February 2023
Volume 76
Number 2

South Dakota medicine

THE JOURNAL OF THE SOUTH DAKOTA STATE MEDICAL ASSOCIATION

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February 2023
Volume 76 | Number 2

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South Dakota **medicine**

The Journal of the South Dakota State Medical Association

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South Dakota Medicine
(ISSN 0038-3317)
Published 12 times per year with one special issue by the South Dakota State Medical Association.

The SDSMA thanks the University of South Dakota Sanford School of Medicine for its financial contributions toward the production of *South Dakota Medicine*.

Subscription price: $50 per year domestic
$65 per year foreign, $8.95 for single copy

Periodicals postage paid at Sioux Falls, South Dakota and additional mailing offices.

Postmaster: Send address changes to
South Dakota Medicine
2600 W. 49th Street, Suite 100
Sioux Falls, SD 57105

SDSMA Home Page: www.sdsma.org

AMA Home Page: www.ama-assn.org

Printer:
Walsworth
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EVERY INVESTOR'S REAL QUESTION: "AM I GOING TO BE OKAY?"

CALEB BROWN CFP® *Lead Advisor*

In my time working with clients, there is one question asked more than any other, "Am I going to be okay?"

Sometimes, this comes on the heels of a market crash, inflation concerns, recession worries, or geopolitical events. Other times, it comes after the loss of a spouse, an unexpected job loss, a move into retirement, or a move into a nursing home. Occasionally, clients ask when they are dreaming big: a major vacation, business venture, retirement home, gifts to loved ones, or a sizeable charitable bequest. I see the question as very natural. We are prone to fear and need validation and reassurance that things are going to turn out all right.

Because this tends to be the essential question of most clients, we, as financial planners, have a great responsibility. This is the most exciting part about what I do. I get to bring peace of mind in the face of this essential question. The peace of mind is knowing. It's the clarity. Some clients are okay and just need to hear it and see it for themselves. For others, there are things they need to change to make it okay. Either way, they get to clearly understand their situation and be validated by someone who is an expert guide. Someone who has seen hundreds of client situations, had thousands of conversations, and is immersed in financial details every day, every week, year in and year out.

The "Am I going to be okay?" question doesn't get answered once and for all. Our face-to-face time with clients is limited. There are lots of hours between meetings. Those hours might be filled in part by your golf buddy telling you how you should be buying I Bonds, or by Jim Cramer telling you to sell a certain stock. Maybe you spend time on Fox News, CNN, or some other media outlet that tells you what you should be doing with your money or what the worry of the day is. Pretty soon your financial confidence starts waning. You have doubts. You aren't sure if you really are okay. You experience what I like to call "financial amnesia". It's a real condition, because we see it in most of our clients at one time or another.

The solution is simple. Call your advisor and get another dose of confidence and optimism. This is the real value in working with an advisor. Sure, we want to make you as much money as we can, but markets fluctuate. The lasting value is in the relationship with a trusted expert. Someone who knows you and what's important to you. Someone you can come back to when you are experiencing financial amnesia or when you need to know if you are going to be okay.

I find that repetition builds confidence. The clients who have been working with our firm for over 20 years understand this. Recently at a client connect meeting with one of those long-term clients, I asked how they were feeling about their financial situation. The husband looked at me and said in all seriousness, "Caleb, I don't even think about it". That might be the best compliment I've ever received as an advisor. We've taken away the burden of having to figure it all out themselves so they can have their time back and focus on the things that really matter to them. This is what keeps me motivated. This is what keeps our firm focused on our current clients and meeting new ones.

Let us help answer the "Am I going to be okay?" question for you. Give us a call!

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The Journey of International Medical Graduates to the U.S. Healthcare System

Lucio N. Margallo II, MD
President, South Dakota State Medical Association

To address the physician shortage, the U.S. Congress has introduced the Residency Physician Shortage Reduction Act of 2021 for the purpose of adding 2,000 residency positions each year between 2023 to 2029.

In 2022, there were thousands of U.S. medical graduates who were unmatched through the National Residency Matching Program (NRMP), and among those unmatched were about 3,000 International Medical Graduates (IMGs).

IMGs, comprising 25 percent of licensed physicians in the U.S., serve as vital healthcare workforce providing accessible high-quality patient care. Their path to a residency program is, however, complicated, and expensive. The process involves four major stages: passing examinations, certification, residency application, and the matching program.

After graduation from medical school, IMGs must register with the Educational Council for Foreign Medical Graduates (ECFMG) for credentialing, as a requirement for application to the U.S. Medical Licensing Examination (USMLE). The USMLE used to require Step 1 Clinical knowledge (CK) and Step 2 Clinical Skills (CS) tests. But, in January 2021, the National Board of Medical Education (NBME) permanently suspended the USMLE step 2 (CS) due to the COVID 19 pandemic. On the other hand, the ECFMG has expanded to six pathways for residency eligibility. As part of this, applicants are required to obtain a satisfactory score on the Occupational English Test (OET) Medicine to satisfy the English language proficiency requirement for ECFMG certification.

As of Jan. 26, 2022, all Step 1 exams receive a pass/fail outcome only. But before the effective date of the change, all Step 1 exams taken received a numeric score and pass/fail outcome. With the overwhelming number of applicants, a very competitive higher score would have to be obtained to avoid being screened out.

A ECFMG certified IMG must now submit a formal application for a residency program to participate in the main residency match through the Electronic Residency Application Service (ERAS) that is serviced by the American Association of Medical Colleges (AAMC). Letters of recommendation (from U.S. physicians), personal statements and appropriate observerships in U.S. medical clinics and hospitals, in addition to exemplary interviews, will have to be obtained and undergone to fortify an application.

At the very least, it's a very challenging journey for IMGs to serve in the U.S. healthcare system.

Editorial

Applying Self Directed Learning to Clinical Education

Jason J. Kemnitz, EdD

As we prepare to move the class of 2025 to the start of the clinical phase (Pillar 2) of their education, it becomes important to reflect on the needs of our students as we move from phase to phase. Pillar One is largely academic, covering system blocks and clinical foundations. Each week students know that there will be a test on the previous week's knowledge, and at the end of the block, there will be two larger comprehensive tests covering the material from the block. In addition, students know they need to be studying for their Step One exam, which they take before entering Pillar 2. Students quickly develop a routine of self-directed studying that includes the use of live or recorded lectures, supplemental instruction sessions, Qbanks, and other third-party material. Shortly after finishing Step 1 students dive headlong into Pillar 2. Clinical rotations, patient management, online cases, and observed encounters are among of myriad of items these students are expected to manage, in addition to studying for their Comprehensive Clinical Self-Assessment (2 rounds), NBME Subject exams (2 rounds), and finally, Step Two. To help students the USD SSOM curricula offer white space or self-directed learning (SDL) time. This time can be spent in study, working with clinical faculty on research, or supplementing their education in a manner the student deems worthy. Unfortunately, some students struggle with managing SDL and meshing it with their academic studies. To help both faculty and students I offer the following six steps to understanding SDL in the clinical environment. This is a brief recap of a small part of a great article published by Liu and Sullivan in BMC Medical Education.[1]

Step 1 – Identify Gaps in Knowledge – Students share that they have difficulty applying what they are learning clinically to Qbank or practice tests. Having a conversation with your student about what they are studying and how it applies to what they are seeing in the clinic can help build the bridge between the two sources of material.

Step 2 – Generate Learning Topics – After learners have identified their gaps, they need to generate learning topics. The best way to help students generate topics is to involve them in direct patient care with guidance from the care team. This will shift the learning from the passive "go learn about this topic" to an active "what do you need to do for this patient?"

Step 3 – Find Learning Resources – Encourage the student to reach out to senior members of the team or other classmates. You can also show them how you would approach learning about this topic and why you use the methods you use. Keep in mind there is a bevy of learning aides available to med students and not all of them are helpful, so your guidance is important.

Step 4 – Implementing Learning Strategies – Time management is often difficult for students entering the clinical phase of their education. In addition, the sheer volume of knowledge acquisition can be overwhelming. Helping students identify and hone in on the true learning issue is an important step. Simple steps like encouraging students to take notes for later study can be immensely helpful.

Step 5 – Self Assess Learning Outcomes – Take a moment and ask the student how they are doing with their exam studying and making the correlation between clinical education and the test. This little bit of feedback is an important step in helping the student do some self-reflection to clarify their learning.

Step 6 – Build a Framework of Learning – Students can build their routines, but often have difficulty building a clinical standard operating procedure. You can help them create an SOP by asking guiding questions to help them understand the overall picture.

As you start to see new students in your clinic, remember this aspect of their education is new to them and often overwhelming, helping them to formulate their self-directed learning strategy is one way we can ensure better clinical education.

A warm welcome to Alan Sazama, MD as he begins his tenure as Assistant Dean of Medical Education, and Pillar 2 Director.

REFERENCES

Liu TH, Sullivan AM. A story half told: a qualitative study of medical students' self-directed learning in the clinical setting. BMC Med Educ. 2021;21:494.

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The Essence of the Scientific Method

To the editor:

As usual, Dr. Wendell Hoffman's letter to the editor, "Buried on Page 16" in the November 2022 *South Dakota Medicine* was spot on! He clearly elucidated the problem of placing too much confidence about a novel subject (in which no one has expertise) into the hands of one person. The temptation for attainment of power is always high. After a while because that person has been given the status of expert, the temptation to believe whatever that individual says is gospel becomes indisputable. And there is no endorsed contrary voice to question the validity of the "anointed one."

The other point to be made is by declaring boldly that a particular product has no utility indeed stifles the recruitment of research subjects into a clinical trial. That tool is the essence of the scientific method which may either verify or contradict the question at hand. And indeed, the stifling of subject recruitment is exactly what happened in a local trial. You may recall that Sanford Clinical Research had an open trial to determine the efficacy and safety of HCQ for the treatment of COVID-19 initiated when a local labor representative urged his fellow workers not to participate. That message also got major local press coverage which had a negative impact on study participant recruitment. The trial was then discontinued.

What we in the medical field must learn from our experiences with the COVID-19 pandemic is not to abandon the scientific method in our zeal to find the optimal treatment alternatives. We must advocate for strong peer review and continuing trials to authenticate treatments that are effective. Unfortunately, the risk of demagoguery is at an all time high in today's political climate. We cannot allow that to influence our rationale for treatment options and decision making. We owe that to the patients that we serve.

V.R. Brandenburg, MD

Truth and Wisdom

To the editor:

I read the letter by Dr. Wendell Hoffman and have some thoughts about it. I have practiced since 1986 and a lot has changed over that time. Eggs and butter is bad for you, now eggs and butter are good for you. I try not to get attached to any one theory or treatment because over time these things change.

I have practiced medicine with two main rules, one – do no harm, and the second – to ease the suffering of patients. Many times, have used medications off label to help patients, such as using metoprolol for hand tremors; and at times, using studies to guide therapies, and other times, a colleague or referral physician.

When a new study comes out like the Swedish study that questions the value of colonoscopy, I don't get bent out of shape. I think it's interesting and look forward to what our GI and surgeon studies will show.

Time will build a pattern of what is best for patients.

Though studies are interesting, there is something nice about talking with a senior physician with the gray hair and see what wisdom he or she will share with me. That wisdom most likely will be not be double blind studies, but will be very enlightening.

Truth and wisdom are what I am after. Truth and wisdom help me take care of my patients, to do no harm and to lessen suffering.

Steve Redmond, MD

The One – The Many – The Method

To the editor:

I deeply appreciate the comments from Dr. Verdayne Brandenburg and Dr. Steve Redmond. Both focus on what is buried on page 16.

Dr. Brandenburg illustrates how Science is diminished by the power of the one *and* of the many. First, Dr. Anthony Fauci famously said on *Face the Nation* in November 2021, that to criticize him was to criticize Science because, "I represent Science."[1] Since none of us is a synonym for all of us, is this Fauci's Science? Such a categorical declaration demands a categorical definition. At a minimum this should be a full-throated representation (per Brandenburg) of the Scientific Method, the foundation of Science *where questioning, argumentation and minority dissent is welcomed – where skepticism of one's own position is robust – and where premature judgment is suspended.* These steeped-in-tradition habits are the Soul of Science – but with hydroxychloroquine (HCQ) for COVID-19 (especially early-use-benefit), they were gutted. Without the method, Science represents an empty suit.

Second, Brandenburg recalls the Sanford Health-led statewide HCQ clinical trial, announced with great fanfare on April 13, 2020 – including a visit to the Sanford Dakota Room in Sioux Falls, by Gov. Kristi Noem, where she declared before a packed house that, "From day one, I've said we're going to let the science…drive our decision-making in South Dakota."[2] But on June 5, 2020 this unique and promising effort was abruptly stopped just two days after the University of Minnesota published a study online, in the *New England Journal of Medicine (NEJM).* The widely quoted "Boulware Study" found that, "After high-risk or moderate-risk exposure to COVID-19, hydroxychloroquine did not prevent illness compatible with COVID-19 or confirmed infection when used as postexposure prophylaxis within 4 days of exposure."[3]

However, in short order, reviews of Boulware et. al. emerged,[4,5] noting that the study had, "…many limitations acknowledged by the invstigators."[4] Without citing other corroborating evidence for or against HCQ and at such a pivotal time, *it was contra-Science* to accept this paper at face value. Perhaps it was even another "flawed"[6] study, per Dr. Fauci.

Boulware's ink was barely dry before precipitous action was taken, and many ran for the exits, with cognitive bias in tow. The bandwagon filled up and drove away – leaving Science behind. June 5, 2020 was not a banner day for the scientific method.

Science has been under scrutiny for decades and Dr. Marcia Angell's words should have been a warning. Angell, the former editor-in-chief of the *NEJM* and author of *Science on Trial*[7] said in 2009 that, "It is simply no longer possible to believe much of the clinical research that is being published or to rely on the judgment of trusted physicians or authoritative guidelines. I take no pleasure in this conclusion, which I reached over my two decades as an editor of the NEJM."[8]

Dr. Redmond ponders the science of simply seeking out a trusted colleague for wisdom regarding patients. The legendary Dr. Robert Talley, premier teacher of the scientific method and transformational dean of USD/Sanford School of Medicine, defined this science. In November 2010 he said to a small group of us, "If you think about it, the physician is primarily a social scientist and not a scientist. We work with others to help yet others."[9]

All of us can represent Talley's science – the science of the patient, where trust is regained, and hope is restored.

Wendell W. Hoffman, MD, FACP, FIDSA

References available on request.

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Photo-Induced Sweet Syndrome: A Case Report

Mashood Badshah, MD; Ifrah Nadeem, MD; Claire Elizabeth Foerster, MS II; Brian Joel Tjarks, MD; Jackson Shriver, MD; and Mohammad Ahmed, MD

Abstract

Sweet syndrome is a rare dermatologic condition frequently accompanied by fever and neutrophilia. Underlying triggers and etiology of the sweet syndrome remain elusive, although infection, malignancy, medications, and more rarely, sun exposure have been associated with its development. We present a case of a 50-year-old female who developed a painful, mildly pruritic rash on sun-exposed areas of the neck, arms, and legs. She also reported chills, malaise, and nausea upon presentation. Before developing the rash, she had preceding upper respiratory infection symptoms, used ibuprofen for joint pain, and had extensive sunlight exposure on the beach. Laboratory findings were significant for leukocytosis with absolute neutrophilia, elevated C-reactive protein, and elevated erythrocyte sedimentation rate. Skin punch biopsy demonstrated papillary dermal edema with dense neutrophilic infiltration. Further evaluation for hematologic or solid organ malignancy was negative. Following the administration of steroids, the patient demonstrated significant clinical improvement. While rare, ultraviolet A and B sunlight has been shown in rare situations to be associated with the development of the Sweet syndrome. The underlying mechanism for the development of photo-induced Sweet syndrome remains unknown. However, excessive sunlight exposure should be considered a potential cause when evaluating the underlying triggers for the development of the Sweet syndrome.

Introduction

Sweet syndrome (SS) is a neutrophilic dermatosis that is characterized by fever and a sudden onset painful rash with small edematous red-purple papules and pustules distributed to the trunk, arms, legs, neck, or face. While the exact mechanism of SS is unknown, it is associated with illness, medications, and several types of cancer. We present a case report of a 50-year-old woman who developed Sweet syndrome after heavy sun exposure.

Case Presentation

A 50-year-old Caucasian female presented to the emergency department (ED) with an abrupt onset of a painful, mildly pruritic rash associated with constitutional chills, malaise, and nausea. The patient had a past medical history of gastroesophageal reflux disease, fibromyalgia, attention-deficit hyperactive disorder, non-specific peripheral neuropathy, and major depressive disorder. Home medications at the time of admission included pregabalin, trazodone, and gabapentin. She reported flu-like symptoms which were concerning for an upper respiratory tract infection about one week before the onset of the rash. She also reported recent oral ibuprofen use two to three weeks before hospital admission for right leg pain. She reported the development of a rash after sunbathing on the beach for two hours, three days before admission. The rash was distributed on the sun-exposed areas including the bilateral upper and lower extremities and the nape of the neck (Figures 1-5). The patient denied any previous history of malignancy, hematological disorders, or autoimmune disorders. She did have a reported allergy to venlafaxine; however, she denied any other known medications or food allergies. She also reported being compliant with the age-appropriate screening including cervical cancer screening and mammography.

In the ED, the patient was found to be hemodynamically stable and afebrile. On physical examination, the patient had an erythematous, edematous, juicy, vesiculo-papular rash strictly involving the sun-exposed areas of the neck, arms, and legs (Figures 1-5). The rash subsequently developed into raised, purple plaque-like lesions involving the back of the neck and lower extremities. Laboratory studies showed white blood cell count of 13300/µL (normal range 4500-9800/µL). with the elevated absolute neutrophil count at 10270/µL (normal range 1400-6500/µL). Polymorphonuclear leukocyte (PMN) percentage was also elevated at 77.3 percent (normal range 57-75 percent). Inflammatory markers were elevated with C-reactive protein 32.3 mg/dL (normal range 0.0-0.9 mg/dL) and erythrocyte sedimentation rate (ESR) at 28 mm/Hr (normal range 0-30 mm/Hr). Initial infectious workup, including chest X-ray and urinalysis, was unremarkable.

The clinical presentation and laboratory evaluation were

Figures 1-3. Vesiculo-papular, erythematous, confluent rash involving the arm.

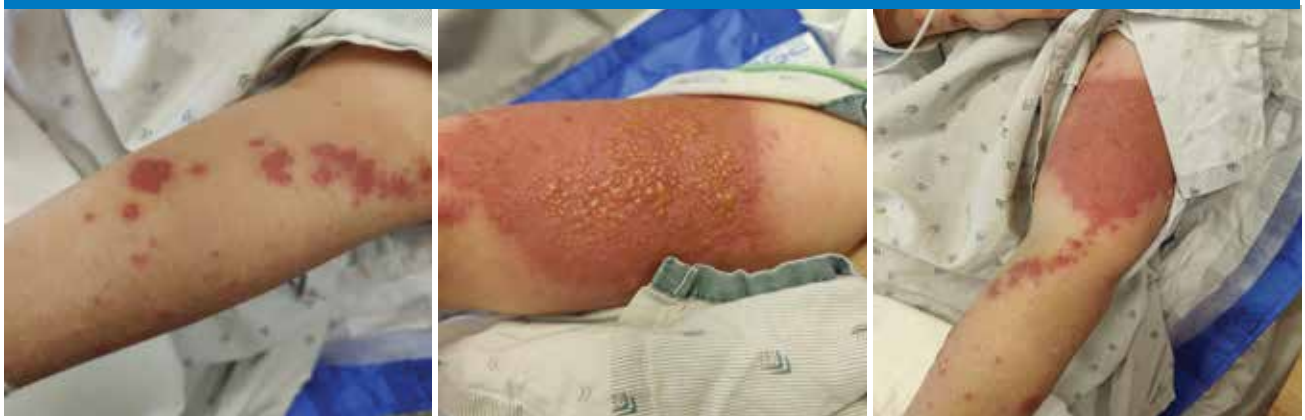


Figure 4. Rash involving the lower extremities.

