LIVS In Plain View

LONG ISLAND VETERINARY SPECIALISTS

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Inside This Issue

Gait Analysis — An Overview

Fernando Leyva, DVM, DACV-SA
Department of Surgery

Gait analysis is the systematic study of animal locomotion, by a trained observer, augmented by instrumentation for measuring body movements, body mechanics, and the activity of the muscles. The use of computer-assisted gait analysis has expanded significantly in the past couple of decades in veterinary medicine.

Gait analysis is useful for evaluating patients with musculoskeletal and/or neurologic conditions, along with evaluation of various treatments for surgical and nonsurgical conditions. Computer-assisted gait analysis techniques are objective, reliable, and more sensitive than a trained observer in detecting lameness. These techniques are useful in detecting and quantifying an abnormality.

Gait analysis is usually divided into two main categories: *kinetics* and *kinematics*. Kinetic gait analysis is the study of forces generated during movement. It includes quantification of ground reaction forces and is required to calculate forces acting on individual joints. Kinematic gait analysis is the study of motion, of the body in space, irrespective of masses or forces. Usually kinetic gait analysis can be performed in areas with limited space; in contrast, kinematic gait analysis often requires a larger laboratory space.

Gait and the Gait Cycle

Gaits are divided into two main categories: symmetrical and asymmetrical gaits. The most commonly studied gaits are symmetrical gaits, which include the walk, trot, and pace. Asymmetrical gaits include the canter, the transverse gallop, and rotary gallop; these gaits increase the complexity of the interpretation and are thus uncommon in gait assessment studies.

Each stride in a gait cycle consists of two main phases: the stance phase and the swing phase. The stance phase is defined as the time in which the foot is in contact with the ground, whereas the swing phase is the time in which the foot is propelled through the air. The stance phase can be further subdivided into braking and propulsion.

Kinetic Gait Analysis

Kinetic gait analysis requires force plates which use transducers to measure force during the stance phase. The measurement of patient velocity and acceleration while the patient moves across the force plate(s) is done with photoelectric switches, commonly referred to as photocells. In gait laboratories with limited space, force plates can be integrated into a

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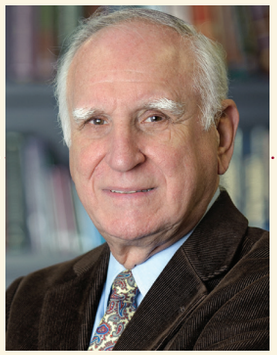
A Note from the Editor



This winter season, although prepared for the worst (our permanent generator is capable of suppling power to all of LIVS' departments simultaneously), we managed to get into spring with only its daily trial runs and no emergency episodes. Warmer weather is much appreciated; enough of winter for 2019.

The mild weather however, is once again promoting dispersal of pollens, weeds, dust and other allergens to add to the itchy, tearing and wheezing sensations we and our pets experience. The LIVS Dermatology department has extended hours so that it may better offer its services to our clients and referring veterinarians and is available to consult in cases that would benefit from appropriate allergic management.

The current issue of "Columbia Magazine",my undergrad alma mater, features a cover photo of a researcher in its lab who is working on JAK (Janus kinase) inhibitors, a category of drugs used to treat rheumatoid arthritis in humans and pets. The evolution of the JAK inhibitor as a treatment for rheumatoid arthritis came on the heels of advancements in immunology and molecular biology and is now used for alopecia, even male (and female) pattern baldness. The process includes taking a small sample of ones own hair follicles, growing more hair in a dish and implanting the new follicles, a net gain of hair as opposed to shifting follicles from one site to another. This procedure should become more popular than Facebook.

A few weeks ago, Newsday printed a letter sent by me to them replying to a comment on an article critical of the money spent on dog food. Here it is: "According to the Centers for Disease Control and Prevention, owning a pet can have positive effects on health such as lower stress levels, heart rates, blood pressure, cholesterol and triglyceride levels. They tend to be happier and have fewer feelings of loneliness. Since we in the US waste 50% of all produce and supermarkets discard 43 billion pounds of food yearly, better management of our food supplies would feed people in need and satisfy our pets' requirements at the same time. Pets promote an immeasurable amount of joy to those who love both children and animals and there are enough resources for both."

