

SCIENTIFIC

PHYSICAL THERAPY

Patient with left foot crush injury and reflex sympathetic dystrophy CASE STUDY

By Stephania Bell, P.T.

HISTORY:

The patient is a 55 year old male employed as a warehouseman. He is not currently working secondary to his injury. Recreationally, he participates in karate; however, he has been unable to do so since his injury. His current activity level is reduced to only activities of daily living with frequent bouts of exercise given to him by his PT. The patient's primary complaint at this time is pain along the left foot and ankle with the pain being concentrated at the left lateral malleolus, dorsum of foot and all toes. He is also sensitive to pressure anywhere on the dorsal or plantar surface of the foot and about the ankle, although this has improved somewhat with time and desensitization measures. Occasionally the pain will travel proximally several inches along the lateral lower leg. He describes this pain as constant, severe, and sometimes burning. He describes all toes as feeling numb "as if there is no circulation." The patient secondarily complains of hip pain which, when he is asked to outline the area with his hand, begins in the left lateral lower lumbar spine and continues laterally to wrap across the hip. He states that when severe, the pain can travel all along the lateral thigh to the lower leg where it overlaps the painful region of the foot (L5 dermatomal distribution). He describes this other pain as a sharp shooting pain with an occasional "catch" in the hip that typically lasts from 45 seconds to one minute at a time. He does not describe a relationship between the first and second areas of pain in that they seem to behave independent of one another.

Aggravating factors for the foot include all foot and ankle motions. Pain is also increased with weight bearing and progresses with length of time that he is on the foot.

In this issue:

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OGI Instructors attend IFOMT in South Africa

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He can be up for about 45 minutes before he needs to sit and rest. Easing factors include rest, ice and elevation of the leg. He also reports general decrease of symptoms following lumbar sympathetic block which is further enhanced by physical therapy. Aggravating factors for the "hip" pain include going from sit to stand and gait, although it is inconsistent in the frequency with which it presents. He does not describe any easing factors for the "hip" in that the symptoms always subside independently within a minute of onset. The patient is currently able to sleep through the night; however, he does have pain immediately upon waking. Medications include Elavil and Neurotin as well as anti-hypertensives. X-rays of the foot and ankle complex taken at the time of injury revealed no fracture or dislocation. The onset of this patient's problem occurred six months previously after a co-worker hydraulically lowered a heavy piece of machinery (600-700 pounds) onto the patient's foot. He describes the machinery as being on his foot with varying amounts of pressure for a total of approximately 25-30 seconds. The patient was wearing work boots at the time and was taken to the ER, where he was told he sustained a soft tissue injury and was advised to follow the R.I.C.E principle and was sent home with crutches. He was eventually referred to an orthopedist and was prescribed a

CAM walker (cast boot). He also developed cellulites within a week. On discharge from the hospital for this condition, he was sent to a pain clinic for lumbar sympathetic blocks on the suspicion of early RSD. He underwent these blocks for two months and due to a miscommunication, did not undergo PT concurrently. When it was ascertained by the physician that this was the case, he was then sent immediately for therapy.

Physical Examination

Inspection:

The patient is a large male who ambulates without assistance. Upon examination, edema is evident throughout the left foot and ankle. Discoloration is noted across the lateral ankle and dorsum of the foot (reddish-brown in appearance) and is present in almost an L5 dermatomal distribution. All toes appear red, especially the great toe. Venous distension is evident in the distal 1/3 of the anterior lower leg. The nails appear to be dry and brittle, several having cracked. Skin along the plantar surface of the foot is red (brightest across the metatarsal heads) and scaly. The foot is maintained in a relatively cavus position. The posterior aspect of the ankle into the lower leg is unremarkable. The right lower extremity appears edematous from the distal 1/3 of the lower leg to the ankle and foot with obvious venous distension. Soft tissue defects about the medial and lateral distal thigh are also noted.

In standing, all pelvic landmarks appear symmetrical; however, the patient stands with the left hip in external rotation. Lumbar spine appears relatively flat. The patient tends to weight bear more on the right due to pain.