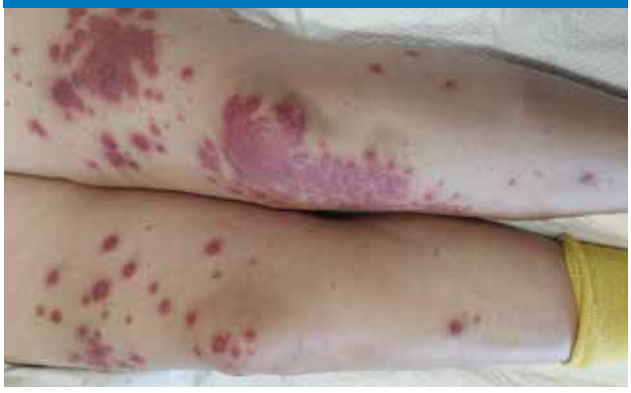
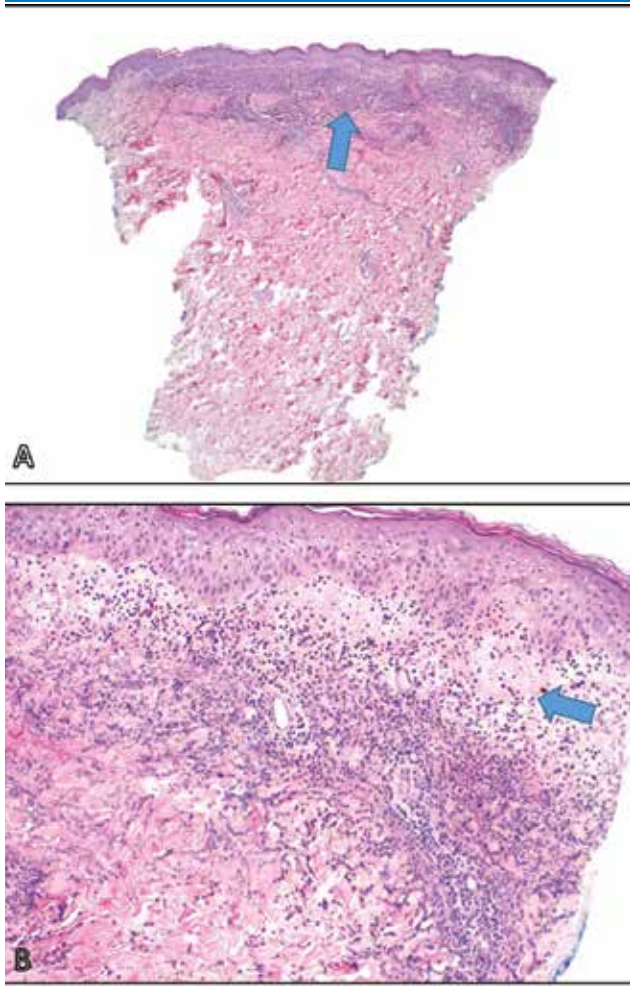


Figure 5. Rash involving the nape of the neck.

concerning for Sweet syndrome (SS). A skin punch biopsy was performed showing an epidermis of normal thickness and rete pattern with papillary dermal edema and a dense neutrophilic infiltrate (Figure 6). Special stains were negative for micro-organisms. These histologic features, in conjunction with the clinical findings, supported the diagnosis of Sweet syndrome. The patient was admitted to the hospital and initiated on high-dose systemic corticosteroids with a single

Figure 6. Sections of a 4 mm punch biopsy showing a dense dermal neutrophilic infiltrate (arrow; A; hematoxylin and eosin, 20x). The epidermis is unremarkable and there is striking papillary dermal edema (arrow; B; hematoxylin and eosin, 100x).



dose of intravenous (IV) methylprednisolone 125 mg for the rash. She also received IV diphenhydramine 50 mg and oral hydroxyzine 25 mg for the pruritis. Nausea responded promptly to IV ondansetron 4 mg. Because of the association of SS with hematologic and solid organ malignancy, the patient underwent computed tomography (CT) scanning of chest, abdomen, and pelvis with 100 mL IV iopamidol contrast which showed non-specific right upper and lower lobe ground-glass nodules, however, did not show any abnormal masses concerning for malignancy. The patient showed dramatic clinical improvement IV methylprednisolone and was subsequently switched to oral prednisone 80 mg daily with a slow taper over three to four weeks per dermatology recommendations. She remained hemodynamically stable during her stay at the hospital and was discharged the next day on oral steroids with dermatology follow-up.

Discussion

SS, also known as acute febrile neutrophilic dermatosis, is characterized by sudden onset of painful, edematous, and erythematous papules, plaques, or nodules on the skin frequently accompanied by fever and peripheral leukocytosis with neutrophilia. The rash may also be accompanied by myriad extra-cutaneous manifestations including neurological, cardiovascular, pulmonary, hepatic, and ocular symptoms, among others. Traditionally, SS has been divided based on etiology into classic/idiopathic, malignancy-associated, and drug-induced.[1] Classical SS, which is the most common form, may occur with a variety of upper respiratory and gastrointestinal infections, inflammatory bowel diseases, or pregnancy. Malignancy-associated SS on the other hand is usually associated with hematologic malignancies most commonly with acute myelogenous leukemia, while drug-induced SS can be due to a variety of medications.

The mechanism of SS remains elusive; however, it may represent hypersensitivity reaction to bacterial, viral, or tumor antigens, leading to stimulation of a cascade of cytokines that precipitate neutrophil activation and homing to the skin.[2] Other postulated mechanisms include cytokine dysregulation especially involving elevated granulocyte colony-stimulating factor (G-CSF), with one study showing significantly elevated G-CSF levels in active SS patients compared to inactive SS cases.[3] Genetic factors may also contribute to the development of SS with some studies indicating a link between SS and MEFV gene of febrile Mediterranean fever.[4,5] Diagnosis of classic or malignancy-associated SS requires both major and two of four minor criteria (Table 1) for diagnosis.[4,6] Drug-associated SS, on the other hand, has a distinct set of diagnostic criteria and requires all five features for diagnosis (Table 2).[7]

Table 1. Diagnostic criteria for classic or malignancy associated Sweet syndrome.

Major criteria
1. Abrupt onset of tender or painful erythematous plaques or nodules occasionally with vesicles, pustules or bullae 2. Histopathologic evidence of a dense neutrophilic infiltrate without evidence of leukocytoclastic vasculitis*
Minor criteria
1. Accompanied by periods of general malaise and fevers >38°C 2. Associated with inflammatory disease, hemoproliferative disorders, solid organ tumors or pregnancy, or preceded by upper respiratory infection, gastrointestinal infection, or vaccination 3. Excellent response to treatment with systemic glucocorticoids or potassium iodide 4. Abnormal laboratory values at presentation (3/4 of the following values necessary) a) Erythrocyte sedimentation rate >20 mm/h b) Positive C-reactive protein c) >8,000 leukocytes per microliter d) >70% neutrophils
Diagnosis of classic or malignancy associated Sweet syndrome requires the presence of both major criteria and two of the four minor criteria.
*The presence of vasculitis does not exclude the diagnosis of Sweet syndrome. Although, vasculitis is not the primary pathological mechanism of Sweet syndrome, the blood vessels in the involved skin can develop vasculitis over time due to prolonged exposure to noxious stimuli from circulating polymorphonuclear leukocytes (PMN).[16]

Table 2. Diagnostic criteria for drug induced Sweet syndrome.

1. Abrupt onset of painful erythematous plaques or nodules 2. Histopathologic evidence of a dense neutrophilic infiltrate without evidence of leukocytoclastic vasculitis 3. Fever >38°C 4. Temporal relationship between drug ingestion and clinical presentation, or temporally-related recurrence after oral challenge 5. Temporally related resolution of lesions after drug withdrawal or treatment with systemic corticosteroids
The presence of all five above mentioned criteria are required for the diagnosis of drug induced Sweet syndrome.

Observational studies indicate that upper respiratory infection is a common trigger for classic SS.[8] There are also studies indicating a possible association between drug-induced SS and non-steroidal anti-inflammatory drugs (NSAIDs) including diclofenac.[9] However, the association of SS onset or aggravation with sunlight is rare. Extensive literature review reveals only around half a dozen studies of sunlight-induced/aggravated SS. A study in 1985 indicated a possible association between ultraviolet B (UVB) light and SS provocation/aggravation, especially with UVB strength five times the minimum erythema dose.[10] Belhadjali et al. reported two cases, with one patient reporting strong sunlight and ultraviolet A (UVA) exposure and the other patient aggravated by sunlight with a photo-distributed rash. The study postulated the Koebner phenomenon as a possible trigger for photo-induced satellite lesions with the UVB releasing inflammatory cytokines leading to neutrophil activation and recruitment to the skin.[11] Koebnerization also known as isomorphic phenomenon involves the formation of new skin lesions in previously uninvolved skin secondary to trauma. The causes of trauma may include sunlight and the satellite lesions at the site of trauma are identical to the original cutaneous disease lesions. Natkunarajah

et al. reported another case of photo-aggravated SS and postulated direct effect of UVB radiation on neutrophil activation and epidermal production of cytokines such as tumor necrosis factor-alpha (TNF-a) and interleukin-8 (IL-8) as a possible mechanism of SS.[12] Meyer et al. also reported a photo-induced SS and affirmed the possible role of UVB in inducing pro-inflammatory cytokines such as IL-1 alpha, TNF-a, prostaglandin E2 and G-CSF as a possible driver of SS.[13] A recent case series investigating uncommon dermatologic complications, including SS in breast cancer patients treated with radiation therapy, also determined Koebner phenomenon as a possible driver of SS.[14] The most recent case report was published by Perez-Feal et al. indicating photo-induced SS in two patients. In one of those cases, the photo-distributed SS rash resolved after withdrawal of hydrochlorothiazide indicating the possible role of medications in addition to UVB in the pathogenesis or augmentation of SS.[15]

Conclusion

SS is a rare febrile neutrophilic dermatitis that is commonly associated with malignancy, upper respiratory infections, and certain medications. Although the most likely trigger seems to be exposure to UVA/UVB, her recent intake of NSAIDs such as ibuprofen, and a recent history of an upper respiratory illness may have primed the response to sunlight in our case. While infrequent, clinicians need to consider the possibility of the photo-induced SS in patients who present with classic symptoms without the more commonly associated triggers mentioned. We suggest further studies on the relationship between sun exposure and induction or aggravation of SS.

REFERENCES

1. Cohen PR. Sweet's syndrome--a comprehensive review of an acute febrile neutrophilic dermatosis. Orphanet J Rare Dis. 2007;2:34.
2. Voelter-Mahlknecht S, Bauer J, Metzler G, Fierlbeck G, Rassner G. Bullous variant of Sweet's syndrome. Int J Dermatol. 2005;44(11):946-7.
3. Kawakami T, Ohashi S, Kawa Y, et al. Elevated serum granulocyte colony-stimulating factor levels in patients with active phase of sweet syndrome and patients with active behcet disease: implication in neutrophil apoptosis dysfunction. Arch Dermatol. 2004;140(5):570-4.
4. Heath MS, Ortega-Loayza AG. Insights into the pathogenesis of Sweet's syndrome. Front Immunol. 2019;10:414.
5. Miyoshi T, Yamashita K, Ohno T, et al. Familial Mediterranean fever gene as a possible modifier of Sweet syndrome with chronic myelogenous leukemia. Acta Haematol. 2008;120(1):57-62.
6. von den Driesch P. Sweet's syndrome (acute febrile neutrophilic dermatosis). J Am Acad Dermatol. 1994;31(4):535-60.
7. Walker DC, Cohen PR. Trimethoprim-sulfamethoxazole-associated acute febrile neutrophilic dermatosis: case report and review of drug-induced Sweet's syndrome. J Am Acad Dermatol. 1996;34(5 Pt 2):918-23.
8. Wojcik AS, Nishimori FS, Santamaría JR. Sweet's syndrome: a study of 23 cases. An Bras Dermatol. 2011;86(2):265-71.
9. Ginarte M, Garcia-Doval I, Toribio J. Sweet's syndrome: a study of 16 cases. Med Clin Barc. 1997;109:588-91.
10. Horio T. Photoaggravation of acute febrile neutrophilic dermatosis (Sweet's syndrome). J Dermatol. 1985;12(2):191-4.
11. Belhadjali H, Marguery MC, Lamant L, Giordano-Labadie F, Bazex J. Photosensitivity in Sweet's syndrome: two cases that were photoinduced and photoaggravated. Br J Dermatol. 2003;149(3):675-7.
12. Natkunarajah J, Gordon K, Chow J, Sarkany R, Millington GW, Marsden RA. Photoaggravated Sweet's syndrome. Clin Exp Dermatol. 2010;35(3):e18-9.
13. Meyer V, Schneider SW, Bonsmann G, Beissert S. Experimentally confirmed induction of Sweet's syndrome by phototesting. Acta Derm Venereol. 2011;91(6):720-1.
14. Dalmasso C, Tournier É, de Lafontan B, et al. Dermatoses réactionnelles rares après radiothérapie : une série de cas avec cancer du sein [Uncommon dermatologic disorders triggered by radiation therapy of breast cancer: A case-series]. Cancer Radiother. 2017;21(3):216-21.
15. Pérez-Feal P, Pita da Veiga G, Moreiras-Arias N, Buján-Bonino C, Suárez-Peñaranda JM, Rodrí guez-Granados MT. Sweet's syndrome triggered by ultraviolet light. Photodiagnosis Photodyn Ther. 2021;34:102258.
16. Malone JC, Slone SP, Wills-Frank LA, et al. Vascular inflammation (vasculitis) in sweet syndrome: a clinicopathologic study of 28 biopsy specimens from 21 patients. Arch Dermatol. 2002;138(3):345-9.

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Intracranial Hemorrhage versus Contrast Extravasation Following Thrombolytic Therapy

Fouad Khalil, MBBCh; Mohammad Ali, MBBS; and Divyajot Sandhu, MD

Abstract

We report the case of a 51-year-old female with history of end stage renal disease on hemodialysis who presented with right hemiplegia and aphasia. On admission, head CT was negative for intracranial hemorrhage. MRI showed an area of acute infarct in the left parietal lobe. The patient received intravenous tissue plasminogen activator. Head CT 24 hours later showed areas of increased density in the left parietal and posterior temporal lobes. Contrast extravasation with superimposed intracranial hemorrhage could not be excluded. Therefore, antiplatelet therapy was held. A follow up CT scan demonstrated the same findings. Another head CT was obtained after hemodialysis showed resolution of the previously noted areas of increased density suggesting that contrast extravasation was the reason of increased density areas.

Introduction

Intravenous tissue plasminogen activator is the standard care of patients with acute ischemic stroke presenting within three hours of symptoms onset.[1] Hemorrhagic transformation is a major adverse event of thrombolytic therapy. Identification of intracranial hemorrhage (ICH) is very important in patients with acute ischemic stroke following IV tPA administration to guide antiplatelet or anticoagulation therapy. Differentiation between iodine contrast extraversion and ICH can be difficult on routine head CT. Serial imaging is the current standard approach for differentiation as contrast extravasation generally washes out within 24 to 48 hours.[2]

Case Presentation

We report a case of a 51-year-old female with history of end stage renal disease (ESRD) on dialysis, uncontrolled diabetes and seizures, who presented with complaints of right sided weakness, facial droop and aphasia. She received intravenous tissue plasminogen activator (tPA) at an outside facility then was transferred to our center for further evaluation.

Vital signs were unremarkable apart from blood pressure of 180/90. Physical exam was remarkable for right sided hemiparesis along with aphasia. Labs including complete blood picture, metabolic and lipid panel were within normal range except for creatinine of 4.5 mg/dl and hemoglobin A1C of 12.8 percent.

CT head was performed prior to IV tPA administration and was negative any intracranial bleeding. MRI revealed an area of infarct in the left parietal lobe (Figure 1). CTA neck showed bilateral mild to moderate atherosclerosis of carotid arteries without any hemodynamically significant stenosis or occlusion. She was monitored on telemetry to evaluate for arrhythmia. On day two hospitalization, CT head showed new areas of increased density in the left posterior temporal lobe and left parietal lobe (Figure 2). This was thought to be secondary to contrast extravasation. However, superimposed

Figure 1. Punctate focus of signal abnormality in the left parietal lobe suggesting an acute to subacute infarct without hemorrhagic transformation or significant mass effect (yellow arrow).

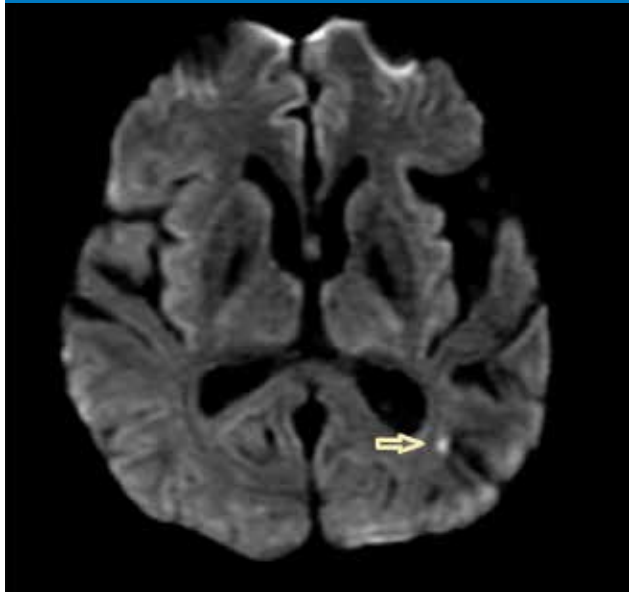

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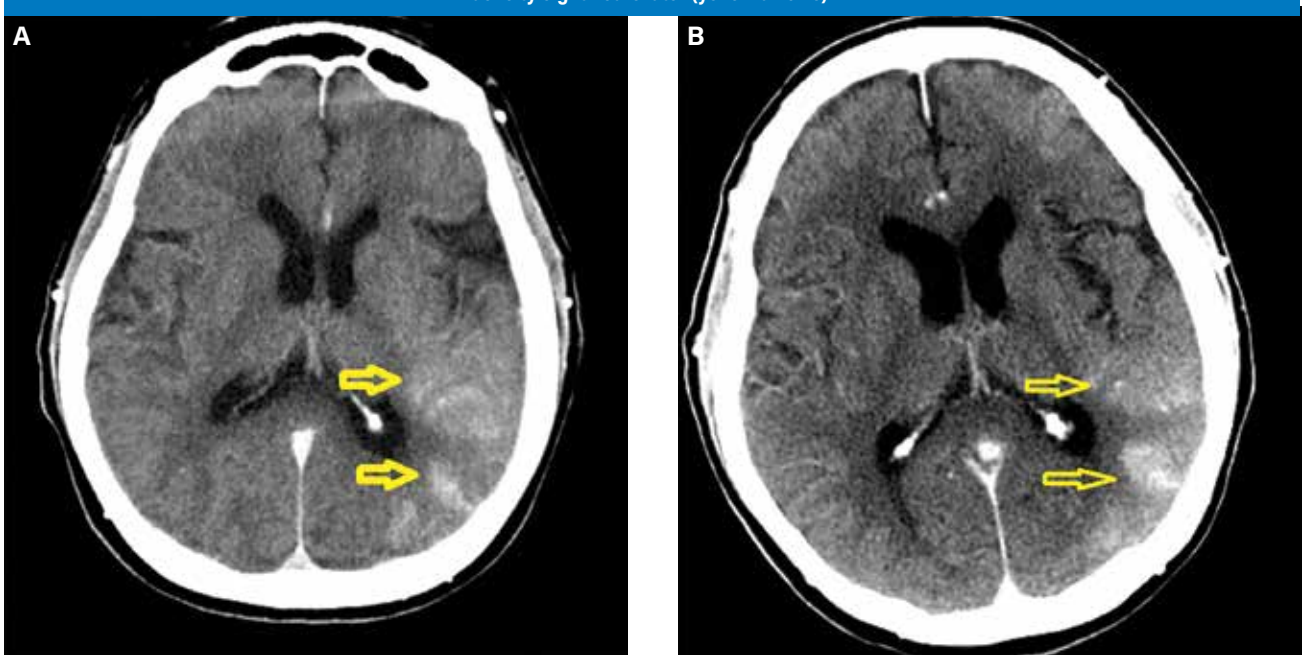
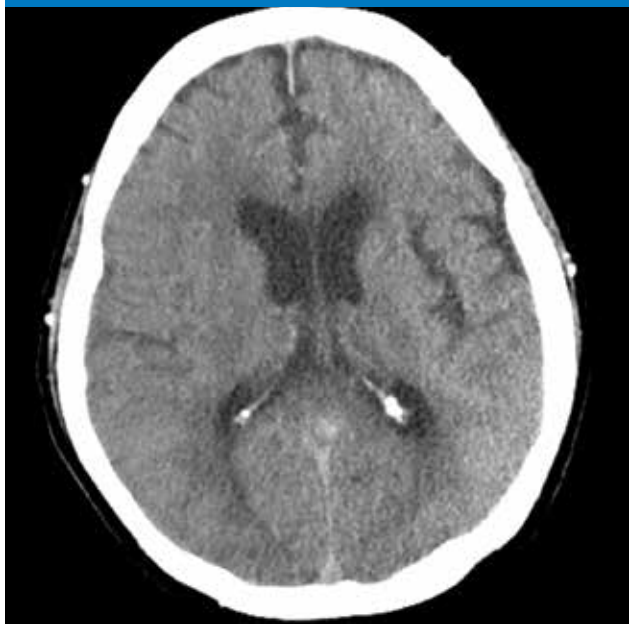
Figure 2. A) New areas of increased density in the left posterior temporal lobe and left parietal lobe. B) Persistent areas of increased density eight hours later (yellow arrows).



subarachnoid bleeding could not be excluded. Repeat CT eight hours later was unchanged. Antiplatelet therapy was held in the setting of possible subarachnoid hemorrhage (SAH). The patient then underwent routine hemodialysis for her ESRD. A follow up CT after hemodialysis showed significant resolution of the previously note areas with increased density suggesting that contrast extravasation was the main cause (Figure 3).

The patient was started on ASA 81 mg for secondary prevention along with statin therapy. Endocrinology was consulted to help with blood sugar control. The patient was improving with physical, occupational and speech therapies during hospitalization and was eventually discharged to a rehabilitation center.

Figure 3. Significant resolution of the previously noted areas of increased density after hemodialysis.



