

In the United States Court of Federal Claims
OFFICE OF SPECIAL MASTERS

Filed: July 23, 2021

* * * * *		PUBLISHED
MARK V. DAVIS,	*	
	*	No. 16-276V
Petitioner,	*	
v.	*	Special Master Gowen
	*	
SECRETARY OF HEALTH	*	Entitlement; Table Injury; Tetanus-
AND HUMAN SERVICES,	*	Diphtheria (Td); Brachial Neuritis;
	*	Parsonage-Turner syndrome (PTS);
	*	Neuralgic Amyotrophy.
Respondent.	*	
* * * * *		

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Julia M. Collison, United States Department of Justice, Washington, DC, for respondent.

RULING ON ENTITLEMENT¹

On September 20, 2013, Mark V. Davis, D.M.D. (“petitioner”) received a tetanus-diphtheria (“Td”) vaccination in his right arm. Twelve days later, on October 2, 2013, petitioner developed acute and persistent aching pain in his dominant right hand and arm, accompanied by the loss of motor function in his right hand, most notably the ability to extend his thumb. Petitioner consulted numerous local providers, who emphasized his preexisting cervical radiculopathy and newly diagnosed carpal tunnel syndrome. Petitioner also suffered a myocardial infarction in January 2014. Eventually on November 10, 2015, petitioner obtained the medical consultation of Joseph Feinberg, M.D., a physiatrist who specializes in the diagnosis and treatment of the brachial plexus and peripheral nerve disorders. Dr. Feinberg provided an *additional* diagnosis of brachial neuritis.

¹ Pursuant to the E-Government Act of 2002, *see* 44 U.S.C. § 3501 note (2012), because this decision contains a reasoned explanation for the action in this case, I am required to post it on the website of the United States Court of Federal Claims. The court’s website is at <http://www.uscfc.uscourts.gov/aggregator/sources/7>. **This means the decision will be available to anyone with access to the Internet.** Before the decision is posted on the court’s website, each party has 14 days to file a motion requesting redaction “of any information furnished by that party: (1) that is a trade secret or commercial or financial in substance and is privileged or confidential; or (2) that includes medical files or similar files, the disclosure of which would constitute a clearly unwarranted invasion of privacy.” Vaccine Rule 18(b). “An objecting party must provide the court with a proposed redacted version of the decision.” *Id.* **If neither party files a motion for redaction within 14 days, the decision will be posted on the court’s website without any changes.** *Id.*

On February 26, 2016, petitioner filed a claim in the National Vaccine Injury Compensation Program,² in which petitioner alleged that he developed brachial neuritis³ as listed on the effective Vaccine Injury Table. Petition (ECF No. 1).⁴ He subsequently retained Dr. Feinberg as a supportive expert. Respondent and his expert neurologist Vinay Chaudhry, M.D., contended that Dr. Feinberg's diagnosis of brachial neuritis was inconsistent with the effective Table's definition of brachial neuritis and that petitioner's injury could be explained by cervical radiculopathy and carpal tunnel syndrome. Upon full consideration of the evidence and for the reasons provided below, I conclude that petitioner has established entitlement to compensation for a Table brachial neuritis injury lasting for more than six months. However, this injury does not encompass his comorbid cervical radiculopathy, carpal tunnel syndrome, and cardiac conditions.⁵

I. Procedural History

As stated above, petitioner initiated this claim in February 2016. Petition (ECF No. 1) accompanied by Petitioner's Exhibits ("Pet. Exs.") 1-29. It was assigned to my docket. After an initial status conference, respondent declined to discuss potential settlement. Respondent's ("Resp.") Status Report (ECF No. 10). Petitioner then filed Dr. Feinberg's initial expert report. Pet. Ex. 30 (ECF No. 11).

Respondent then requested a finding of fact regarding onset. Resp. Motion ("Mot.") (ECF No. 12). Respondent averred that "the contemporaneous treatment records placed the onset of petitioner's symptoms on or about November 20, 2013." *Id.* Petitioner responded that the affidavits of multiple fact witnesses placed the onset of his symptoms on October 2, 2013,

² The National Vaccine Injury Compensation Program is set forth in Part 2 of the National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3755, codified as amended, 42 U.S.C. §§ 300aa-10 to 34 (2012) (hereinafter "Vaccine Act" or "the Act"). Hereinafter, individual section references will be to 42 U.S.C. § 300aa of the Act.

³ The Vaccine Injury Table creates a presumption of causation for "brachial neuritis" if onset occurs within 2 – 28 days after receipt of a vaccine containing tetanus toxoid (but no such similar presumption for seasonal flu vaccine, as implicated in this case. *See* 82 Fed. Reg. 6294 (Jan. 19, 2017); 42 C.F.R. §§ 100.3(a), (c)(6). These terms as well as Parsonage-Turner syndrome, ("PTS") and neuralgic amyotrophy ("NA") are all used to describe the same set of symptoms. *See, e.g., Grow v. Sec'y of Health & Human Servs.*, No. 16-13V, 2020 WL 7366332, at n. 3 (Fed. Cl. Spec. Mstr. Nov. 24, 2020); *Greene v. Sec'y of Health & Human Servs.*, No. 11-631V, 2015 WL 9056034 at n.9 (Fed. Cl. Spec. Mstr. July 31, 2015); *Devonshire v. Sec'y of Health & Human Servs.*, No. 99-31V, 2006 WL 2970418, at *1 (Fed. Cl. Spec. Mstr. Sept. 28, 2006)). However, the most recent medical literature filed in this case indicates that neuralgic amyotrophy is "the most common term in the literature and also neutral with respect to the extent and localization of nerve involvement." Van Alfen (2016) [Pet. Ex. 35] (full citation provided *infra* at n. 36) at 1. This opinion refers most consistently to brachial neuritis because that conforms to the finding of a Table injury.

⁴ Petitioner alleged that in the event his injury does not meet the Table definition, then it was caused-in-fact by the Td vaccination. Petition at Preamble, ¶ 26. Petitioner also reserved the right to submit additional evidence to make out the causation-in-fact claim. Pet. Post-Hearing Brief (ECF No. at 101) at 28; Pet. Post-Hearing Reply (ECF No. 109) at 18-19.

⁵ Pursuant to Section 13(a)(1), in order to reach my decision, I have considered the entire record, including all of the medical records, expert testimony, and literature submitted by the parties. This opinion discusses the elements of the record I found most relevant to the outcome.

while treating a specific dental patient. Pet. Response (ECF No. 15) at 1-2. During a status conference, the parties agreed that onset could be resolved based on the written record without need for a hearing. I concluded, consistent with petitioner's position, that onset was on or about October 2, 2013. *See* Findings of Fact filed October 7, 2016 (ECF No. 16). I ordered the parties and any experts retained in the case to accept the findings of fact in rendering their opinions. *Id.* at 8.⁶ Petitioner subsequently filed his dental practice's contemporaneous records for the patient in question. Pet. Ex. 36 (ECF No. 17).

On January 30, 2017, respondent filed his report pursuant to Vaccine Rule 4(c), in which he recommended against compensation for a Table tetanus/brachial neuritis injury. Resp. Report ("Rep't") (ECF No. 23). Respondent also filed Dr. Chaudhry's initial expert report. Resp. Ex. A (ECF No. 23); *see also* Pet. Ex. 37 (Dr. Feinberg's second report) (ECF No. 26); Resp. Ex. C (Dr. Chaudhry's second report) (ECF No. 29).

Following another status conference, *see* Order filed May 3, 2017 (ECF No. 30), petitioner filed the images from his two cervical spine MRIs (ECF Nos. 35, 39). Petitioner filed Dr. Feinberg's third report as Pet. Ex. 40 (ECF No. 42). Respondent filed Dr. Chaudhry's third report as Resp. Ex. E (ECF No. 49). Respondent also retained a radiologist, David M. Yousem, M.D., to review and interpret the MRI images. *See* Resp. Ex. F (ECF No. 49).

I recommended that the parties explore a litigative risk settlement. *See* Order filed May 10, 2018 (ECF No. 50). Petitioner conveyed a demand, but the parties did not continue settlement discussions. *See* Pet. Status Report (ECF No. 51); Resp. Status Report (ECF No. 52).

The parties filed pre-hearing briefs (ECF Nos. 57, 60). Additionally at my suggestion, respondent filed visual representations of the nerves and anatomy involved in this case as Resp. Exs. H-I (ECF Nos. 61-62). Petitioner also retained a radiologist, Darryl B. Sneag, M.D., to review and interpret the MRI images. *See* Pet. Ex. 47 (ECF No. 65).

An entitlement hearing took place in New York, New York on January 17 – 18, 2019. Petitioner presented expert testimony from Dr. Feinberg and respondent presented expert testimony from Dr. Chaudhry. Petitioner also offered fact testimony about his injury. *See* Transcript ("Tr.") (ECF Nos. 73-74). Petitioner also filed exhibits presented at the hearing ("Hearing Exs.") 1 – 7 (ECF No. 71). I recommended that the parties revisit settlement discussions and I identified questions for post-hearing briefing. Scheduling Order filed March 21, 2019 (ECF No. 77). Petitioner filed his workers' compensation file as Pet. Ex. 48 (ECF No. 78) and Dr. Feinberg's fourth report as Pet. Ex. 49 (ECF No. 86). Respondent filed Dr. Chaudhry's fourth report as Resp. Ex. J (ECF No. 89). An outside mediation was unsuccessful. *See* Joint Status Report (No. 90).

Petitioner filed Dr. Feinberg's fifth report as Pet. Ex. 50 on May 14, 2020 (ECF No. 96) and his post-hearing brief on September 8, 2020 (ECF No. 101). Respondent filed a response on November 10, 2020 (ECF No. 103). Petitioner filed a reply on February 3, 2021 (ECF No. 109)

⁶ The findings of fact are fully incorporated and clarified herein.

as well as Dr. Feinberg's updated curriculum vitae ("CV") as Pet. Ex. 51 (ECF No. 110) the next day. This matter is ripe for adjudication.

II. Legal Standard⁷

The Vaccine Act was established to compensate vaccine-related injuries and deaths. § 10(a). "Congress designed the Vaccine Program to supplement the state law civil tort system as a simple, fair and expeditious means for compensating vaccine-related injured persons. The Program was established to award 'vaccine-injured persons quickly, easily, and with certainty and generosity.'" *Rooks v. Sec'y of Health & Human Servs.*, 35 Fed. Cl. 1, 7 (1996) (quoting H.R. No. 908 at 3, *reprinted in* 1986 U.S.C.C.A.N. at 6287, 6344).

A petitioner bears the burden of establishing his or her entitlement to compensation from the Vaccine Program. The burden of proof is by a preponderance of the evidence. § 13(a)(1).

A. Findings of Fact

A special master must consider, but is not bound by, any diagnosis, conclusion, judgment, test result, report, or summary concerning the nature, causation, and aggravation of petitioner's injury or illness that is contained in a medical record. § 13(b)(1). "Medical records, in general, warrant consideration as trustworthy evidence. The records contain information supplied to or by health professionals to facilitate diagnosis and treatment of medical conditions. With proper treatment hanging in the balance, accuracy has an extra premium. These records are also generally contemporaneous to the medical events." *Curcuras v. Sec'y of Health & Human Servs.*, 993 F.2d 1525, 1528 (Fed. Cir. 1993).

Accordingly, where medical records are clear, consistent, and complete, they should be afforded substantial weight. *Lowrie v. Sec'y of Health & Human Servs.*, No. 03-1585V, 2005 WL 6117475, at *20 (Fed. Cl. Spec. Mstr. Dec. 12, 2005). However, this rule does not always apply. In *Lowrie*, the special master wrote that "written records which are, themselves, inconsistent, should be accorded less deference than those which are internally consistent." *Lowrie*, at *19.

The United States Court of Federal Claims has recognized that "medical records may be incomplete or inaccurate." *Camery v. Sec'y of Health & Human Servs.*, 42 Fed. Cl. 381, 391 (1998). The Court later outlined four possible explanations for inconsistencies between contemporaneously created medical records and later testimony: (1) a person's failure to recount to the medical professional everything that happened during the relevant time period; (2) the medical professional's failure to document everything reported to her or him; (3) a person's faulty recollection of the events when presenting testimony; or (4) a person's purposeful

⁷ Decisions of special masters and the U.S. Court of Federal Claims (some of which are referenced in this ruling) constitute persuasive but not binding authority. *Hanlon v. Sec'y of Health & Human Servs.*, 40 Fed. Cl. 625, 630 (1998). By contrast, Federal Circuit rulings concerning legal issues are binding on special masters. *Guillory v. Sec'y of Health & Human Servs.*, 59 Fed. Cl. 121, 124 (2003), *aff'd*, 104 F. App'x 712 (Fed. Cir. 2004); *see also Spooner v. Sec'y of Health & Human Servs.*, No. 13-159V, 2014 WL 504728, at *7 n.12 (Fed. Cl. Spec. Mstr. Jan. 16, 2014).

recounting of symptoms that did not exist. *La Londe v. Sec’y of Health & Human Servs.*, 110 Fed. Cl. 184, 203-04 (2013), *aff’d*, 746 F.3d 1335 (Fed. Cir. 2014).

The Court has also said that medical records may be outweighed by testimony that is given later in time that is “consistent, clear, cogent, and compelling.” *Camery*, 42 Fed. Cl. at 391 (citing *Blutstein v. Sec’y of Health & Human Servs.*, No. 90-2808, 1998 WL 408611, at *5 (Fed. Cl. Spec. Mstr. June 30, 1998)). The credibility of the individual offering such testimony must also be determined. *Andreu v. Sec’y of Health & Human Servs.*, 569 F.3d 1367, 1379 (Fed. Cir. 2009); *Bradley v. Sec’y of Health & Human Servs.*, 991 F.2d 1570, 1575 (Fed. Cir. 1993).

The special master is obligated to fully consider and compare the medical records, testimony, and all other “relevant and reliable evidence contained in the record.” *La Londe*, 110 Fed. Cl. at 204 (citing § 12(d)(3); Vaccine Rule 8); *see also Burns v. Sec’y of Health & Human Servs.*, 3 F.3d 415, 417 (Fed. Cir. 1993) (holding that it is within the special master’s discretion to determine whether to afford greater weight to medical records or to other evidence, such as oral testimony surrounding the events in question that was given at a later date, provided that such determination is rational).

B. Nature of Injury

Special masters are generally not tasked with diagnosing injuries. In *Lombardi*, the Federal Circuit explained: “The function of a special master is not to ‘diagnose’ vaccine-related injuries, but instead to determine ‘based on the record evidence as a whole and the totality of the case, whether it has been shown by a preponderance of the evidence that a vaccine caused the petitioner’s injury.’” *Lombardi*, 656 F.3d at 1343, *citing Andreu v. Sec’y of Health & Human Servs.*, 569 F.3d 1367, 1382 (Fed. Cir. 2009).

However, the Federal Circuit has determined that in certain instances, “if there is a dispute as to the nature of a petitioner’s injury, the special master may opine on the nature of the petitioner’s injury.” *Contreras v. Sec’y of Health & Human Servs.*, 844 F.3d 1363, 1368 (Fed. Cir. 2017), *citing Hibbard v. Sec’y of Health & Human Servs.*, 698 F.3d 1355 (Fed. Cir. 2012); *see also Locane v. Sec’y of Health & Human Servs.*, 686 F.3d 1375 (Fed. Cir. 2012); *Broekelschen v. Sec’y of Health & Human Servs.*, 618 F.3d 1339 (Fed. Cir. 2010)).

