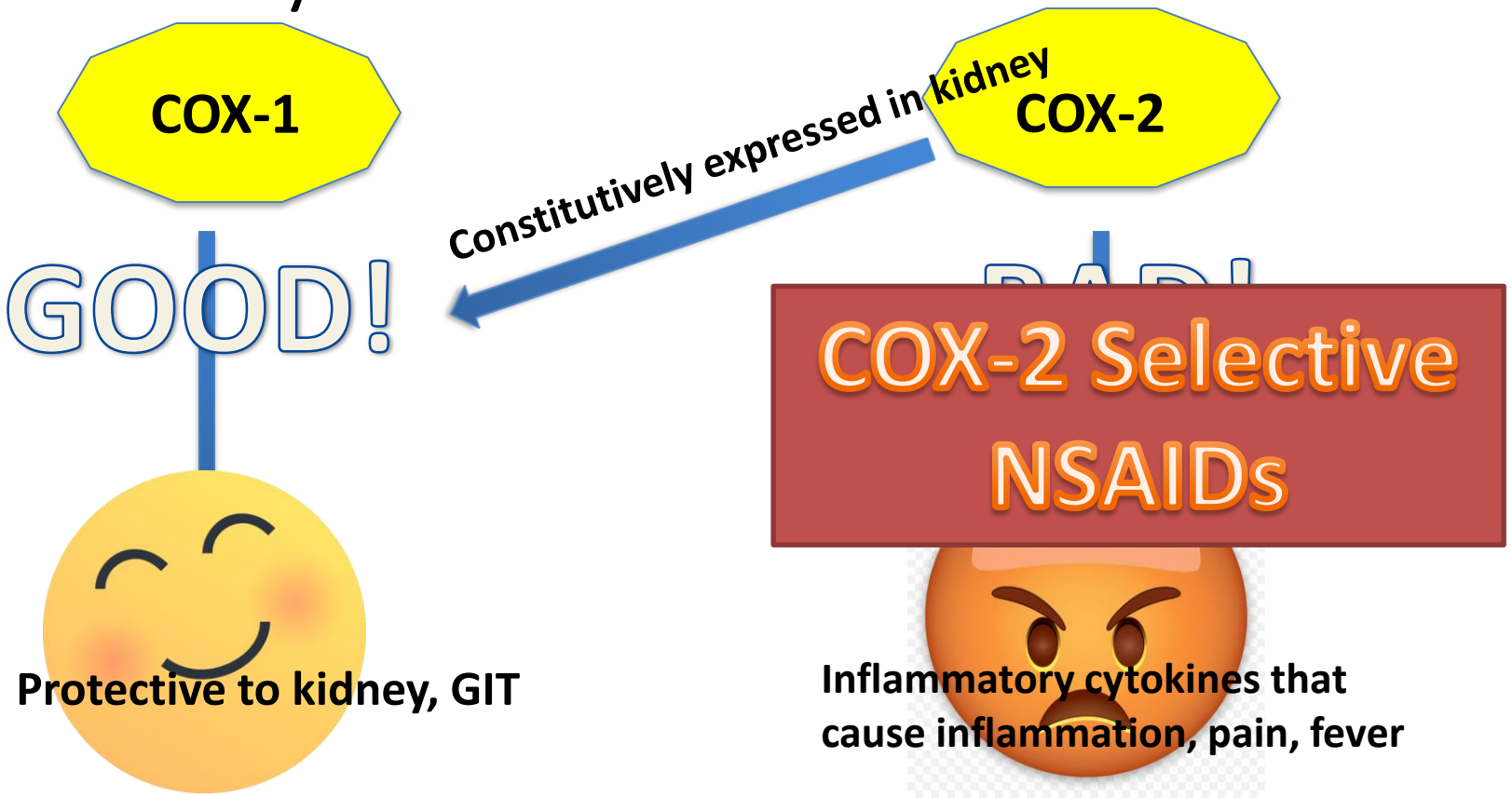
Vinny Naidoo,[1] Kerri Wolter,[2] Duncan Cromarty,[3] Maria Die kmann,[4] Neil Duncan,[1] Andrew A. Meharg,[5]
Mark A. Taggart,[5,6] Leon Venter,[1] and Richard Cuthbert[7,*]

Mechanism of Renal Damage

- Cyclo-oxygenases are precursors to eicosanoids
- Eicosanoids (prostaglandins, thromboxane) are inflammatory mediators produced for various reasons
  - "Good" vs. "Bad"
- COX-1 = constitutive – generates protective PGs for GI, kidney, mediates platelet aggregation
- COX-2 = inducible – generates pro-inflammatory PGs