Discussion

Contrast extravasation can occur in stroke patients especially following intra-arterial thrombolytic therapies due to injection of large volume of contrast. However, studies delineating the relationship between the amount of injected contrast and extravasation are lacking. Contrast extravasation in these patients is likely secondary to disruption of the blood brain barrier (BBB). Many mechanisms have been proposed for the breakdown of blood-brain barrier in this population including chemotoxicity of the contrast agent, hyperosmolality, increased pinocytosis in the setting of a damaged BBB secondary to ischemia.[3] Thrombolytic agents might such as tPA might increase microvascular permeability through acceleration of BBB, basal lamina, platelet–fibrin plugs dissolution with subsequent vasogenic edema.[4-6] Furthermore, reperfusion injury following thrombolytic therapy through formation of reactive oxygen species and activation of matrix metalloproteinases might compromise

microvascular integrity and increased risk for hemorrhage.[7,8] Therefore, contrast extravasation and ICH frequently coexist as they share the same etiology. However, when the damage is limited to the endothelium, the hyperdensity is likely contrast without blood. On the other hand, if damage extends to basal lamina, blood and contrast likely coexist.[9]

Distinguishing contrast extravasation from intracranial hemorrhage is critical to initiate antithrombotic or anticoagulation therapy. Serial imaging is required in this patient population to demonstrate washout of the contrast, assuming that ICH, unlike contrast extravasation, persists after 24 hours.[10] However, there is no systematic studies to validate this cut off. Therefore, delayed wash out of the extravasation in some patients might compromise optimal medical therapy and predispose the patient to further brain ischemic events. We believe ESRD in our case contributed to delayed washout of the contrast extravasation.

MRI with diffusion-weighted imaging (DWI) and susceptibility-weighted imaging (SWI) has been proven to be effective for blood detection within an equivocal area on post-acute stroke therapy CT.[11] Dual-energy CT (DECT) might be an alternative approach for early differentiation between ICH and contrast extravasation with reliable accuracy. Two different x-ray spectra are used in DECT to get two image datasets of the same area. Accurate differentiation between materials based on specific change in attenuation on images obtained with high and low energy spectra. While two different agents might have similar attenuations on images acquired with one energy spectrum, they may show significant differences on images acquired with the other spectrum.[12] For example, the CT number of ICH (80 Hounsfield units) doesn't change significantly at low (80 kV) and high (140 kV) energy X-rays. Conversely, Iodine shows high attenuation difference between high and low energy x-ray as the CT number of iodine at low energy spectrum is twice that as high energy x ray.[13] A study has demonstrated accuracy approaching 100 percent using DECT in to distinguish hyperdensities secondary to contrast extravasation from ICH.[2]

Conclusion

Contrast extravasation following IV tPA therapy in patients with ischemic stroke can mimic ICH on head CT. Serial imaging is the standard of care for differentiation. Early differentiation is critical to initiate antithrombotic or anticoagulation therapy. MRI or DECT can be helpful in such circumstances. We believe ESRD was contributing to delayed washout of contrast extraversion in our patient. Providers should be aware of this possibility as it might impact the initiation of optimal medical therapy. Future research is needed for better understanding of contrast extravasation and ICH in the setting of renal impairment and the role of dialysis in this population.

REFERENCES

1. Albers GW, Bates VE, Clark WM, Bell R, Verro P, Hamilton SA. Intravenous tissue-type plasminogen activator for treatment of acute stroke: the Standard Treatment with Alteplase to Reverse Stroke (STARS) study. JAMA. 2000;283(9):1145-50.
2. Phan CM, Yoo AJ, Hirsch JA, Nogueira RG, Gupta R. Differentiation of hemorrhage from iodinated contrast in different intracranial compartments using dual-energy head CT. AJNR Am J Neuroradiol. 2012;33(6):1088-94.
3. Yoon W, Seo JJ, Kim JK, Cho KH, Park JG, Kang HK. Contrast enhancement and contrast extravasation on computed tomography after intra-arterial thrombolysis in patients with acute ischemic stroke. Stroke. 2004;35(4):876-81.
4. Luzzani F, Morisetti A, Bussi S, Tirone P, DE HAËN C. Neurotolerability of nonionic X-ray contrast media: the role of chemotoxicity. Investigative Radiology. 1996;31(6):338-44.

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Documentation of Sepsis in Patients Meeting Pediatric Sepsis Criteria: An Area for Improvement

Gokhan Olgun, MD; Shelley Y. Feng, MS IV; Amber J. Veldman, MS IV; and Jody N. Huber, MD

Abstract

Objective: Documentation is a critical aspect for properly evaluating a patient's medical status. In order to accurately diagnose sepsis promptly, the need for proper documentation becomes even more necessary. We conducted a retrospective chart review to assess accuracy and frequency of sepsis documentation by electronic medical records (EMR) review. The patients are children aged 0 to 18 years of age in whom the sepsis trigger tool fired in the EMR and were admitted on the inpatient floor or pediatric intensive care unit.

Methods: An EMR sepsis notification alert is currently utilized by our institution. Two pediatric intensivists reviewed the EMR charts of hospitalized, pediatric patients in whom the notification fired. The primary outcome was to identify the patients who met criteria for sepsis according to the 2005 International Pediatric Consensus Conference Guidelines. In patients who met the criteria, physician charting was inspected manually to evaluate documentation of sepsis and/or septic shock within 24 hours of meeting sepsis criteria.

Results: Using the 2005 International Pediatric Consensus Conference Guidelines, 359 patients met sepsis criteria. Of those, 24 (7 percent) were documented to have sepsis and/or septic shock in the EMR. Sixteen of those patients had septic shock, while the remaining eight had sepsis.

Conclusion: Although sepsis is not uncommon, it is often not documented appropriately in electronic medical records. Hypothesized explanations include difficulty in diagnosing sepsis and using alternative diagnoses. This study demonstrates the ambiguity of the current pediatric sepsis criteria and difficulty capturing this diagnosis in the EMR.

Introduction

Pediatric sepsis is a common occurrence with significant morbidity and mortality.[1] The accurate diagnosis of sepsis in a pediatric population is historically a challenge. The diagnostic criteria for pediatric sepsis utilize the 2005 International Pediatric Sepsis Consensus Conference definition, relying on the systemic inflammatory response syndrome (SIRS) criteria.[2] Patients are determined to be septic if they meet SIRS criteria and have documented or suspected infection which can be bacterial, fungal or viral in origin. SIRS criteria are presence of core temperature of greater than or equal to 38.5°C or less than or equal to 36°C, heart rate or respiratory rate greater than 2 standard deviations for age-appropriate levels and abnormal leukocyte count. Presence of two of the criteria mentioned above fulfills criteria for SIRS. The SIRS criteria base the diagnosis of sepsis on systemic inflammation combined with documented or high suspicion of sepsis. SIRS criteria were found to be problematic in the adult population which led to new sepsis-3 criteria, utilizing a sequential organ failure assessment (SOFA) score[3] The SOFA score is a validated tool for adults with validation also occurring in pediatrics, pSOFA score.[4]

In accordance with recommendations from the American Academy of Pediatrics and Society of Critical Care Medicine, our institution implemented a pediatric early sepsis recognition system utilizing the electronic medical record (EMR). As part of the hospital's quality improvement project, the documentation of sepsis was evaluated. Documentation of sepsis in the EMR is critical for proper patient diagnosis and billing. It is important to accurately diagnose sepsis for proper benchmarking and resource allocation. Balamuth and colleagues demonstrated difficulty with identifying sepsis diagnoses in the EMR using the ICD-9 coding.[5] The purpose of this study was to assess accurate sepsis documentation in the EMR. The primary outcome was to identify the number of pediatric subjects with documented sepsis in the medical record.

Methods

This was a retrospective chart review of children in whom

a sepsis recognition tool was triggered in the EMR. This project received IRB approval. Consent for the study was waived by the IRB.

Our hospital utilizes a sepsis early recognition tool. This tool triggers a best practice alert (BPA) in the EMR when there is concern for sepsis based on vital signs, laboratory values and physical exam findings. Indications for BPA firing were elevated or low temperature, elevated heart rate, elevated respiratory rate, low systolic blood pressure, peripheral pulse strength (weak or bounding), capillary refill time (delayed or flash), skin color (such as mottled or pale), level of consciousness and preexisting medical conditions. Presence of temperature abnormality is required. In addition to temperature abnormality two additional parameters are required within a six hour time period. The medical records of subjects were reviewed from December 2018 through April 2020. Inclusion criteria included children aged 0 to 18 years of age who in whom the sepsis trigger tool fired in the EMR and were admitted on the inpatient floor or PICU (pediatric intensive care unit). If there was concern for sepsis, an order set was utilized for ordering laboratory work, antibiotics, and fluid boluses. Two pediatric intensivists reviewed medical records of those that triggered the sepsis tool/BPA (92 percent interrater agreement). A diagnosis of sepsis was determined to be present if patients met 2005 pediatric sepsis consensus conference.[2] For subjects with a split decision, a third critical care physician reviewed for final decision. Admission, discharge, progress and supplemental progress notes were reviewed in subjects meeting the sepsis definition. If sepsis or septic shock was mentioned in the assessment or problem list of a note, sepsis was considered to be documented even if the primary diagnosis was different than sepsis. ICD-10 (International Classification of Diseases, version 10) codes were also queried and patients were included if sepsis or septic shock was coded.

Mean and standard deviations were used for continuous variables. Categorical variables were presented as values and percentages.

Results

There were 555 inpatient pediatric subjects with a sepsis BPA alert activation during this study period. Of these subjects, 359 met the 2005 pediatric sepsis definition (Figure 1). Demographics of subjects are described in Table 1. Median age was 4 years old with 58 percent being female. The majority (67 percent) were Caucasian and 25 percent were American Indian.

All subjects with sepsis met SIRS criteria and had presumed infection within the six-hour window of BPA activation. There were 181 subjects who met diagnostic criteria for sepsis on the inpatient service and 178 in the PICU. Of those patients meeting criteria for sepsis, 24 had documentation of sepsis in the EMR within 24 hours of meeting criteria. Location of the subjects included 19 (79 percent) in the PICU and 5 (21 percent) on the inpatient service.

All subjects with documentation of sepsis received antibiotics. Septic shock was present in 16/24 (67 percent) with all of these patients requiring vasoactive medication support. All patients meeting criteria for septic shock had a documentation of sepsis in the EMR (Table 1).

Figure 1. Chart review of EMR for diagnosis of sepsis in documentation.

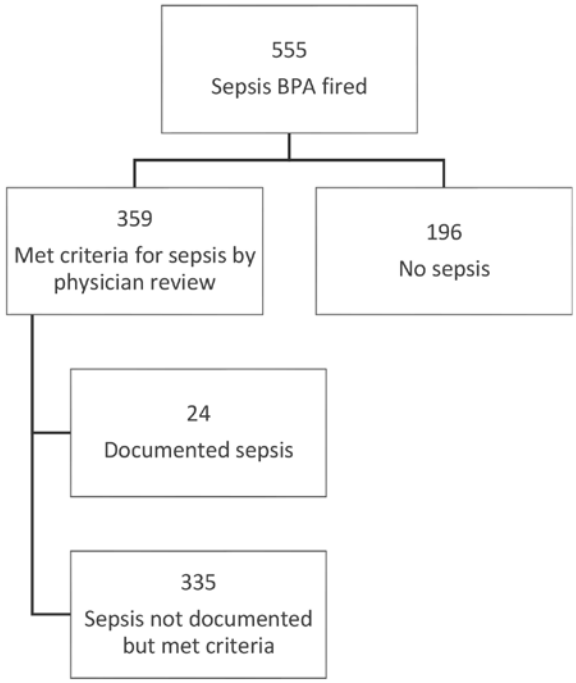

Table 1. Demographics.

Characteristic	Value
Age (mean, years)	4
Gender	
Female	14 (58%)
Male	10 (42%)
Ethnicity	
Caucasian	16 (67%)
American Indian	6 (25%)
Other	2 (8%)
Location	
PICU	19 (79%)
Floor	5 (24%)
Mortality	8 (33%)

Discussion

This study identified 359 subjects with sepsis in the pediatric inpatient and critical care population using the 2005 pediatric sepsis diagnostic criteria.[6] Of those 359 subjects, only 24 had sepsis documented in the EMR. Of the subjects with sepsis documentation, 16 actually had septic shock requiring vasoactive medications. Children were more likely to have sepsis documented if septic shock was present.

Sepsis is a not an uncommon diagnosis for children. The SPROUT study identified a global point prevalence of severe sepsis at 8.2 percent (95 percent CI; 7.6-8.9).[2] The exact incidence of sepsis in children is difficult to define due to the varying interpretations of the definition.[7]

Documentation of sepsis in the EMR was low in this study. In addition, sepsis appeared to be documented when, in fact, septic shock was the more accurate diagnosis. The diagnosis of sepsis is challenging to capture in documentation and coding.[7-9] The gap in sepsis diagnosis and documentation could lead to treatment aberrations. The mean time to antibiotics for patients presenting to emergency department with sepsis was much shorter in the group in which sepsis documented in the chart.[10] In addition, physicians perceived lack of correct documentation of sepsis as a barrier to good patient outcomes.[11] The low rate of sepsis documentation is similar to study in the Netherlands where documentation was seen in only 27 percent.[12] Some institutions are improving documentation of sepsis by implementing a hospital-wide pediatric sepsis identification pathway. This showed improvement in provider documentation of sepsis from 50 percent to 80 percent and maintained this documentation for the following six months.[13]

The 2005 sepsis criteria were revised in 2016 for adult critical care due to difficulty identifying sepsis and multiple false positives in adult patients using the SIRS criteria. According to the "Sepsis-3" definition, national societies including the Society of Critical Care Medicine (SCCM) and the European Society of Intensive Care Medicine (ESICM) moved away from using SIRS but rather use a sequential organ failure assessment (SOFA) or quick SOFA (qSOFA) scoring system for early detection of sepsis. Although pediatric SOFA (pSOFA) scoring has been validated, pediatricians still use SIRS criteria in determination of sepsis as pediatric diagnostic guidelines have not been revised.[4] SIRS criteria are consistently sensitive but not as specific, leading to questions in sepsis diagnosis.[14,15] The lack of documentation in our study may be partially due to lack of physician agreement with current diagnostic criteria. Another possibility is the misperception that the diagnosis of sepsis occurs in the PICU with hypotension, not the inpatient floor. Sepsis is thought to occur throughout a spectrum with the last stage being septic shock with cardiovascular dysfunction. Throughout this spectrum, the diagnosis of sepsis without septic shock should be more common. Our current study demonstrates that septic shock is documented more frequently than sepsis without shock.

There are limitations to this study. This was a retrospective chart review. The subject population included subjects admitted to the inpatient pediatric floor and PICU. These findings reflect one children's hospital and may not be generalizable for the pediatrics population nationally. It is also a snapshot of a selected period of time and may not demonstrate an overall trend. Also we acknowledge that there may be cases of sepsis that are not caught by BPA (false negativity) and we can not comment on documentation of those subjects.

In conclusion, this study demonstrates that there is room for improvement in documentation of sepsis among pediatric providers. This is possibly due to the difficulty of diagnosing sepsis and use of alternative diagnoses or hesitancy to document sepsis when patient is not critically ill. Our study demonstrates ambiguity with the current pediatric sepsis criteria and difficulty capturing this diagnosis in the EMR. There is a need for documentation improvement and further discussion regarding pediatric sepsis diagnostic criteria.

REFERENCES

1. Weiss SL, Fitzgerald JC, Pappachan J, et al. Global epidemiology of pediatric severe sepsis: the sepsis prevalence, outcomes, and therapies study. Am J Respir Crit Care Med. May 15 2015;191(10):1147-57.
2. Goldstein B, Giroir B, Randolph A, Sepsis MotICCoP. International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics.* Pediatr Crit Care Med. 2005;6(1):2-8.
3. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA. Feb 23 2016;315(8):801-10.
4. Matics TJ, Sanchez-Pinto LN. Adaptation and validation of a pediatric sequential organ failure assessment score and evaluation of the sepsis-3 definitions in critically ill children. JAMA Pediatrics. 2017;171(10):e172352.
5. Balamuth F, Alpern ER, Grundmeier RW, et al. Comparison of Two sepsis recognition methods in a pediatric emergency department. Acad Emerg Med. Nov 2015;22(11):1298-306.
6. Goldstein B, Giroir B, Randolph A. International pediatric sepsis consensus conference: definitions for sepsis and organ dysfunction in pediatrics. Pediatr Crit Care Med. Jan 2005;6(1):2-8.
7. Hsu HE, Abanyie F, Agus MSD, et al. A national approach to pediatric sepsis surveillance. Pediatrics. Dec 2019;144(6).

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A Case of Intraventricular Coronary Artery Perforation Following Percutaneous Coronary Intervention in the Setting of Myocardial Bridge of Left Anterior Descending Artery

Aditya Singh, MBBS, MD; Mansi Oberoi MBBS; Kevin Coy, MD; Tomasz Stys, MD, FSCAI, FACC; and Adam Stys, MD

Abstract

Coronary artery perforation during percutaneous coronary intervention is a rare but potentially fatal complication. Intraventricular rupture is more commonly seen in setting of myocardial bridging where the epicardial coronary artery takes an intramuscular course. We describe a case of acute thrombotic in-stent restenosis of the intramyocardial (myocardial bridge) distal left anterior descending artery complicated by intraventricular perforation in the setting of an anterior ST elevation myocardial infarction managed by covered stenting.

Introduction

Coronary artery perforation (CAP) is one of the most challenging and feared complications of percutaneous coronary intervention (PCI). It is more commonly seen in patients with complex coronary anatomy including myocardial bridging where the epicardial coronary artery takes an intramuscular course.[1] Myocardial bridging has been associated with angina, sudden cardiac death,[2] myocardial infarction[3] and arrhythmias, especially those that are exercise induced.[4] The occurrence of coronary artery disease in patients with myocardial bridging is considered to be a result of direct compression of the left anterior descending (LAD) by myocardial bridge.[5] We describe a case of intramuscular LAD artery in-stent restenosis presenting as anterior ST elevation myocardial infarction (STEMI) complicated by intraventricular perforation.

Case Report

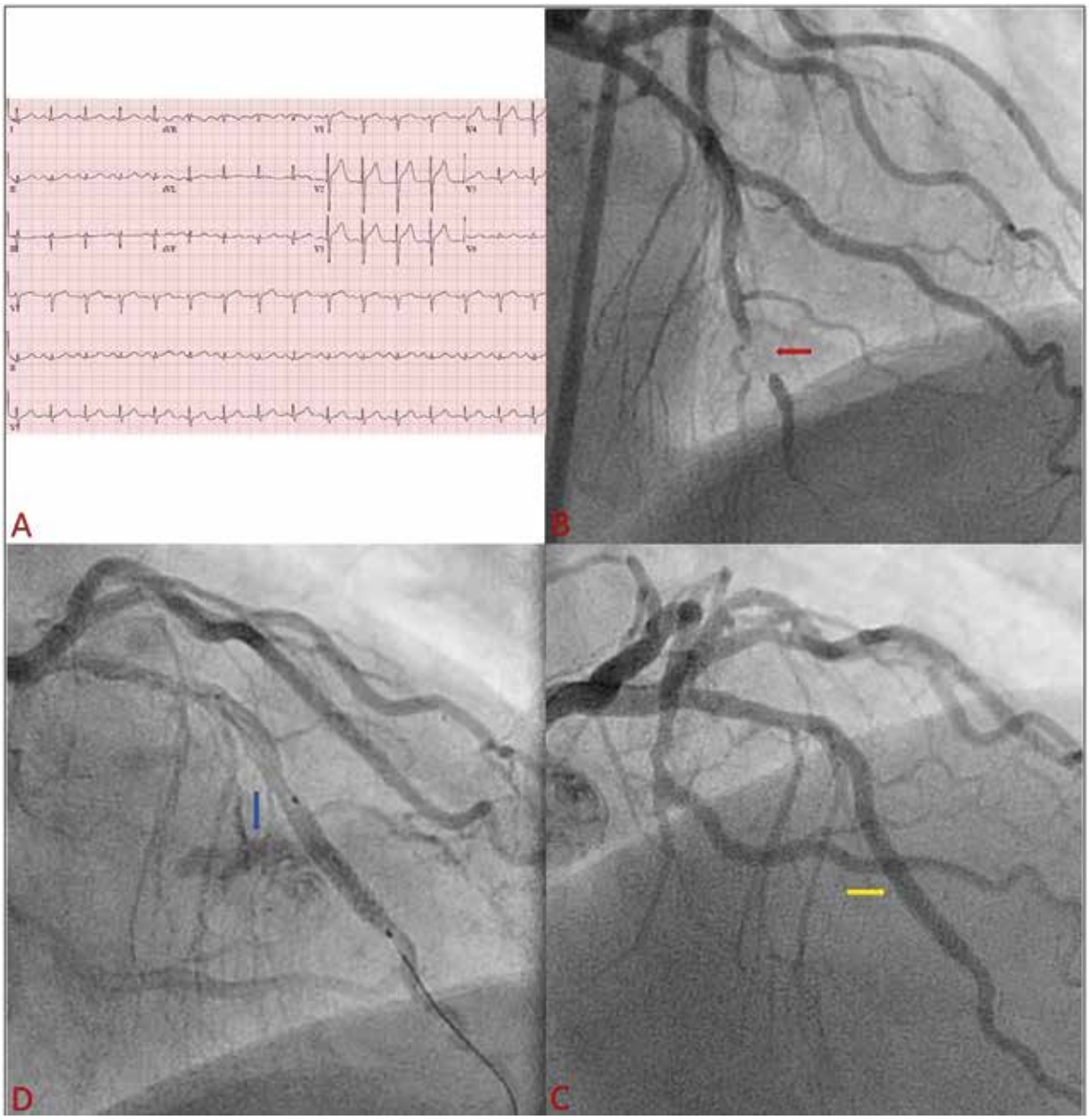
A 65-year-old male with a past medical history of hypertension, hyperlipidemia and recent PCI of the LAD and left circumflex (LCX) artery six months ago presented to an outside ER with sudden onset severe substernal chest pain of four-hour duration. He had been compliant with his medications including his dual antiplatelet therapy (DAPT). Electrocardiogram (EKG) revealed anterior ST elevation (Figure A) with subtle reciprocal changes in the inferior leads. Initial troponin was 0.5 ng/mL (0.00-0.013 ng/ml). Full dose Aspirin and systemic thrombolytics were administered and the patient was transferred to our hospital for invasive management.