C. Causation

A petitioner may prevail by proving either that (1) the vaccinee suffered an injury listed on the Vaccine Injury Table with onset beginning within a corresponding time period following receipt of a corresponding vaccine (a “Table Injury”), for which causation is presumed or that (2) the vaccinee suffered an injury that was actually caused by a vaccine. Under either method, however, the petitioner must also show that the vaccinee “suffered the residual effects or complications of the illness, disability, injury, or condition for more than six months after the administration of the vaccine.” Section 11(c)(1)(D)(i). Here, petitioner alleges a Table brachial neuritis injury, for which the criteria are set forth and applied below in section VII.

A petitioner often presents expert testimony in support of his or her claim. *Lampe v. Sec’y of Health & Human Servs.*, 219 F.3d 1357, 1361 (Fed. Cir. 2000). Expert testimony in the Vaccine Program is usually evaluated according to the factors set forth in *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 594-96 (1993); *see also Cedillo*, 617 F.3d at 1339 (citing *Terran v. Sec’y of Health & Human Servs.*, 195 F.3d 1302, 1316 (Fed. Cir. 1999)). A special master may use the *Daubert* framework to evaluate the reliability of expert testimony, but expert testimony need not meet each *Daubert* factor to be reliable. *Boatmon v. Sec’y of Health & Human Servs.*, 941 F.3d 1351 (Fed. Cir. 2019). The *Daubert* factors are “meant to be helpful, not definitive,” and all factors “do not...necessarily apply even in every instance in which the reliability of scientific testimony is challenged.” *Boatmon*, 941 F. 3d at 1359 (citing *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151, 119 S. Ct. 1167, 143 L.Ed.2d 238 (1999)). Thus, for Vaccine Act claims, a “special master is entitled to require some indicia of reliability to support the assertion of the expert witness.” *Moberly* at 1324. Where both sides offer expert testimony, a special master’s decision may be “based on the credibility of the experts and the relative persuasiveness of their competing theories.” *Broekelschen v. Sec’y of Health & Human Servs.*, 219 F.3d 1339, 1347 (Fed. Cir. 2010) (citing *Lampe*, 219 F.3d 1357 at 1362).

If the petitioner makes a *prima facie* case supporting vaccine causation-in-fact, the burden shifts to respondent to show by a preponderance of the evidence that the injury is instead due to factors unrelated to the administration of the vaccine. *Deribeaux v. Sec’y of Health & Human Servs.*, 717 F.3d 1363, 1367 (Fed. Cir. 2013) (citing § 13(a)(1)(B)). Respondent has the burden of demonstrating that: “[A] factor unrelated to the vaccination is the more likely or principal cause of injury alleged. Such a showing establishes that the factor unrelated, not the vaccination, was ‘principally responsible’ for the injury. If the evidence or alternative cause is seen in equipoise, then the government has failed in its burden of persuasion and compensation must be awarded.” *Knudsen*, 35 F.3d at 551.

III. Summary of Relevant Facts

A. Introduction

Petitioner was born in 1942. He graduated from the University of Kentucky College of Dentistry in 1967. His first day of dental practice was October 2, 1968. Over the course of his career, petitioner came to specialize in dental implants and advanced restorative dentistry. He managed his own dental practice in Clearwater, Florida. *See generally* Petition; Pet. Exs. 18, 29. Petitioner testified that in 2006, he spent approximately one million dollars on improvements to the dental practice. Tr. 452. He planned to “work forever.” Tr. 450-52 (citing his family’s considerable longevity and his knowledge that other implant dentists tend to work well into their eighties).

B. January 20, 2009, Cervical Spine MRI

The MRI was apparently performed at Morton Plant Hospital (“MPH”) in Clearwater, Florida. Pet. Ex. 27 at 28. The clinical indication was “neck pain primarily left-sided.” *Id.* The local radiologist recorded that interspaces C3-4, C4-5, C5-6, and C6-7 showed moderate to

advanced degenerative spondylosis.⁸ *Id.* Additionally, the right side of C5-6 and the left side of C6-7 showed mild foraminal narrowing.⁹ *Id.*

C. Other Medical Records Predating the September 20, 2013, Td Vaccination

Petitioner filed records from his primary care provider Thomas E. Austin, M.D. in Clearwater, Florida beginning in 2011. Those records reflect that petitioner had hypertension,¹⁰ hyperlipidemia,¹¹ and obstructive sleep apnea.¹² He also had chronic pain in his neck. In one June 2011 record, the review of systems was positive for “joint pain in shoulders and neck” but the physical exam did not have any positive findings. Pet. Ex. 1 at 29-30. There is no other evidence that petitioner’s chronic pain extended to his chest, shoulders, arms, or hands. *See generally* Pet. Ex. 1 at 1-29. Petitioner’s medication list included Tramadol 50 mg to take every six hours for pain. *Id. but see* Tr. 459-61 (petitioner’s testimony that he “might take a Tramadol once or twice a week, if [he was] uncomfortable from work”). In March 2013, he reported that taking non-steroidal anti-inflammatory drugs (“NSAIDs”) increased his blood pressure. Pet. Ex. 1 at 19. In May 2013, he reported that his neck pain was “doing OK” but he had “off and on sciatica.”¹³ *Id.* at 17. Dr. Austin referred petitioner, based on his complaint of sciatic discomfort and sore back, for a series of ten physical therapy appointments which took place in the summer of 2013. *See* Pet. Ex. 28 at 1.

On September 20, 2013, just before his seventy-first birthday, petitioner saw Dr. Austin for an annual exam. Pet. Ex. 1 at 13. Petitioner reported that he was “doing well.” *Id.* The review of systems was positive for chronic neck pain and some lower back pain but was negative for joint swelling, morning stiffness, or motor or sensory losses. *Id.* Dr. Austin did not record any complaints or any findings relating to petitioner’s right arm or hand. There is no record of

⁸ Cervical spondylosis is defined as a “degenerative joint disease affecting the cervical vertebrae, intervertebral disks, and surrounding ligaments and connective tissue, sometimes with pain or paresthesia radiating along the upper limbs as a result of pressure on the nerve roots.” *Dorland’s*.

⁹ Neural is “pertaining to a nerve or to the nerves.” Foramina is the plural of foramen, which is defined as “a natural opening or passage, especially one into or through a bone.” Stenosis is “an abnormal narrowing of a duct or canal.” *Dorland’s*.

¹⁰ Hypertension is “high arterial blood pressure; various criteria for its threshold have been suggested, ranging from 140 mm Hg systolic and 90 mm Hg diastolic to as high as 200 mm Hg systolic and 110 mm Hg diastolic.” *Dorland’s*.

¹¹ Hyperlipidemia is “a general term for elevated concentrations of any or all of the lipids in the plasma.” *Dorland’s*.

¹² Sleep apnea is “transient periods of cessation of breathing during sleep. It may result in hypoxemia and vasoconstriction of pulmonary arterioles, producing pulmonary arterial hypertension.” The obstructive type “result[s] from collapse or obstruction of the airway with the inhibition of muscle tone that occurs during REM sleep”, which among adults “is seen primarily in middle-aged obese individuals, with a male predominance[.]” *Dorland’s*.

¹³ Sciatica is “a syndrome characterized by pain radiating from the back into the buttock and along the posterior or lateral aspect of the lower limb; it is most often caused by protrusion of a low lumbar intervertebral disk. The term is also used to refer to pain anywhere along the course of the sciatic nerve.” *Dorland’s*.

his range of motion, reflexes, strength, or sensation. *Id.* at 14. At this encounter, petitioner received a Td vaccination in his right deltoid. *Id.*

D. Medical Records from November 22, 2013, Hospital Encounter

The first medical encounter was sixty-three (63) days post-vaccination, on November 22, 2013 at approximately 3:30 a.m., when petitioner presented to the MPH emergency room. Pet. Ex. 19 at 11. He had a past history of sleep apnea, cervical disc disease, and hyperlipidemia. *Id.* at 9. His chief complaint was: “right-sided chest pain with high b/p [blood pressure] [and] right hand numbness. Has been going on for day and half.” *Id.* at 10.

“Immediately upon [petitioner’s] arrival” at 3:34 a.m., he was seen by Joshua Kaplan, D.O. Pet. Ex. 19 at 15. Petitioner reported his history of cervical radiculopathy, but that the current pain “felt different and he was concerned for his heart.” *Id.* Dr. Kaplan felt that petitioner was “very knowledgeable” but incorrectly described him as a “retired dentist.” *Id.*¹⁴ Dr. Kaplan did not record any abnormal findings whatsoever on the review of systems or on physical examination. *Id.* at 15-16. Dr. Kaplan suspected cervical radiculopathy but admitted petitioner for “a cardiac rule out.” *Id.* at 16-17. His chest pain subsided and further testing was unremarkable. *See id.* at 21-22. Afterwards, the primary care provider Dr. Austin evaluated petitioner. *Id.* at 1-2. Although Dr. Austin’s record contains a physical examination section this was a telemetry¹⁵ encounter and there is no indication that any other medical professional was physically present to facilitate a physical examination. *Id.* at 1-2. Dr. Austin believed that the acute chest pain was attributable to radiculopathy and he planned an “MRI of his neck.” *Id.* at 2. Afterwards, a cardiology nurse practitioner evaluated petitioner for the “atypical” right-sided chest pain as well as right arm numbness; she “suspect[ed] cervical radiculopathy – doubt[ed] cardiac.” *Id.* at 3,6. She noted that the pain and the resulting increased NSAID use were “possibly” contributing to his poorly controlled hypertension. *Id.* Petitioner was discharged that same day without a comprehensive diagnosis. *Id.* at 13.

At a December 2, 2013 appointment (in person), Dr. Austin recorded that petitioner was “experiencing worsening sx’s [symptoms] of weakness, numbness, loss of R hand grip in RUE [right upper extremity], he’s expressing concerns of being able to safely perform his dental duties because of this.” Pet. Ex. 1 at 2. Petitioner was already taking NSAIDs and tramadol for pain. *Id.* Dr. Austin recorded that on physical exam: “motor function normal, he is able to move hand fingers ok today,” but he did not address sensation, strength, or muscle tone. *Id.* Dr. Austin’s assessment was “brachial neuritis or radiculitis nos [not otherwise specified]” and he ordered a cervical spine MRI. *Id.*

¹⁴ Petitioner established that in fall 2013, he was working full-time and had recently made renovations to his dental practice.

¹⁵ Telemetry is “the making of measurements at a distance from the subject, with measurable evidence of the phenomena under investigation being transmitted by radio signals, wires, or other means.” *Dorland’s*. In this context, it suggests that Dr. Austin was not at the hospital in person, rather, he provided a telehealth or telemedicine appointment: “consisting of provision of consultant services by off-site health care professionals to those on the scene; diagnosis and treatment can be done at a great distance through methods such as the videoconference or rapid transmission of digital files.” *Dorland’s*.

E. December 4, 2013, Cervical Spine MRI

The local radiologist recorded that: “Compared with 1/20/09, there has been progression of central stenosis at [interspace] C5-6.” Pet. Ex. 27 at 27. C4-5 and C5-6 also showed moderate central stenosis. *Id.* C3-4, C4-5, C5-6, and C6-7 also showed moderate to severe chronic foraminal narrowing. *Id.* Finally, C7-T1 showed disc bulging and subtle annular tearing, *id.*, however, the treating providers and the experts did not assign any significance to this finding, *see, e.g.*, Resp. Ex. F at 1; Pet. Ex. 47 at 1; Tr. 301-02.

F. Subsequent Medical Records

On December 6, 2013, petitioner presented to Michael Hadley, D.O.¹⁶ at Non-Surgical Orthopedics in Palm Harbor, Florida. Pet. Ex. 6 at 1. Dr. Hadley recorded petitioner’s history of neck and back pain for over 30 years, which had been controlled with osteopathic manipulation and over-the-counter medication. *Id.* He had neck pain in the C4 through C6 areas, which varied in intensity from 2 or 3/10 to 7/10 and was aggravated by certain postures. *Id.* He also had intercostal pain in the right ribs. *Id.* Petitioner reported that two weeks ago, he had the onset of numbness and weakness in his hands and right ulnar¹⁷ forearm. *Id.* He was also experiencing “severely bothersome” pain characterized as “burning” and “needles.” *Id.*

On physical exam, Dr. Hadley observed normal strength except for 4/5 pincer grasp on right and left, right wrist flexion, and right shoulder abduction. *Id.* Bilateral biceps and left triceps reflex were at 2/4, but the right triceps reflex was entirely absent. *Id.* Petitioner also reported that “a position of his neck which reproduces a Spurling’s test¹⁸... increases finger numbness, specifically his middle finger on the right side.” *Id.* However, when Dr. Hadley actually performed the Spurling’s test, it was negative. *Id.* Examination of the cervical spine did not find any additional tenderness, asymmetry, tissue texture changes, or abnormal range of motion. *Id.* Dr. Hadley assessed petitioner with cervical radiculopathy as well as right upper extremity weakness. *Id.* at 2. Dr. Hadley believed that petitioner’s “symptoms were caused by [petitioner’s] profession and his positioning that is required for his job” and recommended seeing another orthopedist for further evaluation. *Id.*

¹⁶ Dr. Hadley’s father is Mr. Ron Hadley, who submitted an affidavit in this case averring that he was a dental patient of petitioner “for many years going back to the early seventies.” Pet. Ex. 29 at 16. Mr. Hadley’s “landscaping company provided landscape design and completed the landscape for [petitioner’s] first dental office.” *Id.* Mr. Hadley had considerable dental issues and also attended regular cleanings every three months to avoid infection, which were motivated by his remission from a rare leukemia. *Id.* During an October 2013 appointment, they discussed their health and petitioner confessed that he was having trouble with his hand and arm. *Id.* Mr. Hadley encouraged petitioner to see his son Dr. Hadley “immediately,” but at another appointment in November 2013, petitioner said that he “was going as soon as he could get some time.” *Id.*

¹⁷ The ulna is “the medial long bone of the forearm, on the side opposite that of the thumb.” *Dorland’s*.

¹⁸ A Spurling test is an assessment for cervical radiculopathy, during which: “The examiner presses down on the top of the head while the patient rotates the head laterally and into hyperextension; pain radiating into the upper limb ipsilateral [on the same side] to a rotation position of the head indicates radiculopathy.” *Dorland’s*.

During a December 13, 2013, follow-up appointment, Dr. Hadley performed osteopathic manipulation and traction, which improved petitioner's feeling of tightness in the ribs and chest area. Pet. Ex. 6 at 3-4. Petitioner reported continuing right arm weakness as well as burning pain which disrupted his sleep and was not alleviated by two Medrol dose packs. *Id.* Dr. Hadley referred to the "significantly worsened" cervical spine MRI and recorded that if petitioner continued to do dentistry in certain positions required for his job, that his symptoms would continue to worsen. *Id.* Dr. Hadley referred petitioner to an orthopedic surgeon, Dr. Davidson (discussed below) and to physical therapy. *Id.*

Also on December 13, 2013, Dr. Austin recorded that petitioner had ongoing pain in his right neck and upper arm, which disrupted his sleep. Pet. Ex. 1 at 10. He was "also now getting numbness and weakness in the first three fingers on his right hand." *Id.* Dr. Austin observed that petitioner could not flex his right thumb and in addition, the right thumb and second finger grasp were weakened. *Id.* Petitioner's hand symptoms were affecting his ability to work as a dentist, as he held his tools in the right hand. *Id.* Trying to work exacerbated the problem, causing severe pain and weakness down his right arm. *Id.* Petitioner reported that the repeat cervical spine MRI showed severe spinal stenosis at C5-6, and that he planned to go on disability and consult a neurosurgeon. *Id.* Dr. Austin maintained his earlier assessment of brachial neuritis but added cervical stenosis. *Id.* at 10-11.