Our congratulations are extended to the entire surgical staff as we now have six boarded surgeons at LIVS, the highest number on the Island. Dr. Doherty was also feted at the LIVS' party for our happy group.

In contrast, no praise was bestowed on a former vet student who was convicted in Brooklyn Federal court this month of implanting heroin bags in puppies' stomachs so they could serve as "mules" to get drugs into the U.S. Some died of infections but one who was saved after removal was named "Heroina" and became a drug sniffing dog for police in Colombia.

Again, rabid raccoons have been found in the city prompting the NYC Department of Health to urge New Yorkers to get their pets vaccinated against Rabies as exposure is almost always fatal. Four were found in upper Manhattan, one in the Bronx and another on Staten Island.

Our department head of Ophthalmology, Dr. John Sapienza recently returned from Spain where he lectured a full day on Glaucoma in animals at the University of Barcelona. He then went to Madrid to lecture on the use of an acellular corneal graft in dogs as well as participated in 2 round table discussions on cataract surgery at the SEOVET meeting, all enthusiastically received.

Our Surgical Department chief, Dr. Dominic Marino, was in Copenhagen this month to perfect techniques used in the treatment of refractive seizures in dogs. More on that as the study progresses.

Our extended hours for consultation at LIVS, including the Behavior Department, led by Dr. Sabrina Poggiagliolmi is designed to serve our clients more efficiently. Appointments can be made through our telephone receptionists at 516 501-1700.

On a regular basis, Dr. Curtis Dewey, associate professor and section head of Neurology/Neurosurgery at the College of Veterinary Medicine at Cornell is here at LIVS for consultation. Appointments can be also made at 516-501-1700.

As before we welcome all comments, please submit them to lmarino@livs.org.

Leonard J. Marino, MD, FAAP, LVT

Gait Analysis — An Overview

➤ *Continued from Front Cover*

treadmill. In general, this allows for rapid collection of a large amount of data with the use of minimal laboratory space. However, animals have to be trained or habituated to properly use the treadmill, thus this method has its challenges.

An alternative to force plates to study kinetic gait analysis, are pressure walkway systems. Similar to treadmills with integrated force plates, pressure walkways do not require large amounts of storage space. Pressure walkways have a strong appeal for clinical practice due to their portability and ease of storage—as they are typically rolled up for storage and can be transported to an appropriately sized walkway. However, it is important to identify the differences between pressure walkways and the more traditional force plate systems. Force Plate systems allow for the recording of direct force in newtons (N) in three directions: vertical, craniocaudal, and mediolateral. Pressure walkways measure pressure only in the vertical direction and are therefore unable to measure pressure in the shear directions.

Each time an animal's paw contacts the ground, it exerts a force on the ground and the ground reacts with an equal and opposite force, the ground reaction force (Newton's third law of motion). The term "ground reaction force" is often used to refer to only the directional force vectors: (1) vertical (F_z), (2) craniocaudal (F_y), and (3) mediolateral (F_x). When kinetic data are collected, the most widely reported and compared values for all three orthogonal forces (F_z, F_y, and F_x) are the *peak force* and *impulse values*. Peak force is simply the "maximum" force exerted in the retrospective direction. The impulse value is the area under the force-time curve and takes both the force and contact time into consideration. Both peak force and impulse are a measure of function and an indirect measure of pain. With lameness both of these values would be decreased on the affected limb. The rising slope of the curve is the period from initial contact (i.e. 0 value) to the maximum force. This slope gives the *loading rate*. In animals with lameness, the rising slope is reduced, which is consistent with a more cautious initial placement of weight on the limb (reduced loading rate). The falling slope is increased, which is consistent with a quicker removal of weight from the limb (increased o ffloading rate). **Figure 1** depicts force-time curves with graphic representation of ground reaction forces at a walk and a trot.

