PASIG MONTHLY CITATION BLAST: No.11 **June 2006**

Dear PASIG members:

This month's Citation BLAST is the second of our special topic series. Upcoming special topics will include *emergency response relevant to performing artists*, contributed by past PASIG President Jeff Stenback, *focal dystonia*, contributed by SPT Yuriko Nabeta, and *core control*, contributed by past PASIG President Jennifer Gamboa.

Again, I'd like to remind PASIG members about the upcoming deadline for CSM abstract submissions.

- Poster and Platform abstracts for CSM '07 in Boston are due: July 14, 2006. Website addresses are below.
  Call for Abstracts: http://www.apta.org Enter CSM 2007 in the search window.
  Online Submission: http://apta-csm2007.abstractcentral.com/

Reminder, students must submit an abstract to CSM that is accepted, to be eligible for the PASIG annual student research scholarship award. CSM abstract topics may include pilot and full scientific research studies, case studies, and clinical topics. For more information on the research award please check our webpage (www.orthopt.org/sig_pa.php).

And don't forget to enroll in this exciting PASIG continuing education offering: Red Cross Certification as an Emergency First Responder with a focus on the performing artist. The course will be taught at University of Delaware on September 16 - 18, 2006 by our own Tara Jo Manal. This course is designed specifically for physical therapists working with the performing artists where injuries/emergencies may arise on-stage, backstage, during rehearsal or practice, or while traveling. This course provides a 3-year certification as an Emergency First Responder (and 1-year CPR for the professional Rescuer, AED, and O2 Administration).

For more information, go to https://www.orthopt.org/ and you will be directed where to go for further registration information or contact PASIG Vice President Tara Jo Manal at: Tarajo@udel.edu.

As always, your comments and entry contributions to these Citation BLASTs are always welcome. Please drop me an e-mail anytime.

Shaw Bronner
Chair, PASIG Research Committee
sbronner@liu.edu

SPECIAL TOPIC: FLEXOR HALLUCIS LONGUS DISORDERS

Flexor hallucis longus disorders continue to be a frequently missed diagnosis in dancers and other athletes. This can delay appropriate treatment and prolong return to full activity. I hope this annotated bibliography provides greater insight on this topic.

Cooper, M. E. and P. M. Wolin (1999). "Os trigonum syndrome with flexor hallucis longus tenosynovitis in a professional football referee." Med Sci Sports Exerc **31**(7 Suppl): S493-6.

The presentation of posterior ankle pain in any patient poses a diagnostic dilemma. The os trigonum syndrome and flexor hallucis longus stenosing tenosynovitis have been reported to occur in professional and amateur ballet dancers. It is important to consider these diagnoses in a patient who is not a dancer, as is shown in the case presented here. The patient in this case is a professional referee who injured his ankle while working on artificial turf. The treatment for os trigonum syndrome and flexor hallucis longus tenosynovitis is initially conservative, but in refractory cases, surgical removal of the os and release of the flexor hallucis longus tendon can be successfully performed. This is the first reported case of os trigonum syndrome and flexor hallucis longus tenosynovitis presenting simultaneously in a patient who is not a dancer.

Femino, J. E., E. Trepman, et al. (2000). "The role of the flexor hallucis longus and peroneus longus in the stabilization of the ballet foot." Journal of Dance and Medicine Science **4**(3): 86-89.

The importance of the flexor hallucis longus (FHL) and peroneus longus tendons in the stabilization of the subtalar joint and the longitudinal arch of the foot was demonstrated in 8 fresh-frozen human cadaver foot and ankle specimens. Dissection of the foot was done to transect stabilizing structures including joint capsule and periarticular ligaments of the medial side of the subtalar, talonavicular, navicular-first cuneiform, and first metatarsalcuneiform joints; the subtalar ligaments in the sinus tarsi and the lateral capsule of the middle subtalar facet were also transected. The FHL and peroneus longus tendons were isolated and the specimen fixed to a frame. Without any tension on the FHL and peroneus longus tendons, the foot was supple and unstable. With tension

applied to the FHL tendon alone, the boney arch of the foot became rigid, with inversion of the subtalar joint, rising of the longitudinal arch, plantar flexion of the forefoot, and slight adduction of the forefoot. With tension applied to the peroneus longus tendon alone, the boney arch of the foot became rigid, with eversion of the subtalar joint, rising of the longitudinal arch, plantar flexion of the forefoot, and abduction of the forefoot. With tension applied to both the FHL and peroneus longus tendons synchronously, the boney arch rose and became rigid, with plantar flexion and neutral abduction-adduction position of the forefoot. When additional tension was applied to the peroneus longus, the rigid foot assumed a locked position in mild hindfoot eversion and forefoot abduction. These qualitative observations are consistent with the hypothesis that the FHL and peroneus longus are important stabilizers of the foot in dance (demi-pointe and pointe) and soccer (kick) and may provide an explanation for injury of these tendons with these activities.