On December 19, 2013, petitioner presented to J. Byron Davidson, M.D. at Orthopaedic Specialties of Tampa Bay. Pet. Ex. 21 at 1. Dr. Davidson recorded that petitioner had a long history of neck pain associated with his job, but that in November,¹⁹ "was the first time he woke up with right arm numbness and pain... so he went to MPH ER to get checked out." *Id.* Petitioner "ha[d] taken three Medrol DP [dose packs] without any change." Pet. Ex. 21 at 1. His symptoms were aggravated with extension of the right arm and body rotation. *Id.* Physical examination found decreased sensation in the right radial forearm, thumb, and index finger in a C6 nerve root distribution; absent triceps reflex; and a positive Spurling's test. *Id.* at 2-3. Based on these findings and his review of the cervical spine MRI, Dr. Davidson concluded that petitioner's profession had led to this radiculopathy and right hand weakness. *Id.* Dr. Davidson had petitioner undergo an epidural steroid injection at approximately the C6-7 nerve root. *Id.*; see also Pet. Ex. 24 at 1 (procedure note); Pet. Ex. 22 at 3, 10, 13 (petitioner's physical therapy intake forms confirming his receipt of the steroid injection). Dr. Davidson recommended that petitioner follow up in four to six weeks, but he never returned. Pet. Ex. 21 at 1.

On December 20, 2013, petitioner presented to Jose L. Gallastegui, M.D., at Clearwater Cardiovascular Consultants. Pet. Ex. 13 at 33-35. Dr. Gallastegui recorded that petitioner had inadequately controlled hypertension and hyperlipidemia, but that his November 22, 2013 episode of chest pain and ongoing right arm symptoms were due to cervical radiculopathy, for which he should pursue "neurology consult – Dr. Sinoff schedule ASAP." *Id.* at 35.

¹⁹ Dr. Davidson inaccurately records that the ER encounter was on November 14, instead of November 22, 2013. Compare Pet. Ex. 21 at 1 and Pet. Ex. 19 at 1-30.

On January 3, 2014, petitioner presented for recommended cardiac tests. *See* Pet. Ex. 19 at 33. During the infusion for a PET scan, he felt discomfort in his chest. *Id.* The study was negative for ischemia and his ejection fraction was noted to be 50%. *Id.* While undergoing an echocardiogram, he developed pain in his right shoulder that went back to his chest and scapula, followed by shortness of breath and nausea. *Id.* Petitioner was transported to MPH, where he was diagnosed with a myocardial infarction with a near complete occlusion of the left anterior descending coronary artery, for which he underwent angioplasty and insertion of a stent. *Id.* at 33-37.

After stabilizing from the acute cardiac event, on February 6, 2014, petitioner followed through with the referral to Stuart Sinoff, M.D., who is identified in the records as a neurologist and neuro-ophthalmologist based at the MPH Center for Dizziness and Balance Disorders. *See generally* Pet. Ex. 25. Petitioner wrote on a new patient questionnaire that for over twenty years, he had been experiencing episodic neck discomfort on rotation and muscle spasms primarily around the scapula, which were related to the posture and positions required for his job. *Id.* at 4. Approximately five years before, he developed high blood pressure and his neck discomfort transformed from episodic to chronic, but this discomfort was “primarily cervical, occasionally sciatica without any symptoms in my hands or arms.” *Id.* Then on November 22, 2013, he awoke at 3:00 a.m. with considerable right-sided chest pain. *Id.* at 4, 13. Petitioner also wrote that he had developed a “sudden radiculopathy which persists to the present... with some loss of grasping strength and a persistent numbness with the radial²⁰ and median²¹ nerves.” *Id.* at 13. His symptoms were “constantly present” as opposed to “appear[ing] in attacks.” *Id.* at 5. Dr. Sinoff observed right-sided moderately severe thenar²² atrophy; mild weakness in the right hand, triceps, and biceps; and decreased subjective sensation over the right digits 1, 2, 3, and the inside of digit 4. *Id.* at 2-3. Dr. Sinoff’s initial impression was cervical spine disease and carpal tunnel syndrome, both primarily right-sided, but he referred to another neurologist, Raphael Schneider, M.D., for further evaluation including EMG²³ and NCV²⁴ studies. *Id.* at 4.

²⁰ The radial nerve originates from the posterior cord of the brachial plexus (C6–C8, and sometimes C5 and T1). Its branches are the posterior brachial, inferior lateral brachial, posterior antebrachial cutaneous nerves, muscular, deep, and superficial rami. It descends down the back of the arm and forearm. It is ultimately distributed to “skin on back of arm, forearm, and hand, extensor muscles on back of arm and forearm, and elbow joint and many joints of hand.” *Dorland’s*.

²¹ The median nerve originates from the lateral and medial cords of the brachial plexus (C6-T1). Its branches are the anterior interosseous nerve of forearm, common palmar digital nerves, muscular and palmar rami, and a communicating branch with the ulnar nerve. Its distribution is to the elbow, wrist, and intercarpal joints, anterior muscles of the forearm, muscles of the digits, skin of the palm, thenar eminence, and digits. *Dorland’s*.

²² Thenar pertains to “the mound on the palm at the base of the thumb.” *Dorland’s*.

²³ Electromyography (“EMG”) is “an electrodiagnostic technique for recording the extracellular activity (action potentials and evoked potentials) of skeletal muscles at rest, during voluntary contractions, and during electrical stimulation; performed using any of a variety of surface electrodes, needle electrodes, and devices for amplifying, transmitting, and recording the signals.” *Dorland’s*.

²⁴ Nerve conduction velocity (“NCV”) is a measure of “the speed, in meters per second, at which an impulse moves along the largest fibers of a peripheral nerve.” *Dorland’s*.

At a February 7, 2014 follow-up with Dr. Austin, petitioner reported that he had congestive heart failure and that he had stopped working. Pet. Ex. 1 at 8. His “sciatica pain”²⁵ had improved but he was still “dealing with the RUE radiculopathy.” *Id.* Dr. Austin’s record does not include any abnormal findings, but there is no indication that he actually performed a physical exam and he did not offer an assessment relating to the right upper extremity. *Id.*

On February 12, 2014, the orthopedist Dr. Hadley recorded that the cervical epidural steroid injection two months prior did not deliver “any significant help.” Pet. Ex. 6 at 5. Petitioner still had neck pain; right wrist weakness and pain on flexion; right hand weakened grasp; inability to do movements with thumb and index finger that were necessary for his job; right elbow pain, decreased flexion, and decreased extension; and decreased range of motion on abduction of his right shoulder. *Id.* Dr. Hadley recommended further physical therapy, traction, osteopathic manipulation, and possibly another epidural steroid injection. *Id.* at 5-6; *see also* Pet. Ex. 6 at 7.

On February 17, 2014, petitioner presented to Jean Raphael Schneider, M.D., at Clinical Neurosciences of Tampa Bay. Pet. Ex. 27 at 7-10. Dr. Schneider observed right sided thenar atrophy, decreased sensation in a median nerve distribution, and absent reflexes in the biceps and triceps. *Id.* at 10. Dr. Schneider’s assessment was right-sided cervical radiculopathy and right-sided carpal tunnel syndrome which together represented a “double crush syndrome.”²⁶ *Id.* Dr. Schneider planned NCV and EMG studies to confirm this assessment. *Id.*

At a February 21, 2014, follow-up appointment, Dr. Hadley recorded that petitioner had continued right arm pain. Pet. Ex. 6 at 7. Osteopathic manipulation had helped while it was being performed but had no lasting effect. *Id.* Petitioner had paresthesias in his right forearm and hand which did not involve the thumb or pinky finger. *Id.* He also had difficulty abducting his forearm. *Id.*

On April 3, 2014, Dr. Schneider conducted the NCV and EMG studies. He tested nerve conduction of only the bilateral median and ulnar motor and sensory nerves at the wrists. This testing found evidence of carpal tunnel syndrome which was moderate on the right and mild to moderate on the left. Pet. Ex. 27 at 18-19. In May 2014, petitioner discussed carpal tunnel release with a colleague of Dr. Schneider. Pet. Ex. 11 at 1-2. The procedure was tentatively planned for July 2014, *see* Pet. Ex. 27 at 2, but never occurred.

²⁵ Sciatica is “a syndrome characterized by pain radiating from the back into the buttock and along the posterior or lateral aspect of the lower limb; it is most often caused by protrusion of a low lumbar intervertebral disk. The term is also used to refer to pain anywhere along the course of the sciatic nerve,” which originates at L4-S3. *Dorland’s*.

²⁶ Double crush syndrome is defined as “compression or other damage of the same nerve at two different points, such as carpal tunnel syndrome with cervical radiculopathy. Some authorities believe that damage at one point makes a nerve group more vulnerable to injury somewhere else.” *Dorland’s*. However, respondent’s expert Dr. Chaudhry testified that this is a misnomer and does not necessarily refer to two “crushes” on the same nerve, but “two independent things.” Tr. 225.

Also on April 3, 2014, Dr. Schneider's EMG study tested selected muscles²⁷ on the right side of the body correlating to nerve roots C5 through T1. Pet. Ex. 27 at 20. The findings were generally unremarkable, however, the right biceps muscle, which is supplied by the musculocutaneous nerve originating from nerve roots C5-6, displayed an increased duration. *Id.* The right pronator teres muscle, which is supplied by the median nerve originating from nerve roots C6-7, showed the same increased duration as well as increased insertional activity, increased amplitude, reduced recruitment pattern, and 3+ fibrillations. *Id.* The right triceps muscle, supplied by the radial nerve originating from nerve roots C6-7-, showed an increased duration, increased insertional activity, increased amplitude, reduced recruitment pattern, and 4+ fibrillations. *Id.* However, EMG of right-sided paraspinal muscles at C6 – T1 were found to be normal. *Id.* Dr. Schneider concluded that the EMG findings evidenced acute and chronic C6-7 radiculopathy on the right. *Id.* at 18.

On April 23, 2014, petitioner filed a claim with the Florida Department of Financial Services Division of Workers' Compensation. Pet. Ex. 44 at 2. He was referred for a May 12, 2014 evaluation with George Kardashian, M.D., at the Center for Bone and Joint Disease in Hudson, Florida. Pet. Ex. 26 at 1-3. Dr. Kardashian did not review the cervical spine MRIs, but he did review the NCV/EMG studies which demonstrated cervical radiculopathy and carpal tunnel syndrome. *Id.* at 3. Dr. Kardashian noted petitioner's neck pain from years of working as a dentist but focused on his more recent development of right extremity symptoms. *Id.* at 1. He recorded that "5 months ago," petitioner had an episode that started with significant right chest, shoulder and upper arm pain"; that petitioner "subsequently" developed weakness and diminished flexion in the right thumb and index finger; and that petitioner developed numbness and tingling in the right hand "around the same time." *Id.* Dr. Kardashian recorded that the bilateral upper extremities showed "normal appearance without obvious deformities," however, there is no indication that upper extremity strength, reflexes, or range of motion were tested. *Id.* at 2. There was 5/5 strength in the bilateral thenar muscles, fingers on abduction/adduction, and the wrists. *Id.* However, the right flexor pollicis longus ("FPL") muscle showed 0/5 strength and the right index finger's distal interphalangeal ("DIP") joint had 4/5 strength on flexion. *Id.* Sensation was intact to light touch bilaterally in median, ulnar, and radial nerve distribution. *Id.* There was full active range of motion of bilateral elbows, wrists, and all fingers except for the right thumb interphalangeal ("IP") joint. *Id.* The shoulders are not addressed in the physical exam. *Id.* Dr. Kardashian's assessment was that petitioner "likely had right-sided brachial neuritis that eventually developed into a R AIN [anterior interosseous nerve] syndrome."²⁸ Patient still has weakness of the thumb and index finger." *Id.* at 3. Dr. Kardashian submitted paperwork confirming his diagnosis of "R AIN syndrome" as well as right carpal tunnel syndrome to the workers' compensation program. Pet. Ex. 44 at 4-7. At a May 21, 2014 follow-up appointment, Dr. Kardashian added petitioner's history of "a tetanus booster vaccine one months [sic] prior to the start of the brachial neuritis episode." Pet. Ex. 26 at 4; *see also* Pet. Ex.

²⁷ Of note, Dr. Schneider's EMG did *not* assess the right serratus anterior, flexor pollicis longus, and pronator quadratus muscles. Dr. Feinberg's later EMG tested those muscles and found evidence for two separate nerve injuries, which were consistent with brachial neuritis. *Compare* Pet. Ex. 27 at 19-20 to Pet. Ex. 15 at 1-2.

²⁸ Anterior interosseous nerve ("AIN") syndrome is defined as "a complex of symptoms caused by a lesion of the anterior interosseous nerve... symptoms include pain in the proximal forearm and weakness of the muscles innervated by the nerve." *Dorland's*.

29 at 2 (petitioner's recollection that he conducted internet research on his condition in May or June 2014 and "eventually" discovered a link between Td vaccination and brachial neuritis).

At a May 27, 2014, follow-up appointment with Dr. Schneider, petitioner reported that his right arm and hand symptoms were about the same and that he continued to have right forearm wasting. Pet. Ex. 27 at 2. He also felt that "the symptoms in the left hand and arm are getting worse" and that he was "losing dexterity in the hands." Pet. Ex. 27 at 2. Petitioner was "concerned about the possibility of brachial plexopathy related to the tetanus shot he got around the time when symptoms began." Pet. Ex. 27 at 2. Dr. Schneider discussed that the EMG and NCV findings were "very focal which goes along more with the right C6 or C7 radiculopathy and bilateral carpal tunnel syndrome." *Id.* There is no indication that Dr. Schneider was aware of petitioner's workers compensation claim or his recent consultation with Dr. Kardashian, who had offered the assessment of brachial neuritis *in addition to* cervical radiculopathy and carpal tunnel syndrome. *Id.* The same is true for subsequent records from the primary care provider Dr. Austin, *see* Pet. Ex. 1 at 2-6.

On September 22, 2014, Dr. Kardashian added the following dictation to petitioner's records and his workers' compensation claim: "It is possible that [petitioner] had a vaccination that led to brachial neuritis. The brachial neuritis likely led to AIN [anterior interosseous nerve] syndrome and carpal tunnel syndrome. [Petitioner] also has neck problems and radiculopathy. He is not interested in pursuing further carpal tunnel syndrome treatment and patient is at MMI [maximum medical improvement] at this time." Pet. Ex. 44 at 9.

G. Petitioner's Letter to Dr. Feinberg²⁹

Petitioner conducted internet research and came across descriptions of brachial neuritis including a 2010 article coauthored by Dr. Feinberg. Pet. Ex. 14 at 2. Then on November 3, 2015, he wrote a letter to Dr. Feinberg, seeking only "an informed opinion from an experienced clinician who can properly evaluate the possibility of [brachial neuritis] pancaking onto my pre-existing cervical problems which never affected my hands or arms or caused me to miss a single day of scheduled work since October 2, 1968." *Id.*³⁰ In the letter, petitioner recounted that he had received a Td vaccination on September 20, 2013, and that "within two weeks," he experienced the onset of "right hand cramps while treating patients." *Id.* at 1. He had to "remove various dental instruments from my cramped right hand using the left hand to force the right hand open." *Id.* He initially assumed that these cramps were related to his hypertension medication, so he improved his hydration and began taking potassium. *Id.* He described that these "hand cramps" occurred numerous times during dental surgeries until November 22, 2013 at 2:00 a.m., when he awakened with alarming right-sided chest, arm, shoulder, and back pain with accompanying hand, forearm, and shoulder numbness and elevated blood pressure. *Id.* He recounted telling numerous doctors that his acute condition on November 22, 2013, was "very

²⁹ Feinberg and Radecki, *Electrodiagnosis Corner/ Review Article: Parsonage-Turner syndrome*, 6 HSSJ 199 (2010) Pet. Ex. 33].