Angiography revealed acute thrombotic in-stent re-stenosis of the intramyocardial segment of the mid LAD (Figure B). Balloon angioplasty followed by PCI with 2.5 x 15 mm drug eluting stent was performed. Following stent deployment extravasation of contrast with rapid washout was noted at the site of stenting, representing intraventricular coronary perforation (Figure C). Perforation was successfully contained with rapid balloon re-inflation and deployment of a covered stent (Figure D). Transthoracic echocardiogram (TTE) following PCI revealed newly reduced ejection fraction (EF) of 40-45 percent (prior 60-65 percent) with severe anterior septal and apical wall hypo-kinesis. There was no evidence of pericardial effusion. Troponins peaked at 17. The patient was reloaded with clopidogrel and discharged home on appropriate medical therapy. On follow up evaluation at 7 days and 12 weeks the patient denied having any anginal symptoms including chest pain and shortness of breath.

Discussion

Myocardial bridging is a congenital anomaly where a segment of a coronary artery has tunneled under a bridge of overlying myocardium.[1] Bridging results in compression during systole and may cause angina, acute coronary syndrome, arrhythmias or sudden cardiac death.[6] Coronary occlusion typically occurs immediately proximal to the bridged segment often sparing the compressed area. It is usually diagnosed upon coronary angiography or with coronary computed tomography. Treatment is typically medical with beta-blockers[7] and non-dihydropyridine calcium-channel blockers[8] being the preferred first line therapy for symptomatic patients. For

Figure 1. A) EKG with ST elevation in leads V1-V4. B) Coronary angiogram showing in-stent restenosis of intramyocardial part (myocardial bridge) of mid LAD (red arrow). C) Coronary angiogram showing intraventricular extravasation of contrast (blue arrow) following stent deployment in myocardial bridge3. D) Coronary angiogram demonstrating perforation contained by covered stent (yellow arrow).



refractory cases surgical myotomy, coronary stenting or bypass grafting can be considered but the long-term benefit remains uncertain.

In our case, given the acute thrombotic in-stent restenosis, the decision was made to deploy another smaller stent within the previously stented myocardial bridge. In this situation we felt that medical management would have been insufficient to establish acceptable coronary flow. Despite careful stent sizing and pressure inflation CAP occurred likely resulting from the shearing milking forces within the myocardial bridge.

CAP is a dreadful complication of PCI. It is more commonly seen in females, older patients and complex coronary anatomies including myocardial bridging. Inciting

factors include direct trauma related to coronary guidewire manipulation or by inflation of balloons and stents, especially if oversized or over inflated[6]. The incidence of CAP is 0.43 percent with PCI[9] but increases to 2.9 percent in chronic total occlusion interventions due to complexity of procedure.[10] Ellis classification (Table 1) is the most used classification for CAP which assesses the severity and determines the risk of adverse events from the perforation including need for emergent cardiac surgery, cardiac tamponade, MI or death.[11] Intraventricular CAP is rare and associated with increased risk of adverse events including death. A characteristic rapid wash out of contrast is unique to bridging related CAP as the myocardial contractions serve to dissipate the agent. Typical epicardial CAP results in contrast that lingers within the pericardial space.

Table 1. Ellis classification for coronary artery perforation.[11]

Type I	Extraluminal crater without extravasation
Type II	Pericardial or myocardial blush without contrast jet extravasation
Type III	Extravasation through frank (>1 mm) perforation
Type IV (cavity spilling)	Perforation into an anatomic cavity chamber, coronary sinus, etc

The angiographic characteristics, coronary artery flow and hemodynamic status ultimately dictates management. Hemostasis may require multiple strategies including balloon inflation, implantation of a standard or covered stent, coil embolization or surgical repair.

Conservative management is a valid approach even for perforations that result in small fistulizations.[12] Leaks in distal coronary beds or side branches, often seen with guidewire exit perforation, can be managed successfully by coiling or particle embolization technique. In cases like ours with an active rupture into the ventricle, the use of covered stents to conceal the perforation is necessary.

Covered stents were originally designed for in-stent restenosis[13] however are now often used as bail-out treatment for CAP. They allow sealing of the perforation and have been shown to offer survival benefit. Covered stents do have disadvantages including the risk of side branch occlusion and increased thrombogenicity, especially those that are polytetrafluoroethylene (PTFE) covered.[14] This can be mitigated by using DAPT and newer generation covered stents.[15] It is essential to perform an intra or post-operative echocardiography to rule out pericardial effusion and monitor for tamponade.

Conclusion

Iatrogenic coronary artery perforation is a rare but potentially fatal complication of PCI. Early identification and appropriate management are critical. Whilst proper stent sizing and balloon inflation are always important to mitigate this risk, even more caution is warranted in the setting of myocardial bridging.

REFERENCES

1. Angelini P, Velasco JA, Flamm S. Coronary anomalies: incidence, pathophysiology, and clinical relevance. Circulation. 2002;105(20):2449-54. Epub 2002/05/22.
2. Bestetti RB, Costa RS, Kazava DK, Oliveira JS. Can isolated myocardial bridging of the left anterior descending coronary artery be associated with sudden death during exercise? Acta Cardiol. 1991;46(1):27-30. Epub 1991/01/01.
3. Arjomand H, AlSalman J, Azain J, Amin D. Myocardial bridging of left circumflex coronary artery associated with acute myocardial infarction. J Invasive Cardiol. 2000;12(8):431-4. Epub 2000/08/23.
4. Feld H, Guadanino V, Hollander G, Greengart A, Lichstein E, Shani J. Exercise-induced ventricular tachycardia in association with a myocardial bridge. Chest. 1991;99(5):1295-6. Epub 1991/05/01.
5. Möhlenkamp S, Hort W, Ge J, Erbel R. Update on myocardial bridging. Circulation. 2002;106(20):2616-22. Epub 2002/11/13.
6. Tio RA, Van Gelder IC, Boonstra PW, Crijns HJ. Myocardial bridging in a survivor of sudden cardiac near-death: role of intracoronary doppler flow measurements and angiography during dobutamine stress in the clinical evaluation. Heart. 1997;77(3):280-2. Epub 1997/03/01.
7. Schwarz ER, Klues HG, vom Dahl J, Klein I, Krebs W, Hanrath P. Functional, angiographic and intracoronary Doppler flow characteristics in symptomatic patients with myocardial bridging: effect of short-term intravenous beta-blocker medication. J Am Coll Cardiol. 1996;27(7):1637-45. Epub 1996/06/01.
8. Alessandri N, Dei Giudici A, De Angelis S, Urciuoli F, Garante MC, Di Matteo A. Efficacy of calcium channel blockers in the treatment of the myocardial bridging: a pilot study. Eur Rev Med Pharmacol Sci. 2012;16(6):829-34. Epub 2012/08/24.
9. Shimony A, Joseph L, Mottillo S, Eisenberg MJ. Coronary artery perforation during percutaneous coronary intervention: a systematic review and meta-analysis. Can J Cardiol. 2011;27(6):843-50. Epub 2011/08/25.
10. Patel VG, Brayton KM, Tamayo A, Mogabgab O, Michael TT, Lo N, et al. Angiographic success and procedural complications in patients undergoing percutaneous coronary chronic total occlusion interventions: a weighted meta-analysis of 18,061 patients from 65 studies. JACC Cardiovasc Interv. 2013;6(2):128-36. Epub 2013/01/29.
11. Ellis SG, Ajluni S, Arnold AZ, Popma JJ, Bittl JA, Eigler NL, et al. Increased coronary perforation in the new device era. Incidence, classification, management, and outcome. Circulation. 1994;90(6):2725-30. Epub 1994/12/01.
12. Youssef M, Schob A, Kessler KM. Iatrogenic coronary septal artery-to-right ventricular fistula complicating percutaneous transluminal coronary angioplasty with spontaneous resolution. Am Heart J. 1997;133(2):260-2. Epub 1997/02/01.
13. Stankovic G, Colombo A, Presbitero P, van den Branden F, Inglese L, Cernigliaro C, et al. Randomized evaluation of polytetrafluoroethylene-covered stent in saphenous vein grafts: the Randomized Evaluation of polytetrafluoroethylene COVERed stent in Saphenous vein grafts (RECOVERS) Trial. Circulation. 2003;108(1):37-42. Epub 2003/06/25.
14. Lee WC, Hsueh SK, Fang CY, Wu CJ, Hang CL, Fang HY. Clinical Outcomes Following Covered Stent for the Treatment of Coronary Artery Perforation. J Interv Cardiol. 2016;29(6):569-75. Epub 2016/10/27.
15. Chen S, Lotan C, Jaffe R, Rubinshtein R, Ben-Assa E, Roguin A, et al. Pericardial covered stent for coronary perforations. Catheter Cardiovasc Interv. 2015;86(3):400-4. Epub 2015/07/15.

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Gestational Surrogacy and Ethical Considerations

Annika van Oosbree, MS IV; and Tiffany Von Wald, MD, MPH, FACOG

Abstract

Gestational surrogacy provides patients with the ability to reproduce in the wake of medical contraindications to pregnancy or an inability to become pregnant. Outcomes of gestational surrogacy are overall positive and are quite similar to those of other assisted reproductive technologies. Gestational surrogacy presents several ethical considerations, including gestational carrier autonomy, procreative liberty, access to care, and cross-border surrogacy. Additionally, its legalities differ between states. Gestational surrogacy continues to be a topic that is worthy of consideration, legislation, and discussion.

Introduction

Gestational surrogacy is an important method of family building that allows an individual or couple to become parent(s) when carrying a pregnancy is either biologically impossible or high risk. Surrogacy is defined when a woman (known as the gestational carrier) intentionally bears a child for another individual or couple (known as the intended parent[s]). This involves the use of assisted reproductive technology including *in vitro* fertilization (IVF). In the past, traditional surrogacy referred to using the surrogate mother's egg in addition to carrying the pregnancy. Because this process is complex with regard to ethical, legal and psychosocial aspects, traditional surrogacy is no longer practiced in modern medicine. The current approach involves using a gestational carrier who is not biologically related to the embryo that is transferred to her uterus.[1,2]

Background and Epidemiology

The first known case of surrogacy is documented in the Bible in Genesis 16:1-15, in which Sarah struggles with infertility. Sarah and her husband Abraham then use Sarah's maidservant, Hagar, to bear them a child to raise. The first known surrogacy in the U.S. occurred in 1976; this was an uncompensated traditional surrogacy. Also in the U.S., the first surrogacy contract written by an attorney occurred in 1980, and the first successful gestational surrogacy pregnancy through IVF was in 1985.[3] The number of people accessing gestational surrogacy to build their families has increased over the years with better access to care. Of the 662,165 IVF fertilization cycles in the U.S. between 2010 and 2014, 16,148 (2.4 percent) used gestational carriers.[4]

Terminology has evolved over the years. In current terms, the woman carrying the pregnancy is referred to as a gestational carrier (GC), and the parent who will raise the child, whether he/she is genetically related to the child or not, is referred to as the intended parent (IP).

Two subsets of surrogacy exist: compensated and uncompensated. Uncompensated, also known as altruistic, involves a gestational surrogate who carries the pregnancy without financial compensation above medical costs. In contrast, compensated surrogacy is when the gestational surrogate is compensated (usually financially) in addition to the medical costs for treatment.

Surrogacy is indicated in a multitude of conditions. These include but are not limited to conditions that would make carrying a pregnancy life-threatening (e.g. pulmonary hypertension, cardiac anomalies, etc.), repeated pregnancy failure, repeated miscarriage with or without a genetic explanation, repeated implantation failure with IVF, significant uterine anomalies, or the absence of a functioning uterus. [5,6] The absence of a functioning uterus can be either congenital (e.g. Mullerian aplasia) or acquired (e.g. Asherman syndrome).[7] Same sex partners (e.g. male-male) or single men may necessitate a third party's egg and uterus to conceive; in this case, usually a donor egg will be used to create an embryo which is transferred into a genetically unrelated surrogate.[8]

Outcomes

In general, the outcome data for gestational surrogacy are limited. Most studies show similar outcomes to IVF pregnancies. The Society of Assisted Reproductive Technology's data from 2016 showed that live birth rates from GCs correlate with the age of the oocyte, with a 54.4 percent success rate in oocytes from women less than 35 years old and 4.1 percent in those from women greater than

42 years old.[9] Though the latter percentage may seem small, GC cycles are associated with higher rates of successful pregnancies than other assisted reproductive technologies (ARTs), perhaps because of a younger age of the GC and oftentimes a history of an uncomplicated pregnancy.[10-12]

Birth defects in GC pregnancies are similar to that of the IVF population — 0 percent to 6.5 percent, vs. 1.1 percent to 2.9 percent, respectively.[13] In a 2016 analysis, the rate of low birth weight was lower in the GC population versus IVF population.[13]

There are limited data published regarding psychological outcome of GCs; however, the majority that does exist comes from small case studies in the United Kingdom and is reassuring. One study found that postpartum depression in GCs was between 0 percent to 20 percent, similar to controls.[14] A U.S. study also found low rates of postpartum depression in GCs, with only 5.3 percent experiencing postpartum blues.[15] A study of 184 uncompensated surrogates in Canada found that 88.1 percent had "very high" or "quite high" levels of satisfaction with their surrogacy experience.[16] This same study also found that 90 percent of GCs reported that their children either reacted positively or were neutral towards their GC pregnancy. One study showed at five to 15 years after a GC gave birth, no children born through the process experienced negative effects.[17] There are potential psychological hurdles that may affect GCs, such as negative judgement regarding their surrogacy and navigating time off work. In a Canadian study of 184 uncompensated GCs, 70 percent reported some sort of negative judgement from a part of their social circle; 38 percent reported this from a healthcare provider, and 31 percent reported difficulty navigating obtaining time off work.[16] These findings may not be generalizable to gestational carriers in the U.S., given the differences in health care systems between the U.S. and Canada.

Current Guidelines

The American Society of Reproductive Medicine (ASRM) has issued a committee opinion on recommendations for the use of GCs.[18] A general summary includes the following:

Indications for use of a GC: A GC may be used "when a true medical condition precludes the intended parent from carrying a pregnancy or would pose a significant risk of death or harm to the woman or fetus" [18] (Table 1).

GC selection: A few criteria are requirements for GCs, while many others are recommendations. A review of the medical history and full physical examination is warranted to ensure that she is medically cleared to carry a child.[18] (Table 1). In addition, laboratory testing may include but is not limited to a complete blood count, thyroid studies, infectious disease screening, varicella titer, rubella titer, blood type, Rh status, and antibody screen.

IPs: If IPs are both going to be the genetic parents, they should both undergo an appropriate genetic evaluation for diseases that are common in all genetic backgrounds (i.e. cystic fibrosis, spinal muscular atrophy). If parents are of certain ethnicities which have higher incidences of certain genetic diseases, these should be tested for as well (i.e. Tay-Sachs, sickle cell disease). Genetic parents should be screened in the same manner as gamete donors[19-21] (Table 1).

Important considerations: Expectations should be well-communicated and understood between the GC and IPs. In general, the GC is still legally autonomous over her body and therefore the pregnancy, even if the child is not genetically related to her. Hence, it is strongly recommended that the GC and IPs have legal agreements regarding special situations such as pregnancy interventions/testing (i.e. amniocentesis), fetal anomalies, pregnancy reduction, and induced abortion. This right extends through delivery (i.e. includes method of

Table 1. Gestational surrogacy guidelines.[18-21,37]

Indications for use of a GC
• Absence of a uterus (congenital or acquired) • Significant uterine anomalies • Absolute medical contraindication to pregnancy • Inability to conceive (i.e. single males or male-male couples) • Unknown endometrial factor (i.e. multiple unexplained pregnancy losses with IVF)*
GC selection
• Age 18 or older • Negative for sexually transmitted infections (STIs) • Sexual partner(s) negative for STIs • Medically cleared to safely gestate including a physical examination and laboratory testing • 21-45 years old+ • 1 term, uncomplicated pregnancy** • Maximum of 5 vaginal births** • Maximum of 2 Cesarean section deliveries** • Stable, supportive home environment** • Psychological testing** • Psychological counseling**
IP clearance
• Psychosocial education • Psychological testing • Genetic testing+ • Complete physical examination • STI testing+

*: GC may be considered
**: preferred, but not required
+: if IPs are also genetic parents

delivery and acceptance of medical interventions) until the child has exited her body.[18]

Ethical and Legal Considerations

Surrogacy presents multiple ethical issues which must be thoroughly considered, including biomedical ethical principles. A chief concern is that autonomy of the GC must be understood and upheld; however, this can create conflict with the IPs. Even with a legal contract in place, once a surrogate pregnancy occurs, both the GC and IPs' thoughts on a matter previously agreed upon can change, making this situation at risk for conflict. The GC has the right to medical decision-making during pregnancy. Additionally, surrogacy allows both the GC and healthcare providers to demonstrate beneficence — by helping IPs create their desired family.

Simultaneously, nonmaleficence should be considered—though this should be balanced with autonomy. A major concern is the GC's ability to give the child away after giving birth in addition to her psychological state after the matter.[2] As previously stated, limited research suggests that GCs view their relationship with the child differently than they would their own child.[22-26] However, this does not preclude the GC from forming a deep bond with the child she carries. It should be considered that GCs undergo rigorous counseling and psychological evaluation.[27] If she passes the psychological screening, some feel it is unethical to limit the GC's autonomy by eliminating her choice to carry a child.[28]

The concept of procreative liberty underscores the importance of surrogacy. Procreative liberty refers to a patient's right to reproduce without having sex. Surrogacy is an avenue to allow patients to reproduce who do not have the ability to carry a child.

Compensated surrogacy is a controversial topic, partially because of the concern for coercion of vulnerable women.[29-31] Some countries have outlawed it completely; additionally, its legality varies between states in the U.S (Table 2). However, the counter argument for allowing some level of compensation is that carrying a pregnancy involves unique circumstances, including an extended time period of commitment and the inherent risks of pregnancy. These include but are not limited to physical changes to ones' body; obstetric risks such as miscarriage, blood clots, gestational diabetes or high blood pressure, and mental health risks including postpartum depression.[13] GCs should be thoroughly screened for potential financial coercion prior to proceeding with this process.[19]

Table 2. General state-by-state surrogacy laws.[38]

Compensated surrogacy is illegal
• ***Nebraska***
• Louisiana
• Michigan
Surrogacy is permitted for all parents; both parents are named on the birth certificate; pre-birth orders* granted
• California
• Connecticut
• District of Columbia
• Delaware
• Maine
• New Hampshire
• New Jersey
• Nevada
• Rhode Island
• Vermont
• Washington
Surrogacy is permitted; may require post-birth legal procedures
• Arkansas
• Arizona
• Colorado
• Florida
• Illinois
• ***Iowa***
• Kentucky
• Massachusetts
• Maryland
• Missouri
• ***North Dakota***
• Texas
Surrogacy is permitted because there are no laws/statutes prohibiting it
• Alabama
• Alaska
• Georgia
• Hawaii
• Kansas
• ***Minnesota***
• Mississippi
• ***Montana***
• North Carolina
• Oregon
• Pennsylvania
• South Carolina
• ***South Dakota***
Surrogacy is practiced, but there may be legal issues+
• Idaho
• New York
• Tennessee
• Virginia
• ***Wyoming***
Surrogacy is practiced, but surrogacy contracts are void and unenforceable
• Arizona
• Indiana

*Pre-birth order: a legal document created before conception that establishes the IPs as legal parents after the baby is born

+ including but not limited to: the GC being the legal parent until the IPs adopt the baby, commercial surrogacy only being available to legal residents of the state, and a non-genetically related IP needing to adopt the baby

Bold italics denote South Dakota and the states that border it.

Given that compensated surrogacy is only explicitly protected in a handful of countries (Georgia, Israel, Ukraine, Russia, India, and a few U.S. states), cross-border surrogacy is another ethical dilemma.[13] Cross-border surrogacy occurs when IPs from one country seek out a GC in a country where surrogacy is legal, and the child is born in the GC's country before being transported to the IPs' country. A 2012 study estimated that more than 25,000 children have been born to GCs in India, most of them whose IPs are from the West.[32] Cross-border surrogacy may put the IPs, GC, and child in danger;[29,33] additionally, the IPs and child's relationship may be at risk by potential legal battles involving citizenship and guardianship.[33-35]

Another ethical concern lies in access to care.[36] Many potential IPs exist, yet the number of GCs is low, especially given the limited legality of compensated surrogacy. As surrogacy becomes less stigmatized and more accessible, this could pose inequality in accessibility to a gestational carrier. In some areas, access to care may be stratified by IP socioeconomic status, given the high cost of both the medical and legal aspect of surrogacy. Simultaneously, the socioeconomic status of GCs should be addressed by all medical, psychological, and legal team members to protect financially vulnerable women who could be exploited by high compensation when they would not otherwise serve as a GC.

Conclusion

Gestational surrogacy is an important option for many people and affords an opportunity to build a family that would not have otherwise existed. It can empower women who choose to become gestational carriers. The data published to date are mostly supportive in regard to psychological effects of gestational surrogacy and show this reproductive option may provide a fulfilling experience to all parties involved with minimal negative aspects. Medical governing bodies should continue ethical deliberation around this topic to further guide best practices.

