You're the Flight Surgeon

This article was prepared by Russell C. Tontz, M.D., M.P.H.

You are the junior flight surgeon at a busy Air Force fighter base. A 23-yr-old, left-handed, female foreign military active duty weapon systems officer (WSO) assigned to the international fighter squadron at your base presents to your flight medicine clinic window at 07:15 asking if she can "have a different pain med for a sore left wrist." She explains that her pain has been "off and on" when pulling Gs in her F-15SG aircraft. She has been taking paracetamol, prescribed by her flight doc "back home." It worked initially, but no longer seems to relieve her pain. She "grounded" herself last week, but needs to fly today and is worried she will not make her 08:30 aircrew transport time.

1. Which of the following is the most appropriate for this patient at this time?

- A. Prescribe ibuprofen and tell her to use it as directed and have a nice flight.
- B. Put her on duty not involving flying (DNIF) status and prescribe Vicodin.
- C. Make her DNIF and tell your staff to fit her into a "walk-in" slot.
- D. Do not make her DNIF until she can make an appointment.

ANSWER/DISCUSSION

1. C. This is the best answer to ensure patient and flight safety. Although it would be easy to comply with the patient's request for a new prescription, this is not good medicine, as the exact history is unclear and is a risk to flight safety. Vicodin is not an aircrew-approved medication and its risk for addiction is high. Making the patient DNIF immediately will ensure patient and overall flight safety.

The patient explains that her left wrist is painful only under high G maneuvers. She describes numbness, tingling, and coolness of her fingers starting 30 min postflight, all of which last approximately 1 h before completely resolving. Her pain begins during the initial "G warm-up" and spikes with sustained Gs. The pain is "pressure-like," 8/10, with no radiation, weakness, or temperature complaints while in the jet. She claims to be able to do all WSO duties, including ability to hands-on-throttle-and-stick, check 6, and denies egress difficulties, including harness disconnects. Yet she does admit that during postflight debriefs, her left fingers become numb and cool in temperature for approximately 30 min, and pain with full flexion of her left wrist.

2. What would be your next step?

- A. Continue DNIF and order a magnetic resonance imaging (MRI).
- B. Complete a thorough physical exam and, based on findings, continue DNIF, order an MRI, and call her commander.
- C. Return to flying status (RTFS) and change pain meds to a different nonsteroidal anti-inflammatory drug (NSAID).
- D. RTFS and order mental health evaluation.

ANSWER/DISCUSSION

2. B. Although ordering an MRI may be part of the eventual management, a thorough physical examination is required before ordering any studies. With this flyer's symptoms, it would not be wise to RTFS at this point. Considering a change in pain medications may be an option, but would require a ground test to rule out any idiosyncratic reaction potential. As a flight surgeon and the occupational medicine physician for her squadron, you should call the commander. This flyer is in an accelerated B-Course and a DNIF may cause her to miss certain training "gates," resulting in a mission-ready delay. This may also give you an idea if there is any suspicious history to suggest a fear of flying, but a call to Mental Health is premature.

Upon further review of her past medical history, the flyer admits that she first injured her left wrist 3 yr earlier, in 2008, after a snowboarding fall before she entered the military. She states X-rays were negative and she had a full recovery after 2 wk in a soft splint. In 2010, 1 wk after completing officer commissioning school, she reinjured the same wrist during a fall and was diagnosed with a sprain. Shortly thereafter, she was selected for flight school after passing the flight physical despite pain with pushups.

Prior to starting Undergraduate Navigation Training (UNT), she required centrifuge training. She terminated midway through the initial F-16 profile secondary to left wrist pain at her first 6-G peak. She failed the repeat centrifuge 6 wk later. Due to her second failure, an MRI was obtained and was interpreted as a "suspected ligamentous injury, repeat in 6 mo if symptoms continue." She was treated with a light wrist splint at nighttime, advised to stretch daily, and given a waiver to start flying the Alpha Jet in the fall of 2010.

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DOI: 10.3357/AMHP.4086.2015
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Over the next 6 mo of UNT, her left wrist symptoms continued to occur only during high-G flights. She did not ask for pain medications for fear of not being allowed to continue with flight school, and she was able to "tough it out." Her only treatment during UNT was three separate steroid shots, which alleviated the pain for 4-6 wk per injection. She finished UNT training at the top of her class and was chosen for B-Course training in the United States to start the fall of 2011.

On her initial clearance to base, she did not mention the wrist pain. She believed this lack of pain was from not flying for a month during her PCS to the United States. Since arriving to your base, her symptoms have become more frequent, which she believed was secondary to flying in the more sophisticated, higher G aircraft.

