IJSPT

CLINICAL COMMENTARY

PERTINENT DRY NEEDLING CONSIDERATIONS FOR MINIMIZING ADVERSE EFFECTS – PART TWO

John S. Halle, PT, PhD, ECS[1]
Rob J. Halle, PT, DPT, OCS, CSCS[2]

ABSTRACT

Background: Dry needling (DN) is an evidence based treatment technique that is accepted and used by physical therapists in the United States. This clinical commentary is the second in a two-part series outlining some of the pertinent anatomy and other issues that are needed for optimal utilization of this treatment modality. Part one was an overview of the thorax with a summary of reported adverse effects (AEs) and the underlying anatomy that could be used to minimize patient risk. As is the case with any intervention, the technique of dry needling has some inherent patient risk. The incidence of AEs with this procedure is typically low, ranging from zero to approximately 10 percent. Knowledge of the underlying anatomy can be a key factor associated with decreasing the likelihood of an AE.

Purpose/Objective: The second part of this clinical commentary goes beyond the thorax, to explore the anatomy associated with dry needling the abdomen, pelvis, and back. In the abdomen, pelvis and back, dry needling can penetrate the peritoneal cavity or adjacent organs, resulting in AEs. A physiological reaction that is an AE secondary to a needle insertion, pain or fear, is an autonomic vasovagal response. Additionally, suggestions for dealing with the fearful patient, the obese patient, universal precautions, and other clinical considerations, are discussed. The purpose of parts one and part two of this clinical commentary is to minimize the risk of a dry needling AE.

Conclusions/Implications: Dry needling is an effective adjunctive treatment procedure that is within the recognized scope of practice of the physical therapist. An evidence-based implementation of the procedure must be based on a thorough understanding of the underlying anatomy and the potential risks, with risks communicated to patients via informed consent.

Level of Evidence: Level 5

Keywords: Adverse effect, anatomy, dry needling, informed consent, pneumothorax, vasovagal response

[1] Belmont University, Nashville, TN, USA
[2] US Army-Baylor University Post-Professional Sports Medicine, Physical Therapy Doctoral Fellowship, Keller Army Community Hospital, West Point, NY, USA

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the U.S. Army or Department of Defense.

CORRESPONDING AUTHOR
John S. Halle, PT, PhD, ECS
Professor, School of Physical Therapy
Belmont University
1900 Belmont Blvd
Nashville, TN 37212
E-mail: John.halle@belmont.edu

INTRODUCTION

A common anatomical phrase used during gross anatomy instruction is that 'structure sub-serves function'. Succinctly stated, the key meaning of this statement is that the structural design of the sub-units that make up the human body underlies the function of these sub-units, and understanding this design provides the clinician with ways to test and safely intervene in the presence of dysfunction. As was outlined in part one of this clinical commentary,[1] the underlying anatomy across individuals has variability, and an in-depth knowledge of anatomy is required prior to DN or any other type of needle placement (acupuncture, EMG, etc). Part one[1] dealt with the thorax and issues that can be associated with small diameter needle placement in this region such as pneumothorax, cardiac tamponade, hematoma, central nervous system injury, and other complications. In addition, the first clinical commentary provided a description of DN, the theories associated with its use, how physical therapists are well positioned to perform this procedure effectively and safely due to their professional training, and the variable frequency of AEs reported in the literature. This second part of the clinical commentary will examine some potential issues associated with placing a needle in or near the abdomen, pelvis, back, or other areas such as the extremities. In addition to direct structural considerations, other general responses that can occur during dry needling such as a vasovagal response are described and considered. Lastly, the issue of providing informed consent for dry needling will be addressed with several suggestions outlined, as well as a discussion of the fearful patient, the obese patient, universal precautions, and DN as an adjunctive procedure.