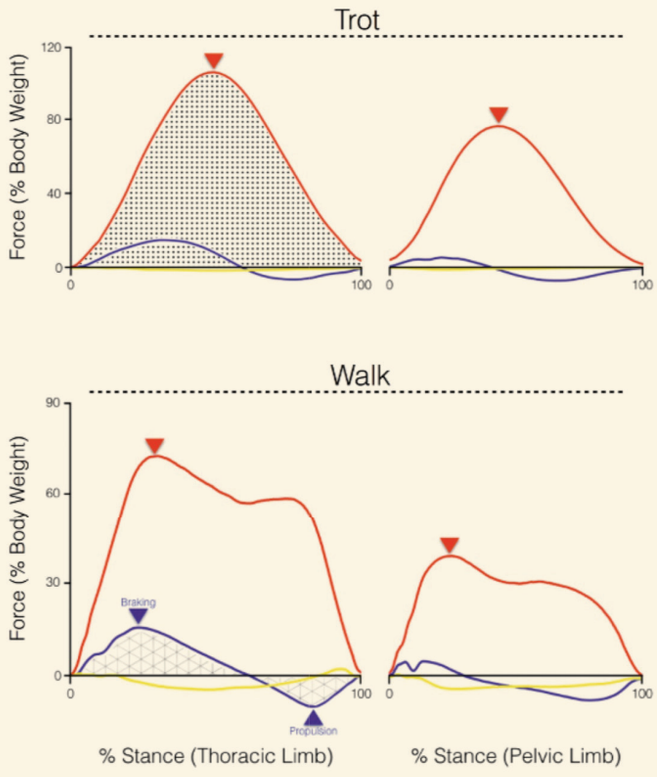


Figure 1
Veterinery Surgery: Small Animal, 2nd Ed., Johnston S.A. andTobias K. M.

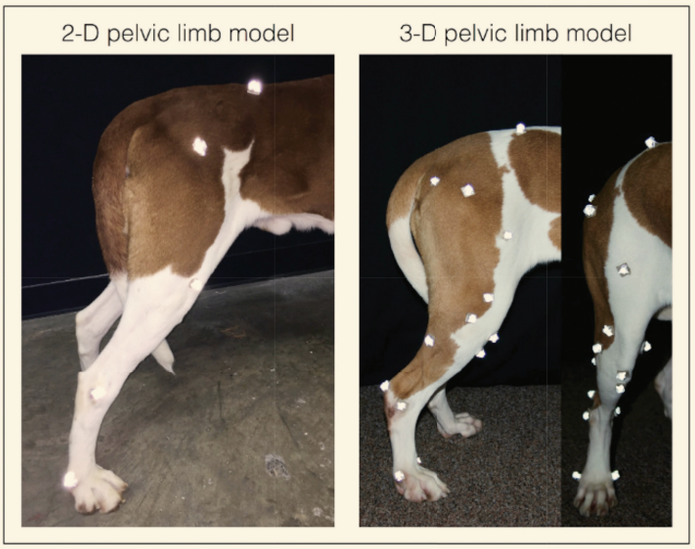


Figure 2
Veterinery Surgery: Small Animal, 2nd Ed., Johnston S.A. andTobias K. M.

Kinematic Gait Analysis

Kinematic gait analysis allows clinicians to evaluate the positions, angles, velocities, and accelerations of body segments and joints during motion. It can be performed in two dimensions or in three dimensions. Joint motion occurs in three dimensions which can be described in three planes: sagittal, transverse, and frontal planes. In two-dimensional analysis only one of the planes is evaluated (usually the sagittal plane). Currently, two-dimensional kinematic analysis equipment costs less than $1000. However, a three-dimensional kinematic analysis system requires specialized equipment and often exceeds $100,000. Kinematic data, like kinetic data, can be collected in pets during ground movements or with the use of a treadmill. In order to collect kinematic data markers are usually placed over bony landmarks. This allows for repeatable placement of markers in exact locations and minimizes skin motion artifact since there is decreased soft tissue coverage. **Figure 2** shows images of two-dimensional and three-dimensional marker sets used for kinematic gait analysis of the pelvic limb of dogs. Other less commonly used methods of kinematic evaluation include various radiographic and advanced imaging methods, such as, high frame-rate biplane fluoroscopy.