Function:

The patient is able to perform a ¾ squat being limited by ankle motion without any increase in symptoms. During gait, decreased stance time is noted on the left and the left is abducted. There is also decreased push-off with all toes, especially the first, but the patient is able to heel strike properly. The patient attempts to ambulate on the toes but is limited by lateral malleolus pain.

Active Range of Motion:

Dorsiflexion = 5 degrees with pain in the medial ankle. Plantar flexion = 35 with general capsular stiffness limiting further motion. Inversion = 15 degrees with lateral ankle pain at end range. Eversion was limited to 10 degrees with the most significant reproduction of pain in the lateral ankle. Toe flexion and extension was approximately 50% limited due to capsular stiffness.

Lumbar active motion revealed full flexion with pain radiating to left hip. Extension relieved hip pain. Right side bending provoked pressure in the left low back. Left sidebending increased low back pain and L5

dermatomal pain to foot.

Passive Range of Motion:

Passive motion equaled that seen actively, with empty end-feel, except dorsiflexion which was stiff throughout range. Great toe extension end feel was stiff and painful. Testing of the left hip increased hip and low back pain at end range flexion and internal rotation.

Resisted _____ Movements:

Strength was grossly 3- to 3+/5 in foot and ankle for all tests. Dorsiflexion and inversion provoked the greatest pain in shortened range. Plantarflexion provoked the most pain in lengthened range, eversion equally painful in all ranges. All toe flexion and extension movements increased pain throughout all ranges.

Palpation: Lower leg anterior and posterior aspects were not painful. Toes 3-5 were cold on dorsal surface, warm on the plantar surface. The patient was exquisitely tender along the dorsum of the great toe, especially at the MTP joint. Soreness along the shaft of all metatarsals, especially 2 and 3 and described achy pain. Tenderness noted at the navicular, talus, and along all medial soft tissue structures (pain/swelling make it difficult to differentiate tissues). Fourth and fifth metatarsal shaft and cuboid all tender to palpation as well; calcaneus was not tender posteriorly but was so laterally and at the

calcealacuboid joint line. In the lumbar spine, palpation at L5 and facet joint of L5-S1 caused shooting pain from the hip down to the foot.

Neurology: Due to generalized weakness and pain about the foot and ankle, it was difficult to attribute to segmental levels. Hip flexion was 4/5, quadriceps 4-/5, hip abductors 4-/5, hamstrings 4/5. Sensory changes of hypersensitivity were noted along the entire dorsum of the foot, the medial arch and anterior mortise. The patient describes all toes as "feeling numb"; however, with testing it was determined that he could feel pressure but could not distinguish between sharp/dull in toes 2-5. Patellar reflex was unable to be elicited bilaterally, even with reinforcement. Ankle reflexes not test secondary to pain.

Special tests: Ligamentous stress tests were limited by the patient's pain. Homan's sign was negative. Straight leg raise on the right was limited at 60 degrees by hamstring tightness and 65 degrees on the left because of foot pain only. The addition of internal rotation, adduction at the hip (approx. 20 degrees) increased the patient's pain in his back and hip. This was then eased by the addition of ankle inversion; however, this produced local lateral ankle pain.

Joint Accessory Mobility:

Superiortibia-fibula: note fibula appears to sit posteriorly-pain at attempts this glide. Internal rotation and also at the hip. Mobility was limited 2/6.

Inferior tib-fib: not assess because of pain.

Talocrural distraction: immediately pain-relieving- 2/6.

Talocrural anterior glide: 2/6 with pain.

Talocrural posterior glide: 2/6 with pain, though not as severe as previous.

Subtalar distraction: 3/6 without pain

Subtalar anterior glide: 3/6 with pain at end range

Subtalar posterior glide: 3/6 without pain.

Subtalar medial/lateral glide: 2/6 with pain.

Calcaneocuboid dorsal and plantar glide: 3/6

Talonavicular dorsal glide: 1/6 with the most intense pain provocation.