Dry Needling In the Region of Abdomen, Pelvis and Back

The abdomen and pelvis constitute the region below the diaphragm extending inferiorly to the perineal region. Unlike the separation of the thorax from the abdomen by the musculotendinous structure of the diaphragm, there is not a clear boundary that separates the abdomen and pelvis.[2] Rather, for descriptive purposes the abdomen is considered as that region inferior to the diaphragm that remains superior to an imaginary line running from L5-S1 to the pubic symphysis.[2] The pelvis is that region below the previously cited imaginary line, inferiorly represented by the perineum with the pelvic diaphragm (levator ani muscles).[2] Like the thorax that has a pleural cavity that encompasses the lungs, the combined abdomen and pelvis have many structures enclosed within the peritoneal cavity. The peritoneal cavity is lined by a surface that consists of parietal peritoneum in proximity to the endoabdominal fascia, and visceral peritoneum that is adjacent to the structure that is enclosed or covered. Functionally, this provides a closed space within the peritoneal cavity, with the one exception in females of a small open pathway associated with the ovaries and the fimbria of the fallopian tubes.[2] The enclosed region encases or covers key structures such as the stomach, duodenum, spleen, pancreas, and large and small intestines, as an abbreviated list. Structures that pass from the abdomen and pelvis into the lower extremity are typically retroperitoneal, existing behind the posterior extent of the peritoneal cavity.[2] Some of the structures that are contiguous to the peritoneal cavity, either passing into the lower extremity or existing behind the peritoneal cavity, are at potential risk when dry needling in this region is performed. The next several paragraphs highlight dry needling sites in the region of the abdomen and pelvis that have the potential for AEs and factors that should be considered by the clinician employing this technique in these regions. By and large, this involves a clear understanding of the regional anatomy and what tissues the needle passes through to reach its intended target.

Needling the iliacus superior to the inguinal ligament: One site that is described as a DN site is the iliacus.[3] When a clinician determines that this muscle should be needled due to either a clinical condition associated with this muscle or trigger points identified as arising within the muscle, then a determination needs to be made on whether the site of the needle placement should be superior to or inferior to the inguinal ligament. This muscle is commonly needled to treat conditions like pelvic floor pain, hip flexor strain, or iliotibial band tendonitis.[4–6] For review, the iliacus muscle runs from the upper two-thirds of the iliac fossa, the ala of the sacrum, and the anterior sacroiliac ligaments, passing under the inguinal ligament to insert on the lesser trochanter of the femur.[2] The inguinal ligament runs from the anterior superior iliac spine (ASIS) to the pubic tubercle, and is more appropriately the turned under connective tissue fibers of the aponeurosis of the external abdominal oblique muscle, rather than a typical ligament that runs from bone to bone.[2] As such, the iliacus resides in the posterior abdominal wall and in the proximal aspect of the thigh, each of which have some specific anatomic challenges to safe needle placement. Should the decision be made to place a needle in the bulk of the muscle superior to the inguinal ligament, then the clinician will be passing through the following layers of the antero-lateral abdominal wall to move deeply toward the level of the muscle (protected posteriorly by the bony ilium). The needle will pass through the following: (1) the skin; (2) Camper's and Scarpa's fascia (Scarpa's fascia is a specialized deep membranous layer within the lower abdomen comprised of elastic and collagen fibers, providing sufficient strength that surgeons may include this layer when suturing);[2] (3) three thin muscle layers with their surrounding deep investing fascia or their respective aponeurosis (in the case of the anterior-lateral abdominal wall muscles, they are the external abdominal oblique, internal abdominal oblique, and transversus abdominis); (4) transversalis fascia; (5) a thin layer of extra-peritoneal fat; and (6) parietal peritoneum. Once the peritoneal cavity has been entered, it is likely that the needle will also pass through visceral peritoneum, and some of the tissue structures that occupy this space (such as the descending or sigmoid colon), will be impacted when needling on the left side of an individual. Anecdotal reports are that some instructors teach that the colon or aspects of the intestines can be mobilized and moved off of the iliacus muscle, but the anatomical layout of this region of the abdomen and pelvis argues against such a possibility. Structurally, it is not advantageous for the contents of the abdomen to be freely moveable, since this could lead to a twisted gastrointestinal tract (a twisted loop of bowel is a volvulus and while possible, is more likely to occur in other animal species such as quadrupeds).[7,8] The small intestine is firmly affixed posteriorly by the mesentery to the posterior abdominal wall and serves as a pathway for the blood vessels and nerves that supply the abdomen, with the anterior aspect of the small intestines being more mobile. In terms of the large intestines, on the right side the ascending colon is described as being 'secondarily retroperitoneal', as is the descending colon on the left side. What this means is that while the ascending and descending colons were developmentally intraperitoneal and relatively mobile, as they formed they 'fell-back' onto the posterior abdominal wall and became affixed to the posterior abdominal wall. So, structurally, at the time of surgery or upon opening the abdomen in a cadaver lab, these structures are fixed in place along the two sides of the abdomen and are therefore not moveable by the clinician attempting to push them out of the way to insert a needle.[2] When a needle is placed in this region, it will, by necessity, pass into and puncture the peritoneal cavity and the needle has the potential to pass into a portion of the bowel.