At LIVS we have permanently mounted Advanced Mechanical Technology Inc. force plates (model# OR6-7-1000) with photocells. We commonly use computer-assisted gait analysis in complex cases in which pets present with multiple limb lameness, as it can help guide therapy towards the most affected limb. We also commonly use gait analysis for objective outcome assessment in our research studies. ❑

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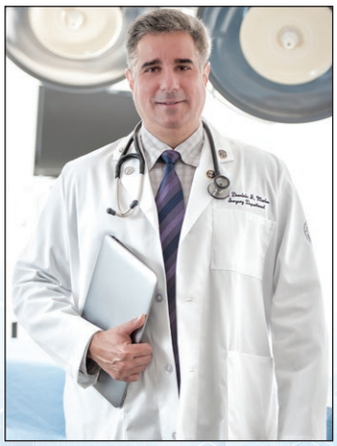

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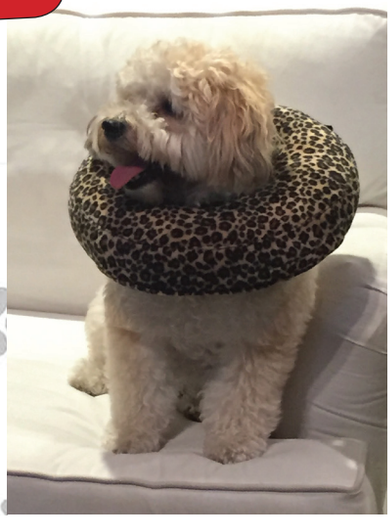

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Anesthetic Considerations for Surgical Patients with Renal Disease

Matthew Morgan, DVM, DACV-SA, Department of Surgery

Renal disease is common condition seen in our animal population and can develop in a wide range of ages. It is most common seen in our older animals with prevalence increasing with age. For older animal populations renal disease affects up to 10% of dogs and 35% of cats. As medical care trends are helping pets to live longer this may also increase the cases of renal disease in patients requiring surgery.

The anesthetic management of patients with renal disease can be challenging, but with a few precautions and anesthetic adjustments our success can be greatly improved. Three main factors that need to be considered are: 1. the effect of drugs on renal function, 2. the effect of renal disease on drug metabolism, 3. fluid and electrolyte balance.

The anesthetist can be faced with two different scenarios regarding anesthesia of patients with renal disease: animals with chronic renal insufficiency or failure and animals with acute renal failure. At the heart of chronic renal failure is the inability of the kidney to filter blood and concentrate urine normally. Classically patients exhibit dehydration, polyuria and polydipsia, hypokalemia, hypocalcemia, metabolic acidosis and muscle wasting. Animals with chronic renal failure are frequently anemic. In general packed cell volume less than 20% may result in compromised oxygen delivery.

Acute renal failure may be renal or post renal in the case of acute obstruction to the lower urinary tract. Patients with acute renal failure may present with vomiting, lethargy, hyperkalemia and metabolic acidemia. Patients with acute renal failure are unable to create or pass urine and consequently tend to be more ill than patients with chronic renal failure.

Patients with renal insufficiency should be stabilized before anesthesia is administered for non-emergent scenarios. For elective cases 24 hours of intravenous fluids before anesthesia with provide intravascular volume and a more stable anesthesia. Fluids may be used to stabilize electrolyte abnormalities (e.g. hyperkalemia, hypokalemia, hypocalcemia). Nonsteroidal anti-inflammatory drugs that inhibit cyclooxyrgenase are contraindicated in patients with renal disease due to decreased renal blood flow. The body's response to decreased glomerular filtration rate is to increase the systemic blood pressure, thus many animals with chronic renal failure are hypertensive. Maintenance of blood pressure during anesthesia is thus even more important to retain adequate renal function. The goal of with renal patients is to maintain mean arterial blood pressure above 85mmHg.

Animals with acute renal failure due to lower urinary tract blockage may have severe hyperkalemia. If emergent, hyperkalemia should be treated using calcium gluconate 50-150mg/kg intravenously slowly to lower the serum potassium. Other therapies can be used for non-emergent patients such as regular insulin, glucose and sodium bicarbonate.

Premedications

Patients with chronic renal failure may be significantly dehydrated and patients with acute renal failure may be significantly overhydrated. Therefore subcutaneous administered medications may have an unpredictable onset of action. It is recommended to administer premedications intravenously or intramuscularly. A neuroleptanalgesic combination (i.e. opioid and tranquilizer) is safest for systemically ill patients. For severely ill patients premedications may not be necessary and opioids can be administered intravenously as part of induction.

