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Individuals with Low Literacy, Type 2
Diabetes and Euglycemia

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EDITOR'S MESSAGE

Welcome to Summer

Ronald Januchowski, DO, FACFP, Editor, *Osteopathic Family Physician*

Welcome to the summer of 2021! Sixteen months into the coronavirus pandemic, there is a definite difference this summer compared to one year ago. Memorial Day marks the unofficial beginning of summer for some, which is often associated with the poppy. Blooming just as summer begins, it is supposed to remind us to remember and reconnect with the Americans who have sacrificed their lives to further the values of democracy—connected with Independence Day at the beginning of July.

Remembering and reconnecting this summer is helped by vaccination, something that many of our readers have directly contributed to, either through assisting with immunization clinics or spreading the scientific truth to reduce fear and sensationalizing of information. Some may feel like George Washington in 1777 during the Revolutionary War when he had lost his patience and ordered William Shippen Jr., the surgeon general of the Continental Army, to inoculate all soldiers coming through Philadelphia. Historians have credited his decisions as crucial for saving the army, and, ultimately, the revolution. While the diseases may have their differences, the unpopular decisions feel very similar.

Some of the excellent articles in this issue may help you reconnect with your patients through well-worn ideas. A review of saltwater gargles to prevent upper respiratory infections seems to be common sense but is now backed by scientific evidence. Dr. Bray *et al.* show how using osteopathic principles with COVID-19-infected patients can lead to a quicker and more functional recovery from the illness. The final review article deals with a common complaint, heel pain, and incorporating a whole-patient approach to treatment. Our research article in this issue will hopefully help you reconnect with your patients with diabetes.

Once again, welcome to summer and this issue of the *Osteopathic Family Physician!*



FROM THE PRESIDENT'S DESK



Leadership—A Journey with Many Paths

Nicole Heath Bixler, DO, MBA, FACOFP

ACOFP President

When you hear the word leadership, what comes to mind? Is it the qualities that a leader possesses, the success of their organization or the impression they have made on others to lead in the future? Is it measured by data points and clear-cut objectives or by an individual's passion and empathy? Does it take place nationally, on a state level or in a small community? Does it occur in a classroom, a boardroom or a patient room? The complexity and simplicity of leadership is that it is all these things—and more.

Great leaders never set out to actually lead; they set out to make a difference. By virtue of the very profession we have chosen, we make a difference every day. We empathize with our patients in their time of need, we advocate responsibly for matters that affect our patients and our profession, we educate the future of our profession by serving as mentors and preceptors, we serve and protect our country through military service and we serve as role models to our community in matters of scientific information by our actions and behaviors. The COVID-19 pandemic has certainly altered many of these roles, requiring us to be creative, adaptable, patient, courageous and humble—or, in other words, has required us to display the very characteristics that make a great leader.

In our profession, leadership is happening all around us, and we are provided with numerous opportunities to lead in ways that are meaningful. This time of the year brings two of those opportunities within ACOFP: 1) to become a Fellow and 2) to lead at a national level on the ACOFP Board of Governors.

The designation, Fellow of the American College of Osteopathic Family Physicians (FACOFP), signifies the recognition of a member's experience, dedication and contributions of the highest order to the advancement of family medicine by his/her peers. To join this esteemed group of approximately 800 osteopathic family physicians signifies outstanding leadership on the state and national level, while demonstrating a commitment to advocacy of the profession through educational endeavors. The call for applications for the 2022 Class of Fellows is available right now with a deadline of September 15.

Fourteen of those Fellows proudly serve on your current ACOFP Board of Governors. On behalf of our Board, I encourage you to consider the opportunity of serving with us by submitting your nomination for the position of Governor, Resident Governor or Student Governor by September 1. These titles are not meant to bestow honor but, rather, to impose a level of responsibility for the betterment of our college and profession through dedication and passion.

Of course, the greatest work and success of our organization is through the collective leadership of our numerous committees, task forces and work groups. Without their energy, wisdom and selfless sacrifice of their time, the objectives set forth by the ACOFP Board and Congress of Delegates could not be met. A quote by the famous coach Vince Lombardi summarizes this best: "Individual commitment to a group effort—that is what makes a team work, a company work, a society work, a civilization work."

And since football season is right around the corner, let's stick with that theme; as family physicians, we are the quarterbacks of our teams—our medical teams, our educational teams for students and residents, our community teams, our office teams, our teams of wellbeing and our home teams. We are intricately woven into the fabric of our society and with our osteopathic hearts, hands and minds, we make civilization work better.