Due to the location of the colon, another safety procedure that has been advocated when dry needling in this region is to use a needle only once and discard it to minimize issues should the intestines be penetrated. If a needle has potentially perforated a bowel, albeit with a very small diameter needle, contamination could occur that would involve the peritoneal cavity. Should a real infection develop, this would be a peritonitis. While this type of infection associated with needling has not been reported in the literature, the structural possibility should be considered, and any clinician performing dry needling in this region should consider both the potential risk and the inherent benefit of needling here.

Needling the iliacus inferior to the inguinal ligament: The distal aspect of the iliacus muscle, just before it inserts into the lesser trochanter of the femur, constitutes the floor of the lateral aspect of the femoral triangle (the femoral triangle is a region demarcated by the sartorius laterally, the adductor longus medially, and the inguinal ligament superiorly). Should the decision be made to needle the distal portion of the iliacus due to its relationship to the pelvic floor,[3] the muscle can be needled while avoiding the peritoneal cavity. This can be done with relative safety since the anatomy in this region is predictable, with the key structures overlying this muscle represented by the acronym NAVEL (nerve, artery, vein, empty space, and lymph tissue, when proceeding from lateral to medial). If a clinician is able to palpate the femoral artery and then move laterally a couple of centimeters while staying medial to the sartorius muscle, they should be able to place the needle into the combined iliacus and psoas major muscle (iliopsoas). Properly positioned, the key structures of the femoral nerve and femoral artery should be avoided. The emphasis is on 'should', since there are at least two variants in this region that can complicate the issue, the structure of the femoral nerve and the variability in branches arising off of the femoral artery. The femoral nerve differs from most other peripheral nerves in the body, since after passing under the inguinal ligament, it splits into multiple (many) fascicles that spread out to supply both cutaneous and muscular branches. This extensive splitting is recognized with some functional tests such as nerve conduction velocity assessments, where it has been noted that "there is no reliable method of measuring the motor NCV (nerve conduction velocity) in the femoral nerve".[9] Following palpation of the femoral artery, the clinician can move laterally in the femoral triangle and work to avoid the nerve. This will typically be effective, but due to the presence of many fascicles, it is possible to place the needle in a fascicle that is more laterally positioned than what is normally described in anatomy texts.[2,10] Second, arteries have more variability than nerves[2] and do not always follow the classical course described in anatomy texts. One of the authors has referenced a variant where a large lateral circumflex artery arose directly off the proximal femoral artery and passed superficially in a lateral and distal direction across the femoral triangle.[11] Had this individual been needled in a manner that was completely appropriate according to an atlas, but without an awareness of arterial variability, the noted arterial variant could have become compromised. Since this anatomical variant was superficial, a needle placed in the substance of the artery may have resulted in a significant hematoma. The only way to absolutely assure that this would not happen would be to use a modality like diagnostic ultrasound, to visually inspect the region prior to placing a needle into the distal aspect of this muscle. On occasion, hematomas will occur as AEs, and these are typically minor adverse effects. While the patient should have been informed before the procedure that this type of outcome could occur, due to the needle size, this typically is not a major event that would change or prohibit the utilization of the needle insertion in this region.

The quadratus lumborum: The quadratus lumborum is also known as the 'hip-hiker' muscle. This muscle is a deep muscle in the back, and it is occasionally the target for dry needling.[12] Simons and Travell suggest that this muscle can refer pain to regions like the lateral thigh, sacroiliac region, lower gluteal region, along the iliac crest, to the lower abdomen, and to the inguinal region.[13] Due to this potential distribution of referred pain and symptoms, needling of this muscle may be implicated for lateral thigh pain, inguinal pain, and pain in the region of the sacroiliac joint. This muscle arises from the medial half of the inferior border of the twelfth rib and tips of the lumbar transverse processes, and extends inferiorly to the iliac crest and iliolumbar ligament.[2] In terms of its accessibility by a needle, this structure has an advantage over the iliacus in that the muscle is both retroperitoneal (behind the peritoneum), and accessible from a posterior approach. So, a needle can be placed within the muscle without entering the peritoneal cavity. Having noted that, there are a number of other anatomical structures that may be implicated or involved with a needle insertion in this region. The first is a kidney, a retroperitoneal structure typically located towards the lateral portion of the quadratus lumborum muscle. However, it should be noted that anatomy atlases show the typical two kidney configuration, and kidneys vary widely in shape and size, with variants such as the 'horseshoe kidney' that is continuous across the midline. This variant is the most common type of renal fusion anomaly.[14] A needle placed in this region has the potential to enter a kidney, unless the clinician is able to be certain of the depth of penetration, through the use of imaging ultrasound or some other imaging modality. Other structures that are in the region and are also susceptible to being penetrated by a needle are the sympathetic chain, the suprarenal glands, renal arteries and veins, the ureter, and the posterior aspect of the iliohypogastric and ilioinguinal nerves.[2] The key point here is that the quadratus lumborum muscle is a deep structure and the clinician placing a needle in this muscle needs to be familiar with the pertinent anatomy and inherent risks associated with placing a needle in this structure.