REFERENCES

1. Family building through gestational surrogacy. Committee Opinion No. 660. American College of Obstet Gynecol. 2016;127:e97-103.
2. FIGO Committee Report: surrogacy. Int J Gynaecol Obset. 2008;102:312-3.
3. Patel NH, Jadeja YD, Bhadarka HK, Patel MN, Patel NH, Sodagar NR. Insight into different aspects of surrogacy practices. J Hum Reprod Sci. 2018;11:212-8.
4. Perkins KM, Boulet SL, Levine AD, Jamieson DJ, Kissin DM. Differences in the utilization of gestational surrogacy between states in the U.S. Reprod Biomed Soc Online. 2017;5:1-4. Published 2017 Sep 28.
5. Brinsden PR. Gestational surrogacy. Human Reprod Update 2003;9:483-91.
6. Practice Committee of the American Society for Reproductive Medicine and Practice Committee of the Society for Assisted Reproductive technology. Recommendations for practices utilizing gestational carriers: a committee opinion. Fertil Steril. 2015;103:e1-8.
7. Lindenman E, Shepard MK, Pescovitz OH. Mullerian agenesis: an update. Obstet Gynecol. 1997;90:307-12.
8. Dempsey D. Surrogacy, gay male couples and the significance of biogenetic paternity. New Genet Soc. 2013;32:37-53.
9. National summary report. Final national summary report for 2016. 2017. Retrieved from www.sartcorsonline.com/rptCSR_PublicMultYear.aspx?reportingYear=2016#donor-donated-embryo.
10. Perkins KM, Boulet SL, Jamieson DJ, Kissin DM; National Assisted Reproductive Technology Surveillance System (NASS) Group. Trends and outcomes of gestational surrogacy in the United States. Fertil Steril. 2016; 106:435-42.e2.
11. Murugappan G, Farland LV, Missmer SA, Correia KF, Anchan RM, Ginsburg ES. Gestational carrier in assisted reproductive technology. Fertil Steril. 2018;109:420-8.
12. Parkinson J, Tran C, Nelson J, Batzofin J, Serafini P. Perinatal outcome after in-vitro fertilization-surrogacy. Hum Reprod. 1999;14:671-6.
13. Soderstrom-Anttila V, Wennerhold UB, Loft A, Pinborg A, Aittomaki K, Romundstad LB, and Bergh C. Surrogacy: outcomes for surrogate mothers, children and the resulting families—a systematic review.
14. Jadva V, Murray C, Lycett Et, MacCallum F, Golombok S. Surrogacy: the experiences of surrogate mothers. Hum Reprod. 2003;18:2196-204.
15. Parkinson J, Tran C, Tan T, Nelson J, Batzofin J, Serafini P. Perinatal outcome after in-vitro fertilization-surrogacy. Hum Reprod. 1999;14:671-6.
16. Yee S, Goodman CV, Librach CL. Determinants of gestational surrogates' satisfaction in relation to the characteristics of surrogacy cases. Reprod Biomed Online. 2019;39:249-61.
17. Jadva V, Imrie S. Children of surrogate mothers: psychological well-being, family relationships and experiences of surrogacy. Hum Reprod. 2014;29:90-6.
18. Practice Committee of the American Society for Reproductive Medicine and Practice Committee of the Society for Assisted Reproductive Technology. Fertil Steril. 2016;107(2):e3-10.
19. Practice Committee of American Society for Reproductive Medicine and the Practice Committee of Society for Assisted Reproductive Technology. Recommendations for gamete and embryo donation: a committee opinion. Fertil Steril. 2013;99:47-62.
20. Society for Assisted Reproductive Technology. Female donor physical examination form. Retrieved from www.sart.org.
21. Society for Assisted Reproductive Technology. Male donor physical examination form. Retrieved from www.sart.org.
22. Ragone H. Surrogate motherhood: conception in the heart. Boulder, CO: Westview Press; 1994.
23. Jadva V, Murray C, Lycett E, MacCallum F, Golombok S. Surrogacy: the experiences of surrogate mothers. Hum Reprod. 2003;18:2196-204.
24. Hibino Y, Shimazono Y. Becoming a surrogate online: "message board" surrogacy in Thailand. Asian Bioeth Rev. 2013;5:56-72.
25. Teman E. Birthing a mother. Berkeley: University of California Press; 2010.
26. Lambda N, Jadva V, Kadam K, Golombok S. The psychological well-being and prenatal bonding of gestational surrogates. Hum Reprod. 2018;33:646-53.
27. Sifris R. Commercial surrogacy and the human right to autonomy. J Law Med. 2015;23:365-77.
28. Swanson K, Ayala NK, Barnes RB, Desai N, Miller M, Yee LM. Understanding gestational surrogacy in the United States: a primer for obstetricians and gynecologists. Am J Obsetet Gynecol. 2020; 222(4):330-7.
29. Pende A. Transnational commercial surrogacy in India: gifts for global sisters? Reprod Biomed Online. 2011;23:618-25.
30. Tieu MM. Altruistic surrogacy: the necessary objectification of surrogate mothers. J Med Ethics. 2009;35:171-5.
31. Deonandan R, Green S, van Beinum A. Ethical concerns for maternal surrogacy and reproductive tourism. J Med Ethics. 2012;38:742-5.
32. Shetty P. India's unregulated surrogacy industry. Lancet. 2012;380:1633-4.
33. Crockin SL. Growing families in a shrinking world: legal and ethical challenges in cross-border surrogacy. Reprod Biomed Online. 2013;27:733-41.
34. Deampo D. Defining parents, making citizens: nationality and citizenship in transnational surrogacy. Med Anthropol. 2015;34:210-25.
35. Schover LR. Cross-border surrogacy: the case of Baby Gammy highlights the need for global agreement on protections of all parties. Fertil Steril. 2014;102:1258-9.
36. Klock SC, Lindheim SR. Gestational surrogacy: medical, psychosocial, and legal considerations. Fertil Steril. 2020;113(5):889-91.
37. American Psychological Association. Ethical principles of psychologists and code of conduct. Retrieved from www.apa.org/ethics/cide/index.aspx.
38. The United States surrogacy law map: state-by-state gestational surrogacy law & statutes. Creative Family Connections. Retrieved from www.creativefamilyconnections.com/us-surrogacy-law-map/.

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Trends in Eligibility and Geographic Variations in Breast Cancer Screening Participation Among Underserved Women in South Dakota

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Abstract

Introduction: Breast cancer is the most common cancer among women and early detection is critical to improve breast cancer survival. The All Women Count! (AWC!) Program, part of the National Breast and Cervical Cancer Early Detection Program, provides breast and cervical screening services at no cost to underserved women in South Dakota. Aiming to investigate program participation, we examined trends in the number of women eligible for breast cancer screening services through the AWC! Program along with mammography screening participation by county.

Methods: Using the State-level Small Area Health Insurances Estimates data and the AWC! data, we calculated the proportion of South Dakotan women eligible for mammography screening under the AWC! Program from 2016 to 2019, and calculated the standardized participation ratio and 95 percent confidence interval by county (2019). To investigate differences in screening participation over time and by counties, analysis of variance (ANOVA) and Tukey statistical test were conducted, respectively.

Results: From 2016 to 2019, the number of women eligible for breast cancer screening services declined by 12 percent. Differences in screening participation were not statistically significant over the four-year period. Conversely, county-level variations in screening participation were found. In 2019, among the 59 counties with screening data, 15 percent presented statistically higher participation in screening.

Conclusion: A decrease in the number of women eligible for breast cancer services provided by AWC! was observed. Additionally, screening participation varied by county. A more comprehensive investigation is needed to explain these geographic disparities so prevention strategies can reduce the burden of breast cancer among South Dakota underserved women.

Background

Female breast cancer, the most common cancer and the second leading cause of cancer deaths, occurs mostly in women over age 50 and accounts for 30 percent of all female cancers.[1] Early detection of breast cancer is an important determinant in preventing metastasis and improving breast cancer survival.[2] Studies have shown that screening mammography has contributed to a reduction in breast cancer mortality from 20-40 percent.[1] Among the nation, South Dakota ranked 18th in incidence and 17th in breast cancer mortality, with 3,169 new diagnoses and 532 breast cancer related deaths from 2014 to 2018.[4] When compared to the national rates, South Dakota breast cancer age-adjusted incidence was 124.8 cases per 100,000 and mortality was 19.0 deaths per 100,000 women, slightly lower than the national rate at 126.8 and 20.1, respectively.[4] The latest five-year trend suggests that South Dakota breast cancer incidence rate was stable, and mortality was declining at 1.8 percent annually.[5]

All Women Count! Program

As part of an effort to support low-income women in completing the recommended screening schedule for breast and cervical cancer, the Centers for Disease Control and Prevention (CDC) established the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) in 1991.[6] The NBCCEDP delivers screening and diagnostic services to low income, uninsured or underinsured women. In South Dakota, All Women Count! (AWC!) is part of the national program funded through CDC since 1997. The

AWC! Program works with approximately 230 provider sites across the state.[7] Although the U.S. Preventive Services Task Force (USPSTF) recommends that women ages 50-74 years should be screened regularly for breast cancer with a mammography every two years,[8] the AWC! program serves women 40-64 for annual mammograms, following the American College of Obstetricians and Gynecologists[9] and the American College of Radiology[10] breast cancer screening guidelines.

Eligibility Criteria

Breast cancer screening and diagnostic services are available through the AWC! Program for women who meet the eligibility criteria. To be eligible, women must be: (a) below or at 200 percent of federal poverty level, (b) uninsured or underinsured which is defined as those who cannot afford the copayments or deductibles or whose insurance does not cover breast or cervical cancer screening services and (c) between the ages of 40 and 64 years.[7] The information on the number of women eligible for AWC! breast cancer services aids in future efforts toward resource allocation, monitoring and program evaluation.

The aim of this study was threefold. The first purpose was to investigate trends in the number of women eligible for mammography screening through the AWC! Program from 2006-2019. Secondly, to examine if geographic variations in mammography screening participation exists (2019), and finally to investigate differences in mammography screening participation from 2016-2019.

Methods

Data Sources

The estimated number of South Dakotan women who were age 40-64, with incomes below or equal to 200 percent federal poverty level and uninsured by state and county level was obtained from the Small Area Health Insurance Estimates (SAHIE) which provides yearly estimates of health insurance coverage.[10] The data were extracted for the years 2006-2019.

The individual level of breast cancer screening data for the number of initial mammograms by year and county of residence were extracted from the All Women Count! (AWC!) Program data for the same period.[7]

Measures and Statistical Analysis

To investigate trends in eligibility for the AWC! Program, we calculated the proportion of women in South Dakota eligible for the AWC! Program by year based on age, income level and insurance status, using 2006-2019 SAHIE data. The percent eligible was calculated by dividing the number of women in the specified county who meet the eligibility criteria (ages 40-64, <= 200 percent federal poverty level and uninsured), by the number of all women aged 40-64 in the specified county, multiplied by 100.

To examine the geographic variation in breast cancer screening participation through the AWC! Program, we calculated the standardized participation ratios (SPR) by year and county. The SPR was calculated by dividing the observed by the expected total number of mammography screening events through the AWC! Program by county. Thus, the SPR was calculated as:

$$SPR = \frac{O_{ij}}{E_{ij}},$$

Where 0_{ij} is the observed number of women ages 40 to 64 residing in the county j and in i-th year. The observed number of AWC! participants (0_{ij}) was obtained by aggregating the number of unique women receiving a mammogram screening funded by the AWC! Program by county of residency and year. Then, using the SAHIE data, we extracted the number of women eligible (ages 40-64, <= 200 percent federal poverty level and uninsured) for a mammogram for each county and the total number of eligible women in the state. Thus, for each county, we calculated the expected (E_{ij}) number of eligible women to be screened by the AWC! Program as follow:

$$E_{ij} = \frac{A_{ij} * U_i}{S_i},$$

Where A_{ij} denotes the total number of women eligible for a screening in the county j in i-th year, U_i represents the total number of women screened by the program in i-th year in the state, and S_i the total number of women eligible in i-th year in South Dakota. A SPR greater than 1 indicates that the number of mammography screening in a county is higher than expected. Conversely, an SPR less than 1 indicates that the number of mammography screening in a county was lower than expected. Furthermore, we calculated the 95 percent confidence interval for SPR using

$$SPR_l = \frac{\chi^2_{2O_{ij},0.025}}{2E_{ii}} \text{ as lower bound and}$$

$$SPR_u = \frac{\chi^2_{2(O_{ij}+1),0.975}}{2E_{ij}} \text{ as upper bound.}$$

To determine whether the observed screening numbers by county were significantly different from the expected, and not due to chance or random fluctuation, we used the 95 percent confidence interval (CI). Specifically, if the 95 percent CI range did not include the value 1, then the number of women screened was significantly different from the expected. In

addition, to investigate differences between the SPR values over the years and by county, analysis of variance and Tukey test were carried out. Counties with missing data on breast cancer screening were excluded from the analysis. All p-values <0.05 were considered significant. Statistical analyses were conducted using R Statistical Software (version 4.0.4). ArcMap 10.8 software was used to depict the geographic variation in participation rates.

Results

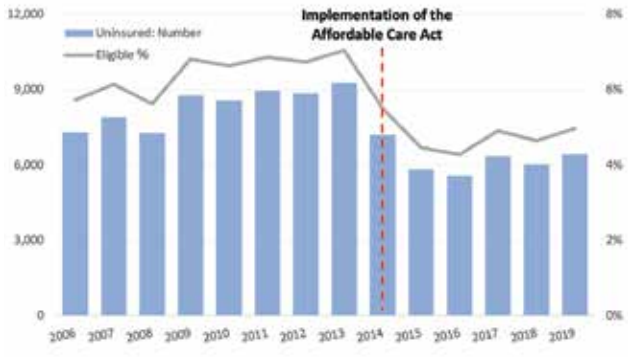
Figure 1 depicts the trend in the number and proportion of women ages 40-64 who were eligible for a breast cancer screening through the AWC! Program. From 2006 to 2019, the number of women eligible for breast cancer screening services declined by 12.1 percent (from 7,309 to 6,422) with a substantial decline occurring after 2013.

According to the latest SAHIE data available from 2019, there were approximately 129,110 South Dakotan women ages 40-64. Among those, the estimated number of women uninsured and with a family income at or below the 200 percent federal poverty level was 6,422 (5.0 percent). The proportion of women eligible for a mammogram by county ranged from 2.5 percent to 14.6 percent. The five counties with the highest proportion of women eligible were: Jackson County (14.6 percent), Buffalo County (13.6 percent), Todd County (13.5 percent), Mellette County (13.4 percent), Corson County (12.4 percent). The lowest percent eligible was found in Lincoln County (2.5 percent), Union County (2.6 percent), Hughes County (3.4 percent), Lake County (3.4 percent), and Brookings County (3.5 percent) (results not shown).

Screening Participation Ratios

The geographic variations in screening participation under the AWC! Program over the years is shown in Figure 2.

Figure 1. Trends in the number and percent of women eligible (ages 40-64) for breast cancer screening services under the All Women Count! Program, 2006-2019.



Among the 66 counties, data was available for 59 counties. The counties with significantly higher participation rates were Buffalo County (SPR= 7.4), Hughes County (SPR = 3.9), Lyman County (SPR = 2.2), Butte County (SPR =2.0), Davion County (SPR = 1.7), Charles Mix County (SPR =1.6), Lawrence County (SPR = 1.5), Pennington County (SPR = 1.3), and Minnehaha County (SPR = 1.2). Ten counties with screening rates lower than expected were Oglala Lakota (SPR =0.0), Walworth County (SIR=0.1), Clay County (SPR = 0.2), Corson (SPR =0.3), Todd (SPR =0.3), and Roberts County (SPR =0.3), Codington County, (SPR =0.4), Brookings County (SPR =0.5), Brown County (SPR =0.6) and Lincoln County (SPR =0.6). Differences in participation rates by county were also found. However, no statistical difference was found in the overall participation rates from 2016 to 2019 (p= 0.948) (Figure 3).

Figure 2. County-level variation in standardized participation ratios (SPR) of mammography screening in South Dakota in 2019 for women ages 40-64 (AWC! screening data).

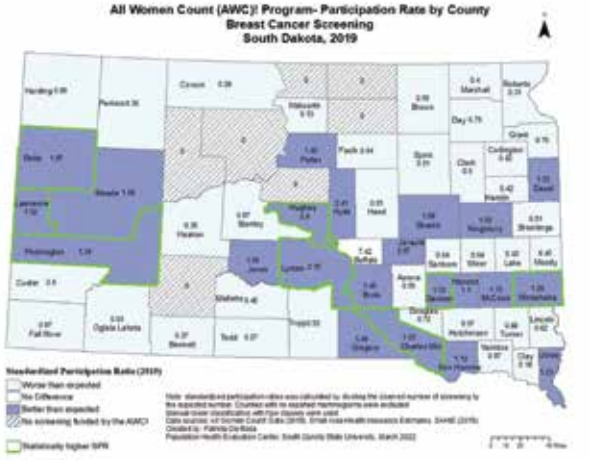
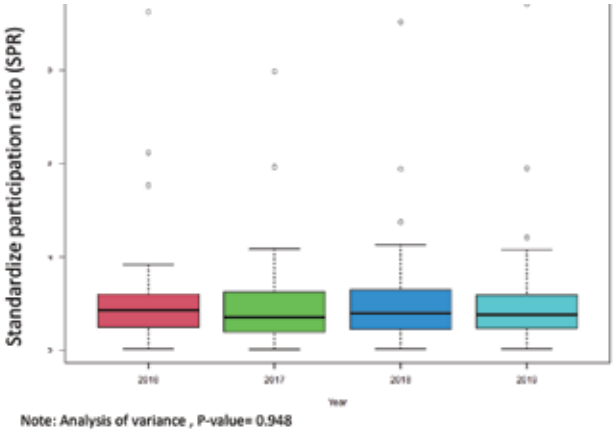


Figure 3. Standardized participation ratios of mammography screening under the AWC! Program from 2016 to 2019.



Note: Analysis of variance , P-value= 0.948

Discussion

From 2006-2019, there was a decline in the number of women eligible for breast cancer services through AWC!. Similar results were also reported with the NBCCEDP.[11] The major decline occurred in 2014 which coincided with the introduction of the Affordable Care Act (ACA).[12] Although the state of South Dakota did not implement Medicaid expansion,[13] women in South Dakota with household incomes below or equal to 200 percent FPL were still eligible for premium tax credits by purchasing private insurance on the Health Insurance Marketplace. Another explanation may have been the decline in the unemployment rate during this period which may have contributed to more women receiving health insurance through their jobs or to an increase in their income, putting them above the eligibility threshold. For instance, the decline in unemployment rate occurred from 7.9 percent in 2011 to 3.3 percent in 2019.[14] Although this might be a positive development, women potentially face high out of pocket premiums while carrying out diagnostic tests, potentially contributing to a late breast cancer diagnosis and/or treatment.

Geographic variations in mammography screening participation were also observed. Among the 59 counties with screening data available, 15 percent of the South Dakota counties had screening participation rates higher than expected. Differences in participation rates may be explained by a variety of factors, including overlapping reach with other NBCCEDP programs. For instance, women who live in counties bordering other states may seek mammography services across the state line. In such cases, they may be enrolled in that state's NBCCEDP program. Similarly, some tribal organizations within the state receive NBCCEDP funding, which may explain the lower participation rates, or no mammogram services provided by AWC! in counties such as Dewey and Ziebach.

In addition, a better understanding of the barriers to breast cancer screening is needed. Studies investigating the expansion of mobile mammography, the adoption of worksite cancer screening policies, and enhanced implementation of evidence-based interventions (client reminders, provider reminders, provider assessment/ feedback, and reduction of structural barriers) at the clinic level could assist in the implementation of evidence-based strategies.[15] Finally, studies have shown that health care providers have an important role in improving participation in cancer screening programs by recommending mammography.[16] However, health care providers rely on national screening guidelines, and conflicting recommendation in breast cancer screening among different agencies may impact providers' adherence to screening recommendations.[16] Thus, continued effort and collaboration with healthcare organizations and their providers to support screening efforts is needed.

There were some limitations to this study. Caution with interpretation of the SPRs is warranted due to the large variation in SPRs caused by the small number of participants in those counties. In addition, women who had undergone mastectomies were not accounted for in the program, which could have slightly overestimated the percentage of eligible women. Finally, SAHIE only includes data on uninsured women while AWC! includes both uninsured and underinsured women causing the number of eligible women to be underestimated.

Conclusions

Despite a reduction in the number of women eligible for a breast cancer screening service and the AWC! attempts to reach and screen low-income, uninsured, and underinsured women in South Dakota, the geographic variation in breast cancer screening shows that there are a substantial number of underserved women across the state who could be screened under the AWC! Program. To reduce the burden of breast cancer among the most vulnerable population, continued efforts to identify and enroll South Dakota eligible women is vital.

Acknowledgments – The authors would like to thank the All Women Count! team and partner provider sites, along with the thousands of women who have participated in the program in its 25-year history. We also thank Joshua Clayton, PhD, MPH, for his careful and insightful reviewing of this manuscript. Finally, we thank the funding agency that made this work possible: Centers for Disease Control and Prevention (CDC), Cooperative Agreement Number, DP006293.

The contents of this manuscript are solely the responsibility of the authors and do not necessarily represent the official views of the CDC or the Department of Health and Human Services.

REFERENCES

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin. 2020 Jan;70(1):7-30. Epub 2020 Jan 8.

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Differentiation of Peripheral Nerve Tumors in the Brachial Plexus

Amber Veldman, MS IV; and Heath Eggleston, MD

Abstract

Schwannomas are benign extracranial nerve sheath tumors that can rarely affect the brachial plexus. Due to the relative rarity of these tumors and the complexity of the anatomy of the neck and shoulder, these tumors are a challenging diagnosis for clinicians. We present a case report of a 51-year-old male with a brachial plexus schwannoma definitively treated with surgical resection. It is our hope that this case serves as a reminder to consider schwannomas in the differential diagnosis for infraclavicular tumors.