If you have a desire to serve within our organization, it does not have to start with volunteering for a committee or work group. We encourage your perspective through blog post submissions, participation in our surveys, and through our centralized call for content—a mechanism to share your ideas and expert knowledge on topics of interest for CME and educational webinars. Your contributions in these areas allow an array of diverse voices to shine through—and ultimately lead to improving ACOFP and the profession.

"Individual commitment to a group effort—that is what makes a team work, a company work, a society work, a civilization work."

—Vince Lombardi, American football coach

You can invest in the future of osteopathic family medicine through a donation to the ACOFP Education and Research Foundation *Forging Our Osteopathic Future* campaign or to sponsor a resident or newly practicing physician to attend the Future Leaders Conference. This conference is an excellent opportunity to achieve

awareness of your own leadership style early in your career and how that impacts your performance. Fifteen years ago, I was fortunate to attend the very first Future Leaders Conference, and, each year, I look forward to reuniting with other alum to engage with a new class of leaders. After all, if your actions inspire others to dream more, learn more, do more and become more, you are a leader—a thought attributed to John Quincy Adams. If you are interested in doing the same, look for more information to be available in Fall 2021 about the next Future Leaders Conference.

It is my greatest honor to serve as your ACOFP president—not because of the title, but because of the opportunity it affords me to collaborate with like-minded individuals with a true passion to reflect the best of what osteopathic family medicine has to offer. In my leadership journey, I have had exceptional role models and unwavering support from my family. ACOFP has been a part of that family for almost 20 years, and my greatest hope is

that during that time I have ignited the desire in someone else to become a leader. My achievements in this position will not be measured by what I have done, but rather what we have done to strengthen the organization through innovation, collaboration and diversification. I challenge you to become a part of this team, to put your thoughts into action and to make a meaningful impact on the future of our profession.

Osteopathically,



Nicole Heath Bixler, DO, MBA, FACOFP

CALENDAR OF EVENTS

JULY 23-25, 2021

2021 Intensive Osteopathic Update
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JULY 29 - AUGUST 1, 2021

MAOFP 2021 Summer Family Medicine
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AUGUST 12, 2021

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Care Determination in Your Primary Care
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AUGUST 13-15, 2021

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North Carolina Society of the American
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Physicians
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OCTOBER 13-17, 2021

45th Annual CME Seminar & Convention
American College of Osteopathic Family
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OCTOBER 22-24, 2021

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RESEARCH ARTICLE

EXPLORING SELF-CARE STRATEGIES IN INDIVIDUALS WITH LOW LITERACY, TYPE 2 DIABETES AND EUGLYCEMIA

Sharon L. Casapulla, EdD, MPH¹; Joy Dugan, MPH, DHSc, PA-C2,³; Emily Reinig DO³; Jay H. Shubrook, DO, FACOFP²; Shannon E. Nicks PhD, MPH⁴

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KEYWORDS:

Health Behaviors

Health Literacy

Numeracy

Self-Care

Type 2 Diabetes

ABSTRACT:

Purpose

This qualitative study utilizes the health belief model to explore how individuals with type 2 diabetes mellitus and low diabetes numeracy achieve and maintain good glycemic control.

Methods

Participants (n=10) participated in semi-structured interviews and completed the Patient Diabetes Knowledge Questionnaire, the Health Belief Questionnaire, and the Social Support Assessment Tool.

Results

Results indicate that participants had low levels of diabetes knowledge, high levels of perceived social support and strong self-efficacy related to type 2 diabetes management, despite low numeracy. Self-designed routines mitigated potential educational, socioeconomic, and knowledge barriers. Self-efficacy and social support were strong protective factors.

Conclusions

The healthcare team can help high-risk patients manage their type 2 diabetes by improving self-efficacy and identifying social support. Diabetes self-management education should encourage activities that promote higher levels of self-reflection and critical thinking.

INTRODUCTION

Improving health outcomes for individuals with diabetes mellitus is of increasing concern to healthcare professionals and community leaders. It is estimated that 34 million Americans have diabetes and another 88 million individuals are at risk of developing the disease.¹ Diabetes is a complex chronic disease that is largely

self-managed, and diabetes self-management education (DSME) and support are central to diabetes care.² Despite the importance of DSME, only 5% of Medicare patients receive timely, formal diabetes education during their first year of diagnosis.³

Review of Relevant Literature

Because diabetes is largely self-managed, effective diabetes self-care is critical to short- and long-term health outcomes. Individuals with diabetes employ numeracy skills every day during self-care activities, such as interpreting blood glucose readings, calculating carbohydrate intake and adjusting medications. Low general literacy—including document literacy, prose literacy, and numeracy—and low health literacy can be barriers to successful self-care.⁴ Specifically, low numeracy skills may be