Hamilton, W. G., M. J. Geppert, et al. (1996). "Pain in the posterior aspect of the ankle in dancers. Differential diagnosis and operative treatment." J Bone Joint Surg Am **78**(10): 1491-500.

A retrospective review was performed of the results of operative treatment of stenosing tenosynovitis of the flexor hallucis longus tendon or posterior impingement syndrome, or both, in thirty-seven dancers (forty-one operations). The average duration of follow-up was seven years (range, two to thirteen years). The results were assessed with use of a questionnaire for all patients, and a clinical evaluation was performed for twenty-one patients (twenty-two ankles). Twenty-six operations were performed for tendinitis and posterior impingement; nine, for isolated tendinitis; and six, for isolated posterior impingement syndrome. A medial incision was used in thirty-three procedures; a lateral incision, in six; an anterior and a medial incision, in one; and a lateral and a medial incision, in one. Thirty ankles had a good or excellent result; six, a fair result; and four, a poor result. (The result of the second procedure on an ankle that was operated on twice was not included.) The result was good or excellent for twenty-eight of the thirty-four ankles in professional dancers, compared with only two of the six ankles in amateur dancers.

Jaffee, N. W., L. A. Gilula, et al. (2001). "Diagnostic and therapeutic ankle tenography: outcomes and complications." AJR Am J Roentgenol **176**(2): 365-71.

OBJECTIVE: The purpose of our study was to evaluate tenography complications and outcomes in a large series. MATERIALS AND METHODS: Of 144 tenograms obtained consecutively from May 5, 1995, to March 17, 1997, 111 were located for at least a 6-month follow-up; 65 were posterior tibial, 39 peroneal, two anterior tibial, three flexor digitorum longus, and two flexor hallucis longus tenograms. Tenography was performed fluoroscopically with contrast material and anesthetic followed by steroid placement into tendon sheaths. RESULTS: Of 65 patients undergoing posterior tibial tenography, 31 (48%) had complete or near-complete symptom resolution; 17 (26%) had no relief. Seventeen patients (26%) had initial relief with the subsequent return of pain to the pretenography level. Of 39 patients undergoing peroneal tenography, 18 (46%) had complete or near-complete symptom resolution; 10 (26%) had no and 11 (28%) had initial relief with subsequent pretenography pain return. Of three patients undergoing flexor digitorum longus tenography, one had complete, one had no, and one had initial relief with complete pretenography pain return. One of two patients who underwent flexor hallucis longus tenography had no relief; the other had initial relief with complete

pain return. Two patients who underwent anterior tibial tenography had complete pain relief. We found no correlation between degree of tenosynovitis shown radiographically and therapeutic improvement with anesthetic and steroid injection. Tenography complications included one posterior tibial tendon rupture (0.89%) and 14 patients with skin discoloration at the tendon sheath injection site. CONCLUSION: Forty-seven percent of surgical candidates whose condition was refractory to conservative therapy had complete or near-complete prolonged symptom relief after tenography. In appropriate patients, tenography is excellent therapy for tenosynovitis. Certain precautions make complications rare.

Kolettis, G. J., L. J. Micheli, et al. (1996). "Release of the flexor hallucis longus tendon in ballet dancers." J Bone Joint Surg Am **78**(9): 1386-90.