Introduction

A schwannoma is a benign tumor that arises from Schwann cells of the nerve.[1] These tumors can arise in cranial nerves III-XII and sympathetic nerves, but rarely in the brachial plexus.[1] In fact, only 5 percent of all reported schwannomas occur within the brachial plexus.[2] In this case, we present an infraclavicular schwannoma that clinically mimicked a lipoma. It is our goal to provide a relevant literature review to differentiate schwannoma, neurofibroma, fibrosarcoma, and lipomas for further aid in clinical diagnosis.

Case Report

A 51-year-old patient presented to his primary care provider in November 2021 for assessment of a painful right shoulder. The patient has a history of osteoarthritis (OA) of his right shoulder, but noticed an enlarging mass on that shoulder for about two to three months prior to presenting to clinic. The patient described no sensory loss or motor weakness. He reported that if the mass was manipulated, he experienced a shock like pain down the right arm. On physical exam, there was an 8 cm infraclavicular soft tissue mass with no overlying redness or erythema. The mass was tender to palpation. There was no sensory loss, motor weakness, and reflexes were intact bilaterally. He had a negative Spurling's test. His medical history was significant for lipomas. His family history was non-contributory.

Further review of his records showed an incidental right shoulder mass on CT three months prior to clinic presentation (Figure 1). Subsequently, an ultrasound with needle biopsy was ordered. The patient reported that during the procedure he experienced significant pain and shock-like sensations down his arm. Pathology report showed diffusely positive S100 protein immunostain consistent with a schwannoma. MR of the brachial plexus with and without contrast demonstrated a 4.4 cm schwannoma of the right brachial plexus suspected to arise from the lateral cord

Figure 1. Schwannoma (red arrow) noted on axial postcontrast CT image.

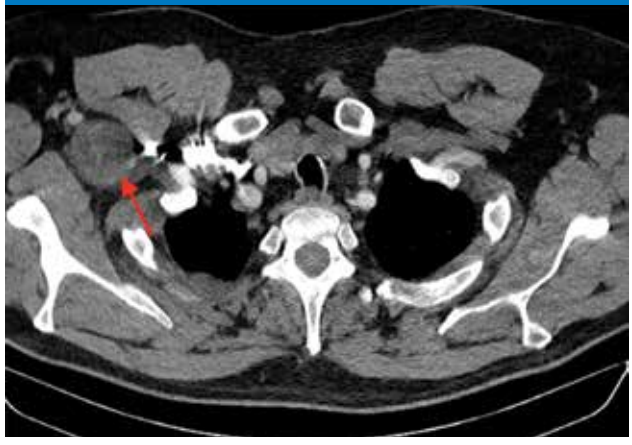
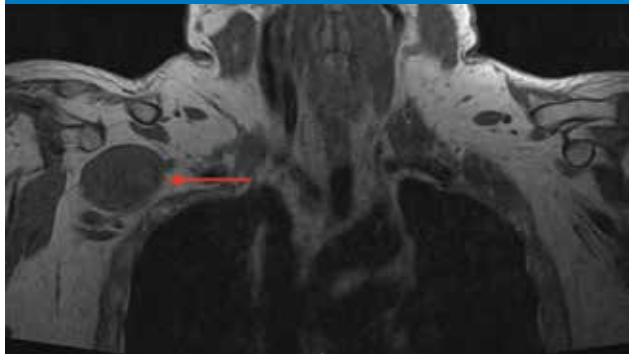


Figure 2. Schwannoma (red arrow) noted on coronal T1 weighted MR image.



(Figure 2). Upon follow up with a neurosurgeon, the patient reported losing sensation to light touch in the palm of his right hand. Physical exam demonstrated a loss of pinprick on the radial 2/3 of the palm. Considering the progressing symptoms and location of the mass, the patient was referred to Mayo Clinic and on Jan. 25 a 5.5 cm mass was excised. He has experienced no complications to date.

Discussion

A literature review of brachial plexus tumors demonstrates the scare nature of these tumors.[3] A study at Louisiana State University Health Sciences Center (LSUHSC) demonstrated that over 30 years only 226 brachial plexus primary tumors were reported.[4,5] Of these tumors, the most common was a neurofibroma (38 percent) followed by schwannoma (20 percent). The remainder consisted of a variety of different benign and malignant tumors.[4,5] Apart from the study at LSUHSC, only sporadic individual reports are available.[4,5]

Tumors arising in the brachial plexus can be divided into two main categories: nerve sheath associated and non-neural sheath associated.[4] Schwannoma's are thought to arise from the Schwann cell and are thus nerve sheath associated tumors.[3,4] Bilaterally acoustic schwannomas are a defining characteristic of neurofibromatosis II, but these only comprise 4 percent of all schwannomas.[4] Schwannomatosis should be suspected only if an individual presents with two or more non intra-dermal schwannomas, no history of a vestibular schwannoma, and a family history of schwannomas.[6] The patient presented in case report did not fulfill these criteria and was not recommended to have a further genetic work up.[6]

The histology of schwannomas is one component that can be used to differentiate from a lipoma or fibrosarcoma.[7] There are three major histological features that aid in diagnosis: Antoni A, Antoni B, and Wagner-Meissner bodies.[7] The Antoni A pattern illustrate cells and nuclei that are elongated.[7] Antoni A pattern can occasionally demonstrate a special structure known as a Verocay bodies – which are large collections of fibrous elements.[7] Antoni B patterns exhibit a looser pattern with irregular cells and sporadic areas of hyalinization.[7] The looser pattern of Antoni B allows for high signal intensity on T2-weighted MRI.[8] Histology can also demonstrate Wagner-Meissner bodies which are similar to Antoni A and B pattern, but with xanthomatous changes.[7] All of these patterns will stain positive for S100.[8,9] Additionally, these tumors will stain positive for Leu-7 – an epithelial membrane antigen – vimentin, collagen, and neurofilament.[8,9]

Schwannomas tend to grow in a well-circumscribed mass that pushed onto surrounding structures.[8] While benign, the location of these tumors will dictate what symptoms present.[8] Due to the variable nature of location there is no pathologic motor or sensory symptom for these tumors.[8] Typically, patients present clinically with complaints of local pain that is worsened by tumor movement.[8] Tumors are palpable and often mobile in just the transverse plane.[8,9]

Neurofibromas were the most common primary tumor of the brachial plexus in the LSUHSC study.[5,7] Neurofibromas are thought to arise from the connective tissue of the peripheral nerve sheaths – perhaps a more primitive form of the Schwann cell.[8] These tumors are often associated with neurofibromatosis I, but can arise in solitude as the LSUHSC study demonstrated.[5,10] When associated with NF I, these tumors have a 15 percent risk of malignant conversion.[10] Unlike Schwannoma's, these tumors tend to grow infiltratively and have a tendency to arise from the motor portion of nerves.[10]

While schwannomas are benign, neurofibromas can give rise to neurofibrosarcoma or neurosarcoma.[11] While these tumors are only 5% of all malignant peripheral nerve sheath tumors, more than half arise from neurofibromas particularly in the setting of NF I.[11] The differentiation of neurofibrosarcoma from fibroma and schwannoma is difficult.[12] Clinically, there is no reliable method of differentiation.[12] Currently, histology and immunostaining are the main methods to distinguish these types of tumors.[11,12] Neurofibrosarcomas have alternating hypo and hyper-cellular areas or diffuse spindle cell patterns.[11,12] These tumors can have heterogenous components including rhabdomyolyses, cartilaginous, osseous, and rarely smooth muscle components.[11,13]

Lipomas are benign tumors composed of adipose tissue.[14] These tumors represent the most common of the non-neural sheath tumors of the brachial plexus.[14] On histology, these tumors are composed of mature adipocytes.[14,15] These tumors typically have high intensity T1 and T2 weighted MRIs.[14] Lipomas clinically present very similarly to a schwannoma or neurofibroma.[14] Depending on location, symptoms include numbness, shock-like pains, weakness, or an enlarging mass.[14]

Conclusion

The case presented will hopefully remind clinicians to consider brachial plexus tumors on the differential for shoulder pain.[3] Tumors of the brachial plexus are difficult to differentiate clinically since presentation depends on size and location of the tumor.[15] The most common symptoms

include numbness, weakness, and pain on palpation of the tumor.[15] Schwannomas of the brachial plexus are treated definitively with surgical resection as demonstrated in the case presented.[15] Optional outcomes are complete resection of the tumor with preservation of the nerve.[4]

REFERENCES

1. Hwa RH, Moon J, et al. Brachial plexus schwannoma mimicking cervical lymphadenopathy. Medicine. 2018; 97:42.
2. Lusk MD, Kline DG, et al. Tumors of the brachial plexus. Neurosurgery. 1987;21:439-53.
3. Vucemil K, et al. Brachial plexus schwannoma – case report and literature review. Acta Clinical Croat. 2018; 57:366-71.
4. Go M, KM S, Cho K. Brachial plexus tumors in a consecutive series of twenty-one patients. J Korean Neurosurg Soc. 2012; 52:138-43.
5. Kim DH, Murovic JA, Tiel RL, Moes G, Kline DG. A series of 146 peripheral non-neural sheathed nerve tumors: 30 years' experience at Louisiana State University Health Science Center. J Neurosurg. 2005;102:256-66.
6. Radhika D, Plotkin S. et al. Schwannomatosis. GeneReviews. 2018. Bookshelf ID: NBK487394
7. Mankin HJ, Mankin, KP. Schwannoma: a rare benign tumor of soft tissue. Musculoskeletal Surg. 2014;98:9599.
8. Das S, Ganju A. et al. Tumors of the brachial plexus. Neurosurg Focus. 2007;6:E26.
9. Fine SW, McClain SA, Li M. Immunohistochemical staining for calretinin is useful for differentiating schwannomas from neurofibromas. Am J Clin Pathol.2004;122:552-9.
10. Gorrfried ON, Viskochil DH, Fults DW, Couldwell, WT. Molecular, genetic, and cellular pathogenesis of neurofibroma and surgical implications. Neurosurgery. 2006;58:1-16.
11. Danid NL, Hiroko O, Otmar DW. WHO classification of tumors – pathology and genetics of tumors of the nervous system. WHO 4th edition. 2007; 160.
12. Roberto T., Malcolm G., Robert B., et al. Liposarcomatous differentiation in malignant peripheral nerve shenath tumor: a case report. Pathol. Res. Practice. 2010;206:138-42.
13. Jacczar K, Tybor K, et al. Low grade malignant peripheral nerve sheath tumor with divergent differentiation. Indian J. Patho. Microbiology. 2009;52:74-6.
14. Graf A, Yang K, King D. et al. Lipomas of the brachial plexus: a case series and review of the literature. Am Ass for Hand Surg. 2019;14:333-8.
15. Anghel A, Tudose I, Terzea D et al. Unusual median nerve extracranial head and neck schwannomas. Eur Arch Otorhinolaryngol. 2015;55:159-64.

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Presumed Multidrug-Resistant *Mycoplasma genitalium* Urethritis in a Man with HIV Infection

Annika van Oosbree, MS IV; Alaire Buchholz, III; and Jennifer Hsu, MD

Abstract

Sexually transmitted infection (STI) rates in the U.S. have rapidly increased in the past decade. Although most of this rise is due to syphilis, gonorrhea, and chlamydia, less common STIs are also rising, including *Mycoplasma genitalium*. We present the case of a 40-year-old male with a history of virologically-suppressed human immunodeficiency virus (HIV) infection who presented with recurrent nongonococcal urethritis. Unfortunately, his symptoms were refractory to multiple empiric drug regimens, and he was eventually diagnosed with *Mycoplasma genitalium*. After consultation with the Centers for Disease Control and Prevention STI branch, minocycline was successfully used to eradicate the infection.

Introduction

Sexually transmitted infections (STIs) are rising across the U.S., specifically in South Dakota. Though not a part of routine STI screening, *Mycoplasma genitalium* causes 15-20 percent of nongonococcal urethritis (NGU), 20-25 percent of nonchlamydial NGU, and 40 percent of persistent urethritis.[1-3] Macrolide-resistant *M. genitalium* has rapidly increased, ranging from 44 percent to 90 percent in the U.S., Canada, Western Europe, and Australia.[1] Though quinolone resistance is lower,[2,4-7] clinically-relevant quinolone resistance is often associated with coexistent macrolide resistance.[8] This report describes a male with virologically-suppressed HIV infection who presented with recurrent, multidrug-resistant NGU.

Case Presentation

A 40-year-old male with a history of HIV infection, varicocele, hyperlipidemia, and condyloma acuminata of the anus presented to his primary care provider with intermittent penile discharge associated with intermittent pelvic and testicular pain. His HIV infection was fully suppressed on bictegravir/emtricitabine/tenofovir alafenamide (Biktarvy) since 2016. He was in a monogamous sexual relationship with a male partner; his partner was asymptomatic. Testing for gonorrhea and chlamydia multiple times via urine and urethral swab nucleic acid amplification testing (NAAT) was negative. The first episode resolved spontaneously. However, his symptoms recurred, so he was referred to a urology clinic. While awaiting this appointment, he tried a course of doxycycline 100 mg twice a day for 10 days, and his symptoms resolved. His symptoms recurred but again resolved with empiric doxycycline. The patient's relationship ended, and he was abstinent from all sexual activity through the remainder of the described clinical course.

About three months later, the patient experienced pruritus at the tip of his penis. Further testing was negative, including urinalysis with reflex to microscopic and culture, urine *C. trachomatis* and *N. gonorrhoeae* NAAT, and serum syphilis IgG and IgM antibody. Due to inclimate weather and a delay in transport, the specimen was no longer viable for laboratory testing, and *M. genitalium* NAAT could not be performed. His symptoms progressed to slightly odorous, purulent discharge and perineal aching, so the decision was made to treat empirically for *M. genitalium* with azithromycin 500 mg once followed by 250 mg daily for four days (Zithromax, Z-Pak) for a total dose of 1.5 grams. His symptoms did not improve, so he was switched to empiric moxifloxacin 400 mg daily for 14 days. The penile discharge decreased in volume and became clearer in appearance. Additionally, the pruritus at the tip of the penis and perineal discomfort also improved.

Approximately two weeks after completion of moxifloxacin, his symptoms recurred. *M. genitalium* NAAT was positive from a urine specimen. Simultaneous testing for *Trichomonas vaginalis* was negative. He was given a 14-day course of doxycycline, on which he initially experienced improvement. However, his symptoms again relapsed a short time after antibiotic completion. Antibiotic susceptibility testing is not currently commercially available; therefore, this information was not available to guide treatment decisions. Ultimately,

in consultation with the Centers for Disease Control and Prevention (CDC), the patient was treated with minocycline 100 mg twice daily for 14 days. His symptoms resolved, and test-of-cure *M. genitalium* NAAT one month later was negative. One year post-treatment, the patient is doing well without relapse of urethritis. However, he does continue to experience perineal discomfort of undetermined etiology.

Discussion

In 2018, the CDC estimated that one in five people in the U.S. had an STI on any given day, and STI rates continue to rise.[9-10] From 2016 to 2020, the CDC reports a 45 percent increase in cases of gonorrhea, a 52 percent increase in cases of syphilis, and a 1.2 percent decrease in cases of chlamydia.[10] In South Dakota, the Department of Health's South Dakota Infectious Disease Dashboard reports state data on several STIs, including gonorrhea, chlamydia, syphilis, and both acute and chronic hepatitis B.[11] At the time of publication, several of these STIs have shown notable growth in incidence[11] (Table 1).

At the time of publication, syphilis cases in South Dakota have increased by 1,877 percent in 2022.[11] As stated above, the total number of syphilis cases for the entire year of 2020 was 101.[10] Gonorrhea cases have increased by 55 percent with 716 cases year-to-date (YTD) and a five-year median YTD of 461.[11] Chlamydia cases have increased by 10 percent with 1,238 cases YTD and a five-year median YTD of 1,128. Chronic hepatitis B cases have decreased by 57 percent with three cases YTD, and acute hepatitis B cases continue to be 0 percent.[11] This rapid increase in syphilis and the steady growth in gonorrhea and chlamydia cases in South Dakota is alarming. Physicians in South Dakota should be vigilant for symptoms and risk factors for STIs.

M. genitalium is not one of the eight commonly monitored STIs and thus, falls into the category of "other STIs." Because the bacterium is difficult to culture, NAAT is the only currently available diagnostic tool, and information regarding the epidemiology of *M. genitalium* is limited.[12] One study found that of 914 men who presented to STI clinics with symptoms of urethritis, 28.7 percent of them were positive for *M. genitalium*.[2] The CDC estimates that *M. genitalium* is the cause of 40 percent of recurrent or persistent urethritis in men.[13] With the recently expanded availability of NAAT to diagnose *M. genitalium*, surveillance should be expanded to quantify better the incidence of *M. genitalium* in the U.S. and South Dakota specifically.[12]

M. genitalium resistance has been declared a public health issue due to its antibiotic resistance profile.[14] It lacks a peptidoglycan-containing cell wall, making it inherently resistant to beta lactam antibiotics.[15] A recent systematic review and meta-analysis calculated that azithromycin resistance has increased from 10 percent before 2010 to 51 percent in 2016-2017. Moxifloxacin resistance is stable

Table 1. STI case trends in South Dakota.[10]

Year	Chlamydia	Gonorrhea	Syphilis
2011	3,412	602	0
2018	4,441	1,694	50
2020	4,007	2,399	101
2022*	716	1,238	257

*Year-to-date at time of writing

Table 2. CDC M. Genitalium treatment recommendations by resistance (CDC).

Treatment options	Macrolide-susceptible	Macrolide-resistant	Resistance testing unavailable
Step 1	Doxycycline 100 mg orally 2 times/day for 7 days	Doxycycline 100 mg orally 2 times/day for 7 days	Doxycycline 100 mg orally 2 times/day for 7 days
Step 2	Azithromycin 1 g orally initial dose	Moxifloxacin 400 mg orally once daily for 7 days	Moxifloxacin 400 mg orally once daily for 7 days
Step 3	Azithromycin 500 mg orally once daily for 3 days (2.5 g total)		

at 8 percent, and dual-resistance to both azithromycin and moxifloxacin is 3 percent. Macrolide-resistant *M. genitalium* is more common in men that have sex with men than in men that have sex with women.[15] Doxycycline has traditionally been used as treatment, but only 20 to 40 percent of infections are now cured using this regimen.[16] A one-time dose of 1 gram of azithromycin has also been used as first-line treatment; however, the CDC no longer recommends its use because it may confer additional resistance.[1]

In the wake of rapidly increasing resistance, the first-line treatment for *M. genitalium* is doxycycline 100 mg twice a day for seven days to reduce the organism load, followed by either high-dose azithromycin (1 g/day initial dose followed by 500 mg orally once daily for three additional days) or 400 mg of moxifloxacin once daily for seven days[1] (see Table 2). Note that our patient was initially treated with azithromycin 500 mg followed by 250 mg daily for four days for a total dose of 1.5 grams, which is no longer the guideline-recommended dose. If symptoms relapse or test-of-cure NAAT is positive, an expert should be consulted, as in the present case. There are data suggesting minocycline may be effective in refractory cases; however, this data is limited to two case reports.[17] Additionally, there is interest in use of newer antibiotics, including lefamulin (Xenleta), an FDA-approved pleuromutilin antibiotic, and solithromycin (non-FDA-approved.)

This case highlights the importance of a high index of clinical suspicion for *M. genitalium* in men with recurrent NGU. It also underscores the need for improved surveillance of "less common" STIs to fully understand their epidemiology and clinical impact, including long-term effects. Additionally, the availability of commercial resistance testing needs to be enhanced. To the authors' knowledge, this case provides a third published example of minocycline successfully resulting in a negative test-of-cure after presumed multidrug-resistant *Mycoplasma genitalium* urethritis.