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a barrier to effective self-care in the management of diabetes mellitus. Studies demonstrate that many patients with diabetes have difficulty determining what values are within the normal blood glucose range, counting carbohydrates and calculating an insulin dose.⁵ One randomized controlled trial found that low Diabetes Numeracy Test (DNT) scores were associated with lower perceived self-efficacy, fewer self-management behaviors and possibly poorer glycemic control.⁵ More recently, another study demonstrated a higher level of diabetes medication adherence and lower HbA1c in participants with higher numeracy skills and medication self-efficacy.⁴

It is estimated that 43 million adults in the United States have low literacy skills, and more than 62 million have limited numeracy skills.^{6,7} These challenges often go unrecognized; however, many individuals with limited literacy and numeracy skills can still successfully maintain good control of their diabetes,^{8,9} but research explaining why and how this occurs sparsely. This study focuses on that subgroup of individuals: those patients with type 2 diabetes mellitus and limited numeracy skills, multiple barriers and risk factors for poor self-care, yet who have maintained target glucose control. Understanding how individuals with limited diabetes numeracy successfully manage their diabetes will help inform educational and clinical interventions. In addition, as patient-centered approaches to diabetes management increasingly emphasize building on patients' existing strategies and skills, it is important to understand the scope of those strategies. Ultimately, this information can help diabetes educators and healthcare providers work with patients to successfully manage their diabetes, improve their blood glucose control and reduce rates of diabetes complications.

There is a large body of research on the risk factors associated with diabetes and its complications. For example, low income and low educational attainment have been associated with poor health outcomes.¹ Low socioeconomic status is associated with poor health literacy, which can be a barrier to effective self-care.⁴ Individuals living in impoverished neighborhoods tend to be less physically active¹⁰ and experience higher rates of food insecurity, resulting in reduced access and consumption of fruit and vegetables.^{11,12}

Previous research has also shown a correlation between social support—including emotional and tangible support from family,¹³ involvement in community organizations and online social networks—and positive diabetes management.¹⁴ Individuals with diabetes rely on experimentation¹⁵ and “self-initiated strategies”¹⁴ including taking ownership of medication-related needs and integrating taking medicine into daily routines.¹⁴

However, health education alone is not sufficient to change behavior in patients with chronic disease. Many health behavior theories have been proposed over the past several decades.¹⁶ The Health Belief Model (HBM)^{12,17} has been used to explore self-care behaviors in patients with diabetes mellitus. There are six main constructs of the HBM that influence people's decisions about whether to take action to control illness. According to HBM, people will engage in health behaviors if they: (1) believe they are susceptible to the illness (perceived susceptibility), (2) believe there are serious consequences if they acquire the illness (perceived

severity), (3) believe taking action would reduce their susceptibility to the illness or its severity (perceived benefits), (4) believe any barriers to taking action (perceived barriers) are outweighed by the benefits, (5) are exposed to factors that prompt action (cue to action), and (6) are confident in their ability to perform an action (self-efficacy) successfully. Health motivation is the central focus of the HBM, making it a good fit for addressing problem behaviors that evoke health concerns.^{12,18}

This study investigates the psychosocial protective factors via HBM to better understand how individuals with limited numeracy skills successfully manage their diabetes. In this context, HBM theorizes that an individual's self-care behaviors are based on their perceived susceptibility to developing diabetes mellitus, perceived severity associated with the impact of diabetes mellitus on one's physical and mental wellbeing, perceived benefits of and perceived barriers to engaging in self-care behaviors,¹⁸ cues to action to encourage that behavioral engagement¹⁹ and self-efficacy to successfully complete self-care behaviors.¹² Recently, demographic variables, including age, sex, education and income, have been added to the model as modifying factors, resulting in an expanded HBM framework.²⁰ Few studies have investigated the influence of demographic or environmental variables within this expanded HBM.²⁰

In this study, we were interested in applying the expanded HBM (including demographic and environmental factors) as a descriptive instead of an explanatory or predictive framework to understand better how individuals with limited diabetes numeracy skills and limited diabetes knowledge successfully managed type 2 diabetes. To address the limitations of the HBM, we included broad interview questions and applied an open coding process during the analysis to allow related findings to emerge. We also included assessments for diabetes knowledge, health beliefs and perceived social support.

METHODS

Design

Qualitative studies, which can be described as naturalistic and interpretive, are well-suited to understanding the complexity of chronic diseases. Therefore, a qualitative collective case study design²¹ was chosen to successfully understand the various strategies individuals with low literacy used to navigate type 2 diabetes successfully. Collective case studies are designed to study the phenomenon in different contexts and allow for comparison within and between cases.²² To standardize the measurement of diabetes knowledge, health beliefs and perceived social support across participants, quantitative assessments were used to supplement this qualitative approach. The Institutional Review Boards at Ohio University and Touro University California approved this study.