Induction

Ketamine should be avoided in cases of chronic renal failure and actor renal failure that are not going to be rapidly resolved due to the fact ketamine is excreted unchanged in the urine. Anesthesia can be induced with propofol or alfaxalone. In advanced illness induction can per performed with an intravenous neuroleptanalgesic combination such as hydromorphone and midazolam.

Maintenance

Patients with renal failure may be maintained with most inhalant anesthetics. Some anesthesiologists avoid sevoflurane due to the interaction with soda lime that can create a vinyl compound called compound A. Previous reports have associated compound A with nephrotoxicity in rats. Peri-anesthetic fluid therapy should be based off a patient's blood pressure. Typically a starting anesthetic rate of 5ml/kg/hr in dogs and 3ml/kg/hr in cats should be used. A urinary catheter may be helpful to monitor fluid input and excretion during surgery. If urine output is not adequate during surgery despite adequate intravascular volume, drugs such as mannitol (0.5g/kg intravenously) or furosemide (0.2-2mg/kg intravenously) may be indicated to encourage urine flow. Mannitol is a free radical scavenger that may help decrease swelling of renal epithelial cells and flush the renal tubules. Dopamine administered at lower doses 2-5mcg/kg/min) will increase renal blood flow and urine output.

Postoperative

Routine analgesic protocols may be used postoperatively. It is important to monitor patients for signs of post obstructive diuresis. Intravenous fluids administered and urine output should be matched to prevent dehydration. For patients that are adequately hydrated producing less then 1-2ml/kg/hr of urine post operatively a repeat serum chemistry should be performed to evaluate for worsening azotemia. Furosemide (0.2-2mg/kg intravenous or 0.66mg/kg/hr) can be given to encourage urine flow.

Signs of disequilibrium may be seen if the blood urea nitrogen (BUN) drops quickly after relief of an obstruction. The rapid decrease in serum osmolarity and cause fluid shifts resulting in cerebral edema. Mannitol 0.5g/kg is the preferred therapy for those patients.

Using anesthetic techniques that minimize further renal impairment, maintain fluid and electrolyte balance, and maintain normotension is essential for a successful outcome. ❑

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(Neurology)

Curtis Dewey, DVM
MS, CTCVMP, DACVS, DACVIM
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Dominic J. Marino, DVM
DACVS, DACCT, CCRP
(Neurosurgery)

Patrick Roynard, DVM
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Kristy Farruggia
Client Liaison

Marissa O'Donnell
Client Liaison

Glaucoma Secondary To Uveitis: Medical Considerations

John S. Sapienza, DVM, Diplomate, ACVO

Glaucoma is a difficult disease process to control solely with medications. Glaucoma secondary to uveitis is even more difficult to successfully control with medications alone but several guidelines may be helpful in select cases. Glaucoma is almost always a disease which requires rapid surgical intervention, especially if vision is the main goal. We have two main goals with glaucoma: 1. Vision preservation and 2. Control of intraocular pain. Uveitis can lead to many secondary ocular sequelae; namely, glaucoma, cataract formation, posterior and anterior synechiae, vitreal opacification, retinal detachment and corneal endothelial decompensation. Clearly, glaucoma secondary to uveitis carries a two-edged sword: How can we control the glaucoma and the uveitis simultaneously in two opposing disease processes.

Glaucoma is almost always a disease which requires rapid surgical intervention, especially if vision is the main goal.

Typically, for uveitis cases, we recommend topical prednisolone acetate or dexamethasone to control the intraocular inflammation as well as atropine to cause cycloplegia (and thus decreased ocular pain from ciliary spasms). Prednisolone acetate is considered a better choice than dexamethasone for active uveitis cases. A newer, but very expensive topical anti-inflammatory steroid is difluprednate 0.05% (Durezol) and is said to be 8X more potent than prednisolone acetate. Cost is a big factor for Durezol with bottles costing up to $200 each! Topical steroids are used judiciously in humans with glaucoma, as they are known to induce glaucoma episodes. We do not see glaucoma spikes associated with our canine patients (perhaps in cats, this may be a factor). Use topical steroids 3-4 times daily depending on the level of flare in your uveitis patients. Be cognizant of the corneal health, which may be compromised in some patients (especially cats) and lead to the development of corneal ulcerations. Atropine does indeed help with ocular pain in uveitis patients but must be avoided in patients with ocular hypertension and frank glaucoma, as atropine further compromises the outflow of aqueous humor.