³⁰ Petitioner declares that he wrote to Dr. Feinberg "long before [petitioner] ever considered any legal action of met with legal counsel." Pet. Post-Hearing Brief at 15; *see also* Pet. Post-Hearing Reply at 7-8, 12.

different from the chronic discomforts of cervical radiculopathy.” *Id.* at 2. Petitioner wrote that as of November 3, 2015: “There has been no improvement in the hand, arm, and shoulder for 24 months. Generalized muscle weakness, slight muscle wasting with dorsal forearm and shoulder paresthesia along with numbness of the right thumb, index, middle, and proximal surface of the 3rd finger is present. I experience shoulder pain when the right hand is elevated above the head. There is some motor deficit of the entire extremity.” *Id.*

H. Dr. Feinberg’s Medical Evaluation³¹

Petitioner traveled from Florida to New York City for the medical evaluation on November 10, 2015. Pet. Ex. 15 at 1-3. Dr. Feinberg recorded his history of “right arm weakness, atrophy, cramping, numbness, and tingling since receiving a tetanus toxin vaccination on September 20, 2013.” *Id.* at 1. The April 2014 EMG showed “acute and chronic C6-C7 radiculopathy on the right side as well as moderate bilateral carpal tunnel syndrome.” *Id.* Dr. Feinberg recorded: “Neck full ROM without end range pain. Negative Spurling’s. Mild scapular winging with dyskinesia on the right... Right shoulder APROM [active and passive range of motion] is wnl [within normal limits].” *Id.* There was: “Atrophy of the deltoid and elbow flexors and ABP [sic, APB?] on the right. No fasciculations noted. 5/5 strength in bilateral deltoid, biceps, triceps, infraspinatus, wrist extensors, wrist flexors, FDI, ADM, APB, EIP, FDP. Sensation intact to light touch and pinprick, EXCEPT C6-C7 on the right.” *Id.* Dr. Feinberg planned to evaluate for brachial neuritis as well as cervical radiculopathy. *Id.*

Dr. Feinberg’s NCV study found that the right median motor nerve, at the abductor pollicis brevis (“APB”) muscle, had a delayed onset of 4.4 milliseconds (reference range: less than 3.6 milliseconds) and an increased amplitude of 10.3 mV (reference range: less than 4 mV). Pet. Ex. 15 at 1-2. The right ulnar segment motor nerve, at the abductor digitorus minimus (“ADM”) muscle had a normal onset but an increased amplitude of 6.9 mV. *Id.* at 2. Dr. Feinberg tested numerous sensory nerves in both arms, which were normal at the forearms but there were delayed onsets in the bilateral median nerves and the right ulnar nerve. *Id.*

Dr. Feinberg’s EMG study tested selected muscles on the right side of the body, some of which were included in Dr. Schneider’s earlier study and some that were not. Of note, Dr. Schneider found that the right biceps muscle, associated with the musculocutaneous nerve and roots C5-6, had normal findings including a normal duration. Pet. Ex. 15 at 2.

With regard to interspace C6-7, Dr. Feinberg did not test the median nerve-supplied pronator teres muscle, which Dr. Schneider had previously recorded to be abnormal. *See* Pet. Ex. 27 at 20. But Dr. Feinberg recorded that the median nerve-supplied flexor carpi radialis (“FCR”) muscle and the radial nerve-supplied triceps (lateral head) muscle were normal. Pet. Ex. 15 at 2. However, the long thoracic nerve-supplied serratus anterior muscle displayed an abnormal “discrete” recruitment pattern. *Id.*

³¹ Petitioner emphasizes that “Dr. Feinberg was a treating physician in this case. When he conducted his examination on [petitioner,] and performed the EMG in New York, Dr. Feinberg had no idea this matter would be a matter of litigation... Dr. Feinberg formed his diagnosis long before he was asked to serve as an expert in this case.” Pet. Post-Hearing Reply at 7-8; *see also id.* at 12; Tr. 50-51, 78, 129-30.

Dr. Feinberg also recorded that the flexor pollicis longus (“FPL”) and pronator quadratus (“PQ”) muscles displayed the same “discrete” recruitment pattern as well as 1+ fibrillations, which Dr. Feinberg characterized as “mild abnormal spontaneous activity.” *Id.* The EMG study provides that both of these muscles are associated with the anterior interosseous nerve (“AIN”) and the C7-8 nerve root. *Id.* Of note, C7-8 was entirely unremarkable on petitioner’s MRIs, *see* Pet. Ex. 27 at 26-28.

Dr. Feinberg recorded that the EMG/NCV studies showed evidence of bilateral median neuropathy (carpal tunnel syndrome) that was mild to moderate on the right side and mild on the left. Pet. Ex. 15 at 3. However, his *primary impression* was “a chronic partially recovered right anterior interosseous neuropathy and a chronic partially recovered right long thoracic neuropathy,” which findings were “most likely secondary to Parsonage-Turner syndrome/ neuralgia amyotrophy,” also known as brachial neuritis. *Id.*

I. Subsequent Medical Records

At a June 26, 2018 follow-up appointment, the primary care provider Dr. Austin recorded that petitioner’s main complaint was continued achiness in his right arm and hand. Petitioner and Dr. Austin “discuss[ed] the etiology of his arm pain, first noticed this two weeks after getting a Td booster routinely Sept, 2013. He’s had multiple evaluations for this and [it, sic] was originally thought to be a cervical radiculopathy. Now thought to be a vaccine-related injury. The arm pain has been constant over the past 5 years. Currently using ibuprofen which takes the edge off the pain.” Pet. Ex. 45 at 1. Dr. Austin’s assessment included “injury of right brachial plexus, sequela.” *Id.* at 2.

J. Affidavits

As previously reviewed in the findings of fact, petitioner and ten (10) other fact witnesses submitted affidavits focusing on the onset of his symptoms. *See generally* Pet. Ex. 29. The affidavits describe that petitioner developed new symptoms twelve (12) days post-vaccination, on October 2, 2013. This was petitioner’s work anniversary and close in time to his birthday. That day, he saw an established patient for a prescheduled appointment for dental surgery involving anesthesia, extraction of several teeth, and placement of a bridge for dentures and crowns. *See generally* Pet. Ex. 29 (affidavits); *see also* Pet. Ex. 36 (dental practice records). Petitioner recalled that: “On or about October 2, 2013, I began having severe right hand and right arm muscle pain that was immediately noticeable. The ‘cramps’ I experienced were deep and consistent aching pains and occurred numerous times in addition to a progressive inability to flex the right thumb and loss of grasp as I began to drop small objects previously easily held and manipulated until November 22, 2013...” Pet. Ex. 29 at 1. A medical assistant recalled that during the October 2, 2013 appointment, petitioner was unable to use his right thumb to aspirate (pull back) the plunger on a syringe while administering an anesthesia injection. *Id.* at 15. That evening, petitioner recounted to his wife that he used his left hand to force the right fingers to open and release an instrument, presumably the syringe. *Id.* at 18. During the same procedure, he was also unable to change handpiece burs which required right thumb pressure. *Id.* at 15. He also had trouble grasping small objects. *Id.* at 1, 12, 15. Several witnesses characterized petitioner’s hand symptoms as “cramps” or “cramping.” *Id.* at 4, 6, 7, 12, 15, 18. From that

point on, petitioner took longer to perform procedures and required two rather than just one assistant. *Id.* at 12, 18. At some point in October 2013, his patient Ron Hadley recommended consulting his son, the orthopedist Dr. Michael Hadley. *Id.* at 16. However, petitioner did not seek treatment until he awakened on November 22, 2013, at approximately 2:00 a.m., with right-sided chest pain and he was concerned for his heart.

K. Fact Testimony

At the hearing, petitioner provided credible testimony including additional detail about the events on October 2, 2013. He recalled that the specific appointment began at 1:30 p.m. Tr. 432. The first step was to administer anesthesia into both sides of the patient's mandible (lower jaw). Tr. 432-33. Petitioner was unable to use his right thumb to aspirate (extend) the needle. *Id.* at 433. He ultimately managed to administer the anesthesia. *Id.* While waiting approximately five to seven minutes for the anesthesia to take effect, he stretched and checked on other patients. *Id.* Upon returning to the patient in question and starting the procedure, petitioner used his right hand to form a "pencil grip" on a dental tool, but then he could not release the tool. *Id.* at 433-34. He used his left hand to pry open his right fingers. *Id.* at 434. Petitioner testified that his hand was not precisely "cramping" but instead "locked" due to the pain. *Id.* at 435. These symptoms continued throughout the procedure. *Id.* He could use his right hand to manipulate objects, but he could not open his hand. *Id.* At the same time, petitioner noticed an aching pain extending from his forearm to near his shoulder. *Id.* at 435, 445. However, he was more focused on the hand symptoms that were impeding the dental procedure. *Id.* at 435.

I asked petitioner about what happened after that "one event" on October 2, 2013. Tr. 444. Petitioner answered: "That went on through -- all of the time that I was working my arm hurt. I mean, it just hurt all the time." *Id.*; *see also id.* at 435 ("my arm pretty much ached all of the time"). He initially believed that these new symptoms were from an electrolyte imbalance. *Id.* at 445. As Thanksgiving, Christmas, and the end of the year were approaching, many patients were wanting to finish treatment and he was very busy. *Id.* at 435. He continued to work, but as a result of the new symptoms in his arm and hand, he required both assistants "right on top of me all of the time to help me take the hand piece away, put it in the holder, change the cutting instrument that goes in the hand piece, because we're continually changing those. And I finished my patient schedule up until the famous night of November the 22nd being really, really uncomfortable." *Id.* at 436. Petitioner summarized: "all of the contortions and the accommodations that I had to make from October the 2nd to November 22nd put me in pretty bad shape." *Id.* at 437.

Petitioner testified that as of January 2019, his motor function had improved "some," but it was not back to baseline. Tr. 449. He had persistent pain in his right upper arm and forearm, for which he took 800 milligrams of ibuprofen per day. Tr. 449. At some point in 2014 or later, petitioner sold his dental practice. He attributed the "distress sale" of the dental practice and the resulting lost wages to "the chain of events" which started with the Td vaccination and onset of brachial neuritis. *See* Pet. Ex. 29 at 2.

IV. Findings of Fact

There are no medical records or other contemporaneous evidence from between petitioner's Td vaccination at issue on September 20, 2013, and his emergent presentation on November 22, 2013, at approximately 3:30 a.m. The later medical records generally do not address symptoms beginning in October, but rather, relate all of the changes in petitioner's condition to late November coinciding with his hospital presentation. However, I previously concluded that the later recollections from petitioner and ten (10) other fact witnesses were sufficiently "consistent, clear, cogent, and compelling" to outweigh the later medical records with regard to the events occurring during this time period. *See* Findings of Fact filed October 7, 2016 (ECF No. 16).

Consistent with the original findings of fact, a preponderance of the available evidence supports that on October 2, 2013, petitioner suddenly developed aching pain in his right hand and arm, accompanied by the loss of motor function in his right hand, most notably the ability to extend his thumb. This pain was consistent and progressive, then gave way to weakness over the subsequent weeks. These symptoms significantly impacted petitioner's ability to perform his job. He took longer to complete dental procedures and required additional assistance. Then, in late November 2013, petitioner experienced numbness, tingling, and decreased sensation in his right arm as well as sharp right-sided chest pain.

I concluded that when petitioner first presented to the emergency room on November 22, 2013, "it is quite likely that he was primarily concerned that he was having a heart attack, and recounted the chest pain with more accuracy and detail than the right hand and right arm pain." Finding of Fact at 7. "It is also very likely that the medical professionals were more concerned with the chest pain and did not inquire about any history of prior right arm pain." *Id.* Additionally: "The medical professionals also may have associated petitioner's hand and arm pain with his history of cervical disc disease... [which rebutted] the presumption that the medical records were accurate and complete with regards to petitioner's hand and neck symptoms." *Id.*

V. Expert Qualifications

A. Petitioner's Expert Dr. Feinberg

After initiating his claim in the Vaccine Program, petitioner retained Dr. Feinberg, whose first expert report is dated August 25, 2016. Pet. Ex. 30 at 1. Dr. Feinberg is a physiatrist with active board certifications in physical medicine and rehabilitation, pain medicine, and electrodiagnostic medicine. Pet. Ex. 51 at 2-3. After completing medical school and relevant post-doctoral training, in 1996, Dr. Feinberg joined the Hospital for Special Surgery ("HSS"), a world-renowned institution which is focused on treating orthopedic conditions. Tr. 8-9. Dr. Feinberg previously served as the director of the physiatry department, but his current title is director of HSS's Center for Brachial Plexus and Traumatic Nerve Injuries. Tr. 8; Pet. Ex. 51 at 6. He presents and publishes on this subject regularly, including in the United States' preeminent EMG journal, *Muscle and Nerve*, Tr. 19, 24-25.³² He is also a full professor at

³² Feinberg et al., *The Electrodiagnostic Natural History of Parsonage-Turner Syndrome*, *Muscle & Nerve* (2017), published online in Wiley Online Library (wileyonlinelibrary.com), DOI 10.1002/mus.25558 [Pet. Ex. 42]; Feinberg

HSS's affiliated medical school, Cornell University Weill Medical College. Pet. Ex. 51 at 2. Dr. Feinberg's largest referral base is hand and neck surgeons asking him to evaluate patients with presumed carpal tunnel syndrome and cubital tunnel syndrome. Tr. 10. Additionally, orthopedists and spine surgeons ask him to evaluate patients with presumed radiculopathies. Tr. 9-10. "At least 75 to 80 percent" of his patients are referred with a suspicion of carpal tunnel syndrome and/or radiculopathy. Tr. 14. He diagnoses brachial neuritis in approximately one patient per week and has treated "hundreds" of patients with these injuries over his twenty (20) years of clinical experience. Tr. 27. However, for approximately half of patients presenting for suspected brachial neuritis, he rules out that diagnosis. Tr. 26. Dr. Feinberg recognized that experts in particular conditions can "tend to be biased in what they see," but he focuses on determining the right diagnosis in service of delivering the correct treatment. Tr. 26.

Dr. Feinberg has limited experience as an expert witness. Since 2006, he has consulted for the U.S. Department of Justice in three or four cases outside of the Vaccine Program, not involving brachial neuritis. Tr. 41; *see also* Pet. Ex. 51 at 9. He agreed to serve as an expert for one defendant concerning brachial neuritis which did not go to trial. Tr. 50. Dr. Feinberg emphasized that he does not automatically support either plaintiffs or defendants and will not "defend Parsonage-Turner syndrome for someone just because they want someone who's an expert in it." Tr. 50. Dr. Feinberg agreed to see Mark Davis as a patient and conducted his medical evaluation, long before learning that there was "any legal aspect" or even knowing that the Vaccine Program existed. Tr. 50-51, 78, 129-30. Afterwards, Dr. Feinberg agreed to serve as an expert in petitioner's claim, but he has declined other claims from petitioner's attorney Leah Durant and another firm in Philadelphia. Tr. 51. At the entitlement hearing, on petitioner's motion and without objection from respondent, I admitted Dr. Feinberg as an expert in the subjects of physiatry, electrodiagnostic medicine, peripheral nerve injuries and disease, and the diagnosis and treatment of brachial neuritis. Tr. 60.