Sample

Eligible participants were patients of a county family health services primary care clinic (federally qualified health center) with type 2 diabetes who scored 5 or below on the DNT-15 and had a current HbA1C < 8.0 mg/dL. Eligible participants were introduced

to the study during their clinical care. Those interested were given consent information and called by research assistants to schedule a time for a consent visit. Those who were eligible were contacted by phone, and if still interested, were scheduled for a consent visit.

The sample was a diverse group of 10 participants, all with very low or no income, reflective of the population served by the county family health services (Table 1).

TABLE 1.

Demographics of participants

PART. CODE	AGE	RACE	SEX	DURATION OF DISEASE	DIABETES KNOWLEDGE (% CORRECT)	MEDS (#SMBG/TIME)*
Alice	54	African American	Female	30 yrs.	90	none (0)
Beth	69	Caucasian	Female	15 yrs.	70	metformin (1x/day, lately "hit or miss")
Chris	60	Caucasian	Male	Newly diagnosed	40	insulin, victoza (4x/day)
Dolly	78	African American	Female	> 50 yrs.	33	insulin (2x/day)
Ed	63	Haitian	Male	4 yrs.	38	none (1x/3-4days)
Frank	85	Filipino	Male	7 yrs.	71	metformin, glipizide (3x/day)
Georgia	59	African American	Female	> 20 yrs.	38	none (0)
Hannah	50	African American	Female	1.5 yrs.	50	none (0)
Isaac	56	African American	Male	2 yrs.	70	glipizide (1x/day)
James	62	Hispanic	Male	5 yrs.	70	metformin

There is no formal threshold for low numeracy on the DNT-15; a score of 5 is generally agreed as "low literacy." It was used to screen patients for this study.

*SMBG - self monitoring of blood glucose

The participants in the study ranged in age from 50–85 years of age, with a mean age of 63.6±10.9. Five participants were female and five male. All were English speaking. Four of the participants had been diagnosed with type 2 diabetes within the last five years and the other six had been diagnosed 15 or more years ago. Many of the participants had comorbidities, with hypertension and arthritis being the most common. Four participants were on oral medications for diabetes and two were on injectable insulin. Four of the participants were not taking any medications for their diabetes. The mean A1C was 6.7 % (50 mmol/mol).

Data Collection

The principal investigator reviewed the consent form with each participant at the time of the interview. Interview questions focused on the strategies, resources and assets that the individuals use to manage their diabetes and their barriers to managing their diabetes. Interviews lasted approximately 45 minutes. Before the interview, the following questionnaires were administered verbally to all participants: (a) Patient Diabetes Knowledge Questionnaire (PDK)²³ a 24-item, true/false knowledge assessment, (b) The Health Belief Questionnaire (HBQ)²⁴ to explore beliefs about diabetes self-management and (c) Social Support Assessment Tool (SSAT),²⁵ which utilizes a five-point Likert scale to explore levels of social support in various aspects of their lives.

Analysis

Interviews were transcribed and loaded into ATLAS Ti qualitative data analysis software.²⁶ Utilizing the process of thematic analysis,²⁷ an initial cycle of open coding²⁸ was completed on the first three interviews as a team, resulting in a codebook. We applied the codebook to the remaining interviews. We met to reconcile emergent codes. The principal investigator completed the second cycle of coding to ensure that all new codes were applied accurately across all interviews. After coding was completed, we met to complete the analysis and interpretation, grouping codes into categories and reviewing the cases for patterns and themes within and across cases.²⁹ This approach further allowed a comprehensive set of factors to emerge.³⁰

The questionnaires were scored and means calculated for the overall group of participants. Once scored, associations between average scores on the survey instruments and the qualitative responses were triangulated and explicated for each participant in a case report developed for each participant. Thus, combining qualitative and quantitative methods, and focusing on the convergence of results, can "elucidate complementary aspects of the same phenomenon."³¹ The following presents the results of this cross-case analysis.

RESULTS

Five themes emerged from the cross-case analysis: (1) I Know How Food Affects My Body, (2) I am Responsible for My Health, (3) I am an Active Participant in Maintaining My Health, and (4) TABLE 1.

Demographics of participants, and (5) My Family Supports Me in Staying Healthy. Each triangulated finding is framed around the constructs of the health belief model and is presented below. (Table 2)

TABLE 2.