Thirteen female ballet dancers had an operative release of the flexor hallucis longus tendon because of isolated stenosing tenosynovitis, and the results were reviewed after a mean duration of follow-up of six years and six months (range, two to ten years). All of the patients danced at the advanced or professional level, and all had failed to respond to non-operative management. The mean age of the patients at the time of the operation was twenty years (range, thirteen to twenty-six years). Symptoms, which included pain and tenderness over the medial aspect of the subtalar joint, had been present for a mean of six months (range, two to twelve months) preoperatively and were exacerbated by jumping and by attempts to perform en pointe work. Crepitus was present in six patients, and triggering was present in three. No patient had evidence of a symptomatic os trigonum. Postoperatively, all patients participated in a formal physical-therapy program for a mean of nine weeks (range, four to thirteen weeks). All patients returned to dancing, within a mean of five months (range, two to nine months), and eleven reached a level of full participation in dancing without restriction. At the time of the most recent follow-up, all patients noted improvement compared with the pre-operative condition. Eight patients were professional ballet dancers, four were students at advanced ballet schools, and one had stopped performing ballet for reasons unrelated to the tenosynovitis of the flexor hallucis longus. In addition, two of the students had decided not to pursue careers in dancing because of persistent, but greatly diminished, symptoms. No complications were noted in this series. We concluded that an operative release of the flexor hallucis longus is effective for the treatment of isolated stenosing tenosynovitis in female ballet dancers who place high demands on the foot and ankle and for whom non-operative treatment has failed.

Na, J. B., A. G. Bergman, et al. (2005). "The flexor hallucis longus: tenographic technique and correlation of imaging findings with surgery in 39 ankles." Radiology **236**(3): 974-82.

PURPOSE: To examine the use of tenography for evaluation of the flexor hallucis longus (FHL) sheath. MATERIALS AND METHODS: Institutional review board approval was waived, patient consent was obtained, and the study was HIPAA compliant. Retrospective review of 192 FHL tenograms and associated surgical records identified 39 ankles in 37 patients (17 male, 20 female; mean age +/- standard deviation, 38 years +/- 13.8; range, 14-68 years) in which both tenography and surgery had been performed. Two radiologists reviewed tenographic findings, including contrast agent extravasation, synovial irregularity, stenosis, fibrous bands, sheath outpouching, extent of opacification, and communications with adjacent structures. Alterations in pain after anesthesia of the tendon sheath were also recorded. Surgical reports were reviewed. RESULTS: Thirty-four of 39 tenograms were diagnostic. Some extravasation occurred in nine (45%) of 20

injections with an initial injection method and in two (11%) of 19 with a new injection technique. Synovial irregularity was present in all 34 studies (15 mild, 16 moderate, three severe). Stenoses were identified in 23 (68%) of 34 ankles, fibrous bands were seen in 16 (47%) of 34 ankles, and outpouching of the sheath above a stenosis was present in 13 (38%) of 34 ankles. Communication of the FHL sheath with the ankle, flexor digitorum longus, or subtalar joint occurred in half the cases. Most patients with pain reported relief; relief was complete (100% reduction from preprocedural pain) in eight of 27, moderate (50%-90% reduction) in nine of 27, and mild (<50% reduction) in eight of 27 patients. CONCLUSION: Tenography of the FHL sheath produced diagnostic images in almost all patients and effectively demonstrated abnormalities of the tendon sheath. Pain relief with anesthetic injection helped confirm the FHL sheath as the pain generator.

Nachazel, K. M. J. (2002). "Mechanism and treatment of tendinitis of the flexor hallucis longus in classical ballet dancers." Athletic Therapy Today **7**(2): 13-15.

Faulty technique, poor trunk alignment, and repetitive stress can predispose dancers to FHL-tendon injuries. Classic symptoms include crepitus and pain along the line of the FHL as far as the medial longitudinal arch. Testing for the FHL includes having the dancer plantar flex the ankle and flex and extend the great toe with the ankle in a neutral position. For a positive test, there will be triggering, or clicking, in the great toe and crepitus in the FHL posterior to the medial malleolus.

Oloff, L. M. and S. D. Schulhofer (1998). "Flexor hallucis longus dysfunction." J Foot Ankle Surg **37**(2): 101-9.

Nineteen consecutive cases of flexor hallucis longus stenosing tenosynovitis that underwent operative tenolysis from September 1994 to December 1996 were retrospectively reviewed. This is classically a disorder of ballet dancers, and to a much lesser extent, running athletes. The patients were primarily nonathletic, male, and middle-aged. The mean symptom duration was 20 months, multiple physicians had been encountered, and misdiagnosis was common. Patients presented with overlapping signs and symptoms of flexor hallucis longus tendinitis, plantar fasciitis, and tarsal tunnel syndrome. A cross-reference of patients with posteromedial ankle pain, medial arch pain, and/or a positive Tinel's sign revealed that 14 (74%) and 6 (32%) feet had two of three, or all three signs, respectively. Magnetic resonance imaging and tenography proved valuable in establishing the correct primary diagnosis. Nonoperative protocols were unsuccessful. Flexor hallucis longus tenolysis was successful in each case with a mean return to regular activity at 9 weeks. Flexor hallucis longus stenosing tenosynovitis may be more prevalent than reported and should be a diagnosis of inclusion among all patient populations who present with posterior ankle, medial arch, and/or tarsal tunnel symptoms.