B. Respondent's Expert Dr. Chaudhry

Dr. Chaudhry is board-certified in neurology, clinical neurophysiology, neuromuscular medicine, and electrodiagnostic medicine. Resp. Ex. B at 1. After completing medical school and relevant post-doctoral training, in 1987, he joined the Johns Hopkins University School of Medicine, initially as a fellow in neuromuscular diseases. *Id.* at 2. He is currently the director of the neurology outpatient center, codirector of the neurology EMG laboratory, and a full professor of neurology. *Id.* at 1-3. In a year, Dr. Chaudhry sees approximately 2,000 patients, of whom between 50 – 70% have peripheral nerve diseases including brachial neuritis, carpal tunnel syndrome, Guillain-Barré syndrome ("GBS"), chronic inflammatory demyelinating disease ("CIDP"), and multifocal neuropathies. Tr. 220-21. About 50 to 100 of these patients are suspected or indeed have brachial neuritis. Tr. 347. Dr. Chaudhry testified that he sees all patients with suspected brachial neuritis who come to Johns Hopkins, "if not directly, then at least as a... favor or consult to help other physicians diagnose this." Tr. 349. His predominant role is to conduct the electrodiagnostic studies to confirm the diagnosis before a colleague

et al., *MRI Bullseye Sign: An Indicator of Peripheral Nerve Constriction in Parsonage-Turner Syndrome*, *Muscle & Nerve*, doi:10.1002/mus25480 (2016) [Pet. Ex. 36]; Feinberg & Radecki, *Electrodiagnosis Corner/ Review Article: Parsonage-Turner Syndrome*, *6 Hospital for Special Surgery Journal* 199 (2010) [Pet. Ex. 33].

proceeds with surgery. Tr. 228, 349. Dr. Chaudhry contributed a section on brachial neuritis to a book which was published in 1993.³³ He has written more on the subject, but nothing as specific as Dr. Feinberg's publications on brachial neuritis and findings such as hourglass constriction on MRI. Tr. 349-50. He has also spoken but has not been specifically "invited to lecture on the topic" like Dr. Feinberg has. Tr. 350.

Dr. Chaudhry has been a medical expert in the Vaccine Program for the respondent since 1999. Resp. Ex. B at 31. Each year, he reviews approximately five to ten claims and testifies at approximately one to two hearings. Tr. 340. Petitioner's counsel Mr. Milmoie asked Dr. Chaudhry whether, upon reviewing a case for HHS, he has ever determined that there was vaccine causation. Tr. 342. Dr. Chaudhry said that HHS may ask him "off record my opinion, then I would say no or yes." Tr. 342. But more often, "either the HHS or the attorneys have already reviewed the records and they have made the determination that it [the injury] is not [caused by the vaccine]... so it's already gone through first or second level of scrutiny I would think... they [HHS or the attorneys] have already made the determination, otherwise they've already settled." Tr. 342. Mr. Milmoie then asked: "Have you ever been sent a case for review by HHS where you later had to say I can't be an expert in the case because I think the vaccine was the cause of the injury?" Tr. 342-43. Dr. Chaudhry answered: "I don't believe so." Tr. 343. He could not remember doing so, adding: "It's possible. I am not going to say – 20 years is a long time." Tr. 343. On respondent's motion and without objection from petitioner, I admitted Dr. Chaudhry as an expert in the subjects of neurology and the diagnosis of brachial neuritis, cervical radiculopathy, and carpal tunnel syndrome. Tr. 228-29.

C. Discussion

The parties devoted significant time to debating the experts' qualifications. Petitioner contended that while Dr. Chaudhry is an experienced and respected neurologist who is board-certified to conduct and interpret EMGs, Dr. Feinberg has had more focused experience and qualifications concerning this specific disorder of brachial neuritis. Pet. Post-Hearing Response at 12-16; *see also* Pet. Post-Hearing Reply at 7-11. In turn, respondent contended that Dr. Chaudhry is equally qualified to opine in this case because "he is the primary person at his hospital to diagnose brachial neuritis"; he is a neurologist whose role is to diagnose, rather than rehabilitate patients; he has more publications overall; and that he has a higher academic rank than Dr. Feinberg. Resp. Post-Hearing Response at 15-16, citing Tr. 354-55. But as I stated at the hearing, both experts are well-qualified and I am more focused on the substance of their opinions. Tr. 355.

Respondent also contended that "Dr. Feinberg's opinion deserves no special weight" because petitioner sought him out for the purpose of diagnosing brachial neuritis and that Dr. Davis "had incentives" for making that diagnosis, apparently because petitioner subsequently retained him as a paid expert witness. Resp. Post-Hearing Response at 11, 13. I disagree in light of Dr. Feinberg's credible testimony, noted above, that he is invested in reaching the correct diagnosis that will benefit the patient; he evaluated Dr. Mark Davis as a patient before knowing

³³ Cornblath & Chaudhry, *Brachial Neuritis*, pp. 353-55 in *Current Therapy in Neurologic Disease* (Johnson et al., 4th ed. 1993) [Resp. Ex. A-2].

of the present legal action or that he would be asked to serve as an expert; and he does not automatically agree to serve as an expert. Accordingly, I find that Dr. Feinberg's medical records are entitled to comparable weight as those from the other treating providers.

Respondent also contended that "Dr. Feinberg did not perform a proper differential diagnosis because he did not consider a full history, he placed too much emphasis on a single EMG, and he ignored his own physical examination findings." Resp. Post-Hearing Response at 13-15. This is somewhat of an overstatement because Dr. Feinberg's medical records note the prior EMG and diagnosis of carpal tunnel syndrome. Dr. Feinberg also evaluated for cervical radiculopathy. No medical record in this case is completely comprehensive, but Dr. Feinberg acknowledged petitioner's separate diagnoses of cervical radiculopathy and carpal tunnel syndrome in his medical evaluation and separated those out in his expert opinion.

VI. Expert Opinions

A. Dr. Feinberg

Dr. Feinberg opined that as a result of the September 20, 2013, Td vaccination, petitioner suffered acute injury to the anterior interosseous nerve resulting in decreased function in his right thumb and index finger, as well as acute injury to the long thoracic nerve resulting in decreased right shoulder strength and scapular winging. Pet. Ex. 30 at 2. These two nerve injuries together represented brachial neuritis. *Id.* While this condition generally has a favorable prognosis, petitioner has had an incomplete recovery and his condition is now chronic. *Id.*; *see also* Pet. Post-Hearing Brief at 16-26; Pet. Post-Hearing Reply at 2-6.

1. Anterior Interosseous Nerve Injury

Assessing this issue requires understanding the relevant anatomy beginning at the cervical spine. The C8 and T1 nerve roots supply fascicles that travel through the brachial plexus's medial cord and help to innervate the median nerve. Resp. Ex. I at 9.³⁴ The median nerve travels down the arm. Resp. Ex. I at 4. Below the elbow, in the forearm, certain fascicles branch off from the median nerve to form the anterior interosseous nerve, which controls three muscles in the forearm: the pronator quadratus ("PQ"), the flexor pollicis longus ("FPL"), and the flexor digitorum profundus ("FDP"). *Id.* The PQ muscle controls downward rotation of the palm, the FPL controls flexion of the distal part of the thumb, and the FDP controls flexion of the index finger. Pet. Ex. 30 at 2; Tr. 89-90, 253.³⁵

For all three muscles, nerve root C8 is the "dominant" contributor of innervation and T1 is a "significant" contributor. *Id.* at 8. Importantly in this case, petitioner did *not* have any pathology at the C8 or T1 nerve roots. *See* Pet. Ex. 27 at 26-28.

³⁴ Nerve roots C5 and C6 provide additional fascicles that travel through the lateral cord before reaching the median nerve. Resp. Ex. I at 9. However in this case, the experts did not suggest that C5 and C6 are involved in the AIN.

³⁵ The experts agreed that the FDP also contributes to flexion of the middle finger, but that is not always impacted with anterior interosseous nerve injury. Tr. 89-90, 253.

Acute nerve injury will cause inflammation of the tendons, resulting in pain, which can lead to cramping and spasming of the affected muscles. Tr. 488-89. However, the onset is variable and Dr. Feinberg has even seen two or three patients “without pain,” only spontaneous weakness and loss of function. Tr. 114, 488-89. Additionally, the leading author on this condition, Nens van Alfen, M.D., Ph.D.,³⁶ has recognized that certain patients can have “identical symptoms and a disease course that does not have pain at the onset.” Pet. Ex. 35 at 2. Dr. Chaudhry agreed that “pain can have various manifestations.” Tr. 489-90.

In describing the loss of function associated with injury to the anterior interosseous nerve, Dr. Feinberg focused on the FPL muscle, for which there is not a “classic” description in the literature. Tr. 89. Dr. Feinberg testified that it is common for a patient with a compromised FPL muscle to describe getting his or her thumb “getting caught” upon reaching into a pocket. Tr. 89. Dr. Feinberg has also treated two or three surgeons and a dentist (other than the petitioner) who described not being able to hold instruments. Tr. 64. Dr. Feinberg recognized that the loss of thumb function alone “really is problematic even though it’s just one thing.” *Id.* Similarly in this case, on October 2, 2013, petitioner suddenly experienced severe “cramping” pain in his right hand, particularly in his thumb and index finger, which made it significantly difficult to perform dental procedures. *See* Pet. Ex. 29 at 1, 12, 15, 18. As two of petitioner’s professional colleagues explained: “Our work is so dependent on coordination and physical ability to control our hands and fingers for delicate movements.” Pet. Ex. 29 at 8.

Dr. Chaudhry objected that anterior interosseous nerve weakness would impact finger flexion, not extension, Tr. 486-87, but Dr. Feinberg explained that the acute pain “triggered a spasm in these muscles so they tightened up.” Tr. 488-89.

Dr. Feinberg opined that over time, the pain gives way to weakness, which makes the diagnosis of these injuries challenging and often missed. Tr. 489. Here, petitioner recalled a “progressive inability to flex the right thumb and loss of grasp.” Pet. Ex. 29 at 1. His medical assistant recalled that he “dropped dental handpieces and other equipment more frequently.” *Id.* at 15. His wife recalled that his hand became weaker over time. *Id.* at 18-19. Additionally in the medical records, on December 10, 2013, the primary care provider observed that petitioner “can’t flex R thumb at dip, thumb/ 2nd finger grasp is weakened.” Pet. Ex. 1 at 10. On December 12, 2013, the orthopedist Dr. Hadley observed that he had “4/5 pincer grasp on right and left” and “right wrist flexion 4/5.” Pet. Ex. 6 at 1. On February 12, 2014, petitioner remained “unable to curl his right index finger (flex distal interphalangeal joint) and... to do movements with thumb and index finger that are required of him in his job.” *Id.* at 5. In February 2014, the local neurologist Dr. Schneider recorded petitioner’s complaints including “right hand weakness and incoordination.” Pet. Ex. 27 at 7. Of course, Dr. Schneider did not suspect injury to the anterior interosseous nerve and he did not test the relevant muscles on EMG. *Id.* at 18-20.

Finally in May 2014, petitioner reported right thumb and index finger weakness to the orthopedic surgeon Dr. Kardashian, who observed “0/5 strength of FPL R side [e.g., the thumb] and 4/5 strength of DIP flexion R IF [index finger], and then diagnosed petitioner with “R AIN

³⁶ *See* Van Alfen et al., *Invited Review: Neuralgic Amyotrophy: An Update on Diagnosis, Pathophysiology, and Treatment*, 53 *Muscle and Nerve* 337 (2016) [Pet. Ex. 35, also filed as Resp. Ex. A-3].

[anterior interosseous nerve] syndrome.” Pet. Ex. 6 at 2. Dr. Chaudhry had several critiques of this evaluation. First, he opined that the observation of “0/5 strength of FPL” but “4/5 strength of DIP flexion” was a “big disconnect”: “You can’t have an anterior interosseous nerve injury causing zero strength and not being able to flex... and then also have a relatively normal strength in the other muscle that’s noted by the same distribution.” Tr. 317. I later asked both experts whether the degree of injury be variable within a nerve. Tr. 420-21. Dr. Feinberg agreed that you can get “involvement of certain fascicles” but it is hard to prove without a biopsy of the nerve. Tr. 421. Dr. Chaudhry did not rebut this point and I find that Dr. Feinberg provided a credible explanation for this “disconnect.” Separately, Dr. Chaudhry suggested at least twice that Dr. Kardashian was somehow “biased” in his evaluation of petitioner, *see* Tr. 317, 326. I find no evidence in the record for this assertion.

In November 2015, petitioner reported symptoms consistent with right sided PQ, FPL, and FDP dysfunction to Dr. Feinberg. *See* Pet. Ex. 14 at 1; Pet. Ex. 15 at 1. Dr. Feinberg did not record his physical exam findings about the FPL and PQ muscles. Pet. Ex. 15 at 1.³⁷ However, he tested those muscles on EMG. He testified that he would not have tested these muscles if they were not weak. Tr. 63.

Dr. Feinberg included the third anterior interosseous nerve-supplied muscle, the FDP, in a list of numerous right arm muscles that had normal strength. Pet. Ex. 15 at 1. He did not test the FDP on EMG. *Id.* at 3. He testified that anterior interosseous nerve injury can be diagnosed based on involvement of only two muscles. Tr. 90. The FPL and PQ muscles are anatomically easier to identify. Tr. 91. In comparison, it is difficult to identify the FDP muscle especially if it is atrophic. Tr. 91. Therefore, Dr. Feinberg determined that it was not necessary to check petitioner’s FDP muscle. Dr. Feinberg also testified that in the event that petitioner *did not* lose index finger function, that would not be uncommon. Tr. 406. The most common muscles to be impacted are the FPL (which controls the thumb) and the PQ (which controls wrist rotation). *Id.* Dr. Feinberg has seen many cases of anterior interosseous nerve injury where the FDP is completely normal. *Id.*

With regard to the significance of the EMG findings, it is important to understand that an EMG measures the electrical activity of muscles during rest, slight contraction, and forceful contraction. Abnormal findings can be indicative of nerve injury.³⁸ Here, the local neurologist did not examine the anterior interosseous nerve-supplied muscles, but Dr. Feinberg did and he found evidence of chronic partially recovered nerve damage – specifically a 1+ fibrillation potential (which he characterized as “mild abnormal spontaneous activity”) and a “discrete” recruitment pattern. Pet. Ex. 15 at 3.

³⁷ While cross-examining Dr. Feinberg, respondent’s counsel stated: “And for FPL weakness. I see five out of five strength noted.” Tr. 141. This is incorrect. *See* Pet. Ex. 15 at 1.

³⁸ *See* Johns Hopkins Medicine, *Treatment, Tests, and Therapies: Electromyography (EMG)*, available at <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/electromyography-emg> (last accessed July 9, 2021).

Fibrillations represent abnormal electrical activity while the muscle is at rest. Tr. 270-71; *see also* Johns Hopkins website *infra* note 38. Dr. Chaudhry opined that a 1+ fibrillation potential is not “severe” because the spectrum is from 1+ up to 4+. Resp. Ex. E at 4; Tr. 307-08. However, Dr. Feinberg did not suggest that this finding was severe, but rather, “chronic” and “partially recovered,” approximately two years into the course. Pet. Ex. 15 at 1-2.