REFERENCES

1. Workowski KA, Bachmann LH, Chan PA, et al. Sexually transmitted infections treatment guidelines, 2021. MMWR Recomm Rep. 2021;70(4):1-187. Published 2021 Jul 23.
2. Bachmann LH, Kirkcaldy RD, Geisler WM, et al., the MAGNUM Laboratory Working Group. Prevalence of Mycoplasma genitalium infection, antimicrobial resistance mutations and symptoms resolution following treatment of urethritis. Clin Infect Dis. 2020;71:e624-32.
3. Taylor-Robinson D, Jensen JS. Mycoplasma genitalium: from chrysalis to multicolored butterfly. Clin Microbiol Rev 2011;24:498-514.
4. Dionne-Odom J, Geisler WM, Aaron KJ, et al. High prevalence of multidrug-resistant Mycoplasma genitalium in human immunodeficiency virus-infected men who have sex with men in Alabama. Clin Infect Dis. 2018;66:796-8.
5. Pitt R, Fifer H, Woodford N, Alexander S. Detection of markers predictive of macrolide and fluoroquinolone resistance in Mycoplasma genitalium from patients attending sexual health services in England. Sex Transm Infect. 2018;94:9-13.
6. Unemo M, Salado-Rasmussen K, Hansen M, et al. Clinical and analytical evaluation of the new Aptima Mycoplasma genitalium assay, with data on M. genitalium prevalence and antimicrobial resistance in M. genitalium in Denmark, Norway, and Sweden in 2016. Clin Microbiol Infect. 2018;24:533-9.
7. Anderson T, Coughlan E, Werno A. Mycoplasma genitalium macrolide and fluoroquinolone resistance detection and clinical implications in a selected cohort in New Zealand. J Clin Microbiol 2017;55:3242-8.
8. Bissessor M, Tabrizi SN, Twin J, et al. Macrolide resistance and azithromycin failure in Mycoplasma genitalium-infected cohort and response of azithromycin failures to alternative antibiotic regimens. Clin Infect Dis. 2015;60:1228-36.
9. Sexually transmitted infections prevalence, incidence, and cost estimates in the United States. Centers for Disease Control and Prevention. Reviewed January 25, 2021. Retrieved from www.cdc.gov/std/statistics/prevalence-2020-at-a-glance.htm.
10. Sexually transmitted disease surveillance 2020. Centers for Disease Control and Prevention. Reviewed April 12, 2022. Retrieved from www.cdc.gov/std/statistic s/2020/default.htm.
11. Monthly infectious disease dashboard. South Dakota Department of Health. Updated April 12, 2022. Retrieved from https://doh.sd.gov/statistics/surveillance/default.aspx.
12. Torrone EA, Lewis FMT, Kirkcaldy RD, et al. Genital Mycoplasma, shigellosis, zika, pubic lice, and other sexually transmitted infections: neither gone nor forgotten. Sex Transm Dis. Apr 1 2021;48(4):310-4.
13. Workowski KA, Bachmann LH, Chan PA, et al. Sexually transmitted infections treatment guidelines, 2021. MMWR Recomm Rep. 2021;70(No. RR-4):1–187.
14. US Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States, 2019. Atlanta, GA: U.S. Department of Health and Human Services, 2019.
15. Machalek DA, Tao Y, Shilling H, et al. Prevalence of mutations associated with resistance to macrolides and fluoroquinolones in Mycoplasma genitalium: a systematic review and meta-analysis. Lancet Infect Dis. 2020;20(11):1302-1314.
16. Mena LA, Mroczkowski TF, Nsuami M, Martin DH. A randomized comparison of azithromycin and doxycycline for the treatment of Mycoplasma genitalium-positive urethritis in men. Clin Infect Dis. 2009;48:1649-54.
17. Glaser AM, Geisler WM, Ratliff AE, Xiao L, Waites KB, Gaisa M. Two cases of multidrug-resistant genitourinary Mycoplasma genitalium infection successfully eradicated with minocycline. Int J STD AIDS. 2019;30:512-4.

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Less Common Focal Neuropathies: A Brief Review

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Abstract

Focal peripheral neuropathies (FPN) will be encountered by clinical practitioners in all disciplines. While bedside exam skills are greatly beneficial in the diagnostic approach, new options are improving diagnostic accuracy. A variety of management options are available to assist patients with these diverse disorders. Ten less common focal neuropathies are featured in this review.

Introduction

Focal peripheral neuropathies, also known as mononeuropathies, are common neurologic disorders caused by the damage, disease, or malfunction of a single nerve in the peripheral nervous system. Clinicians and trainees are often familiar with carpal tunnel syndrome, cubital tunnel syndrome, radial neuropathy with wrist drop, and peroneal (fibular) neuropathy with foot drop.[1] A variety of less common focal neuropathies will be encountered in clinical practice. Here, we briefly review ten focal peripheral neuropathies that may challenge practitioners and trainees across many clinical disciplines.

The diagnostic approach to focal neuropathies continues to evolve. The clinical history and exam remain highly informative. In many cases, the clinical findings can be supported by electromyography (EMG) with nerve conduction studies (NCS). Magnetic resonance imaging (MRI) can provide significant anatomical detail and increasingly, ultrasound is used diagnostically.[2,3] Conventional X-ray studies may have occasional utility when addressing specific orthopedic considerations.

Treatment of focal neuropathies will often result in a variety of pharmacologic, non-pharmacologic, and procedural interventions to improve patient comfort and function.

1. Cheiralgia Paresthetica

Cheiralgia paresthetica results from the compression of the superficial branch of the terminal radial nerve. The superficial branch is purely sensory. Compression can result from a variety of causes including trauma, tight handcuffs or watches, acupuncture, steroid injections, lipomas/cysts, cephalic venipuncture, and repetitive wrist movements (hyperpronation, supination, and pronation). Cheiralgia paresthetica occurs primarily in adults, especially women.[4]

Patients typically present with shooting or burning pain, tingling, and paresthesia over the dorsolateral portion of the hand around the 1st dorsal web of the hand. The symptoms can be acute, chronic, or intermittent depending on the cause.[4] Visible sources of compression (i.e. injury, lipoma, cysts, etc.) may be evident. Tingling or pain after tapping over the affected nerve is the most common sign and provides localizing value.[3,4] A peripheral nerve block at the point of maximal tingling or pain can be utilized to support the diagnosis.[4,5]

Treatment is primarily conservative. Removal of causes of compression, rest, and avoidance of aggravating motions are first line. NSAIDs can be used adjunctively as well. For refractory cases, a thumb spica splint, corticosteroid injections, and peripheral nerve blocks can be utilized. Failing these options, surgical decompression or neurolysis can be considered.[4,5]

2. Ulnar Canal Syndrome

Ulnar canal syndrome occurs because of compression of the ulnar nerve in the ulnar tunnel (Guyon canal) of the wrist. The tunnel consists of the pisiform (medial wall), flexor retinaculum (dorsal wall), and fibrous tissues (palmar wall).[6] It is much less common than ulnar neuropathy in the cubital tunnel at the elbow. Common causes of ulnar nerve compression in the Guyon canal include ganglion cysts, abnormal muscle or ulnar artery anatomy, chronic pressure of wrist in dorsiflexion (e.g. cyclists), occupational hazards (e.g. jackhammer use), and fracture/dislocation. This syndrome is associated with carpal tunnel syndrome, and 94 percent of patients who receive carpal tunnel surgical decompression report improvement of ulnar nerve symptoms as well.[7]

Presentation of ulnar canal syndrome depends on the anatomical location of the impingement. Clinical evidence of ulnar motor and/or sensory deficits in the hand can be identified. The ulnar nerve bifurcates into superficial (sensory) and deep (motor) branches within the Guyon canal. Thus, impingement can occur within three distinct zones. Zone I impingement occurs early in the nerve's course through the canal. Impingement here typically causes motor deficits of all intrinsic hand muscles innervated by the ulnar nerve and sensory deficits over the hypothenar eminence and medial two digits. Zone II impingement occurs at the deep branch and presents as motor deficits only. Zone III impingement occurs at the superficial branch and presents as sensory deficits only. Pain can also be associated with all three impingement locations.[7]

Treatment of ulnar tunnel syndrome resembles carpal tunnel syndrome. Conservative treatment includes NSAIDS, wrist splinting, and avoidance of occupational or recreational aggravating factors. Surgical decompression is an option if conservative methods are ineffective. If the patient has a known structural cause, such as a mass, surgical treatment can be offered initially.[7]

3. Occipital Neuralgia

Occipital neuralgia is a condition defined by severe pain along greater occipital nerve (GON), lesser occipital nerve (LON), and/or the third occipital nerve. It most commonly occurs along GON. Symptoms can be unilateral or bilateral. For diagnosis, the patient must also meet two out of the following three additional criteria: paroxysmal pain lasting seconds to minutes, severe pain, and sharp or stabbing pain quality. Potential causes include entrapment by nearby ligaments, compression by muscles the nerve courses through or nearby arteries (occipital artery), myofascial spasm, tumors, posterior head trauma, and iatrogenic causes (i.e. cervical manipulation). [8]

Physical exam often reveals pain with palpation over the course of GON and possible heightened sensitivity to rubbing or light touch within the cutaneous nerve territory. Occipital neuralgia may be associated with nausea, dizziness, vision changes, tinnitus, and nasal congestion which may overlap with symptoms of other primary headache disorders such as migraine. Tapping over the affected nerve that results in tingling can support the diagnosis.[8]

Treatment may be initiated with non-pharmacologic methods including physical therapy, massage, acupuncture, posture improvement, and cold/warm compresses. If ineffective, pharmacologic treatment can be considered. Although no specific evidence-based guidelines are developed, various medications can be tried including NSAIDs, acetaminophen, muscle relaxants, anticonvulsants, selective serotonin reuptake inhibitors, and tricyclic antidepressants. An anesthetic block of GON and LON can be implemented for diagnostic and therapeutic results. Onabotulimin toxin A has been utilized for occipital neuralgia but improvement usually only partial. Radiofrequency ablation has been used with some success with further study ongoing.[9] Occipital nerve stimulation using an implanted nerve stimulator can be utilized for intractable neuralgia. Surgical decompression, neurectomy, and neurolysis is usually a last resort.[8]

4. Tarsal Tunnel Syndrome

Tarsal tunnel syndrome (TTS) is an entrapment neuropathy of the posterior tibial nerve or its branches.[10,11] Nerve entrapment occurs on the medial side of the ankle (below the medial malleolus) within the tarsal tunnel, which is a fibro-osseous tunnel beneath the flexor retinaculum. Additional contents of the tarsal tunnel, include the tibialis posterior tendon, flexor digitorum longus tendon, posterior tibial artery and vein, posterior tibial nerve, and flexor hallucis longus tendon. There are both intrinsic and extrinsic causes of TTS.[10,12] Some intrinsic causes include osteophytes, space occupying lesions like lipomas or neuromas, or hemorrhage secondary to trauma, while some extrinsic causes include direct trauma, constrictive footwear, lower limb edema, or post-surgical scarring.

TTS is uncommon and clinically underdiagnosed.[8,9] TTS commonly presents as pain directly over the tarsal tunnel behind the medial malleolus, that radiates to the longitudinal arch and plantar surface of the foot, including the heel. Pain is often described as burning accompanied by sensations of tingling and/or numbness, and often an associated sensation of tightness. Prolonged standing or walking often exacerbates symptoms, while rest and elevation relieves symptoms.[10] Physical exam produces tenderness with deep palpation and reproduction of pain or tingling by tapping over the nerve inferior to the medial malleolus.[8-11] Ancillary diagnostic tests can be used to confirm the diagnosis.[8,9,11]

Treatment includes non-surgical and surgical options, with best outcomes when treatment is focused on the specific cause of TTS.[10] While conservative therapies like anti-inflammatory medications, activity modifications, shoe orthotics, and physiotherapy can be adequate methods of treatment, there are often excellent results in those patients who elect for decompression.[10,11,13] Decompression is encouraged early for

intrinsic causes of TTS to prevent nerve fibrosis, which can result in muscle wasting and weakness.[10,13]

5. Meralgia Paresthetica

The lateral femoral cutaneous nerve (LFCN) is a sensory nerve that provides innervation to the anterior and lateral aspect of the thigh. Meralgia paresthetica (MP) causes numbness, paresthesia, and pain in an oval shape over the distribution of the LFCN. Presentation is most often unilateral.[14-16] MP can be caused by nerve entrapment, compression, or a neuroma of the LFCN. Location of LFCN impingement is variable but this nerve is most susceptible to entrapment as it exits the pelvis, which is the most common site of entrapment.[15,16]

The etiology of MP is often categorized as spontaneous or iatrogenic. When spontaneous, it is usually due to mechanical nerve compression. Common causes include obesity, tight clothing or belts, pregnancy, and other causes of increased intrabdominal pressure.[14-16] For example, law enforcement officers who were a gun, holster, and other equipment around the waist are commonly associated with MP. Pelvic trauma like crush injuries, limb length discrepancy, iliac crest tumor, and osteoid osteoma in children are less frequent causes of MP.[15,16] Non-structural causes are rare.

Iatrogenic causes of MP can occur following surgical procedures, especially orthopedic procedures of the spine and pelvis.[15] Pelvic osteotomy is the most commonly implicated surgery, but other procedures like posterior lumbar spine surgery, iliac crest bone grafts, and total hip replacements have been reported. Non-orthopedic surgeries including laparoscopic cholecystectomy, laparoscopic myomectomy, coronary artery bypass grafting, aortic valve surgery, gastric reduction surgery for morbid obesity, and laparoscopic inguinal hernia repair have reported causes of MP.[15]

The clinical diagnosis of MP is based on history, physical, and typical exacerbating factors.[12] Patients typically describe a burning, stinging, or tingling sensation over the anterior lateral thigh, rather than overt pain. Upright posture and prolonged standing have been identified as associated aggravating factors, while sitting tends to relieve symptoms.[13,14] Physical exam usually reveals tenderness over the lateral inguinal ligament where the nerve crosses the inguinal ligament. The pelvic compression test, neurodynamic testing, and tapping over the affected nerve are all commonly used to diagnose MP.[16] There may be an area of hair loss on the anterior thigh when patients repetitively rub the region, and this is an important diagnostic marker.[15] Confirmatory testing is usually unnecessary. Infrequently, serious diagnoses mimicking MP such as lumbar disc herniation or neoplastic involvement the iliac crest may need to be considered.[15,16]

Management often involves addressing underlying causes with conservative measures such as: removal of compressive agents, nonsteroidal anti-inflammatory drugs. If necessary, local corticosteroid injections may be helpful.[14-16] Resolution occurs in most cases within four to six months. If pain persists despite conservative measures, surgical intervention can be considered. It is controversial whether neurolysis and decompression or transection is the best approach.[14-16] Research is sparse, but some have suggested that manual chiropractic therapy, kinesio taping, and acupuncture may aid in treatment of MP.[16]

6. Notalgia Paresthetica

Notalgia paresthetica (NP) is a neurocutaneous condition that presents as localized pruritis medial to the scapula on the midback, with or without an associated hyperpigmented or hypopigmented well-circumscribed macule.[17,18] This disorder is common and often underdiagnosed. Middle aged women are most affected. NP is typically unilateral. In addition to itching, patients occasionally report abnormal sensations of burning, tingling, numbness, coldness, and tenderness.

A singular cause of this condition has yet to be established. Many suggest a multifactorial etiology is plausible, with spinal nerve entrapment and muscular compressive neuropathy being likely contributors.[8] Some believe the posterior rami of thoracic spinal nerves T2-T6 as most likely entrapped, leading to pruritis.[9] If a macule is present, it most commonly occurs in the T2-T6 dermatomes and results from scratching and rubbing. Others theorize degeneration of the cervical spine (due to trauma, osteophytes, spinal stenosis, etc.) is causative.[18] The anatomical right angle of the nerve fibers that penetrate the multifidus muscle may predispose to impingement.

No definitive treatment has been established for NP, though physical therapy (TENS, exercise, cervical traction), topicals (botulinum A, lidocaine, capsaicin), systemic drugs (gabapentin, amitriptyline), intralesional steroids, or a combination thereof, are sometimes used for symptom management.[17,18] Physiotherapy and surgical decompression can be considered though evidence of efficacy is scarce.[18]

7. Superficial Peroneal (Fibular) Neuropathy

The superficial peroneal (fibular) nerve provides motor innervation to the peroneus longus and peroneus brevis of the lateral lower leg allowing eversion of the foot, as well

as sensory innervation to the anterolateral lower leg and dorsum of the foot.[19,20] There are a number of anatomical variations in the distribution of this nerve and its branches, making it susceptible to injury and entrapment.

Entrapment of this nerve (and its branches) is uncommon and is most often due to mechanical compression of the nerve as it exits the crural fascia.[19] In some case reports, the accessory superficial peroneal nerve, a branch of the main sensory nerve, has been considered a more specific source of the pain and paresthesia due to entrapment.[20] The superficial peroneal nerve is at risk for damage with traumatic injury to the lateral knee. There is a risk for iatrogenic damage during arthroscopy, local anesthetic block, and other procedures on the leg, ankle, and foot.[19,20]

Exam will localize pain and paresthesia over the dorsum of the foot.[10,11] The usual diagnostic studies can be pursued as needed.[17,18] Symptoms are typically managed conservatively with orthotics and/or physical therapy. Surgical options are reserved for more severe cases.

8. Phrenic Neuropathy

Phrenic nerve palsy can result in either unilateral or bilateral diaphragmatic paralysis and is a rare cause of respiratory compromise. A wide variety of causes for diaphragmatic palsy have been reported.[21] Due to differences in pulmonary physiology, it tends to have greater severity in children than adults. In infants and children, it is typically a result of operative trauma from cardiothoracic surgery or birth injury. Symptom severity varies greatly and may be asymptomatic. When symptomatic, patients typically present with symptoms of respiratory distress. They may also have difficulty feeding, increased reflux, vomiting, recurrent pulmonary infections, and asymmetric chest excursions.[22] In adults, diaphragmatic paralysis is typically due to injury of the phrenic nerve during a cardiac or thoracic surgery. In this situation, the paralysis is usually not clinically significant and resolves on its own.[23]

An elevated diaphragm or hemidiaphragm is seen on chest X-ray. Fluoroscopy or ultrasound can be utilized to confirm the diagnosis. Previously, fluoroscopy was the preferred diagnostic study, but bedside ultrasound provides similar accuracy and avoids radiation exposure. EMG can be considered.[22,21]

There are no specific guidelines for management of phrenic nerve palsy. Each treatment plan must be individualized based on clinical circumstances and underlying etiology. Mild cases may only require close monitoring. Invasive or noninvasive methods of respiratory support may be necessary. Surgical plication of the diaphragm can improve pulmonary function in refractory cases. Since spontaneous resolution is often possible, plication may be delayed, but optimal timing of surgery may be difficult to determine.[20,21] Diaphragmatic pacing may be an option and is most commonly considered in high-level spinal cord injuries and central hypoventilation syndromes.[24]

9. Femoral Nerve

Isolated femoral neuropathy is a rare condition commonly resulting from operative trauma. Other sources include diabetes, penetrating wound, pelvic fracture, retroperitoneal hemorrhage (i.e. in anticoagulated patients), tumor, cyst, and prolonged labor.[25-27] Injury to the femoral nerve can cause weakness of knee extension and hip flexion, loss of sensation over the anterior and medial thigh, and loss of patellar reflex. Diabetic femoral neuropathy can cause significant pain, atrophy, and sensory loss over the affected area. Because of the impact on walking and standing, femoral neuropathies can be debilitating.

When a femoral neuropathy is suspected, imaging studies are usually warranted, especially during post-operative care. An X-ray can rule out fractures as well as out-of-place prosthetics. CT and MRI are important for ruling out bleeding, pseudoaneurysm, or other soft tissue causes of nerve compression.[25]

The cause of the neuropathy directs treatment. When an obvious source is found, immediate surgical exploration and decompression is recommended to prevent long term damage to the femoral nerve. If no source of compression is found on imaging, early surgical intervention, neurolysis, and nerve repair is recommended.[25]

10. Sciatic Neuropathy

When considering focal sciatic neuropathy, it is clinically useful to include considerations of the radicular origins of the sciatic nerve and symptoms commonly described as sciatica. The term sciatica is commonly used by practitioners and the lay public as a way of referring to pain that radiates from the buttock along the course of the sciatic nerve. While nerve root impingement from spinal disk disease may be responsible for up to 85 percent of sciatica cases, a wide variety of other spinal and non-spinal causes have been described.[28]

The sciatic nerve forms from the roots (L4-5; S1-2) of the lumbosacral plexus and emerges from the pelvis passing

inferiorly to the piriformis muscle, towards the lower limb where it divides into common tibial and fibular nerves.[29,30] The L5 and S1 roots are commonly implicated in the diagnosis of lumbosacral radiculopathy. Common structural causes of lumbosacral radiculopathy include disk herniation and degenerative spinal stenosis. Inflammatory disease, infection, and malignancy can also give rise to lumbosacral radiculopathy.[30] Rarely, lumbosacral plexopathy (damage at the lumbosacral plexus) can occur as well causing similar symptoms. It typically results from diabetic amyotrophy, trauma, infection, malignancy, radiation, and pregnancy among other causes.[31]

The sciatic nerve may be affected directly by penetrating trauma. In the absence of penetrating injury, the nerve may be injured by compression, stretch, inflammation, and other less common processes.[26,28] Orthopedic procedures of the hips and knees are relatively common causes of sciatic nerve deficits. Piriformis syndrome, gluteal injections, neoplasms, and pregnancy related damage are uncommonly described.[25,26,28]

Sciatic neuropathy deficits are often partial with the peroneal deficits usually exceeding tibial component. The range of motor and sensory deficits will depend on the extent of injury. [28,32] Plexopathy tend to cause extensive unilateral motor weakness and sensory loss in multiple nerve root distributions which can help differentiate these from sciatic neuropathy or radiculopathy which typically follow a dermatomal or single nerve root distribution.[31]

Treatment of sciatica varies based on underlying etiology, severity of symptoms, and extent of neurologic deficits. Most cases of sciatica resolve spontaneously. Common approaches include activity modification, non-opiate analgesics, anti-inflammatory medications, and medications for neuropathic pain. Epidural steroid injections are often used although benefit is unclear. Surgery, most commonly lumbar disk procedures, may be indicated in selected patients who have pain that radiates distal to the knee that is accompanied by neurologic deficits.[25,26,28,33]

Conclusion

Focal peripheral neuropathies can cause a wide variety of clinical presentations and morbidities. Focal neuropathies may be encountered in any clinical discipline. The initial assessment of these disorders is greatly aided by a synthesis of history and physical findings. Advanced diagnostic options are available to assist the clinician, and multiple modalities can be used to treat symptoms and functional deficits.