Themes with exemplar quotations

	THEME NAME	TOPIC/STRATEGY	EXEMPLAR QUOTE
Theme 1	I Know How Food Affects My Body	How food affects their blood glucose	I experimented with myself. To learn. That's how I learn more than if I go and sit. Because half the stuff I hear, I forget. (Alice)
		How eating large amounts of carbohydrates can impact their weight and blood glucose	I might have to cut out a lot of the fruits. Because a lot of the food is good, but they carry so much sugar. I didn't know that. (Hannah)
			But the danger is in the uh... you also have to watch your carbohydrates, not only the sugar intake... My concern is more for the carbohydrates, the sodium, and So, and I look at the sugars, and the carbohydrates, and the sodium. (Alice)
Theme 2	I Am Responsible for My Health	Motivation to maintain their healthy habits	I wanna live. I have grandkids. I wanna live long enough to see my grandkids have kids (Alice)
			My main motivation is the gift of life. Motivation is staying alive.... grandchildren, I wanna live, for them. Because I love them so much, they take good care of me. And the more I think about them, like this morning, I said I need the will to lose more weight, to take better care of myself because I want to live more years... (Hannah)
		Managing DM on their own	Actually myself. Me. Cuz my dad wasn't doin' it. My mom wasn't you know, doin' it. So I had to learn for myself (Alice)
			And so, I had said to myself the other day, I said, if I don't do it, no one else is gonna do it for myself. I'm starting to, take time and do it. (Isaac)
			I've been following that, what kinda food I have to eat. You know, what kinda vegetable, stuff like that... Nobody help me do that. I figured that by myself. (Ed)
Strict adherence to routines	I think I'm the only one in the family that learned the discipline. And that's what it takes, discipline ... Sometimes I get a cravin' and I don't know if it's my sugars or if it's, you know, if it's something wrong or. So I'll drink some water, more water, I'll drink some more water if I still have it, and then I'm like, okay, I'll just take a little piece. And then I take a little piece and then... I check my sugars first ...and then I eat a piece of candy or I chew a piece of gum or something like that.(Alice)		
	I got a measure(ing) cup, one cup, I measure it. (Ed)		

	THEME NAME	TOPIC/STRATEGY	EXEMPLAR QUOTE
Theme 2		Acceptance of their condition	You just live with it. I mean. First you have to accept it. (Laughter)... the key thing about diabetes is that you have to believe that it can happen to you. It's more of a positive attitude. Because, it's nothin' you can do about it. (Alice)
Theme 3	I am an active participant in maintaining my health	Checking their blood glucose more frequently	Don't beat yourself up. Don't be hurt that you was diagnosed. Life goes on. And find something constructive that makes you feel happy, that you know, and be around people that can help you make your diabetes feel better...And so only thing now is just managing it. You know, and taking better care of your health. (Hannah)
		Eliminating and replacing food items	I substitute my protein shakes for my meal replacement. So instead of having bacon, eggs, and the greasy food that I shouldn't eat, I just substitute half of a banana. And I sometimes put...I use soy milk, and I maybe scramble half an egg replacement...(Hannah)
			I eat full meals and I love vegetables. I love vegetables more than I love fruit. Cuz even natural fruit make my sugars high. (Alice)
		Eating less	...but when it's somethin' like rice or noodles or something like that I eat a smaller portion of it. (Chris)
			It's not that you can't eat what you want to eat, you just can't eat as much of it. (Isaac)
		Reading food labels and avoiding sugar and sodium	My daughter taught me how to read the labels. (James)
			I'm learning to read the back, the labels, to find out what consists of (Isaac)
		Commitment to a regular physical activity	I just walk, you know, walk about 30, 40 minutes every day. (Chris)
And sometimes I walk for 45, 50 minutes... No, not every day, if I do it today, next day I don't do it. Another day I do it... (Every other day) (Ed)			
I usually walk around 45 minutes to an hour (everyday). (Frank)			
Theme 4	My Healthcare Provider is My Trusted Partner in Maintaining my Health	Support from their healthcare providers is meaningful	Cuz I see her [provider]. It's like her voice be in my ear like, "Oh you know you don't need that, girl!" Cuz that's - she just bring a smile to my face all the time. (Hannah)
			Oh yeah, I trust my doctor. I love my doctor, both of them. I love my doctor. They help me a lot. (Ed)
Theme 5	My Family Supports Me in Staying Healthy	Support from siblings, children and partners in managing their diabetes	[My partner] always say you want to make sure you see your kids get grown don't ya? ... your grandkids? I say well yeah, of course. He said well come on, let's walk. You know, and so he the one really encourage me to you know to get out there and walk. (Georgia)
			You know, and when - I'll tell - my brother. Cuz if it wasn't for him, I wouldn't have my diabetes under control the way I do. (tearing up) I wouldn't. Like I said, he scared the crap outta me. (James)

Perceived Barriers

HBM indicates that individuals are motivated to take action when the benefits outweigh the perceived barriers to taking action; as noted earlier, diabetes is a disease that requires self-management. The complicated routines and time-consuming self-management activities were not perceived barriers for these participants. Most of the participants who have lived with diabetes for 15 years or more had integrated diabetes management into their daily routines.