Mechanism of Renal Damage

- NSAIDs inhibit COX 1 and 2
- Generally COX-2 selective NSAIDs are safer



Mechanism of Renal Damage

- Side effects of NSAIDs:
  - Decreased GI perfusion → decreased mucous production, development of ulcers
  - Decreased renal perfusion → renal tubular necrosis
  - Direct toxicity to renal tubular epithelial cells
  - Suppression of platelet aggregation prolongs clotting times
  - Severe overdoses of some NSAIDs can lead to neurological signs

NSAID use in Birds

- Meloxicam widely considered the safest NSAID for birds
- COX-2 selective
- Available in a tasty liquid oral formulation and injectably
- Easy to dose and administer

Meloxicam Use in Birds

- Pharmacokinetics:
  - Carribean flamingos – Inconclusive due to route-dependent differences in elimination and plasma concentration
  - RTHA and GHOW – rapid elimination at 0.5 mg/kg
  - Hispaniolan parrots – 1 mg/kg cleared over 12 hours if given injectably – fast when given PO
  - African gray parrots – much longer clearance than for HPs

Meloxicam Use in Birds

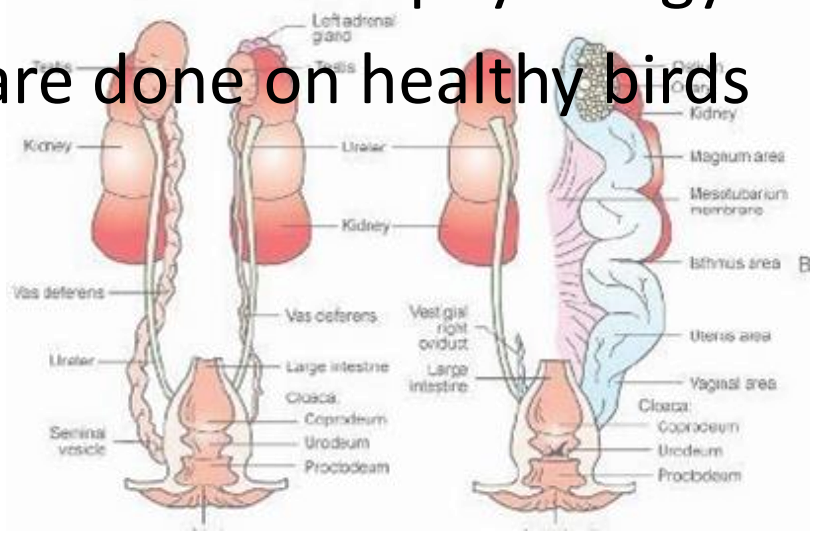
- Safety:
  - African gray parrots –0.5 mg/kg BID x 14 days. Conclusion – does not cause renal disease
  - Hispaniolan parrots - 1.6 mg/kg SID x 15 days – no negative effects
  - AMKE – up to 20 mg/kg PO BID x 7 days – no kidney disease, GI ulceration at high doses, hepatic lipidosis?
  - Budgies– 0.1 mg/kg SID x 7 days – no negative effects.
  - Japanese quail – 2 mg/kg IM BID x 14 days, no affect on kidney function
  - Old-World vulture – rapid elimination time, no side effects with 2 mg/kg daily

Meloxicam Use in Birds

- Analgesia:
  - 2 mg/kg minimized post-op pain in pigeons
  - 1 mg/kg x 3 doses improved weight-bearing in parrots with arthritis
  - Hispaniolan parrots -1 mg/kg PO may not be sufficient for analgesia

Meloxicam Use in Birds

- Problems:
  - Pharmacokinetic, safety, dosing studies done a variety of ways
  - Widely disparate results among species
  - Individual variation in physiology widely unknown
  - Studies are done on healthy birds



Are Pelicans Special?