Petersen, W., T. Pufe, et al. (2003). "Blood supply of the flexor hallucis longus tendon with regard to dancer's tendinitis: injection and immunohistochemical studies of cadaver tendons." Foot Ankle Int **24**(8): 591-6.

The flexor hallucis longus is the most common site of lower extremity tendon disorders in ballet dancers. Reduced vascularity is an important factor contributing to tendon degeneration and rupture under strain. A study was conducted on the vascular pattern of the human flexor hallucis longus tendon with injection techniques and

immunohistochemically by using antibodies against laminin. Blood supply arose from the posterior tibial and the medial plantar artery. Peritendinous blood vessels penetrated the tendon and anastomosed with a longitudinally oriented intratendinous network. Injection specimens and immunohistochemistry revealed one avascular zone in which the tendon passed behind the talus and a second in which the tendon wrapped around the first metatarsal head. These are the most typical areas for tendon degeneration and rupture.

Sanhudo, J. A. (2002). "Stenosing tenosynovitis of the flexor hallucis longus tendon at the sesamoid area." Foot Ankle Int **23**(9): 801-3.

The author presents a case of stenosing tenosynovitis of the flexor hallucis longus tendon at the sesamoid area of the great toe following injury of the hallux. Although stenosing tenosynovitis of the flexor hallucis longus tendon is not rare, occurring frequently in ballet dancers, its entrapment at the sesamoid area was rarely described in the literature. Early recognition of this condition is very important for successful treatment. This patient did not respond to nonoperative treatment and surgical tenolysis was very successful for relief of the symptoms.

Schulhofer, S. D. and L. M. Oloff (2002). "Flexor hallucis longus dysfunction: an overview." Clin Podiatr Med Surg **19**(3): 411-8, vi.

Whereas acute and chronic injuries of the tibialis posterior, peroneal and Achilles tendon are frequently encountered, disorders of the flexor hallucis longus tendon are often overlooked, which may contribute to chronic pain and disability. Patients with stenosing tenosynovitis of the flexor hallucis longus tendon frequently present with overlapping signs and symptoms of flexor hallucis longus tendinitis, plantar fasciitis and tarsal tunnel syndrome, which the authors collectively refer to as "flexor hallucis longus dysfunction." A keen awareness of the presenting signs and symptoms and use of ancillary MR imaging and FHL tenography will assist the practitioner in recognizing this commonly misdiagnosed condition.

Shybut, G. and C. Miller (2005). ""Trigger Toe" in a ballet dancer." Medical Problems of Performing Artists **20**(2): 99-102.

ALM is a 36-year-old, white, female ballet teacher who presented with pain and swelling in the right ankle and with flexor weakness in the right great toe. She reports that she has been unable to demonstrate an en pointe position to her class for the past 6 months. She has had pain, weakness, and catching with flexion of the right great toe for the past year. Initially, she attributed the symptoms to new shoes, but even with shoe modifications her symptoms persisted. She reports that her discomfort improves with periods of rest, but with any attempt to return to her normal activities, she develops a large swollen mass behind her medial malleolus and pain with plantar flexion of the toe. In the past, she was able to flex her toe, but it would "stick" which would require her to passively manipulate it in order for it to move again. Now she is unable to actively flex the toe beyond 30 degrees. When she initially noted the symptoms, she sought treatment from her message therapist and for a short time had relief from her pain; but as she returned to dancing, her symptoms recurred. She added herbal supplements, Pilates exercises, and contrast therapy without improvement. Over the counter nonsteroidal drugs improved her pain and swelling but not her function.

Tamburrini, O., H. Porpiglia, et al. (1999). "[The role of magnetic resonance in the diagnosis of the os trigonum syndrome]." Radiol Med (Torino) **98**(6): 462-7.