REFERENCES

1. Malek E, Salameh JS. Common entrapment neuropathies. Semin Neurol. 2019;39(5):549-59. Epub 2019/10/23.
2. Kollmer J, Bendszus M. Magnetic resonance neurography: improved diagnosis of peripheral neuropathies. Neurotherapeutics. 2021;18(4):2368-83. Epub 2021/12/04.
3. V Penry MC. Neuromuscular ultrasound for peripheral neuropathies. Semin Neurol. 2019;39:542-8. Epub 2019/10/22.
4. Anthony JH, Hadeed A, Hoffler CE. Cheiralgia Paresthetica. StatPearls. Treasure Island (FL) 2021.
5. Kesserwani H. Cheiralgia paresthetica or superficial radial sensory mononeuropathy: a simple diagnosis, a simple solution, and a side note on the pathophysiology of the tinel sign. Cureus. 2020;12(9):e10224. Epub 2020/10/13.
6. Yamamoto R, Izumida M, Sakuraya T, Emura K, Arakawa T. The ulnar nerve is surrounded by the tendon expansion of the flexor carpi ulnaris muscle at the wrist: an anatomical study of Guyon's canal. Anat Sci Int. 2021;96(3):422-6. Epub 2021/02/07.
7. Bachoura A, Jacoby SM. Ulnar tunnel syndrome. Orthop Clin North Am. 2012;43(4):467-74. Epub 2012/10/03.
8. Pan W, Peng J, Elmofty D. Occipital neuralgia. Curr Pain Headache Rep. 2021;25(9):61. Epub 2021/07/22.
9. Lee DW, Pritzlaff S, Jung MJ, Ghosh P, Hagedorn JM, Tate J, et al. Latest evidence-based application for radiofrequency neurotomy (LEARN): best practice guidelines from the American Society of Pain and Neuroscience (ASPN). J Pain Res. 2021;14:2807-31. Epub 2021/09/17.
10. Ahmad M, Tsang K, Mackenney PJ, Adedapo AO. Tarsal tunnel syndrome: a literature review. Foot Ankle Surg. 2012;18(3):149-52. Epub 2012/08/04.
11. McSweeney SC, Cichero M. Tarsal tunnel syndrome-a narrative literature review. Foot (Edinb). 2015;25(4):244-50. Epub 2015/11/08.
12. Takakura Y, Kitada C, Sugimoto K, Tanaka Y, Tamai S. Tarsal tunnel syndrome. Causes and results of operative treatment. J Bone Joint Surg Br. 1991;73(1):125-8. Epub 1991/01/01.
13. Reade BM, Longo DC, Keller MC. Tarsal tunnel syndrome. Clin Podiatr Med Surg. 2001;18(3):395-408. Epub 2001/08/14.
14. Grossman MG, Ducey SA, Nadler SS, Levy AS. Meralgia paresthetica: diagnosis and treatment. J Am Acad Orthop Surg. 2001;9(5):336-44. Epub 2001/09/29.
15. Harney D, Patijn J. Meralgia paresthetica: diagnosis and management strategies. Pain Med. 2007;8(8):669-77. Epub 2007/11/22.
16. Cheatham SW, Kolber MJ, Salamh PA. Meralgia paresthetica: a review of the literature. Int J Sports Phys Ther. 2013;8(6):883-93. Epub 2014/01/01.
17. Howard M, Sahhar L, Andrews F, Bergman R, Gin D. Notalgia paresthetica: a review for dermatologists. Int J Dermatol. 2018;57(4):388-92. Epub 2017/12/16.
18. Mulkoglu C, Nacir B. Notalgia paresthetica: clinical features, radiological evaluation, and a novel therapeutic option. BMC Neurol. 2020;20(1):191. Epub 2020/05/18.
19. Lezak B, Massel DH, Varacallo M. Peroneal Nerve Injury. StatPearls. Treasure Island (FL) 2021.
20. Cheredath A, Ankolekar VH, Sylvan DSA. Variable patterns of the cutaneous innervation of the dorsum of the foot and its clinical implication. Ann Med Surg (Lond). 2021;66:102404. Epub 2021/06/18.
21. Kokatnur L, Rudrappa M. Diaphragmatic palsy. Diseases. 2018;6(1). Epub 2018/02/14.
22. Gerard-Castaing N, Perrin T, Ohlmann C, Mainguy C, Coutier L, Buchs C, et al. Diaphragmatic paralysis in young children: a literature review. Pediatr Pulmonol. 2019;54(9):1367-73. Epub 2019/06/19.
23. Simansky DA, Paley M, Refaely Y, Yellin A. Diaphragm plication following phrenic nerve injury: a comparison of paediatric and adult patients. Thorax. 2002;57(7):613-6. Epub 2002/07/04.
24. Le Pimpec-Barthes F, Legras A, Arame A, Pricopi C, Boucherie JC, Badia A, et al. Diaphragm pacing: the state of the art. J Thorac Dis. 2016;8(Suppl 4):S376-86. Epub 2016/05/20.
25. Kim DH, Murovic JA, Tiel RL, Kline DG. Intrapelvic and thigh-level femoral nerve lesions: management and outcomes in 119 surgically treated cases. J Neurosurg. 2004;100(6):989-96. Epub 2004/06/18.
26. Wong CA, Scavone BM, Dugan S, Smith JC, Prather H, Ganchiff JN, et al. Incidence of postpartum lumbosacral spine and lower extremity nerve injuries. Obstet Gynecol. 2003;101(2):279-88. Epub 2003/02/11.
27. Al-Ajmi A, Rousseff RT, Khuraibet AJ. Iatrogenic femoral neuropathy: two cases and literature update. J Clin Neuromuscul Dis. 2010;12(2):66-75. Epub 2011/03/10.
28. Ropper AH, Zafonte RD. Sciatica. N Engl J Med. 2015;372(13):1240-8. Epub 2015/03/26.
29. Papadopoulos EC, Khan SN. Piriformis syndrome and low back pain: a new classification and review of the literature. Orthop Clin North Am. 2004;35(1):65-71. Epub 2004/04/06.
30. Barbosa ABM, Santos PVD, Targino VA, Silva NA, Silva YCM, Gomes FB, et al. Sciatic nerve and its variations: is it possible to associate them with piriformis syndrome? Arq Neuropsiquiatr. 2019;77(9):646-53. Epub 2019/09/26.
31. Dydyk AM, Hameed S. Lumbosacral Plexopathy. [Updated 2021 Nov 7]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Retrieved from www.ncbi.nlm.nih.gov/books/NBK556030/.
32. Cherian RP, Li Y. Clinical and electrodiagnostic features of nontraumatic sciatic neuropathy. Muscle Nerve. 2019;59(3):309-14. Epub 2018/11/11.
33. Ramaswami R, Ghogawala Z, Weinstein JN. Management of sciatica. N Engl J Med. 2017;376(12):1175-7. Epub 2017/03/23.

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Matthew Simmons, MD, FAAN, Monument Health Neurology, Rapid City, South Dakota; Associate Professor, Department of Neurosciences, University of South Dakota Sanford School of Medicine.

Many overdose situations are unintentional.

Having access to naloxone is critical.

Promote naloxone education & make sure your patients *know* how to get it.

If your patients have opioids in their homes—they are at risk for overdose. Keeping naloxone on hand can reverse an overdose and save lives. The SD Standing Order makes it easy for your patients to get naloxone from participating pharmacies.

Encourage your patients to keep their families safe. Help them understand:

- Naloxone is a safe medication used to reverse an opioid overdose.
- ANYONE can administer naloxone.
- There is no potential for abuse, and side effects are very rare.
- Naloxone is available statewide at participating pharmacies.
- If they can't afford naloxone, their pharmacy can help them get it for FREE!

For more information on naloxone, the State Standing Order, or key data, visit AvoidOpioidSD.com

Refer your patients and their families to the

Resource Hotline
1-800-920-4343

It's FREE, confidential, and available 24/7

Avoid Opioid
PRESCRIPTION ADDICTION

This content and related publications were supported by Grant or Cooperative Agreement number 6 NU17CE924994-01-01, funded by the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services.

Member News

Visit www.sdsma.org for the latest news and information.

For Your Benefit:

Fighting for You and Your Patients

The SDSMA serves as your vehicle for advocacy for your patients and the art and science of medicine through lobbying at the state and federal levels, grassroots activity, and legal initiatives.

SDSMA PAC is your grassroots avenue that works to impact public policy decisions through bipartisan political participation. SDSMA PAC supports and elects pro-medicine candidates on the state level. Members of the SDSMA and their spouses can join SDSMA PAC.

The SDSMA's motto is "Values, Ethics, Advocacy." We take our advocacy role to heart. With your help, SDSMA and SDSMA PAC have the opportunity to dramatically impact the political and legislative process to create meaningful changes in South Dakota's current health care system.

If you would like to become involved in any of our advocacy programs, call 605.336.1965 or visit sdsma.org.

"For Your Benefit" is the SDSMA's monthly update on programs and services available to physicians through their affiliation with the SDSMA.

Save the Date: 2023 SDSMA Annual Leadership Conference is June 2

The 2023 SDSMA Annual Leadership Conference is Friday, June 2 at the Hilton Garden Inn Downtown Sioux Falls.

With presentations, discussions, networking opportunities and the awards banquet, the Annual Leadership Conference is a great time to share ideas and learn from fellow members.

Do you have a policy issue you'd like to bring to the SDSMA's attention? Schedule a time to address the SDSMA Policy Council during the Membership Open Forum. Watch sdsma.org for policy submission information to be posted soon.

The Annual Leadership Conference is a benefit of your membership and there is no conference registration fee. Tickets are required for some events and meals, and will be available for purchase at sdsma.org.

Last Chance to Renew SDSMA Membership for 2023

Thank you for your membership in the SDSMA. Physician membership for those who have not yet renewed will expire this month. If you haven't renewed yet, please do so soon to ensure your benefits are not interrupted.

When you renew, you can choose to renew your AMA dues and sponsor a student's SDSMA membership dues for four years of medical school with one, easy transaction.

The SDSMA works hard to create value for your membership. As the association strives to improve health care in South Dakota, your involvement and advocacy strengthens physician voices, and provides a strong avenue for physicians to be advocates for patients.

Have you recently retired? Please let us know by contacting the SDSMA office at membership@sdsma.org or 605-336-1965.

Please note: if you are a life member, your membership is continuous. You do not need to take any steps to renew.

SDSMA Seeking Volunteers for Doctor of the Day in Pierre

The SDSMA is looking for volunteers for the association's Doctor of the Day Program.

This volunteer commitment involves one day at the State Capitol in Pierre during the state legislative session, by providing basic medical assistance to elected representatives and staff as needed. **Sign up to volunteer at sdsma.org.**

Doctors of the Day have the unique opportunity to interact with legislators and get a first-hand look at the legislative process and how it affects the practice of medicine. Your presence at the Capitol shows legislators not only your expertise, but also your concern for the health of South Dakotans.

It is critical that volunteer physicians are serving each day of session. Every year we receive requests from PAs and NPs who wish to participate in the program.

Questions? Contact Justin Ohleen, SDSMA Director of Advocacy and Policy, at 605.336.1965 or johleen@sdsma.org.

Legal Brief Highlight: Public School Attendance Policies and Verification of Absences

Some school districts in South Dakota have policies concerning student absences and tardiness. These policies may require schools to verify a student's absence from a doctor, dentist or other professional.

The HIPAA-mandated medical privacy rules generally prohibit the release of protected health information (generally defined as individually-identifiable information concerning a person's health or treatment) without an authorization that complies with federal privacy rules, a court order, an appropriately-issued subpoena or "as otherwise required by law."

Information concerning a student's illness should only be released by a physician 1) directly to the student if he or she is 18 or older, 2) directly to the parent or legal guardian, 3) to the school pursuant to an Authorization for Release of Information signed by a parent or legal guardian of a student younger than 18, 4) pursuant to a court or administrative order, or 5) pursuant to a subpoena that complies with the federal privacy rules. Information should not be released directly to the school if there is no Authorization form.

More information is available in the SDSMA legal brief *Public School Attendance Policies and Proof of Illness* at sdsma.org. The SDSMA provides legal briefs for member physicians on a variety of rules and regulations that apply to the medical profession.

Call for Nominations — SDSMA Awards

Nominations for SDSMA Awards are open! The SDSMA Awards honor physicians for their contributions to health care, service to patients, dedication to improving medicine in South Dakota, or service to the SDSMA.

Nominations are being accepted at sdsma.org for the following awards:

- Distinguished Service Award
- Community Service Award
- COPIC Humanitarian Award - the recipient of this award designates a $10,000 donation from COPIC to be provided to a healthcare related 501(c)(3) organization in South Dakota!
- Outstanding Young Physician Award
- Richard P. Holm, MD, Media Award
- Young at Heart Award

Are there people that come to mind who deserve to be recognized? Nominate them today! Award recipients are honored at the awards banquet during the SDSMA Annual Leadership Conference on June 2, 2023.

An individual may work right alongside of you, serve on a committee with you, volunteer in your organization or community, or have made a significant impact in the medical profession. Help your colleagues and supporters get the recognition they deserve!

Nominations Being Accepted for SDSMA Leadership Positions

The SDSMA Nominating Committee will meet in March to nominate officer candidates for 2023-24 to be voted on by the membership. Those positions include president-elect, vice president, secretary-treasurer, and AMA alternate delegate. This committee also nominates candidates for three at-large members of the Board of Directors and a Policy Council chairperson from among (or such persons must be) members of the SDSMA Policy Council.

All SDSMA members who have an interest in a leadership position as an officer, AMA alternate delegate, at-large position, or Policy Council chair, must submit their name to one of the members of the Nominating Committee listed below by March 1. The Nominating Committee member will present your name at the committee meeting.

Those who have questions about the nominating or election process for SDSMA leadership positions may contact the SDSMA office at 605-336-1965.

Nominating Committee Members

- Kara Dahl, MD - kara094@yahoo.com
- Jeremy Beireis, MD - jrmy791@gmail.com
- Mandi Greenway, MD - mandi.greenway@avera.org
- Ty Hanson, DO - hansonty@juno.com
- Dan Heinemann, MD - djheineman@aol.com
- Laura Hoefert, MD - laura.hoefert@madisonhospital.com
- Deepak Goyal, MD - dgoyal@monument.health
- Mary Jo Olson, MD - maryjo.olson@sanfordhealth.org
- Tim Ridgway, MD - tim.ridgway@usd.edu
- Jenna L. Wickersham, DO - jenna.wickersham@avera.org

Read *InSession* For Weekly Legislative Updates

For legislative updates from the SDSMA during session, watch your email for SDSMA's newsletter, *InSession*.

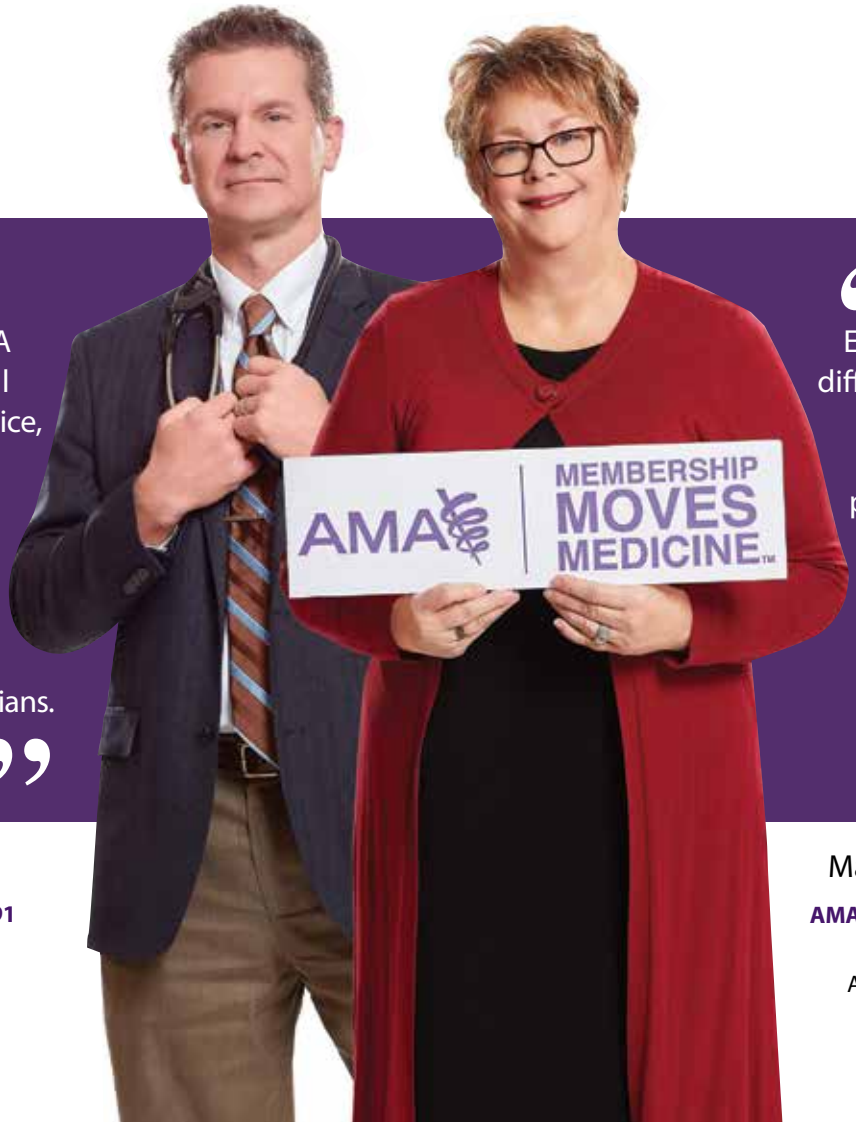
This weekly newsletter keeps members informed about SDSMA's legislative activities and key health-related bills and action alerts, providing a timely look at the actions of the state legislature. The 2023 state legislative session began on Jan. 10 and continues through March 27.

Strengthen the voice of **South Dakota physicians**

Your membership in the South Dakota State Medical Association and the American Medical Association (AMA) ensures you have powerful allies amplifying your voice and advocating for the needs of South Dakota patients and physicians—in your community and across the country.

AMA | MEMBERSHIP MOVES MEDICINE™

SOUTH DAKOTA STATE MEDICAL ASSOCIATION
Values. Ethics. Advocacy.



"The AMA and SDSMA help me "filter out" all the noise in my practice, which allows me to focus on the issues that are most important to me—my patients, the practice of medicine and my fellow physicians."

Robert Allison, MD

AMA MEMBER SINCE: 1991
South Dakota
AMA House of Delegates

"Every locality has a different perspective on what is most important for providing excellent health care. Everyone must be represented when policy is being crafted."

Mary Carpenter, MD

AMA MEMBER SINCE: 1982
South Dakota
AMA House of Delegates

PATIENT EDUCATION:

Grief and Love

Joanie S. Holm, RN, CNP

Writing about grief is like writing about life—huge! Where does one start? It is like describing love: basically impossible. The comedian and late-night host Stephen Colbert lost his father and two older brothers in a tragic accident when he was young, and said, about grief, "It is a gift to exist, and with that gift comes suffering. If I am grateful for life, I must be grateful for all of it. I hope that grief stays with me because it is all the unexpressed love I didn't get to tell you."

So even though grief may be difficult to describe, I'm working to do what Rick taught me: to share my grief publicly, as he did his death. As I've sought to live with my grief, I have found tips and ideas that have helped. Not every tip will be pertinent to every person, so use judgement as you address someone in grief.

- Talk about the one who has died. They are generally the grieving person's favorite subject
- Contact the person in grief frequently. Loneliness can be consuming. Remember birthdays and anniversaries, which can be emotional triggers for the one grieving.
- Include the grieving person in activities. Sometimes getting away from the grief can be a relief.
- Offer to help a person in grief with household chores, as these tasks can become overwhelming. Better yet, just show up and help!
- Be aware that grief can be like a roller coaster, high one day and low on another. Grief can be exhausting. Realize that a person in grief may need extra rest.
- Consider the vulnerability it takes for a grieving person to ask for help. The grieving person may suffer in silence rather than admit defeat.
- And last for this incomplete list: grief has no right or wrong and no timeline. Every individual is different.

The songwriter Nick Cave said "It seems to me, that if we love, we grieve. That's the deal. That's the pact. Grief and love are forever intertwined. Grief is the terrible reminder of the depths of our love and, like love, grief is non-negotiable."

Rick showed us, courageously, how to face death while honoring life, with love and joy instead of dread. Now maybe those of us who grieve can see the shape of our love in our grief. The poet John Roedel wrote: "Your grief is a temple in your heart that honors that love."

I hope that I continue to find wisdom in this grief as I continue my journey.

Joanie S. Holm, RN, CNP, is co-founder and president of Healing Words Foundation that supports Prairie Doc® programming. Follow The Prairie Doc® at www.prairiedoc.org and on Facebook featuring On Call with the Prairie Doc® a medical Q&A show providing health information based on science, built on trust for 21 Seasons, on SDPB and streaming live on Facebook most Thursdays at 7 p.m. central.

SOUTH DAKOTA
BOARD OF MEDICAL & OSTEOPATHIC EXAMINERS

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- Provides Safe Haven, supports, and promotes confidential monitoring of its healthcare providers

Board News is a monthly feature sponsored by the South Dakota Board of Medical and Osteopathic Examiners. For more information, contact the Board at SDBMOE@state.sd.us or write to SDBMOE, 101 N. Main Avenue, Suite 301, Sioux Falls, SD 57104.

Most young people who **VAPE** want to quit.

Help them take the first step
— **refer them** to the **QuitLine** today!

New data* shows that 60% of young people (15-24) want to quit vaping.
They want to quit for their health, financial, and social reasons, and to be free from addiction. That's smart, but they need support.

We know quitting is hard and often takes multiple attempts. Let your patients know there are lots of tools and support to help them make their quit stick.

The South Dakota Quitline has helped thousands of people quit.
We can help anyone 13+ quit vaping too. To find out more, visit **sdquitline.com/providers**

Your DIRECT REFERRAL can make a **HUGE difference** in the health of your patients!

*Truth Initiative Survey, January 2021

A PUBLIC HEALTH MESSAGE FROM THE SOUTH DAKOTA DEPARTMENT OF HEALTH

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COPIC is proud to be the endorsed carrier of the South Dakota State Medical Association. SDSMA members may be eligible for a 10% premium discount.

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