Theme 1: I Know How Food Affects My Body

Many participants discussed their regular schedules for serum glucose self-monitoring. The number of checks varied with providing advice, but many kept medication logs and knew the numbers that constituted “high” or “low” values, and used it to help guide their medication, exercise and food intake.

Some of the participants described eliminating and replacing food items they felt they should not eat, including sugar and foods high in fat (including fast foods) and adding more vegetables into their diets. Most of the participants stated that they cook their own meals. Other participants described just eating less. They have learned to read food labels and avoid sugar and sodium. All of the participants described a commitment to regular physical activity, reporting about 30–45 minutes every day or every other day, some even despite complications making exercise difficult. Some of the participants who had dogs reported that the dogs were their exercise companions and a source of motivation. Participants talked about the need to accept their condition and stated they did not want to worry and concern about the daily self-care behavior to overwhelm them. All of the participants reported finding a positive way to deal with the daily stress they are confronted with in managing their diabetes.

Theme 2: I Am Responsible for My Health

When asked who assists them in managing their diabetes, almost all of the participants responded, with a sense of pride and accomplishment, that this was something they have been managing on their own. In addition, the participants described strict adherence to self-developed routines, whether to their food preparation, eating habits (limiting sugars or serving sizes), checking their blood glucose, or exercise habits, describing this discipline as a critical factor in the successful management of their diabetes. Furthermore, as measured by the HBQ, 80% of the participants disagreed/strongly disagreed with the statements *Taking my medication interferes with my normal daily activities and I would have to change too many habits to take my medication.*

Self-developed routines seemed to mitigate knowledge and education as potential barriers. Despite having low educational levels, low scores overall on the diabetes knowledge assessment and having overall low literacy levels (as measured by the DNT), the participants strongly disagreed with the statements *I am confused by all the medication the doctor has given me, and it has been difficult following the diet the doctor ordered for me.*

Cues to Action

HBM theorizes that cues to action trigger an individual's self-care behaviors. Cues to action can be internal (e.g., physical discomfort, pain) or external (e.g., advice from others, a call from a physician).

Theme 3: I Am an Active Participant in Maintaining My Health

Only two participants had attended diabetes education classes. Rather, personal life experiences generated valuable knowledge about the risks and severity of the disease. The participants described a personal understanding of how food affects their blood glucose. They knew through self-experimentation how their bodies would react to particular foods. In addition to understanding how certain foods affect their blood glucose, participants expressed an understanding of how eating large amounts of carbohydrates can impact their weight and blood glucose. Some participants described checking their blood glucose more frequently than recommended by their physicians to understand better how their blood glucose fluctuates with food and exercise.

Theme 4: My Healthcare Provider is a Trusted Partner in Maintaining my Health

The participants revealed the significance of the guidance from their healthcare providers, stating that their advice stayed with the patients long after they left the office. For example, one respondent described her provider's voice being “in her ear” (a clear cue to action), helping her make healthy choices.

Self-Efficacy

HBM posits that self-efficacy is an important driver of health-related behavior, particularly related to long-term health behaviors such as chronic disease management. As measured by the HBQ, most participants had a positive perception of their ability to manage their diabetes (self-efficacy). Most agreed with the statement: *My diabetes is well-controlled.* As described earlier (Theme 3: I Am An Active Participant in Maintaining My Health), most of the participants developed lifestyle habits that enable successful glycemic control. The strong positive response to the statement that diet will help “them feel better” coupled with strong disagreement that following the diet has been difficult suggests a strong degree of self-efficacy in using diet to manage their diabetes.

Perceived Benefits

HBM indicates that health-related behaviors are influenced by how individuals perceive the value or benefit of engaging in health behaviors. The participants understood the benefits of medication and lifestyle modifications in controlling their diabetes. They discovered the benefits through self-experimentation and paying close attention to how their bodies respond to medication, dietary and lifestyle changes (*Theme 1: I Know How Food Affects My Body*). All of the participants agreed with the following statements: *In general, I believe that my diet for diabetes will help me to feel better; Following a prescribed diet is something a person must do no matter how hard it is; I believe that my medication will control my diabetes; and I believe that my medication for diabetes will help me to feel better.* Interestingly,

despite having strong diet and exercise routines, almost half the participants incorrectly answered the false statement, *Medication is more important than diet and exercise to control my diabetes.*

Diabetes Knowledge

Participants scored an average of 57% on the PDK assessment, indicating a low level of diabetes knowledge overall as measured by this assessment, with wide variation in the group. As a group, the participants scored highest on PDK questions having to do with self-care management of their diabetes and complications of diabetes, including those related to food preparation and foot care. All participants correctly answered the questions related to kidney damage and loss of feeling in hands and feet. Nearly all participants were able to correctly identify that a “fasting blood sugar of 210 is too high.”