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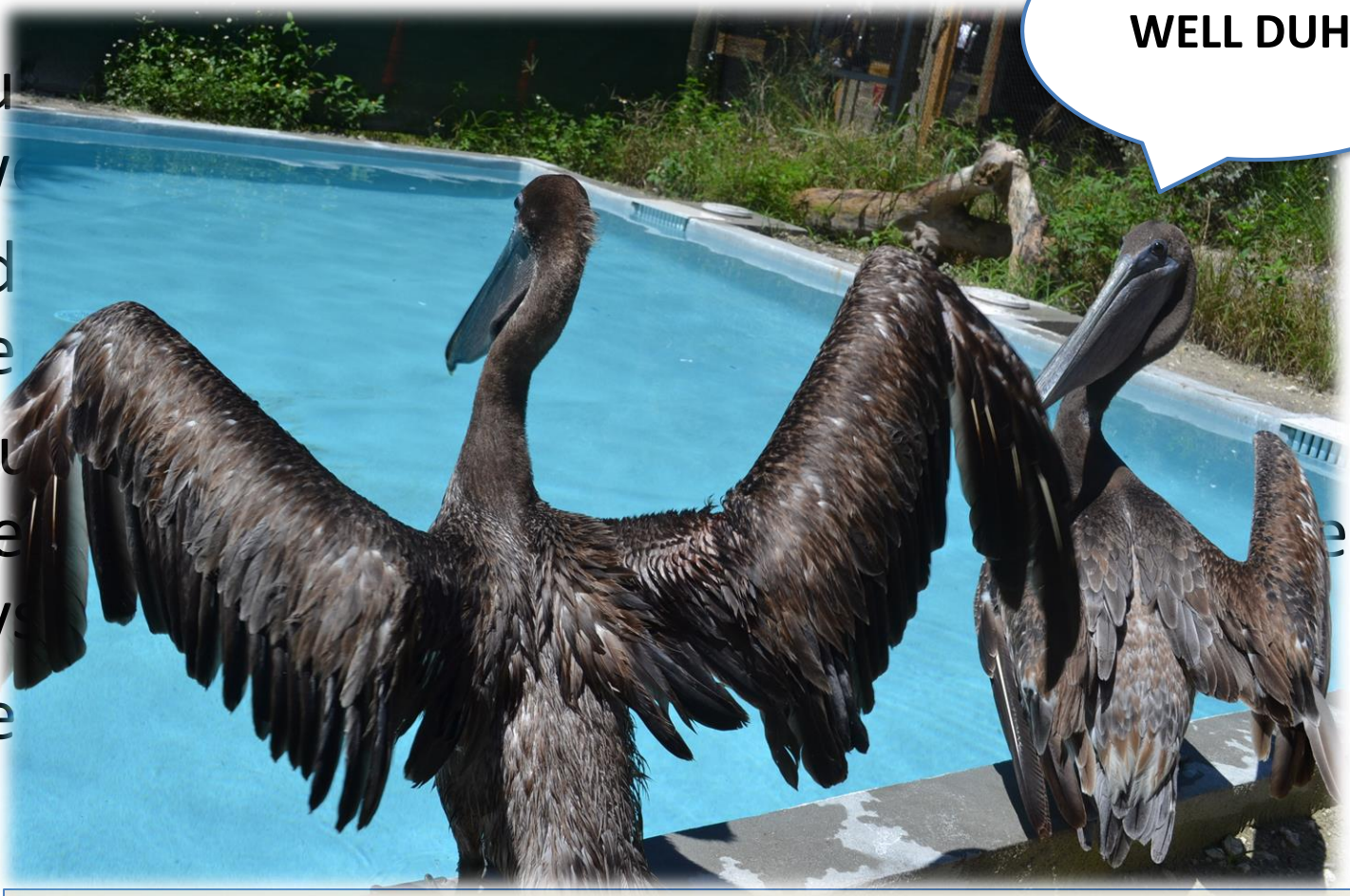

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Duerr RS. 2018. Successful Surgical Management of Pouch and Bill Injuries in Pelicans. In, Proceedings of ExoticsCon 2018, Sept. 22-27, 2018, Atlanta, GA, pp. 363-367.

NSAID Toxicosis

- Management:
  - GI ulcers most common side effects
  - Any inappetant BRPE should be taken off Meloxicam and re-evaluated
  - Sucralfate – 25 mg/kg (0.5-1) tab PO TID
    - Dissolve in 6 ml water, give 1-2 hours prior to or after other meds
  - Famotidine – 0.5-1 mg/kg SID-BID PO, IM, or SQ
  - Omeprazole – 20 mg/kg PO SID

*latter 2 treatments ONLY IF bird is on liquid feeds

NSAID Toxicosis

- Management:
  - Diagnosis of kidney dysfunction is tricky
  - Elevated UA can be helpful : > 30 mg/dl in fasted bird, or sequential elevation
  - Radiographs may show urates in kidneys, on serosal surfaces
  - Fluid therapy is of utmost importance – 2-4 X maintenance to maintain renal function
  - Allopurinol – decreases UA production – 10-30 mg/kg SID – BID -- controversial

Recommendations

- Approach NSAID use with extreme caution
- Dehydrated, underweight, shocky birds should NOT get Meloxicam
- Rehydrate before starting NSAIDs