Dr. Chaudhry also objected that fibrillations do not persist for more than two months. Tr. 271. However, he submitted a table which summarizes the typical evolution of needle EMG findings following an acute nerve injury. Hearing Ex. 6 at 1. The table provides that six months or more into the course, the EMG findings will be “normal (*fibrillations if incomplete reinnervation*).” *Id.* (emphasis added). This is consistent with Dr. Feinberg’s explanation that these nerve injuries *generally* have a good prognosis but that in some cases, there is incomplete reinnervation, which has spurred ongoing research into how the prognosis may be predicted and whether particular treatments can improve recovery. *See, e.g.*, Pet. Ex. 30 at 3. Dr. Feinberg also opined that the anterior interosseous and the long thoracic nerves, both seen in this case, tend to take the longest to recover. Tr. 37-38.³⁹

The “recruitment pattern” is a measure of the motor units (which represent individual axons) that are fired to recruit muscle fibers, when the patient is told to contract a specific muscle. Tr. 55-56, Tr. 271-73. Here, Dr. Chaudhry questioned Dr. Feinberg’s notation of a “discrete” recruitment pattern, saying: “We don’t use the word discrete in our world, in EMG.” Tr. 271; *see also id.* at 327, 378. Dr. Feinberg disagreed, saying that he has been using this terminology in his clinical practice and publications, including in the preeminent journal *Muscle and Nerve*, for twenty-eight (28) years. Tr. 393.⁴⁰ Dr. Feinberg explained that normally at maximal muscle contraction, the EMG visualizes so many motor units that they overlap and flood the image: this is a “full” recruitment pattern. Tr. 413. “One degree lower,” where there are fewer motor units, but they still cannot be individually distinguished, is termed a “decreased” recruitment pattern. Tr. 413. Lower still, where there is such significant dropout that the EMG can visualize individual motor units, is termed a “discrete” recruitment pattern. Tr. 413. Dr. Feinberg explained that a discrete recruitment pattern results after a muscle has been denervated for a prolonged period of time. Tr. 55. The muscle degenerates and the axons “drop out.” *Id.* at 55-56. At this point, there is little potential for recovery. *Id.* at 56. Dr. Feinberg has published an article “discriminating between discrete and decreased recruitment... as a determining factor” regarding the feasibility of nerve transfers. Tr. 393.

³⁹ Dr. Feinberg elaborated, in a peer-reviewed article: “The rate of axonal regeneration is classically described as occurring at a rate of 1-4 mm/ day. So reinnervation of the supraspinatus... will more commonly occur earlier than reinnervation following a long thoracic neuropathy or anterior interosseous neuropathy due to the length-dependent recovery of those conditions.” Feinberg (2010) [Pet. Ex. 33] at 4.

⁴⁰ Dr. Feinberg/s articles that were filed in this case do not refer to a “discrete” recruitment pattern. However, the board specializing in EMGs, to which both Drs. Feinberg and Chaudhry belong, seems to recognize this terminology. *See American Association of Neuromuscular Medicine & Electrodiagnostic Medicine, AANEM Glossary of Terms in Neuromuscular and Electrodiagnostic Medicine* (3rd ed. 2015) at 11, 17, 23, 49, available at <https://www.aanem.org/Practice/Glossary-of-Terms> (last accessed April 20, 2021).

Dr. Chaudhry also opined that an abnormal recruitment pattern should be associated with abnormal velocity, amplitude, and duration. Tr. 307-08, 378. However, Dr. Feinberg anticipated this question and expressly disagreed. He opined that in his clinical experience, this kind of “long-term degeneration” will have a discrete recruitment pattern, but not the other abnormal EMG findings. Tr. 57-58; 393-95; 407-16.

Dr. Chaudhry agreed that he and Dr. Feinberg hold the same board certification in electrodiagnostic medicine, there was no indication that Dr. Feinberg had performed petitioner’s EMG incorrectly, and they were debating “interpretation” and “semantics.” Tr. 380. Dr. Chaudhry also testified that he sometimes disagrees with his professional colleagues at Johns Hopkins about EMG interpretation. Tr. 380-81. While both experts are qualified in conducting and interpreting EMGs, I find that Dr. Feinberg’s explanation of the specific EMG findings associated with chronic, partially recovered neuropathies of this nature, in which he specializes, was persuasive and in fact consistent with the exhibit submitted by Dr. Chaudhry.

2. Long Thoracic Nerve Injury

The C5, C6, and C7 nerve roots supply fascicles to the long thoracic nerve. Resp. Ex. I at 9. The long thoracic nerve innervates the serratus anterior (“SA”) muscle which spans the upper eight or nine ribs underneath the arm and controls movement of the scapula. Tr. 66-68; Pet. Ex. 49 at 1. Injury to the long thoracic nerve will generally cause pain followed by loss of function. Tr. 480-81.

Dr. Feinberg did not focus on the onset of each injury in his expert reports. He testified that the November 22, 2013, emergency room visit for right-sided chest pain was consistent with the typical onset of long thoracic nerve injury. Tr. 98-99.⁴¹ But as noted above, Dr. Feinberg also testified that the degree of pain is variable and he has seen patients without any pain, just weakness and loss of function. Tr. 114, 488-89.⁴² Here, the affidavits provide less detail about

⁴¹ Dr. Feinberg allowed for the potential that October 2, 2013, represented the onset of anterior interosseous nerve injury and that November 22, 2013 represented the onset of long thoracic nerve injury. He testified: “there’s a certain percentage [of patients with Parsonage-Turner syndrome who will have more than one nerve, and a lot of times they may not occur at the same time. And I’ve had a number of other patients who developed a super [sic, supra?] -scapular neuropathy... and then a little later developed another one.” Tr. 198-99. Dr. Chaudhry also opined that: “There are two acute onsets, one on October 2, one on November 22.” Tr. 363. Dr. Chaudhry also agreed (while discussing the potential for recovery) that Parsonage-Turner syndrome can have “multiple episodes.” Tr. 368. Van Alfen supported this proposition in a 2016 review:

Recurrent episodes occur in a significant proportion of patients, with at least 25% of idiopathic cases and 75% of hereditary cases having a second episode during the first years after their initial attack. In our clinical practice, over the last 20 years, we found that recurrences occur even more often, and they seem to be a common feature of the disorder. Recurrences may involve the same extremity or manifest in a totally different pattern or limb. Currently, there is no way to predict or prevent recurrence.

Van Alfen (2016) [Pet. Ex. 35] at 3.

⁴² See also Feinberg (2010) [Pet. Ex. 33] at 2 (“some of the classical symptoms, including the incapacitating pain of 1-2 week duration, may not always be present”); Devathasan & Tong, *Neuralgic Amyotrophy: Criteria for Diagnosis and a Clinical with Electromyographic Study of 21 Cases*, 10 Aust. N.Z. J. Med. 188 (1980) [Resp. Ex.

the long thoracic nerve injury. However, petitioner described that “on or about October 2, 2013, I began having severe right hand *and* right arm muscle pain that was immediately noticeable.” Pet. Ex. 29 at 1 (emphasis added).

Dr. Feinberg explained that long thoracic nerve injury leads to SA muscle weakness. He explained that when the deltoid and rotator cuff abduct the arm, the SA muscle normally rotates the scapula and provides stability. But when the SA muscle is weakened, the trapezius and rhomboid muscles contract and the scapula pops out in the opposite direction than it should; this is termed scapular winging. Tr. 69. Dr. Feinberg opined that the unaffected deltoid and rotator cuff are still able to abduct the arm to at least ninety (90) degrees, but the scapular winging causes reduced stability and easier fatigue. Tr. 401-02, 423-27; Pet. Ex. 50 at 2. He added that over time, the winging will diminish somewhat as the patient finds ways to compensate. Tr. 66.⁴³ There will not be observable atrophy. Tr. 137.

Here, petitioner’s wife recalled that he had trouble steering the lawnmower and asked her to take on some of the mowing. Pet. Ex. 29 at 18. In December 2013, he was observed to have decreased 4/5 strength on right shoulder abduction. Pet. Ex. 6 at 1. He also reported “progressive muscle weakness” in his right arm. Pet. Ex. 13 at 33-34.

Dr. Feinberg suggested that the local providers did not document a long thoracic nerve injury because they did not look for one. Tr. 53, 70-71, 138-39, 151-52. He explained that to detect scapular winging, the physician needs to examine the patient’s shirtless back, which “a large percentage of physicians” do not do. Tr. 139. Dr. Feinberg was not confident that even the local neurologist Dr. Schneider would have examined petitioner properly for scapular winging upon conducting the EMG. *Id.* Dr. Feinberg testified that a thorough EMG study can be conducted without the patient taking off his shirt. *Id.* Dr. Chaudhry testified that you would “have to pull the collar all the way down” to reach the paraspinal muscles especially at T1, which was “right where the scapula is.” Tr. 311-12. Petitioner did not recall Dr. Schneider’s procedure in conducting the EMG. Tr. 462. He said that the orthopedists “probably” asked him to take his shirt off, but then again, they saw him during the holiday season as a favor for “a little bit of a cursory social examination and then refer me on to the next guy.” Tr. 461-62. Petitioner, who was a dentist himself, noted that he was friends with many of the local physicians. *Id.*

Dr. Chaudhry also opined that scapular winging would be observable when the patient is lying on his or her side. Tr. 312. However, both experts’ representative images of scapular winging depict patients standing, facing away from the camera, and extending their arms. *See* Hearing Ex. 4 (Dr. Feinberg); Hearing Ex. 5 (Dr. Chaudhry).

A-1] at 1, 2, 4 (recognizing that the “atypical manifestation” can lack pain and feature only “a lone serratus anterior weakness presenting a winging of the scapula or difficulty in lifting up the arm over the head”).

⁴³ “[M]ost patients with serratus anterior weakness will move the affected shoulder in a compensatory pattern that (over-)uses the levator scapulae, trapezius, pectorals, and to a lesser extent rhomboid muscles...” Van Alfen (2016) [Pet. Ex. 35] at 5-6. “If patients are first seen in the post-acute phase and the onset history was painless, unclear, or not explicitly explored, their symptoms will have changed and will show mainly pain in the shoulder or arm area that increases during the day and with activities...” *Id.* at 7.

In contrast to the local providers, in November 2015, Dr. Feinberg observed that petitioner had right-sided mild scapular winging. Pet. Ex. 15 at 1.⁴⁴ Dr. Chaudhry objected that “significant” scapular winging would prevent active and passive shoulder range of motion beyond 90 degrees. Tr. 303-04; *see also id.* at 325, 379; Resp. Ex. J at 6. But Dr. Feinberg explained, as noted above, that scapular winging does not necessarily prevent shoulder abduction and petitioner’s winging was only “mild.”

After observing petitioner’s scapular winging, Dr. Feinberg found that the SA muscle had no fibrillations, but the same “discrete” recruitment pattern. Pet. Ex. 15 at 2. Dr. Chaudhry opined that if he understood Dr. Feinberg correctly, a discrete recruitment pattern should mean a “very severe injury” resulting in more than “mild” scapular winging and “more restricted” range of motion. Tr. 428. Dr. Chaudhry based his opinion on seeing patients who are recommended for surgery and “textbook anatomical description[s],” but allowed that it “may be functionally Dr. Feinberg is more experienced on [scapular winging].” Tr. 482. However, Dr. Feinberg actually said that after the acute phase of an long thoracic nerve injury, the patient will have ongoing weakness in the serratus anterior muscle but the patient can build up other muscles to compensate somewhat. Tr. 429. Dr. Feinberg testified that this illustrated why he became a physiatrist: he “love[s] the ability of patients conservatively doing rehabilitation to compensate because the body can do a lot.” Tr. 429.

3. Brachial Neuritis

Dr. Feinberg opined that the distribution seen in petitioner’s case, involving the anterior interosseous and long thoracic nerves, was “typical” for brachial neuritis. Pet. Ex. 30 at 2. Dr. Chaudhry objected that that brachial neuritis can involve either one of these nerves, but they are anatomically separate with “nothing in common in between.” Dr. Chaudhry opined that involvement of both these nerves would be “a very unusual situation.” Tr. 384. Dr. Feinberg disagreed and opined that brachial neuritis can feature various combinations of nerves that are “scattered.” Tr. 191.⁴⁵

Dr. Feinberg opined, given the discrete recruitment pattern on EMG two years after the accepted onset of symptoms, that petitioner had an incomplete recovery from his brachial neuritis and he was unlikely to see a major improvement in the future. *See, e.g.*, Pet. Ex. 30 at 2. Petitioner would continue to have decreased function in his right shoulder as well as the right thumb and index finger, which represents “a significant disability for a surgeon.” *Id.* He recommended continued home exercises. Pet. Ex. 37 at 2. He noted research involving MRIs and possible surgical nerve decompression, as well as the consideration of muscle transfers if function does not improve. *Id.*

⁴⁴ Dr. Feinberg also recorded that petitioner had “dyskinesia on the right.” Pet. Ex. 15 at 1. Dr. Feinberg explained that “dyskinesia” is a similar term describing “abnormal motion of the scapula, so as he elevates his arm the scapula is not moving normally.” Tr. 135.

⁴⁵ Dr. Feinberg elaborated in a peer-reviewed article: “The unique feature here is that the nerves involved... vary in the originating root level or brachial plexus trunk or cord distribution. Furthermore, there may be other nerves, which do have the same root level or plexus innervation pattern as the nerve involved but are completely normal.” Feinberg (2010) [Pet. Ex. 33] at 3.

B. Dr. Chaudhry's Opinion

Dr. Chaudhry opined that to the extent that petitioner had anterior interosseous and long thoracic nerve damage, those were mild. Tr. 309-10. He opined that many of the predominant symptoms described beginning in the fall of 2013 could be explained by worsening cervical radiculopathy and the new onset of carpal tunnel syndrome.

1. Cervical Radiculopathy

Dr. Chaudhry first discussed that petitioner had chronic neck pain for which he was prescribed Tramadol in 2011. Resp. Ex. A at 1-2. However, this pain was localized in petitioner's neck and did not extend to his shoulders, arms, or chest. *See generally* Pet. Ex. 1 at 14-30. The MRIs showed that interspace C3-4, which had "moderate" findings in 2009 and "severe left and moderate right chronic foraminal narrowing" in December 2013. Pet. Ex. 27 at 26-28. Interspace C3-4 corresponds to nerve root C4, which manifests only in sensory loss in a cape distribution (across the shoulders) and pain in the lower neck and trapezius muscle. Resp. Ex. H at 3. These findings do not explain petitioner's post-vaccine right hand and arm injuries.

More relevant, cervical radiculopathy ("CR") at interspace C4-5, corresponding to nerve root C5, can compromise sensation in the lateral arm; motor function in the deltoid elbow, and biceps reflex; and pain in the lateral arm, neck, and shoulder. Resp. Ex. H at 3.

Interspace C5-6, corresponding to nerve root C6, can compromise sensation in the lateral forearm and thumb; motor function in the biceps and wrist extension; reflex of the brachioradialis; and pain in the dorsolateral arm, neck, and thumb. *Id.*

Interspace C6-7, corresponding to nerve root C7, manifests in losses of sensation in the dorsal forearm and index finger; motor function in the triceps and wrist flexion; triceps reflexes; and pain in the dorsolateral forearm, middle finger, and neck. *Id.*

Interspaces C7-8 and C8-T1, corresponding to nerve roots C8 and T1, can compromise sensation in the median and ulnar forearm; loss of motor function in the finger flexors and intrinsic; and pain in the neck, medial forearm, and ulnar forearm. *Id.*

Despite my findings of fact, when asked directly about what occurred on October 2, 2013, Dr. Chaudhry testified: "Nobody saw [petitioner] so it's hard to know because there was no examination... *the physicians, not the affidavit[s] now.* All the physicians who have evaluated [petitioner since November 22nd have noted onset of symptoms on November 22nd." Tr. 357 (emphasis added). Dr. Chaudhry also disputed that petitioner experienced the onset of any new symptoms specifically on October 2, 2013: "I don't know... which affidavit you are referring to. There were dates mentioned... around his birthday, which was the 10th, I thought the 2nd, and then other people said fall... so I am not sure what you call sudden." *Id.* at 358-59.