Other structures: There are clearly many other structures that can be and are needled, such as the lumbar paraspinals, muscles associated with the temporomandibular joint (TMJ), and very deep regions such as the suboccipital muscles at the base of the skull. In an effort to keep this overview relatively concise, those regions such as the lumbar paraspinals that have minimal risk associated with a needle insertion are not discussed here. Additionally, those muscles that take specialized or advanced knowledge to accurately place a needle, such as the lateral pterygoids that insert into the capsule of the TMJ are not elaborated upon because the advanced instruction given on needling this muscle should make the clinician well aware of the large parotid gland, extensive venous plexus, maxillary artery arising from the external carotid artery, and nerves in the area, including the mandibular nerve, lingual nerve, inferior alveolar nerve, and chorda tympani nerve.[2] The lateral pterygoid may be needled due to pain referred to the maxilla and/or the TMJ, and for the clinical indications of headache and TMJ dysfunction.[15–17] This is also the case for the deeply situated sub-occipital muscles at the base of the skull, that have both the vertebral artery located in the base of the sub-occipital triangle, as well as the suboccipital nerve and the greater occipital nerve just inferior to this area.[2] The suboccipitals may be needled due to deep pain that spreads from the occiput toward the orbital region, and are used clinically for things like tension headache and neck pain.[18] Since these are recognized as specialized regions, the clinician treating such areas should have the requisite training and experience to safely provide expert care.

The above examples of both commonly needled sites and the brief mention of more specialized regions illustrate that a firm understanding of the structure and function of a given region is imperative for safe clinical care. While the intent of most of the anatomic descriptions within both part one and part two of the clinical commentary has been to identify other structures where it would not be ideal to place a needle, it should also be stressed that DN is not restricted to muscle target sites with 'trigger points' as the only point of interest. Dunning, in his 2014 article summarized this well when he noted that in addition to muscular trigger points, other target structures included " ligaments, scar tissue, tendons, bones, teno-osseous insertion sites, all of which are types of connective tissue. In addition, 'a high density of neurovascular structures' has been found at dry needling sites".[19, p453]

Vasovagal response: The previous examples of the possible interaction of a needle with the underlying anatomy have all been described as the direct result of the needle placement. Another potential response indirectly related to use of the needle or another stimulus that can result in an autonomic response is known as a vasovagal response. Any type of stimulus, including but not limited to visually seeing something that causes fear, visualizing blood, and experiencing pain, have the potential to result in an increased parasympathetic response that can cause the individual to become lightheaded, with the response potentially progressing to a loss of consciousness. A vasovagal response is also known as neurally mediated syncope.[20] Basically, the body has a superb mechanism that maintains blood pressure in spite of a variety of body positions and other challenges that occur throughout the day. Take the case of moving from a sitting position to a standing position. Blood has a tendency to pool in an individual's lower extremities, and it is possible for this change in posture to result in a "relatively empty ventricle owing to shifting of blood from the thorax to the abdomen and lower extremities".[20, p268] This type of a change in position can reduce the cardiac output and decrease the amount of blood that is available to the brain. However, normally within a beat of the heart, the decreased output is identified by the arterial baroreceptors located in the carotid sinus and aortic arch. These receptors transmit signals via the sympathetic trunk to increase sympathetic output.[2,20] The sympathetic output also results in vasoconstriction to non-vital organs and the extremities, along with an increase in heart rate, both of which work to maintain adequate blood flow to the brain. In a vasovagal response, the stimulus created by fear, a needle, or some other stimulus, results in the parasympathetic portion of the autonomic nervous system responding to this stimulus by sending an efferent response that results in bradycardia, hypotension, and syncope.[20,21] The individual undergoing this type of reaction from the abridged list of stimuli outlined above or some other stimulus, may describe symptoms such as lightheadedness, sweating, and potentially have a loss of consciousness.

The common element is some type of trigger, that may cause the patient to have an altered sense of temperature (often feel either hot or cold, typically accompanied by sweating), confusion, tinnitus, and a feeling of nervousness and/or an uncomfortable feeling in the chest.[20] In one of the author's experience,[22] small gauge needle placement in the upper thoracic region, especially when the subject is sitting upright rather than lying prone, can result in this type of response. A research study by Lagasse et al[22] investigating a nerve conduction technique for the suprascapular nerve required the placement of a small, 27 gauge needle into the supraspinatus and the infraspinatus, bilaterally. In the series of 45 subjects, four of the subjects (9%) developed a sensation of being light headed and required removal of the needle and the opportunity to lie down. The sitting position may have influenced the incidence observed during this study. This is based on the anecdotal observation by one of the author's that when performing electromyography studies with the patient prone at the time of the needle insertion, the incidence is near zero.