What are the best topical glaucoma medications for uveitis cases? Topical miotics such as pilocarpine and demecarium bromide are contraindicated in glaucoma cases with uveitis, as these miotic agents would further exacerbate the break-down of the blood-aqueous barrier. Similarly, topical prostaglandins such as latanoprost (Xalatan) and travoprost (Travatan) are contraindicated in glaucoma cases with concurrent active aqueous flare. Because prostaglandins are the major mediators of uveitis in the canine eye, topical prostaglandins only add "more fuel to the ocular fire." If one uses topical prostaglandins in active uveitis, one may notice quite frequently that the intraocular pressure (IOP) will usually become even more elevated. The topical carbonic anhydrase inhibitors (CAI's) such as 2% dorzolamide or 1% brinzolamide are almost always a good choice for any glaucoma case, especially one with concurrent uveitis. Topical CAI's are well tolerated in inflamed eyes and may help to reduce the IOP. Oral CAI's such as methazolamide or dichlorphenamide can be also used but probably does not add much to reduce medically the IOP in addition to topical CAI's. Topical timolol can be used in cases of glaucoma secondary to uveitis, but recent studies show that there is an almost 100% ineffectiveness with this topical beta-blocker in dogs. Yes, you can use timolol, but this drug will probably not help to reduce the IOP significantly.

As a summary: avoid topical pilocarpine, demecarium bromide, and the prostaglandins in causes of active uveitis These classes of drugs will usually cause an exacerbation of elevated IOP rather than helping to reduce the IOP. Topical dorzolamide or brinzolamide can be used almost always in cases of glaucoma secondary due to uveitis. Topical dexamethasone or preferably prednisolone acetate are good choice for topical anti-inflammatory agents. Topical non-steroidal agents

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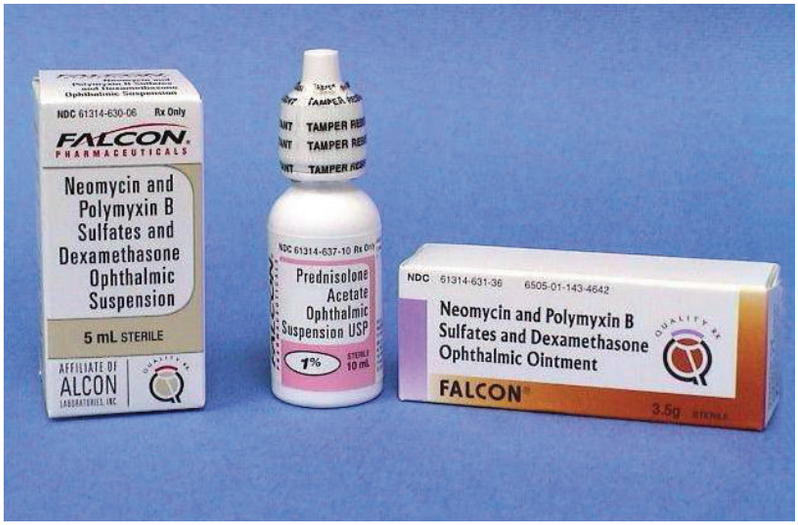

Glaucoma Secondary To Uveitis: Medical Considerations

➤ *Continued from Page 9*

(NSAID's) are not recommended for uveitis cases with secondary glaucoma, as the NSAID's can a decrease in aqueous outflow and a rise in the IOP with their usage.

Summary: UVEITIS, SECONDARY GLAUCOMA, NO ULCER

1. Prednisolone acetate TID-QID (or difluprednate-Durezol)
2. No NSAID's (worsens glaucoma)
3. No atropine, tropicamide or cyclopentolate (mydriatic agents)
4. Oral prednisone or oral NSAID's
5. Topical beta-blocker: Timolol 0.5% BID
6. Topical CAI: dorzolamide (Trusopt 2%) or brinzolamide (Azopt 1%) TID
7. Oral CAI: methazolamide or compounded dichlorphenamide BID-TID
8. No prostaglandin analog such as latanoprost.
9. No pilocarpine nor demecarium bromide

Referral to your regional ophthalmologist is always advised in these cases. We are always available to meet your referral needs. ❑

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