Dr. Chaudhry also suggested that the October 2, 2013 onset included numbness and tingling, *see* Resp. Ex. A at 11; Tr. 331, based on the daughter's recollection of petitioner's symptoms "sometime in the fall" and a patient's recollection of "late in 2013," Pet. Ex. 29 at 19,

13. However, these are outweighed by the recollections of petitioner, his wife, and his two medical assistants, who did not describe the October 2, 2013 onset as involving numbness or tingling, only aching pain. Pet. Ex. 29 at 12, 15, 18. Dr. Chaudhry also relies on a May 2014 medical record which provides that petitioner developed numbness and tingling “around the same time” as the thumb and index finger weakness, *see* Pet. Ex. 26 at 1. However, the earlier medical records support that the numbness and tingling began shortly before the November 22, 2013 emergency encounter. *See, e.g.*, Pet. Ex. 19 at 10; Pet. Ex. 6 at 1.

Dr. Chaudhry also interpreted that petitioner’s symptoms beginning on October 2, 2013, were “intermittent,” *see* Resp. Ex. A at 11; Tr. 331-32, 359, 365, which would also support cervical radiculopathy and/or carpal tunnel syndrome (discussed further below). The affidavits and petitioner’s testimony actually support that the aching pain in his hand and shoulder were persistent for weeks leading up to the emergency encounter. *See generally* Pet. Ex. 19; Tr. 435, 444.

Dr. Chaudhry opined that on November 22, 2013, in the middle of the night, when petitioner presented to the emergency room for right-sided chest pain, he was experiencing an acute episode of “cervical angina” caused by his cervical radiculopathy (without specifying particular nerve roots). Tr. 283-84, 289-90. The fact that the pain was right-sided made cervical angina more likely than an acute cardiac event. Tr. 286. This is consistent with the treating physicians’ assessments. *See generally* Pet. Ex. 19; Pet. Ex. 13 at 35.

Dr. Chaudhry noted that the medical records describe that petitioner developed right extremity numbness “around the same time” as the hospitalization. Tr. 291. He stressed that numbness is not a feature of either anterior interosseous or long thoracic nerve injury, and that numbness is better explained by cervical radiculopathy and/or carpal tunnel syndrome (discussed separately below). *Id.*

Dr. Chaudhry opined that the orthopedist Dr. Hadley’s December 6, 2013, record of numbness and weakness in the hands, diminished strength in right wrist flexion and elbow extension, and absent triceps reflexes were all consistent with C7 radiculopathy. Tr. 277, citing Pet. Ex. 6 at 1. Petitioner also “show[ed] a position of his neck which reproduces a Spurling’s test and states this is the position that increases finger numbness, specifically his middle finger on the right side.” Pet. Ex. 6 at 1. Dr. Chaudhry said that a Spurling’s test is a “telltale sign” for C7 radiculopathy. Tr. 276-78.⁴⁶ However, Dr. Chaudhry skipped over that when Dr. Hadley actually performed the physical exam, petitioner had “a negative Spurling’s.” Pet. Ex. 6 at 1.⁴⁷

Dr. Chaudhry testified that at a December 13, 2013 follow-up appointment with Dr. Hadley, petitioner had the same diminished right-sided wrist flexion and extension and that “he had some traction which improved his symptoms.” Tr. 278. Dr. Chaudhry’s testimony implied that the traction improved the right arm and hand symptoms. However, Dr. Chaudhry then

⁴⁶ Tong et al., *The Spurling Test and Cervical Radiculopathy*, 27 Spine 156 (2002) [Resp. Ex. A-4].

⁴⁷ Additionally, when Dr. Feinberg evaluated petitioner for multiple conditions including cervical radiculopathy, he recorded that a Spurling’s test was negative. Pet. Ex. 15 at 1.

explained that manual traction stabilizes the neck. Tr. 278-80. The record does not state that this traction helped petitioner's right arm and hand symptoms, and Dr. Chaudhry did not explain why it would. Pet. Ex. 6 at 3-4.

Dr. Chaudhry discussed that on December 19, 2013, the orthopedist Dr. Davidson, observed that petitioner had decreased sensation in the right radial forearm, thumb, and index finger; absent triceps reflex; and a positive Spurling's test. Tr. 281-83, citing Pet. Ex. 21 at 1-3.

Dr. Chaudhry noted that petitioner completed three Medrol dose packs and received a cervical epidural steroid injection at approximately the C6-7 interspace (where he had moderate cervical stenosis), for treatment of CR. Pet. Ex. 21 at 3; Pet. Ex. 24. However, the steroids did not alleviate his symptoms. Dr. Chaudhry opined that steroids are used to reduce inflammation, but they do not resolve nerve compression. Tr. 280. Also, an epidural injection's effectiveness depends on proper placement. Tr. 386. Dr. Chaudhry also suggested that steroids are also used to treat brachial neuritis, so petitioner's lack of improvement "doesn't help you either way." Tr. 386; *see also* Tr. 280. Dr. Feinberg agreed that "some physicians" give steroids to patients with brachial neuritis, but many patients do not get significant relief. Tr. 207. He would expect steroids to be more effective in providing at least temporary relief from cervical radiculopathy pain. *Id.* Consistent with his testimony, Dr. Feinberg wrote in a peer-reviewed article: "In cases where imaging studies demonstrate cervical spinal pathology that is suggestive of nerve root-level compression, a cervical epidural may be helpful to distinguish between pain due to cervical radiculopathy and [brachial neuritis]." Feinberg (2016) [Pet. Ex. 33] at 3. This tends to support that petitioner's continued pain in December 2013, despite steroids, was at least not solely due to cervical radiculopathy.

Dr. Chaudhry also noted the neurologist Dr. Sinoff's observations on February 6, 2014, of weakness in the biceps and triceps; numbness in the right dorsal forearm; and decreased sensation to pinprick on digits 1, 2, 3, and the inside of 4 (bilaterally, with a subjective decrease of 40% on the right and 20% on the left) as being not explained by anterior interosseous or long thoracic nerve injury, but rather cervical radiculopathy. Tr. 291-92, citing Pet. Ex. 25 at 1-4.

Later in February 2014, the second neurologist, Dr. Schneider, found similar evidence for CR. Pet. Ex. 27 at 7-11. His EMG found increased duration in the right biceps corresponding to C5-6. *Id.* at 19. The same increased duration as well as increased amplitude, a reduced recruitment pattern, and 4+ fibrillations were found in the right pronator teres muscle, corresponding to C6-7, as well as the right triceps muscle, corresponding to C6-7-8. *Id.* Dr. Schneider's assessment was right-sided acute and chronic C6-7 radiculopathy. Pet. Ex. 27 at 19, *see also id.* at 1-4. Dr. Chaudhry agreed, opining that the pronator teres and triceps muscles had only the C7 nerve root in common. Tr. 262. Dr. Chaudhry also testified that the increased amplitude and duration supported both acute and chronic damage. Tr. 298-99. Dr. Feinberg noted that on the same EMG, the right paraspinal muscles from C6 – T1 were completely normal, which he opined was atypical for cervical radiculopathy. Tr. 76-77. Dr. Chaudhry disagreed, opining that cervical radiculopathy manifests first in the paraspinal muscles and later in the neck and arm. Tr. 313. Dr. Chaudhry added that the paraspinal muscles – which are "a finger or two away from the midline" of the spine and overlap with one another – are uncomfortable to evaluate. Tr. 313-14.

Dr. Chaudhry suggested that the orthopedist Dr. Kardashian's diagnosis of anterior interosseous nerve injury was undercut because he did not seem to review the MRIs. Tr. 319. However, Dr. Kardashian reviewed the EMG, wrote that petitioner had confirmed neck pain and CR, and recommended seeing a spine surgeon for what he apparently viewed to be a separate issue. Pet. Ex. 26 at 3.

Dr. Chaudhry noted that even Dr. Feinberg recorded "numbness and tingling" and observed "C6-7 on the right" reduced sensation to pinprick. Tr. 303-06, 310, discussing Pet. Ex. 15 at 1-3. Indeed, Dr. Feinberg noted the earlier EMG evidencing C6-7 radiculopathy and he "evaluate[d] for... cervical radiculopathy" on EMG, but he found that multiple muscles supplied by C5-6, C6-7, and C7-8 were entirely normal. Pet. Ex. 15 at 2-3.

Dr. Chaudhry discussed the "possibility" that pathology at the C5, C6, and C7 nerve roots caused petitioner's "mild" long thoracic nerve damage and scapular winging. Tr. 314. However, he opined that would be "unusual" because other muscles supplied by the same nerve roots, specifically the deltoid and suprascapular muscles, were tested and found to be normal. *Id.*

Here, Dr. Chaudhry accepted the local radiologist's interpretation that the December 2013 MRI showed "severe (critical) narrowing of the foramina and this was worse than findings in the past." Resp. Ex. A at 9; *see also* Resp. Ex. C at 1-2. But respondent retained his Johns Hopkins colleague, the radiologist Dr. Yousem⁴⁸ to actually review the MRI images. Dr. Yousem opined that the findings were "mild" to "moderate," and that the "greatest degree of foraminal narrowing, which is moderate in severity, is on the left side at C3-4 and on the right side at C5-6." Resp. Ex. F at 1. Dr. Yousem also *disagreed* with the local radiologist's opinion that C5-6 had progressed; he opined that all levels except for C3-4 were "stable." *Id.* Petitioner's expert radiologist Dr. Sneag⁴⁹ tended to agree or suggest that the MRI findings were

⁴⁸ Dr. Yousem is licensed to practice medicine and board-certified in neuroradiology. Resp. Ex. G at 20. He obtained a bachelor's degree in 1980 and his medical degree in 1983, both from the University of Michigan. *Id.* at 1. After completing an internship in internal medicine at Union Memorial Hospital, in 1984, Dr. Yousem joined Johns Hopkins University as a resident in diagnostic radiology, after which he became a fellow in the neurology section. He moved to the University of Pennsylvania for a fellowship in neuroradiology from 1988 - 1990. *Id.* Afterwards, he returned to Johns Hopkins, where in 1998 he became the director of neuroradiology. *Id.* He also teaches at the medical school, where he has been a full professor since 2004. *Id.* His curriculum vitae lists considerable research, peer-reviewed publications, and editorial activities including serving as a reviewer in head and neck radiology for the journal *Radiology*. *Id.* at 1-24. While Dr. Yousem did not testify at the hearing, he would have been readily accepted as an expert in the subject of neuroradiology, including MRI interpretation and cervical radiculopathy.

⁴⁹ Petitioner did not file Dr. Sneag's formal curriculum vitae ("CV") but did file his HSS physician profile. *See* Pet. Ex. 46 at 43-46. He is licensed to practice medicine and board-certified in radiology and electrodiagnostic medicine. *Id.* at 45. After obtaining a bachelor's degree from Brown University, he enrolled at Albert Einstein College of Medicine. *Id.* at 43. During medical school, he served as an MRI research assistant at HSS. *Id.* After obtaining his medical degree, he completed a residency at Brigham and Women's Hospital and then returned to HSS as a musculoskeletal MRI fellow, where he received the fellowship research award. *Id.* He is now an assistant attending radiologist and director of peripheral nerve MRIs at HSS, as well as an assistant professor of radiology at Weill Cornell Medical College. *Id.* Dr. Sneag's faculty profile lists his areas of special expertise as peripheral nerve MRI, spine MRI, and sports medicine. *Id.* at 44. He works closely with physicians at the HSS Center for Brachial Plexus and Traumatic Nerve Injury – which would necessarily include the director, Dr. Feinberg – to help guide operative and non-operative management. *Id.*

even less significant. Pet. Ex. 47 at 1. Afterwards, Dr. Chaudhry acknowledged the “different interpretations from the Johns Hopkins radiologist [Dr. Yousem] and the petitioner’s radiologist,” but he preferred to rely on the “independent radiologist at the institution that the doctors were working at, and... there’s some very significant changes at the level of C6, C7.” Tr. 300-01. However, there is no evidence that the local radiologist ever reviewed the medical records or examined petitioner, or that he is more qualified than the two expert radiologists retained in this case. The expert radiologists also reviewed the images and *agreed* that all levels except for C3-4 were stable from January 2009 to December 2013. I accept their agreement and find that it is significant in understanding petitioner’s clinical picture.

I also asked Dr. Chaudhry why petitioner would experience “the sudden onset of this severe pain when he’s had prolonged cervical radiculopathy?” Tr. 287. Dr. Chaudhry answered that it was “possible that it was at the critical level and then one day it becomes severe. And that’s not uncommon that you’re always going around, you know, it reaches a threshold at one stage and it gets worse. Classically that’s due to a disk disease...this was not a disk, this was a narrowing of the foramen and it was critical. It was low enough. And *whether a certain position* or just with – happened one day, is difficult to know.” Tr. 287-88 (emphasis added). This is intriguing in light of the medical records reflecting that petitioner had managed to work despite his cervical radiculopathy for several decades, the expert radiologists’ agreement that petitioner’s radiculopathy was generally stable from 2009 to 2013, and the affidavits describing the significant accommodations that petitioner had to make after the onset of the new hand and arm symptoms on October 2, 2013. As petitioner summarized at the end of the hearing: “All of the contortions and the accommodations that I had to make from October the 2nd to November the 22nd put me in pretty bad shape.” Tr. 437. This supports petitioner’s contention that the acute onset brachial neuritis forced him to make positional changes while working and to need additional assistance until he no longer could do dental surgeries. However, any resulting worsening of his cervical radiculopathy is not part of his compensable Table brachial neuritis injury.

It also bears repeating that neither Dr. Chaudhry nor any treating doctors identified cervical radiculopathy at the C8 and T1 nerve roots, which supply the anterior interosseous nerve-supplied muscles. Resp. Ex. I at 9; Tr. 301-02. Dr. Feinberg emphasized that these levels were “completely normal.” Tr. 101-02.

2. Carpal Tunnel Syndrome

Dr. Chaudhry adopted the neurologist Dr. Schneider’s characterization that petitioner had a “double crush syndrome.” Pet. Ex. 27 at 10. Dr. Chaudhry explained that the two “crushes” can be on different nerves. Tr. 225. Here, the two crushes would be cervical radiculopathy and carpal tunnel syndrome, affecting different nerves.

Carpal tunnel syndrome describes compression of the C8-supplied median nerve as it travels through the carpal tunnel, where the hand connects to the wrist. Tr. 245. It is called a tunnel because it is surrounded by bones, the transverse carpal ligament, and several tendons. *Id.* Too much crowding can result in compression on the nerve. *Id.* at 245-46; *see also* Tr. 92-95 (Dr. Feinberg’s agreement on the etiology). The experts agreed that carpal tunnel syndrome

causes numbness, tingling, and decreased sensation in the first three fingers. Tr. 28-29, 247. Only advanced carpal tunnel syndrome causes weakness. *Id.* at 28-29, 399.

As noted above, Dr. Chaudhry believed that on October 2, 2013, petitioner's new symptoms were intermittent "numbness and tingling" in the hands, which he believed was most consistent with carpal tunnel syndrome. Tr. 331; *see also id.* at 316-17, 359, 365-66, 376. However, I do not see evidence for this characterization and instead find that the onset of numbness and tingling was around the time of the November 22, 2013 emergency encounter.