Talonavicular plantar glide: 2/6 with moderate pain.

Talonavicular rotations: unable to assess due to pain.

Cuneonavicular dorsal and plantar glides: 2/6 moderate pain

1st Tarsometatarsal dorsal and plantar glides: 3/6 without pain

2-5 Tarsometatarsal plantar glides: 3/6 without pain

2-5 Tarsometatarsal dorsal glides: 2/6 with pain

Intermetatarsal glides:

1 on 2: Plantar = 3/6, pain; dorsal = 2/6, stiff only

3 on 2: Plantar = 2/6, stiff; dorsal = 2/6 with pain

4 on 3: Plantar = 3/6; dorsal = 3/6 with pain

5 on 4: Plantar/dorsal = 3/6 with pain

Decreasing the arch revealed very stiff and significantly painful response by the patient, especially at the dorsum of the foot.

MTPs 2-5: 4/6 in plantar glide without pain; dorsal glide = 3/6

1st MTP: Severe pain with attempts at distraction, plantar/dorsal glides (patient describes a catch, but it is not palpable), and rotation- unable to really accurately assess.

Conclusion and Assessment

The medial diagnosis is left foot crush injury with RSD. The PT assessment is the same, with additions. It appears that the L5 nerve root is involved, whether as a consequence of abnormal posture/gait mechanics following the crush injury or as a predisposing factor now complicating the picture is uncertain. There may be a neural tension component, specifically along the pathway from sciatic to common peroneal to superficial peroneal nerve. Specific tissues involved in the foot are multiple, and due to patient's pain level, it is impossible to completely and accurately assess. I suspect soft tissues including skin, fascia, ligament, tendon, capsule, nerve and vascular tissues. Given the RSD, bone tissue may need to be a consideration (along with

healing and precautions) if osteopenia is present. The patient is generally deconditioned due this injury which may also impact his healing rate. The patient's functional limitation include all weight bearing activities including ADLs and work.

Literature Review

It is commonly accepted that RSD is poorly understood, both in its pathogenesis and in its management. Of the theories that have been put forth to explain it, the most accepted is that external trauma triggers a reflex mechanism involving sensitized neurons within the spinal cord that leads to sympathetic outflow. The most common mechanism of causal injury appears to be crush injury with soft tissue destruction. Crush injury is generally defined as a trauma from an external shear or compressive force applied over a variable period of time. In a retrospective study published in 1996 by Myerson, et al focusing on morbidity following crush injuries to the foot, out of 58 patients studied, 13 complained of symptoms or manifested signs of RSDS. Typically these patients fared poorer in outcome. The authors also speculated that ischemia of nervous tissue following a crush injury may have a role in the onset of chronic pain, either via trauma to the peripheral nerve itself or by fibrosis (intra- or extraneural) following edema.

This in turn may be the trigger for RSD. Recent studies documenting the presence of peripheral nerve in patient with RSD lend support to the hypothesis put forward by Kurvers et al., specifically that traumatic peripheral nerve damage may lead to RSD.

Myerson et al. caution that initial appearance may not be indicative of severity, thus close monitoring of the patient, early recognition and immediate intervention are critical to limiting complications. RSD may be recognized by several important clinical features: pain (typically a burning quality) in the distal portion of a limb that is non-dermatomal, local tenderness and swelling, allodynia (increased sensitivity to light touch), hyperpathia (increased sensitivity to normal touch), dystrophic skin changes (dusky color, shiny skin, brittle nails). Osteopenia may be present on X-ray and there may be demonstrable asymmetry on bone scan. Sympathetic block may be utilized as a diagnostic tool (prompt pain relief) or as a treatment adjunct. Sympathetic block, when used in conjunction with PT for mobilization can be quite effective. Manual therapy techniques such as soft tissue mobilization, joint mobilization, neural gliding and exercise may all be effective in treating this type of patient. Many authors agree that PT is essential in managing this patient

population.