You complete a thorough physical examination that reveals within-normal-range vitals and a body mass index of 19.7. During the neurological exam she displayed normal cranial nerves, grossly intact upper and lower limbs, including tone, strength, fine touch, and reflexes. Her Spurling's and Romberg test were both normal, as was her gait. Examination of her left hand revealed atrophy of the thenar eminence and intrinsic muscles of the hand with no contractures. The patient did have some movement allodynia with left wrist flexion, but not on extension. She had decreased left thumb opposition and grip strength compared to her right. Otherwise the remainder of her musculoskeletal exam and reflexes were within normal. Examination of the skin of the left hand showed hypopigmentation of the anatomic snuffbox. The patient displayed no tactile allodynia to brushing (dynamic mechanical allodynia), but did have some pain in response to light pressure (static mechanical allodynia) to the dorsum of the affected wrist. No temperature differences were noticed, nor was any swelling noted comparing left with right. No hyperhidrosis was noted. Her mental status exam showed a pleasant young woman with an appropriate mood and mannerisms. She denied any fear of continuing her flying training, but did say that training was "stressful."

With the obvious weakness, chronicity of complaint, and no documentation, you order an MRI without contrast and keep the patient DNIF. Based on the findings of the MRI, you will consider a referral to a hand specialist, considering her occupation. A discussion with her commander reveals that she is looked upon as being very bright and friendly in the squadron. He does not believe she has any fear of flying.

The MRI was read as "negative for any abnormalities," and she was prescribed Motrin as needed. The next week the patient presented to the clinic asymptomatic, doing great, and requesting RTFS. If she is not returned to training soon, she may be sent back to her home country and replaced by another WSO. You receive a call from her commander later that same afternoon asking if she could be RTFS, as he does not think she is a risk, especially as a "backseater."

3. What would you do?

- A. RTFS this patient and have her continue Motrin as needed.
- B. Continue DNIF for now and reevaluate in 1 wk.
- C. Arrange for a check ride with a senior instructor pilot to see if symptoms reoccur.
- D. Continue DNIF and NSAIDs and order physical therapy.

ANSWER/DISCUSSION

3. C. At this point, talking to the squadron commander and getting her a "check ride" would be the best option in an attempt to reproduce the concerning symptoms. Continuing her DNIF is an appropriate plan, but incomplete as to an attempt to further discern an underlying cause. The continued use of NSAIDs may control the symptoms, but may also mask the symptoms.

Postcheck ride evaluation by the flight surgeon documented continued pain with maneuvers greater than 5.5 G and postflight numbness. The director of operations noted no deficiencies in WSO duty proficiency and states she does not believe the WSO's condition affects flight safety.

4. What would be your medical evaluation at this point and your aeromedical disposition?

- A. Allow to continue to fly despite continued symptoms and return to clinic as needed.
- B. Allow to continue to fly but refer to a hand specialist.
- C. DNIF based on distracting symptoms and refer to a hand specialist.
- D. DNIF based on distracting symptoms, continue with NSAIDs, and refer to occupational therapy (OT).

ANSWER/DISCUSSION

4. B. You decide to refer the patient to an off-base orthopedic hand specialist and contact via email the patient's home country aeromedical consultants to advise them of the situation and ask for direction concerning "waiver potential." As the squadron flight surgeon, it is your job to balance patient safety, flight safety, and mission requirements. To DNIF at this time would be unnecessary, as the condition is stable and she has been cleared for flight safety. Motrin had to be discontinued secondary to gastrointestinal side effects.

The WSO was scheduled to see an off-base hand specialist exactly 6 mo after her initial presentation to your flight medicine clinic. The orthopedist calls your office to relay the finding of a "very small" ganglion cyst as being a possible cause for the patient's symptoms. As a private pilot herself, she claims that surgery may not relieve the patient's symptoms, but that the patient is requesting surgery to "fix the problem once and for all." She also recommends follow-up with a neurologist at her practice to consider an electromyogram if there is no postsurgical improvement. The ganglion is successfully removed and identified as being "moderate" in size, making it conceivable that it could have been the source of pain. Postoperative plan was 1 wk of Vicodin as needed, OT, and a 3-wk postop visit to consider RTFS.

The patient returns to the clinic the day after her convalescence ends, off all medications, asymptomatic, and claiming that her OT has "worked wonders." You note limited flexion/extension of the left wrist, yet no pain with active or passive movement. During the past 2 wk she had been working in the simulator and denied any difficulties with dexterity or weakness with hands-on-throttle-and-stick and is off all medication with no pain.