Perceived Severity and Perceived Susceptibility

HBM predicts that individuals who perceive themselves to be more susceptible to a particular health problem are more likely to engage in health-promoting behaviors. Additionally, those who perceive a particular disease or condition, or the complications from it as serious, are more likely to take preventative action. Participants were keenly aware of the severity of the complications of diabetes. Most of the participants agreed/strongly agreed that they must follow a prescribed diet and take medication “no matter how hard it is.” On the diabetes knowledge assessment, participants scored high on questions regarding complications of type 2 diabetes. Many participants described someone in their life who did not manage their type 2 diabetes well and their resultant complications.

PERCEIVED SOCIAL SUPPORT

Theme 5: My Family Supports Me in Staying Healthy

While most participants felt they were responsible for their success in managing their diabetes, some of the participants reported that their siblings, children, and partners were supportive of them in managing their diabetes. As stated earlier, most participants reported managing their diabetes on their own. Despite this, the participants reported a high level of perceived social support on the SSAT. Participants felt they have supportive family members who help support type 2 diabetes management, particularly with their diet. Every participant had an important relationship in their lives that they cited as motivation to control their diabetes. As noted in the previous section, participants indicated that their physician and family members were the most supportive individuals in their diabetes management, followed by a paid helper, spouse, and God. One participant responded “no one” when asked this question.

Discussion and Implications

In this patient population with euglycemia and low numeracy, the PDK assessment demonstrated a low general knowledge about type 2 diabetes. Yet, interviews revealed a relatively high functional knowledge of diabetes management and complications. The participants showed high levels of knowledge related to daily disease management strategies. This could be attributed to their practice in maintaining good glucose control.

Only two participants had attended diabetes education classes, reflecting that only 20% of patients with diabetes receive formal diabetes education.³² Rather, personal life experiences generated valuable knowledge about the risks and severity of the disease. The diabetes educator must understand what the patient understands. The etiology of type 2 diabetes, the relative efficacy and importance of medication versus lifestyle changes in long-term management and the home treatment of wounds, especially on the lower extremity, are worthy of focus in DSME. Other topics regarding the responsibility of the kidneys in diabetes or the pancreas' role in insulin production may be relatively less important in the context of day-to-day management.

There were some inconsistencies between interview and survey responses. Discussion with participants about their experiences with hypoglycemia and how they treated it suggested that participants understood the topic and its implications. Most participants, however, answered the PDK questions on hypoglycemia incorrectly. Specifically, many participants switched the symptoms of high and low blood glucose on the questionnaire, although when given the opportunity to self-treat shakiness and diaphoresis (hypoglycemic episode), most had an appropriate plan. This highlights that although some participants cannot name these symptoms as “hypoglycemia,” they know what to do in an emergency. This discrepancy between questionnaire knowledge and interview responses further exemplifies the problematic nature of relying on only one source of information to understand patient knowledge. Some individuals may be better able to express their (correct) understanding of a concept through dialogue and conversation (interview) than via a multiple-choice or true/false assessment.

Many participants incorrectly answered the false statement, *Medication is more important than diet and exercise to control my diabetes.* This highlights another important teaching point: the need to emphasize the lifestyle modification necessary for glucose control and the secondary role of medication, especially with those who present with pre-diabetes and signs of insulin resistance. This may reflect the lack of focus their providers have placed on therapeutic lifestyle change. Team-based care may provide the best support for habit/behavior change but requires access to certified diabetes educators (CDE), nutritionists and exercise physiologists to help individualize nutrition and physical activity plans.

Many participants discussed their regular schedules for serum glucose self-monitoring. Previous research demonstrates patients poorly predicted their blood glucose levels⁴, so the trend of regular glucose checks in the participant group may be an important factor in their successful glucose management. Further evidence of this was the insight of the importance of blood glucose checks before self-treating hypoglycemia.

Participants did not perceive their management routines as barriers that interfere with or compromise their daily activities. On the contrary, they believed that daily disease management is important and manageable within their daily schedules. Research has shown that self-efficacy is associated with glycemic control.⁴ High levels of self-efficacy, coupled with an internal locus of control over type 2 diabetes symptoms and disease, may contribute to their ability to manage their diabetes effectively.