Should a vasovagal response occur, and it will occur for many practitioners performing dry needling over a period of time, key factors are to both provide a safe environment for the individual and to not over-react. Positioning patients appropriately prior to needling provides a safe environment, ensuring that if an individual becomes lightheaded or loses consciousness, they will not fall to the floor or move in any way that would create a potentially harmful situation. One of the authors has described this approach of utilizing positioning, safety, and not over-reacting as being 'laid back' when a vasovagal response occurs. This phrase of 'laid back' is intended to assist the clinician to recall that it will be beneficial for the patient to lie down, so that blood flow in the extremities is at the same level as the heart. The feet can be propped-up, to additionally assist with blood flow. The phrase also suggests that the clinician performing dry needling should be in a position to deal with the vasovagal response in stride, without unduly alarming the subject. In most cases, this will be minor and transient, and typically will not involve much more than stopping the treatment and dealing with the patient's needs.[21,23] In the relatively rare case where an individual loses consciousness, insure that the head is turned to the side to facilitate breathing, and closely monitor the subject. It may also be appropriate to loosen their clothing, to ensure that there is not a restrictive stimulus from the clothing. If consciousness has been lost, then in addition to monitoring the subject and potentially activating the emergency medical response system, there may be a need to have them fully evaluated by an appropriate health care practitioner, especially if they have fallen or if there has been any other associated event. At a minimum, this is an 'unusual occurrence' and should be treated as such through the policies in place at the facility where dry needling is utilized. Additionally, there should also ideally be some follow-up later that day to insure that the subject has fully recovered and is doing well. Vasovagal responses are not rare, they will occur, but the therapist involved should have a clear plan of action in place and not over-react.

Other important considerations associated with minimizing potential adverse effects

Informed consent: Dry needling is an invasive procedure that is within the scope of practice of physical therapists, physicians, and other health care providers approved by their state licensing boards. Since this is an invasive procedure, the patient should be informed about inherent risks in the form of informed consent. As was noted in the Witt et al self-report survey of almost 230,000 patients, 8.6 percent reported an adverse effect that was noteworthy and 2.2 percent reported an adverse effect that required treatment.[24] In most cases when there is an adverse effect, it will be minor such as a notable bruise, small amount of bleeding, muscle soreness, or transient light-headedness. Since this procedure is invasive and has a potential for an untoward effect, the patient should be informed of the small inherent risk. Written consent is appropriate since it meets the standard of providing "explicit and specific consent is deemed necessary for invasive procedures".[25] Through informed consent there is a mechanism for protecting the legal rights of patients and insuring that they are involved in the decision making regarding their care.[26] This dates back to 1914, when the legal precedent for 'simple' informed consent was devised that established a patient's "right to determine what shall be done with his [her] body".[26] This was expanded in 1975, with clarification of a reasonable person standard that requires the practitioner to disclose the information that a "reasonable person" would want to know in a similar situation.[26]

There are potential problems with informed consent that a clinician has to consider. First, if the procedure is typical and customary, is it essential that informed consent beyond 'implied consent' is required? This is an area that has not been as explicitly defined as has been done in research where informed consent is codified for any research with minimal risk. As Wada et al point out, "circumstances seem to exist which allow clinicians to proceed with certain clinical procedures with implicit consent, suggesting that conditions for not requiring formal consent or risk disclosure may exist".[25, p805] As is stated above, this procedure probably does not fall into that category since the procedure is invasive and there is a clear history of some AEs associated with dry needling procedures.[24,27] Second, providing an informed consent and answering patient's questions takes time. In one study that dealt with more invasive procedures than is encountered when performing DN, the mean time taken by providers for elective surgery procedures was 10.9 minutes, with a large standard deviation of 22 minutes.[28] Third, the patient could perceive that something unusual is being done since many of the procedures that are performed by physical therapists do not entail the extra step of informed consent, apart from any paperwork processing that is typically filled out at the time of the first visit or verbally explaining the procedure. This concern is probably balanced by the advantage of including the patient in the decision making process and by being able to clearly articulate the minimal risk in light of the potential benefit to the patient. Additionally, if needling an area that has more than minimal risk, such as in and around the thorax, having an informed patient that understands that not all untoward effects necessarily occur at the time of the treatment is an advantage. It is well documented that when something like a pneumothorax occurs, it may occur at the time or as long as three days after the treatment.[29] An informed patient is able to then respond appropriately, maximizing the chance for a positive outcome even in the case of an AE.