Discussion

Given the patient's progress with the therapies he has had to date, there is no indication to discontinue anything. His hind foot does appear to be particularly limited and joint mobilization at the foot/ankle should be focused on this area to improve his chances of regaining normal mechanics. As his hypersensitivity continues to decrease and as he continues to tolerate more motion, his activities should continue to be progressed towards increasing mobility, strength and return to function. Given his lumbar/hip complaints and the possible relationship to his distal symptoms, the lumbar spine warrants further consideration. His immediate response to joint mobilization would support continuing with this, as well as considering neural gliding techniques. This may in turn help with his sympathetic dystrophy.

Trial Treatment and Progression

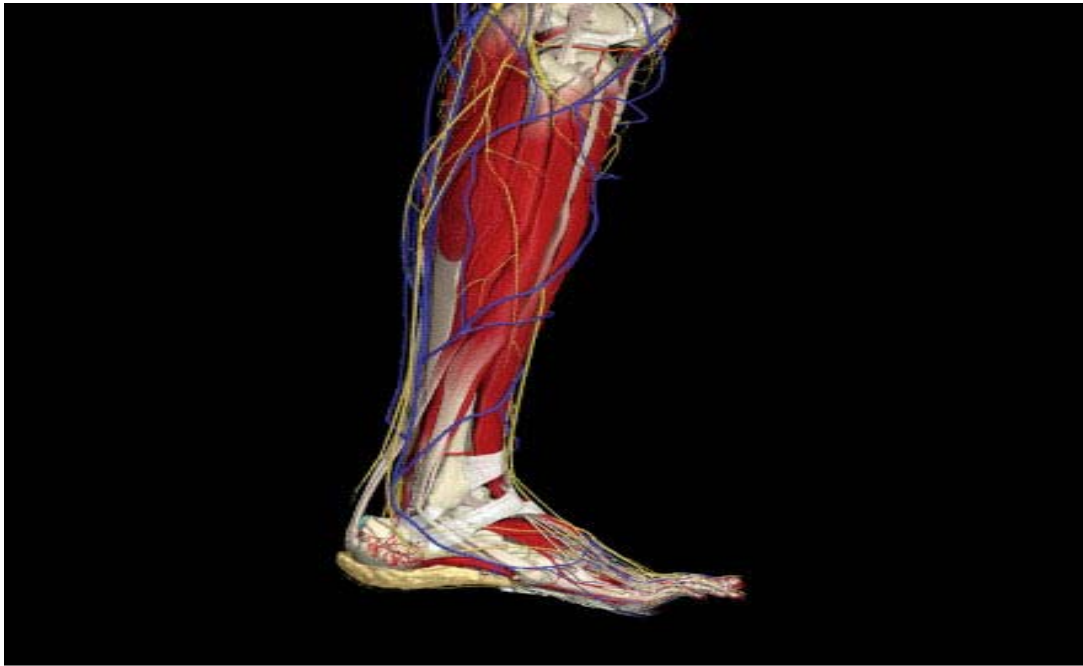
The patient was seen one time for treatment suggestions. A trial of lumbar rotation mobilization in right side lying was performed. He reported that this felt "soothing" during the technique for his hip and low back pain. The foot pain remained the same. Immediately following treatment, he reported hip and back pain to be absent in standing. He had no back pain with active extension (which

he had at the beginning of treatment) and with right side bending, he complained only of a "catch" in the hip at the end of range. He did not have pain into the leg and the foot pain did not increase. Gait was unchanged. The patient was instructed in positioning in sidelying at home with the lower extremity supported on pillows. The patient was also given a prefabricated Plaxtazote shell with a metatarsal arch pad to provide increased support for his foot. He reported immediate relief across the dorsum of the foot and described a feeling of circulation "rushing to the toes." Decreased tonicity of the extensor hallucis longus could be seen immediately.