PURPOSE: We investigated the yield of Magnetic Resonance Imaging (MRI) in hindfoot conditions, particularly the os trigonum syndrome, which are very difficult to diagnose clinically. MATERIAL AND METHODS: We examined 7 consecutive patients complaining of hindfoot pain for more than 4 months (male:female = 1:6; age range 16-22 years, average 18.6). Three patients practiced competitive sports and 4 ballet. We performed conventional radiography (orthogonal projections) and then MRI with a 0.5 T superconductive unit with surface coils; MR images were acquired with T1-weighted spin-echo (SE), T2-weighted gradient-echo (GRE), and fast inversion recovery (FIR) fat-suppressed sequences with 4 mm thickness and 0 mm gap. RESULTS: In 2 cases the os trigonum had irregular margins with subchondral sclerosis and widened synchondrosis. In 3 patients we found flexor hallucis longus tenosynovitis, likely caused by tendon compression and displacement within its sheath; there were neither os trigonum marrow edema nor synchondrosis widening. One patient had os trigonum hypertrophy, mild synchondrosis widening and marrow edema, in the os trigonum and the posterior aspect of talus. One patient had the os trigonum, but no signs referable to the os trigonum syndrome. CONCLUSIONS: In the posterior impingement syndrome, our objective is to show inflammatory changes in the posterior capsule of the ankle joint, adjacent ligaments, tendons and chondrosynovial surface. In these cases, the yield of conventional radiography and CT is rather poor, while MRI provides important information on soft tissues involvement, synovial reaction, chondral and subchondral bone injuries and the association of flexor hallucis longus synovitis, if present. MRI also yields detailed information for correct therapeutic approach. In conclusion, for the (differential) diagnosis of hindfoot pain in clinically suspected os trigonum syndrome, MRI appears to be the technique of choice, after conventional radiography, thanks to its noninvasiveness, multiplanarity, and high spatial and contrast resolution.

Theodore, G. H., G. J. Kolettis, et al. (1996). "Tenosynovitis of the flexor hallucis longus in a long-distance runner." Med Sci Sports Exerc **28**(3): 277-9.

Chronic inflammation of the flexor hallucis longus (FHL) tendon can result in stenosing tenosynovitis. This condition has been well documented in ballet dancers. It usually presents as posteromedial ankle pain, worsened by plantar flexion activities. Although conservative therapy benefits most patients, some recalcitrant cases may require surgical intervention. This is the first case report that describes the occurrence of this condition in a runner with an anomalous flexor hallucis longus muscle.

Trepman, E., N. J. Kadel, et al. (1999). "Effect of foot and ankle position on tarsal tunnel compartment pressure." Foot Ankle Int **20**(11): 721-6.

Tarsal tunnel intracompartment pressures were determined in 10 fresh-frozen normal human adult cadaver specimens. With the foot and ankle held in mild plantar flexion and neutral eversion-inversion, mean tarsal tunnel pressure was minimal (2 +/- 1 mmHg). However, when the foot and ankle were positioned in full eversion, mean tarsal tunnel pressure increased to 32 +/- 5 mmHg ($P < or = 0.005$); in full inversion, mean pressure increased to 17 +/- 5 mmHg ($P < or = 0.05$). There was no significant difference in mean tarsal tunnel pressure between the everted and inverted positions. These results support the hypothesis that increased pressure within the tarsal tunnel when the foot is moved into the everted or inverted position may aggravate posterior tibial nerve entrapment. These findings may also provide an explanation for clinically observed aggravation of

symptoms in these positions, night pain, and improvement of symptoms with neutral immobilization in some patients with tarsal tunnel syndrome.

van Dijk, C. N., P. E. Scholten, et al. (2000). "A 2-portal endoscopic approach for diagnosis and treatment of posterior ankle pathology." Arthroscopy **16**(8): 871-6.

We describe a 2-portal endoscopic approach of the hindfoot with the patient in the prone position. By means of this approach, it is possible to visualize and treat a variety of posterior ankle problems. Not only can pathology of the posterior ankle joint and subtalar joint be visualized and treated, but also periarticular pathology, such as calcifications or scar tissue, can be diagnosed and treated. We describe a professional ballet dancer with chronic flexor hallucis longus tendinitis and a posterior ankle impingement syndrome caused by an os trigonum of both ankles. The patient was successfully treated by removing the os trigonum and releasing the flexor hallucis longus tendon. She resumed her professional activities within 2 months after endoscopic treatment.