Should the clinician agree that informed consent is the right standard of practice to employ with this clinical procedure, then the guidelines identified by Hall et al in their article "Informed consent for clinical treatment" might be helpful.[26] The suggested framework that they describe includes: "(1) develop a practice of involving patients in decisions; (2) explicitly establish the goals of care, and prioritize them in the context of the patient's other life goals; (3) recognize that the informed consent process serves more than one purpose (legal, ethical, administrative, and the development of patient trust); and (4) document the process thoroughly, using an electronic medical record whenever possible to ensure permanence".[26]

Other patient considerations

The fearful patient: Dry needling is one therapeutic procedure that a clinician has at their disposal to treat specific neuromusculoskeletal conditions. The exact mechanism associated with the demonstrated efficacy is not yet known,[30,31] and it is probable that there are benefits simply from the personal interaction and the physical procedures employed. If the patient is overly concerned about being treated with a needle, secondary to pain or some other concern, it is likely that the outcome will not be optimal. There is the additional concern of a vasovagal response, since simply being fearful can be enough to elicit this type of response.[21,23] In the case where an individual is unduly concerned about the treatment suggested by the clinician, this is an instance where another form of treatment may be the best approach.

The obese patient: Dry needling is generally thought to entail an interaction between a muscle trigger point and the needle.[32] To accomplish this successfully, the clinician needs to be able to identify the trigger point and be confident that the needle is being placed in the intended structure or muscle. In an individual that is significantly overweight or obese, this becomes problematic due to the thickness of the superficial fascia (fat) that has to be traversed to reach a therapeutic level. The real issue is not the superficial fascia per se, since a needle of the appropriate length can be obtained that will reach the desired depth. The concern is that the intervening tissue makes precise localization of the needle more difficult. If needling is performed in a region such as an extremity or the lumbar multifidus muscles, this can be done in most cases with a high degree of safety since should the needle not be in the precise expected location, the sites are ones where there is some latitude regarding the needles placement. However, when dealing with sites involving the thorax, abdomen, or sites where there could potentially be an aberrant large artery or other structure, the increased superficial fascia mass creates a safety issue. In these cases, the clinician needs to consider the risk versus the benefit for the patient and make a judgment call. If the procedure can be done safely and the clinician believes that they are able to determine the location and depth of the needle placement, then dry needling may be an appropriate intervention. In those cases where there is a higher risk of an AE, it may be that there is a better therapeutic intervention for that patient. The American Physical Therapy Association's educational resource paper entitled 'Description of Dry Needling in Clinical Practice', outlines 15 precautions, in addition to obesity, to be aware of in prospective patients, to include (abridged list) patients with a cognitive impairment, those unable to communicate, local skin lesions, patient's allergic to the medal in the typical needle, those with a compromised immune system, following some surgeries, and pregnancy.[33]

Dry needling and the use of universal precautions: Any endeavor that involves a needle has the potential for bleeding, albeit small with most dry needling procedures. Universal precautions were clearly outlined in the Federal Register as early as 1991,[34] in order to minimize occupational exposure to a number of pathogens that can be spread by contact with blood or other bodily fluids. It is undisputable that when exposed to blood, there is a risk of transmission of Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and human immunodeficiency virus (HIV).[34,35,36] This argues for the use of gloves for the protection of the health care worker involved with dry needling. While this does not appear to be an area where there would be any controversy, a brief perusal of the internet found both a dry needling site,[37] and an acupuncture site,[38] where the clinician demonstrating needle placement did so with bare hands. Universal precautions should be employed for the protection of the clinician performing dry needling, as well as reinforcing for all involved that for the patient, the needle also needs to be sterile. While not directly related to universal precautions, there is at least one case study referencing the infection of a hip prosthesis after dry needling.[39] Although causality cannot be determined from a case study such as this and it is recognized that DN may not have been the cause of this individuals infection, the skin is being penetrated with DN and therefore systematic, reasonable steps should be utilized for the protection of both the patient and the practitioner.