Results and Summary

Due to the fact that this patient could not be observed for any follow-up prior to this presentation, the immediate results as noted above are all that is currently available. Clearly over the past two months, the patient has responded to the general desensitization measures, soft tissue and joint mobilization and active exercise treatments that he has undergone, which have no doubt been enhanced by the pain relief obtained with the lumbar sympathetic blocks. At this point, it is unclear whether there would be any further benefit to continuing with the blocks since the last one was not effective (even slightly

pain producing) and since he currently tolerates PT much better. Since the patient is already scheduled for more, it would be interesting to observe whether there was any effect, and then make determination for future blocks. As far as PT goes, it appears that the patient's greatest joint limitations are in the midfoot region, particularly at the talonavicular joint and naviculocuneiform joints. The metatarsocuneiform, intermetatarsal and metatarsophalangeal joints also have decreased mobility. Of the forefoot joints, the restrictions, the restrictions at the 1st metatarsophalangeal joint appear to be causing the greatest functional limitation with great toe extension; however, there are limitations at all of these joints as well. The talocrural joint is restricted in anterior greater than posterior glide and the subtalar joint is primarily painful in all directions but no significant restriction was noted. It is difficult to assess what is the primary limiting factor at each joint, but it appears to be some combination of swelling, soft tissue restriction, capsular restriction and pain. As the patient improves, this may become easier to determine. The lumbar spine appears to also have a role in this patient's symptoms but the relationship is unclear. Physical therapy should continue to treat the hip/back pain symptoms with joint mobilization as indicated,



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as well as perhaps some neural mobilizing techniques which would likely affect both areas of symptoms. Perhaps in this way, the relationship of the hip/low back pain to the foot dysfunction can continue to be monitored. Exercises directed at increasing range of motion, weight bearing, strength and functional use of the lower extremity should be continued. Practicing weight acceptance in various functional positions, combined with attempts at moving from pronation to supination, would be indicated. I expect this patient's prognosis to be fair to good. Fair given the seriousness of the injury and the current level of impairment he is experiencing, good given his dramatic response to

physical therapy even though it was initiated late. This patient's case is important to study given the unusual presentation of a serious musculoskeletal injury with unique complications (RSD, late PT, lumbar/hip pain apparently with onset after injury). Also, RSD is not uncommon; however, successful outcomes in managing patients with this problem are infrequent. Recognition and appropriate intervention with physical therapy are critical. Finally, treating the complex patient who has multiple therapy issues that need to be addressed, especially in that they affect another, is a challenging experience but often a good one from which to learn.

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OGI Instructors attend IFOMT in South Africa
By Jojo Sayson PT DMT MOMT FAAOMPT
May 12, 2004

The 8th International Federation of Orthopedic Manipulative Therapy (IFOMT) was held in Cape Town, South Africa last March 21-26, 2004. There were 33 manual therapy delegates from the USA and 10 of which belong to the Ola Grimsby Institute. The IFOMT meets only once every four years since its inception in 1974 in Montreal. The OGI attendees were Ola Grimsby, Donna Gramont, Rick Hobusch, Laurie Nemes, Brian Power, Jim Rivard, Laura Rodgers-Cutchall, Jojo Sayson, Becky Schultz, and David Sheer. The IFOMT was attended by 680 manual therapists from all over the globe and everyone shared professional camaraderie, goodwill, and exchange of ideas with researches vital to proving the efficacy of Orthopedic Manual Therapy in today's demand for evidence-based practice. A "beach party" was organized for all of the delegates starting out in busloads of international manual therapists who trekked to the Cape of Good Hope, the Southern most tip of the African continent where the OGI instructors stood there just 6000 kilometers away from the Antarctic South Pole and where the Atlantic Ocean meets the Indian Ocean. It was quite interesting to observe the multitude of baboons scattered in the parking lot waiting to snatch a sandwich or soft-drink can from the unsuspecting tourist who ignored warnings not to handle food in the open. This we observed happen to a couple of stunned tourists. Diminutive African penguins greeted all of us at Boulder Beach which trotted around us like unmindful butlers in tuxedos. We took turns lying down beside them on a boulder to take snapshots fit for National Geographic Magazine. Another event was the formal Gala dinner at the conference center for socials, IFOMT awards and recognition of the countries of origin of the delegates. Cape Town boasts Table Mountain with its wide plateau overlooking the city where some of the OGI instructors rode a cable car to the top and down. Robben Island is easily seen from the coast where Nelson Mandela was once imprisoned for 27 years when he fought against the now abolished apartheid system. It is quite impressive that even though the social wounds of apartheid is still somewhat fresh, we did not observe nor feel any sense of hatred among the melting pot of races in the city. We were instead, showered with so much unbelievable hospitality that seem to fit only royal guests. We all concurred and shared the same sentiments.