You RTFS her and organize another check ride. Unfortunately, the WSO experiences the same preop pain and postflight numbness. You DNIF the patient, discuss the plan with your Chief of Aerospace Medicine, and send for a Neurology evaluation. Neurology does a full work-up, including an array of laboratory studies, a three phase bone scan, and an electromyogram. All of these were interpreted as negative and the patient was given the diagnosis of complex regional pain syndrome (CRPS), considering her symptoms and history of trauma. It is recommended she start gabapentin and consider a mental health evaluation. You inform the patient that she cannot be RTFS with these continued symptoms and/or the use of gabapentin.

The patient's leadership in her home country makes a decision, in communication with her U.S. training leadership, to discontinue her training and send her back home. The medical advice was to follow the American neurologist's recommendation to start gabapentin, bring copies of all her recent medical work-up, and then follow up with Flight Med back in her home country. She was sent home via commercial airlines the next week and retrained for a nonflying job.

Silas Weir Mitchell, the father of American neurology, gave the first detailed description of CRPS in 1864. Mitchell, together with Morehouse and Keen, noted the frequent occurrence of exaggerated presentation of pain in relation to the injury in veterans of the American Civil War.⁹ Mitchell coined the term "causalgia" from the Greek kausis (fire) + algos (pain).

Although CRPS (formally reflex sympathetic dystrophy) is considered a diagnosis of exclusion, the 1994 consensus criteria from the International Association for the Study of Pain formally defined and divided CRPS into type I and type II. In 2003, these criteria were revised into the Budapest Diagnostic Criteria, which are based on signs/symptoms in one of four categories: sensory, vasomotor, sudomotor/edema, and motor/trophic.

It is estimated that the incidence of CRPS in the United States is 5.5 cases per 100,000 person-years.¹¹ The upper extremity is affected twice as often as the lower limb, and a fracture is the most common trigger.¹² The most prominent and disabling symptoms can be spontaneous, as well as inducible pain with motor dysfunction of the affected limb.⁴ Other symptoms such as skin temperature change, swelling, numbness, or stabbing pain can also be present to different degrees after an initial injury.⁵

The physical examination should compare the affected limb with the unaffected limb; determine evidence of sensory, vasomotor, sudomotor/edema, and motor/trophic signs or symptoms; and identify any possible nerve deficits, including cervical/brachial plexus evaluation.¹² Initial investigation should include erythrocyte sedimentation rate, C-reactive protein, complete blood count, and serum auto-antibodies as well as electrodiagnostic and radiographic studies. The differential diagnosis includes inflammatory arthritis, carpel tunnel, C-spine impingement, thoracic outlet disorder, unilateral vascular disease, autoimmune or neoplastic disorders, malingering, somatization, or even frank fear of flying.

Malingering, fear of flying, and somatization are possible causes of the presenting symptoms, but less likely considering the patient's eagerness to get back into the jet. Symptoms of body and sensory disturbances common in CRPS pathology are often mistaken for somatoform disorder.⁸ Psychological symptoms such as anxiety and depression are most likely a consequence of chronic pain, and there is no indication that psychological factors cause the onset of pain in CRPS patients.⁸ Although psychological states such as attention, anticipation, and preparation for action may be modulators in the experience of pain, research shows that there are no psychological or personality traits that predispose individuals to CRPS type I. 6

One theory of CRPS is that it is the result of limb ischemia or ischemia of reperfusion injury. This would explain this aviator's symptoms being related to G_z stressors, including the centrifuge. This case of a flyer's reproducible, G-force dependent pain is consistent with the CRPS type I criteria² and may have been the reason the patient was symptom-free without G-stimulation.

No reliable treatment protocol is available for use in all patients; however, early recognition of symptoms and early involvement in a multidisciplinary approach can improve patient outcomes.¹² Four pillars of treatment have been described by Goebel: physical and vocational rehabilitation, pain relief, patient information/support, and psychological intervention.⁵ The first line treatment is physical therapy after an initial period of immobilization and splinting.¹² Pharmacological treatment often requires "rational polypharmacy," with the goal being pain relief, while allowing an interdisciplinary rehabilitation.⁶ NSAIDs and oral steroids are usually part of the acute stages of CRPS.¹² Other medications that have shown efficacy in clinical trials are neuromodulators, such as gabapentin, calcium channel blockers, or bisphosphonates. There is limited evidence to support the use of antidepressants, anticonvulsants, and opioids. Surgical treatments are reserved for refractory cases,⁷ with the most common indications being neuroma and secondary compression neuropathies.¹²

Aeromedically, CRPS is not a very favorable diagnosis, as the prognosis for improvement is poor despite rehabilitation, use of pharmaceuticals, or sympatholytic procedures. Nearly 50% of CRPS patients have shown impaired ability to identify the fingers on the affected side.⁴ Studies also show chronic pain patients such as CRPS patients have difficulties making emotional decisions.¹