Dry needling is typically an adjunctive treatment: While dry needling has been demonstrated to be an effective therapeutic approach to a broad variety of neuromusculoskeletal complaints, rarely should it be considered a 'stand-alone' procedure. Since dry needling has been shown to treat a variety of dysfunctions in muscle, fascia, connective tissue, and decrease persistent pain, it can be tempting to consider this as a modality or treatment approach that would benefit a significant portion of a patient population that is seeking care for neuromusculoskeletal problems.[33] With each presenting patient there is an underlying cause of their issue and the patient history, physical exam and other specialized tests should be performed to permit an understanding of the etiology of their symptoms. The treatment provided should then be designed to address or eliminate the etiology of their problem, and this will not usually be achieved with dry needling alone. As effective a modality as dry needling may be, it is typically adjunctive to some other focused treatment approach.[40]

CONCLUSION

Dry needling is an evidence based treatment modality that has broad application in the treatment of numerous neuromusculoskeletal complaints, when applied by a skilled and knowledgeable professional. The approach focuses on releasing or inactivating muscular trigger points to decrease pain, reduce muscle tension, and assist patients with accelerated return to active rehabilitation. To be performed effectively and safely, minimizing the chance that an AE might occur, the clinician must have a clear understanding of the underlying anatomy of the region being dry needled. This clinical commentary, along with a preceding clinical commentary that discussed issues associated with the thorax,[1] have outlined areas of potential concern associated with the neck, thorax, abdomen and pelvis, and discussed relevant anatomy in those areas. Other conditions such as the potential for a vasovagal response, dealing with the fearful or obese patient, and the role for informed consent with dry needling were also reviewed. Future research might examine educational and evaluative techniques to provide feedback on needle placement, a systematic way to collect data on AE's and identify methods to reduce their incidence, and the impact of factors such as body position on the incidence of vasovagal responses. Recognizing the need for a thorough understanding of anatomy and a systematic approach with the application of dry needling should help to minimize the incidence of AE's and increase the positive results obtained with this therapeutic technique.

REFERENCES

1. Halle, JS; Halle R. Pertinent dry needling considerations for minimizing adverse effects - Part one. *Int J Sports Phys Ther*. 2016;11(4):650-662.
2. Moore, KL; Dalley, AF; Agur A. *Clinically Oriented Anatomy*. 7th ed. Philadelphia, PA: Lippincott Williams & Wllkins; 2014.
3. Dommerholt J. *Trigger Point Dry Needling: An Evidence and Clinical-Based Approach*. China: Churchill Livingstone; 2013.
4. Moldwin RM, Fariello JY. Myofascial trigger points of the pelvic floor: Associations with urological pain syndromes and treatment strategies including injection therapy. *Curr Urol Rep*. 2013;14(5):409-417.
5. Pavkovich R. The use of dry needling for a subject with chronic lateral hip and thigh pain: A case report. *Int J Sports Phys Ther*. 2015;10(2):246-255.
6. Pavkovich R. Effectiveness of dry needling, stretching, and strengthening to reduce pain and improve function in subjects with chronic lateral hip and thigh pain: A retrospective case series. *Int J Sports Phys Ther*. 2015;10(4):540-551.
7. Leow JJ, Huey T, Low JK. Primary adult midgut volvulus mimicking acute appendicitis: A case report and review of the literature. *Int J Surg Case Rep*. 2016;24:182-184.
8. Klopfenstein M, Howard J, Rossetti M, Geissbühler U. Life expectancy and causes of death in Bernese mountain dogs in Switzerland. *BMC Vet Res*. 2016;12(1):153.
9. Oh S. Uncommon Nerve Conduction Studies. In: *Clinical Electromyography: Nerve Conduction Studies*. 3rd ed. Philadelphia: Lippincott Williams & Wllkins; 2003:153-309.
10. Agur AMR, Dalley AF. Grant's Atlas of Anatomy, [12th Edition]: Lippincott Williams & Wilkins. Philadelphia, PA. 2009.
11. Halle, JS; Greathouse D. *Abberant Lateral Femoral Circumflex Artery*. [Personal Communication]. Nashville, TN; 2003.
12. Unverzagt C, Berlund K, Thomas JJ. Dry needling for myofascial trigger point pain: A clinical commentary. *Int J Sports Phys Ther*. 2015;10(3):402-418.
13. Simons, DG; Travell, JG; Simons, LS; Cummings B. *Myofascial Pain and Dysfunction: The Trigger Point Manual*. 2nd ed. Philadelphia: Lippincott Williams & Wllkins; 1998.
14. Schiappacasse G, Aguirre J, Soffia P, Silva CS, Zilleruelo N. CT findings of the main pathological conditions associated with horseshoe kidneys. *Br J Radiol*. 2015;88(1045):20140456.
15. Gonzalez-Perez L-M, Infante-Cossio P, Granados-Nuñez M, Urresti-Lopez F-J. Treatment of temporomandibular myofascial pain with deep dry needling. *Med Oral Patol Oral Cir Bucal*. 2012;17(5):e781-e785.
16. Mesa-Jiménez JA, Sánchez-Gutiérrez J, de-la-Hoz-Aizpurua JL, Fernández-de-las-Peñas C. Cadaveric validation of dry needle placement in the lateral pterygoid muscle. *J Manipulative Physiol Ther*. 2015;38(2):145-150.
17. Fernández-Carnero J, La Touche R, Ortega-Santiago R, et al. Short-term effects of dry needling of active myofascial trigger points in the masseter muscle in patients with temporomandibular disorders. *J Orofac Pain*. 2010;24(1):106-112.
18. Bond BM, Kinslow C. Improvement in clinical outcomes after dry needling in a patient with occipital neuralgia. *J Can Chiropr Assoc*. 2015;59(2):101-110.
19. Dunning J, Butts R, Mourad F, Young I, Flannagan S, Perreault T. Dry needling: A literature review with implications for clinical practice guidelines1. *Phys Ther Rev*. 2014;19(4):252-265.
20. Zaqqa M, Massumi A. Neurally mediated syncope. *Tex Heart Inst J*. 2000;27(3):268-272.
21. Raj SR, Coffin ST. Medical therapy and physical maneuvers in the treatment of the vasovagal syncope and orthostatic hypotension. *Prog Cardiovasc Dis*. 55(4):425-433.
22. Lagasse, L; Logan, E; O'Connor, K; Williams, A; Halle J. *Normative Suprascapular Nerve Conduction Using a Monopolar Needle*. [Personal Communication]. Belmont University, Nashville, TN; 2015.
23. Coffin ST, Raj SR. Non-invasive management of vasovagal syncope. *Auton Neurosci*. 2014;184: 27-32.
24. Witt CM, Pach D, Brinkhaus B, et al. Safety of Acupuncture: Results of a Prospective Observational Study with 229,230 Patients and Introduction of a Medical Information and Consent Form. *Forschende Komplementärmedizin / Res Complement Med*. 2009;16(2):91-97.
25. Wada K, Nisker J. Implications of the concept of minimal risk in research on informed choice in clinical practice. *J Med Ethics*. 2015;41(10):804-808.