After the IFOMT, we all flew Northeast to Johannesburg and then to Hoedspruit where we enjoyed the much awaited R & R safari highlight. We stayed at the Shumbalala, a five star lodge in the middle of the Thornybush game preserve contiguous to Kruger National Park. Shumbalala is a Zulu name which means "where the lion sleeps" and indeed, the territorial lion wakes us up at night with its fierce roar. We were prohibited to leave our lodges at night for obvious safety reasons which added drama to our evenings. Our accommodations were nothing short of perfect as even the place is how Tarzan would have lived if Edgar Rice Burroughs made him instead, a millionaire complete with servers, a ranger/driver/waiter/bodyguard, and a Shangaan tribesman tracker. Eddy, our tracker, sat on a modified chair on the hood of the Toyota cruiser during our safaris early mornings at 5:30 am and evenings from 3:30 pm until nightfall. His job is to direct our ranger Chris to drive us to where the animals could be. Out in the African veldlands and grasslands, we were treated into finding the "Big Five". This is an encounter with the five fiercest beasts in the wild namely: the African Elephant, Lion, Leopard, Cape Buffalo, and the Rhinoceros. It is traditionally believed that sighting of these animals will bring good luck to the beholder. It is most fascinating and exciting to encounter these animals as they were in their natural habitats and we were the intruders. We had moments of fear mixed with awe when the territorial lion walked past our vehicle just within 10 feet away from us OGI instructors and our

adrenalin was rushing. We have never been so quiet and motionless altogether since we did not have any protective barrier between us and the animals encountered. In short, we were all vulnerable to attack as we were all within striking distance as possible prey. We experienced these several times including an encounter with a pride of 5 lionesses circling our vehicle as we four-wheeled onto the seasonal Monwana river at dusk and the leopard foraging for food at night. The flora and fauna were all impressive and Rick (nicknamed Indiana Hobusch by Ola) even took notes all the time identifying the various species. Ola was busy documenting the expedition with his digital camcorder and Jojo even ate live termites in exchange for gummy bears for Eddy the tracker. Becky, Laura, and “Safari Dave” were happy just to be far away from home, Donna the adventurous was left behind later and hiked the African East Coast on a solo trek, “Jungle Jim” and Brian were their typical humorous selves always bringing laughter to our gang with their atypical comments, and the charming Laurie endured the OGI characters’ wild side and traveled onward and finished her vacation in Italy.

Indeed, Africa is enormous. The sunrises and sunsets are spectacular. The nights are dark and the stars seem closer. It is a land of contrasts from the wealthy beachfront properties to the townships with overcrowded communities of shanties and poor sanitation. The hospitality we received was nothing like we ever experienced before, truly genuine and much appreciated. We all went back to the USA with a feeling of sadness and a burning desire to return once more. Out of Africa, the OGI has fallen in love and a plans return to the country not for R & R but for a higher purpose of enriching the profession by sharing our expertise with African physical therapy.



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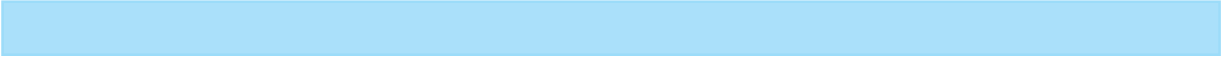


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