CRPS is considered a neurological diagnosis, disqualifying for flying of all classes in the U.S. military. According to the Air Force Medical Standards Directory, residuals after treatment for any neurological condition such as weakness or paralysis of important muscle groups, deformity, incoordination, pain or sensory disturbance, disturbance of consciousness, speech, or mental defects, or personality changes that would interfere with the performance of duty would also be disqualifying for military retention standards.^{*}

The Army and Navy also consider CRPS a disqualifying neurological condition for flying. According to U.S. Army Regulation 40-501, CRPS would be classified as a neurological cause of medical unfitness for flying duty until reviewed by the U.S. Army Aeromedical Activity.¹³ The U.S. Navy Aeromedical Reference and Waiver Guide classifies CRPS as a peripheral neuropathy and, secondary to the safety of flight concerns due to impaired fine motor coordination, strength, sensation, and abnormal sensations in the fingers and hands, grounding would be required. Waiver would include results of electrophysiological studies and functional demonstration of satisfactory recovery (e.g., performance in simulator, cockpit egress testing, operation of safety harness and parachute fittings, etc.).¹⁰

^{*} U.S. Air Force. Medical standards directory; 2013:50. [Accessed 27 March 2014]. Available to those with access from https://kx2.afms.mil/_layouts/login/Privacy.htm?ReturnUrl=/kj/ kx4/FlightMedicine/_layouts/Authenticate.aspx?Source=%252Fkj%252Fkx4%252FFlight Medicine%252FDocuments%252FMedical%2520Dtardards%2520Directory%2520%2528 MSD%2529%252FMSD%25202013%252DDec%252D2%252Epdf&Source=%2Fkj%2Fk x4%2FFlightMedicine%2FDocuments%2FMedical%20Standards%20Directory%20 %28MSD%29%2FMSD%202013%2DDec%2D2%2Epdf.

Based on the Federal Aviation Administration Guide for Aviation Medical Examiners, the Federal Aviation Administration would consider any neurological condition disqualifying if that condition, based on the case history and the medical judgment of the Aviation Medical Examiner, makes the person unable to safely perform his/her duties.³ All of these cases would have to be deferred by the initiating Aviation Medical Examiner to the Federal Air Surgeon for final aeromedical disposition.

Although it is assumed that the visiting country will fly under the host country's aeromedical standards, this is not always the case. This particular case is a good example of where pre-established relationships with the allied country's flight surgeons and a better understanding of the visiting country's aeromedical waiver system would have assisted the expediency of the work-up in the case of an "untrained asset."

Tontz RC. You're the flight surgeon: complex regional pain syndrome. Aerosp Med Hum Perform. 2015; 86(6):574–577.

ACKNOWLEDGMENTS

The author would like to thank Col. Roger Hesselbrock, USAF, MC, FS, neurologist at the U.S. Air Force Aeromedical Consult Service, and Dr. Paolo Sandroni, M.D., Ph.D., Professor of Neurology at the Mayo Clinic in Rochester, for their expert review of this manuscript. The views expressed in this article are those of the author and do not necessarily reflect the official policy or position of the Air Force, the Department of Defense, or the U.S. Government.

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This article was prepared by E. Hugh Mulagha, M.D., M.P.H.

You are the flight surgeon at a joint base that has active duty, Guard, and Reserve members. Your first patient in the afternoon is an urgent care visit, a 41-yr-old African-American female Air Force aeromedical evacuation nurse currently on active duty status who complains of lower chest pain. Her symptoms began after she ate breakfast. She describes the pain as a sudden onset of pain increasing in intensity initially for 15 min and then continuously for several hours. She states it feels like someone is pushing a fist under her sternum and she is having vague discomfort around her right shoulder as well. She'd had similar, though less severe, symptoms the day before, but thought it was heartburn from stress, as she was to take her physical training test later that day. She took Maalox, but her symptoms persisted for another 3 h after the dose. Later that afternoon she passed her physical training test with her best recorded run time. This morning, however, she reports that her symptoms are more intense and are associated with nausea. She took Maalox without benefit and noted that her pain was radiating to her back. She reports no history of similar symptoms prior to this episode.

In her review of systems, she denies dyspnea, lightheadedness, headache, weakness, diarrhea, constipation, or dark stools. She just finished her menstrual cycle 2 d ago. During a recent deployment to Southwest Asia she lost 12 lb, which she attributes to exercise and diet. She had been under stress during her deployment because she had to leave her small children behind and her father had a transient ischemic attack during her deployment. She has no other family history. She takes no medications besides the Maalox noted above and does not use tobacco or illicit drugs. She does not take

DOI: 10.3357/AMHP4136.2015