26. Hall DE, Prochazka A V, Fink AS. Informed consent for clinical treatment. *CMAJ*. 2012;184(5):533-540.
27. Dommerholt J, Mayoral-del Moral O, Gröbli C. Trigger point dry needling. *J Man Manip Ther*. 2006;14(4):70E - 87E.
28. Fink AS, Prochazka A V, Henderson WG, et al. Enhancement of surgical informed consent by addition of repeat back: A multicenter, randomized controlled clinical trial. *Ann Surg*. 2010;252(1):27-36.
29. Miller J. Pneumothorax. Complication of needle EMG of thoracic wall. *N J Med*. 1990;87(8):653.
30. Llamas-Ramos R, Pecos-Martin D, Gallego-Izquierdo T, et al. Comparison of the short-term outcomes between trigger point dry needling and trigger point manual therapy for the management of chronic mechanical neck pain: a randomized clinical trial. *J Orthop Sport Phys Ther*. 2014;44(11):852-861.
31. Kalichman L, Vulfsons S. Dry needling in the management of musculoskeletal pain. *J Am Board Fam Med*. 2010;23(5):640-646.
32. Lewit K. The needle effect in the relief of myofascial pain. *Pain*. 1979;6(1):83-90.
33. American Physical Therapy Association. *Description of Dry Needling in Clinical Practice: An Educational Resource Paper*. In: APTA, ed. Alexandria, VA: American Physical Therapy Association; 2013.
34. Occupational exposure to bloodborne pathogens--OSHA. Final rule. *Fed Regist*. 1991;56(235):64004-64182.
35. Twitchell KT. Bloodborne pathogens. What you need to know--Part I. *AAOHN J*. 2003;51(1):38-45;
36. Butsashvili M, Kamkamidze G, Kajaia M, et al. Occupational exposure to body fluids among health care workers in Georgia. *Occup Med (Chic Ill)*. 2012;62(8):620-626.
37. Trigger Point Dry Needling. http://www.releasept.com/physical-therapy-services/dry-needle/.
38. Acupuncture styles and techniques. http://acupuncture-treatment.com/acupuncture-styles/.
39. Steentjes K, de Vries LMA, Ridwan BU, Wijgman AJ. [Infection of a hip prosthesis after dry needling]. *Ned Tijdschr Geneeskd*. 2015;160:A9364.
40. APTA. *Physical Therapists & the Performance of Dry Needling*. Alexandria, VA. American Physical Therapy Association; 2012.