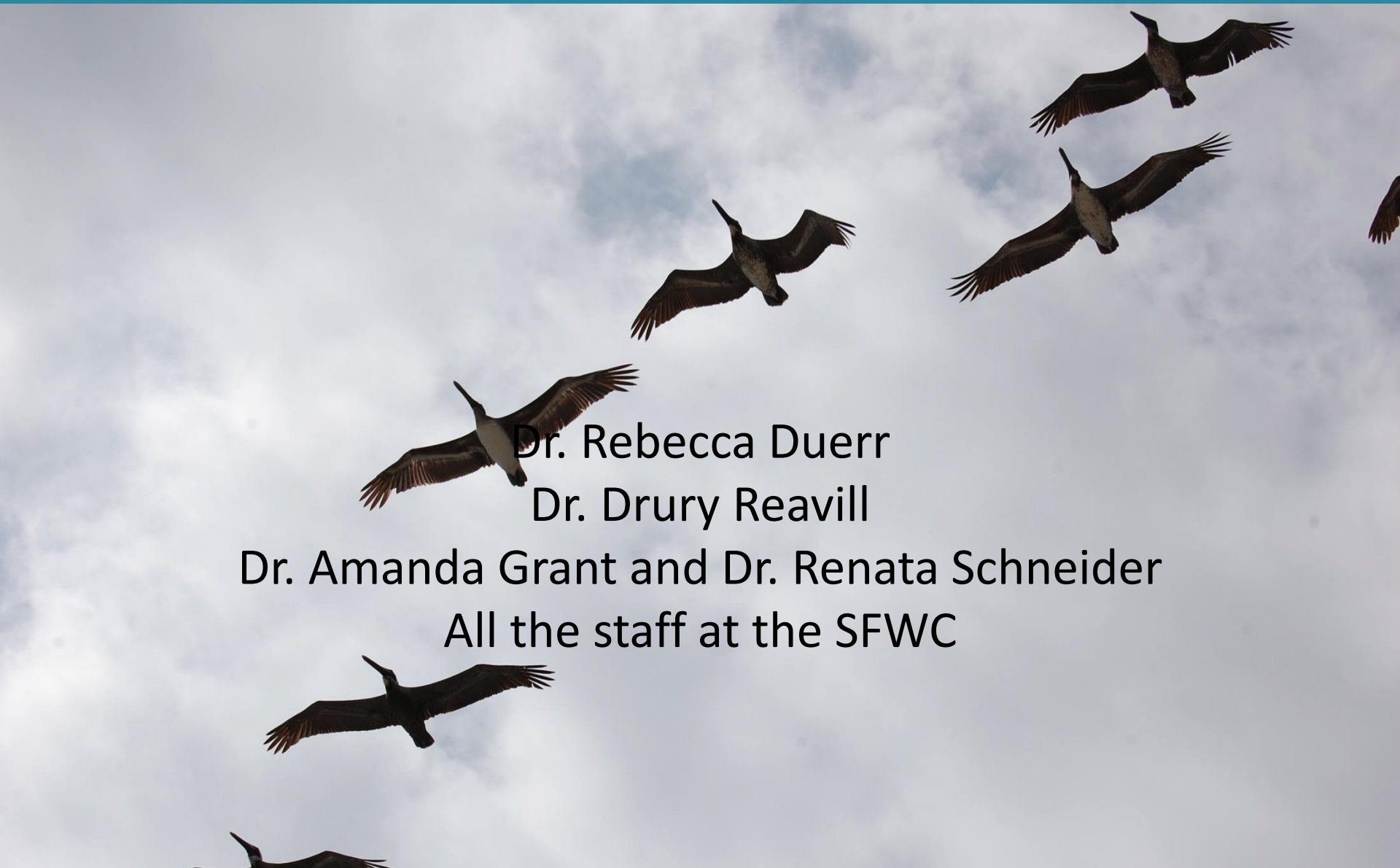
Recommendations

- Avoid NSAIDs in GI patients
- Use cautiously pre-surgically
- Maintain hydration during procedure

Recommendations

- Re-evaluate need for NSAIDs after 3 days
- 0.25 mg/kg SID x 3 days – then q 3 days?
- Multi-modal pain approach
  - Tramadol, Hydromorphone, Buprenorphine
- When in doubt – d/c Meloxicam use and re-evaluate!

Acknowledgements



Dr. Rebecca Duerr
Dr. Drury Reavill
Dr. Amanda Grant and Dr. Renata Schneider
All the staff at the SFWC

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