Dr. Chaudhry mentioned that a positive Tinel sign⁵⁰ can indicate early, but not late stage carpal tunnel syndrome. Tr. 258. Only a few medical records include this test. In December 2013, Dr. Davidson recorded that the Tinel's sign was negative. Pet. Ex. 21 at 2. In February 2014, Dr. Hadley recorded that it was "equivocal." Pet. Ex. 6 at 7. Both records note that the Phalen's test⁵¹ for carpal tunnel syndrome was also negative.

Dr. Chaudhry testified that the first electrodiagnostic sign of carpal tunnel syndrome is delayed conduction in the median nerve from above the carpal tunnel to the fingers. Resp. Ex. I at 6; Tr. 256-57. The time is termed latency. Tr. at 257. The distance divided by time is velocity. *Id.* Longer latency, leading to lower velocity, is supportive of carpal tunnel syndrome. *Id.* Dr. Chaudhry testified that sensory fibers are more prone to damage. *Id.* at 259. The second sign of more progressive carpal tunnel syndrome is the loss of some nerve fibers, which is termed reduced amplitude on the NCV study. Tr. 257-59. The third sign of late stage carpal tunnel syndrome is median nerve denervation, which shows up as fibrillations, positive waves, and motor unit changes on EMG. Tr. 258.

On petitioner's April 2014 electrodiagnostic testing, the right median nerve's sensory fiber latency and velocity were slightly below average bilaterally. Ex. 27 at 19. The amplitude was normal on the left side but reduced on the right side. *Id.* The median nerve-supplied ABP muscle was normal on EMG. *Id.* at 20. On the November 2015 NCV study (conducted by Dr. Feinberg), the right-sided median sensory fibers still had longer latency, reduced velocity, and reduced amplitude. Pet. Ex. 15 at 2. The right-sided median motor fibers had longer latency, reduced velocity, and strangely *increased* amplitude (which the experts did not explain). *Id.* The ABP muscle was normal on EMG. *Id.* Dr. Chaudhry opined that these findings were "not as bad," but "still evidence of carpal tunnel, right greater than left." Tr. 307. This is in fact consistent with Dr. Feinberg's record upon completing the studies, back in November 2015, that petitioner had "superimposed" carpal tunnel syndrome which was "mild to moderate on the right side and mild on the left." Pet. Ex. 15 at 3.

⁵⁰ A Tinel sign is a "tingling sensation in the distal end of a limb when percussion is made over the site of a divided nerve." *Dorland's*.

⁵¹ In a Phalen test, the patient holds the affected hand with the wrist fully flexed or extended for 30 to 60 seconds or a cuff on the arm is inflated. The appearance of numbness and paresthesias indicates carpal tunnel syndrome. *Dorland's*.

After being retained as an expert, Dr. Feinberg maintained that petitioner's carpal tunnel syndrome was mild to moderate. It could cause some numbness, tingling, and loss of sensitivity. *See, e.g.*, Pet. Ex. 30 at 2; Pet. Ex. 37 at 1; Tr. 73, 95-97, 111. However, the right and left electrodiagnostic findings were not significantly different, and he was so significantly disabled on the right side. Tr. 158. Dr. Feinberg maintained that carpal tunnel syndrome would not have any effect on the anterior interosseous nerve and the related PQ muscle, downward rotation of the palm, the FPL muscle, flexion of the thumb, the FDP muscle, and flexion of the index finger. *See, e.g.*, Tr. 65, 95-96; Pet. Ex. 49 at 1; Pet. Ex. 50 at 1.

Dr. Chaudhry opined that another important sign of carpal tunnel syndrome was the finding of right-sided thenar atrophy beginning in February 2014. *See* Pet. Ex. 25 at 2; Pet. Ex. 27 at 10; Pet. Ex. 15 at 1. He explained that carpal tunnel syndrome directly causes the loss of motor function in the median nerve-supplied abductor pollicis brevis ("ABP") muscle, which is located in the thenar area of the palm and controls thumb abduction. This loss of function causes the thenar atrophy. Tr. 250-51; *see also* Resp. Ex. I at 5 (illustrations of the anatomy and appearance of atrophy).

Dr. Feinberg opined that petitioner's NCV findings were not significant enough to cause thenar atrophy. Tr. 184. He also noted that the ABP muscle did not have any signs of denervation on EMG. Therefore, that should not account for the thenar atrophy. Tr. 96, 184, 396, 396. His alternative explanation was that the anterior interosseous nerve-supplied FPL muscle, which was documented to have loss of function and abnormal EMG findings and is also located in the thenar palm, accounted for the atrophy. Tr. 96-97.

Based on the April 2014 NCV/ EMG results, Dr. Feinberg would have recommended a conservative trial of cortisone shots and splinting. Tr. 156-57. He suggested that the local treaters might not have recommended carpal tunnel release if they had realized that his loss of hand function was more from the AIN. *Id.* at 157. He works with a couple of surgeons who will not operate on carpal tunnel syndrome unless there is denervation. *Id.* at 397. He maintained that petitioner's disability and loss of function in his right hand arose not from mild carpal tunnel syndrome but from the injury to the anterior interosseous nerve.

Petitioner appears to have had mild carpal tunnel syndrome which generally involves compression of the medial nerve as it passes through the carpal tunnel in the wrist. Carpal tunnel syndrome does not involve injury to the anterior interosseous and the long thoracic nerves and it is not a component of brachial neuritis. I find Dr. Feinberg's explanation as to the source of motor dysfunction and pain arising from the nerves passing through the brachial plexus to be persuasive on this point.

VII. Table Brachial Neuritis Injury

A. Definition

If a petitioner establishes that he has suffered a Table injury, he is entitled to a presumption of causation. 42 U.S.C. § 300aa-14(a); 42 C.F.R. § 100.3(a). Here, it is undisputed that on September 20, 2013, petitioner received a Td vaccine, which contains tetanus toxoid.

Pet. Ex. 1 at 15. He must show that within 2-28 days after the vaccine, he suffered the onset of brachial neuritis as defined in the controlling Table and the accompanying Qualifications and Aids to Interpretation (the “QAI”). 42 C.F.R. § 100.3(b).⁵² The QAI at section 100.3(b)(7) provides:

- (i) [Brachial neuritis] is defined as dysfunction limited to the upper extremity nerve plexus (i.e., its trunk, divisions, or cords) without involvement of other peripheral (e.g., nerve roots or a single peripheral nerve) or central (e.g., spinal cord) nervous system structures. A deep, steady, often severe aching pain in the shoulder and upper arm usually heralds onset of the condition. The pain is followed in days or weeks by weakness and atrophy in upper extremity muscle groups. Sensory loss may accompany the motor deficits, but is generally a less notable clinical feature. The neuritis, or plexopathy, may be present on the same side as or the opposite side of the injection; it is sometimes bilateral, affecting both upper extremities.
- (ii) Weakness is required before the diagnosis is made. Motor, sensory, and reflex findings on physical examination and the results of nerve conduction and electromyographic studies must be consistent in confirming that the dysfunction is attributable to the brachial plexus. The condition should thereby be distinguishable from conditions that may give rise to dysfunction of the nerve roots (i.e., radiculopathies) and peripheral nerves (including multiple mononeuropathies), as well as other peripheral and central nervous system structures (e.g., cranial neuropathies and myelopathies).

42 C.F.R. § 100.3(b)(7).

B. Petitioner suffered the onset of brachial neuritis within 2-28 days after the Td vaccination.

Petitioner received the Td vaccination on September 20, 2013. Pet. Ex. 1 at 15. The QAI provides that “a deep, steady, often aching pain in the shoulder and upper arm usually heralds onset of” brachial neuritis.” 42 C.F.R. § 100.3(b)(7)(i). Respondent contends that petitioner did not experience such symptoms within 2-28 days of vaccination. Resp. Post-Hearing Brief at 4. Respondent avers that petitioner experienced only “hand cramping on or about October 3 [sic? October 2?], 2013.” *Id.* at 4-5. However, as accepted in my earlier finding of fact and reiterated here, the witnesses described that on October 2, 2013, petitioner suddenly developed deep aching pain in his right hand and shoulder. The pain caused the cramping. This pain was not so severe that petitioner sought medical attention, but it significantly impacted his ability to do his job. He made positional changes and began to have not just one, but two medical assistants present during dental surgeries. This pain was also persistent. Contrary to Dr. Chaudhry’s interpretation, the affidavits do not support that petitioner’s symptoms beginning on October 2, 2013, were intermittent or that they included numbness and tingling. The onset described in the affidavits is consistent with the Table’s description of pain that is “often” but not always severe and current literature which recognizes a range of symptomatology. *See van Alfen (2016)* [Pet.

⁵² Given the date of the petition’s filing, the applicable Table was published July 23, 2015.

Ex. 25] at 2. Dr. Feinberg also explained that the hand symptoms corresponded to the anterior interosseous nerve, the shoulder symptoms corresponded to the long thoracic nerve, and that simultaneous injury to both nerves was consistent with brachial neuritis.

C. Petitioner’s pain was followed within days or weeks by weakness and atrophy in the affected upper extremity muscle groups.

On this question, respondent emphasizes Dr. Chaudhry’s opinion that “petitioner’s clinical examinations in the months following his initial symptoms were variable, and his strength was noted to be *normal* at various points, including in examination by Dr. Feinberg two years post-vaccination.” Resp. Post-Hearing Response at 6-7, citing Resp. Ex. J at 4-5. However, the affidavits describe progressive weakness throughout October and November 2013. Several of the “normal” findings are from medical encounters not focused on petitioner’s left hand and shoulder. Pet. Ex. 19 at 12, 15 (emergency encounter due to “concern for his heart”); Pet. Ex. 1 at 5, 8 (follow-up primary care encounters). Many of the other medical records cited by Dr. Chaudhry do in fact document petitioner’s report of right hand weakness and/or that finding on physical exam. Pet. Ex. 1 at 10, 12; Pet. Ex. 6 at 1-2, 5, 7; Pet. Ex. 15 at 1-3; Pet. Ex. 21 at 1-3; Pet. Ex. 25 at 1-3; Pet. Ex. 26 at 1-3; Pet. Ex. 27 at 1-5, 7-10, 12-16. While many of the local physicians attributed petitioner’s hand weakness and thenar atrophy to carpal tunnel syndrome, Dr. Feinberg was persuasive in explaining that those are only present with late-stage carpal tunnel syndrome and that petitioner’s carpal tunnel syndrome was only mild to moderate. Therefore, those signs and symptoms were more likely attributable to the anterior interosseous nerve component of his brachial neuritis. Dr. Feinberg also explained that long thoracic nerve weakness and atrophy would have been less apparent particularly if the local physicians did not properly examine petitioner shirtless and from behind for scapular winging, which he personally observed in November 2015.

D. Petitioner’s compensable condition is limited to the upper extremity nerve plexus and was documented on physical examination and electrodiagnostic studies.

Dr. Feinberg – acting first as a disinterested medical provider, then as a highly qualified expert – explained that petitioner developed specific dysfunction that was attributable to two specific nerves which pass through the brachial plexus. Most prominently, petitioner developed weakness in the right FPL muscle which controls thumb flexion. He also developed weakness in the FDP muscle which controls index finger flexion and the PQ muscle which controls downward rotation in the thumb. All three muscles are controlled by the anterior interosseous nerve, which stems from the C8 and T1 nerve roots and then passes through the brachial plexus. The relevant interspaces, C7-8 and T1, were normal on the MRIs of petitioner’s spine. Therefore, cervical radiculopathy in this patient does not explain his dysfunction. Neither does petitioner’s carpal tunnel syndrome, which was mild to moderate.

Petitioner also developed weakness in the right SA muscle which rotates the scapula and plays an important role in stabilizing the shoulder during shoulder abduction. This weakness did not have such a significant impact on petitioner’s ability to work as a dentist, which primarily required fine motor control in his hands. However, several local physicians documented that petitioner had decreased strength on right shoulder abduction and he still displayed the hallmark sign of scapular winging when he finally reached Dr. Feinberg. Importantly, while Dr. Chaudhry

suggested that cervical radiculopathy at nerve roots C5, C6, and C7 could have caused the long thoracic nerve injury, SA weakness, and scapular winging, he also recognized that this would be “unusual” because other muscles, like the deltoid and suprascapular, from those nerve roots were normal on both EMGs. Tr. 314. Accordingly, I find that cervical radiculopathy does not explain these specific findings.

As noted in the previous subsection, many of the local physicians’ records documented this dysfunction without recognizing that it was attributable to injuries to the anterior interosseous and long thoracic nerves which together represented brachial neuritis. With regard to the electrodiagnostic studies, it is highly significant that the local neurologist did not test the relevant muscles and nerves. In contrast, Dr. Feinberg, who is highly specialized in testing and diagnosing these injuries, did detect mild abnormal spontaneous activity in the anterior interosseous nerve and a discrete recruitment pattern in both nerves. He explained that these findings were indicative of chronic partially recovered injuries to these two nerves which pass through the brachial plexus.

E. Petitioner’s compensable condition can be separated out from his other comorbidities.

Respondent correctly noted that petitioner has experienced symptoms – including chronic pain in his neck as well as new pain throughout his right arm and chest, numbness and tingling in his hands, sensory loss, and worsening cardiac conditions all beginning in November 2013 – that cannot be explained by his brachial neuritis and are instead explained by chronic cervical radiculopathy and the new post-vaccination diagnosis of carpal tunnel syndrome. Resp. Post-Hearing Response at 7-8. Respondent also contended: “To find that these facts meet the requirements for a Table injury would be unfair to those petitioners who meet or substantially meet the terms presented by the QAI, and would set a poor precedent for future claimants to make Table claims when really their facts really warrant a causation-in-fact analysis.” *Id.* at 10.

It is first noted that a ruling in favor of this petitioner is not unfair to others. Due to petitioner’s complex medical picture, this claim has required several years of litigation and opinions from experts on both sides.

After a careful review, I find that Dr. Chaudhry was persuasive in testifying that the November 22, 2013, episode of acute right arm and chest pain may well have represented cervical angina. He also identified symptoms throughout the medical records which were more consistent with cervical radiculopathy. The expert radiologists were in consensus that the MRI findings were largely stable from 2009 to 2013, but there were not insignificant findings at multiple levels and undisputed progression at interspace C3-4. Dr. Feinberg agreed that petitioner had mild to moderate carpal tunnel syndrome which caused some new numbness and tingling in petitioner’s hands in November 2013. Neither expert devoted significant attention to the cardiac condition, which was not within their area of expertise and is well explained by the presence of a 90% occlusion of the left descending coronary artery. The finding of a Table brachial neuritis injury in this case applies to the loss of motor function in the thumb and other symptoms described above that are attributable to the injury to the anterior interosseous nerve and the long thoracic nerve which both arise in the brachial plexus. The Table injury does not

include the comorbidities including the cervical radiculopathy, carpal tunnel syndrome, and myocardial infarction.⁵³

VIII. Conclusion

For the foregoing reasons, petitioner is entitled to compensation and the case will proceed to determining the damages attributable to petitioner's Table brachial neuritis injury.

IT IS SO ORDERED.

s/Thomas L. Gowen

Thomas L. Gowen
Special Master

⁵³ Petitioner has also established that he suffered residual effects or complications of brachial neuritis for at least six months after the vaccination, *see* section 11(c)(1)(D), based specifically on the persistence of his signs and symptoms as well as Dr. Feinberg's EMG findings of chronic partially recovered neuropathies over two years post-vaccination.