Participants reported high levels of emotional support from family. On the other hand, the participants reported low levels of support in daily chores and friendship (e.g., “someone to do something enjoyable with”). The survey results suggest that social support from family members is a potential protective factor and not a barrier to diabetes self-management for these participants.

Strengths and Limitations

A strength of this study is the triangulation of qualitative and quantitative results across participant cases. While patients had low scores on the DNT-15 and PDK indicating low diabetes numeracy and low diabetes knowledge, their interviews demonstrated they could manage a complex chronic disease such as type 2 diabetes. This overarching finding would not have emerged without analyzing and comparing data collected using multiple methods.

The cross-sectional nature of the study limits the conclusions that can be drawn. This study relied on only a single A1C reading as a measure of glucose control. The patient’s long-term diabetes control may or may not reflect this sole A1C reading. Furthermore, validated questionnaires were challenging for some of these low-literacy participants to understand. For example, if a question about insulin dosing were asked on the DNT survey, many participants would initially state they are not on insulin.

CONCLUSION

Participants had high levels of risk (low income, older, low levels of numeracy, low diabetes knowledge as measured by PDK) yet maintained good glycemic control. They demonstrated self-efficacy, self-knowledge, and discipline and reported strong social support. Self-care routines were not perceived as barriers. The benefits of careful and diligent self-care routines were clear to the participants and outweighed any inconvenience. Cues to action were based on personal experiences and self-awareness developed from experimentation, not from formal diabetes educational experiences.

Recognizing low numeracy can help patients with individualized care plans that may contribute to their successful glycemic control. To develop knowledge and understanding, educators and providers need to build upon existing patients’ knowledge when introducing new information. By activating background knowledge and starting from what patients know, understanding, and experiencing several things that can promote successful type 2 diabetes self-management: 1) builds relationships and increases perceived social support, 2) develops self-reflection and critical thinking and 3) builds a framework for new knowledge.

The social support provided by family members was a significant protective factor for the participants in this study. Future diabetes care interventions should consider expanding the role of the family in diabetes control. There is a strong genetic link in type 2 diabetes. Increased involvement of families may result in better patient outcomes and broader community effects due to lifestyle changes in families with family-based interventions. Future studies could approach diabetes and other chronic diseases from a family or social support standpoint. Exploring social networks as

a decision unit may provide new insights to helping people cope and better manage chronic disease self-care.

Jay H. Shubrook, DO, FACOFP, is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

AUTHOR DISCLOSURES:

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REVIEW ARTICLE

THE EFFECTIVENESS OF SALTWATER GARGLING ON THE PREVENTION OF UPPER RESPIRATORY TRACT INFECTIONS

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KEYWORDS:

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ABSTRACT:

Upper respiratory tract infections (URI) are prevalent in the United States. URIs can also be debilitating and costly. The most common etiology for an URI is viral, and there are currently no antiviral medications for the common cold. Therefore, cost-effective preventative measures are essential in the prevention of URIs. This literature review intends to compare the few studies evaluating the effectiveness of saltwater gargle for preventing URIs. The goals of this review include commenting on the potential for a saltwater gargle in preventing URIs, shortcomings of the few studies performed and recommendations for further research in evaluating saltwater gargle as an effective prevention method. This review looks explicitly at three studies evaluating the effectiveness of saltwater gargling and the prevention of URIs. Conclusions derived from this review include both physiological and clinical evidence of the potential for saltwater gargling in URI prevention. The first two studies demonstrate patient-derived evidence for saltwater gargling, potentially providing a decreased risk of URI when used preventatively. The third study demonstrates the potential for polymerase chain reaction (PCR) in evaluating the effectiveness of saltwater gargling in reducing the duration of illness. Additionally, in the wake of the COVID-19 pandemic, cost-effective treatment options targeting viral URIs, such as SARS-CoV-2, warrant further evaluation and discussion.

INTRODUCTION

Upper respiratory tract infections (URI) are described as acute inflammation of the upper respiratory tract, usually viral etiology. Symptoms typically include rhinorrhea, cough, sneezing, low-grade fever, malaise, myalgia, headache, nasal congestion and/or sore throat. Generally, URIs are self-limiting but may last for up to 10 days or longer, with a residual cough that can last up to 2–3 weeks.¹

Prevention of URIs is of utmost importance. URIs have resulted in an estimated increase of 12.5% in inpatient visits per month during cold and flu season.² The common cold alone resulted in an estimated \$17 billion a year in 1997 related to physician visits, secondary infections and medication costs.²

The physiological hypotheses surrounding URI prevention through saltwater gargle echo similar basic physiological principles of a hypertonic solution that pulls water, other debris and potentially viral particles out of cells. In theory, during a viral incubation period, this could potentially wash out the virus

from the nasopharynx cells, disrupt the propagation of the virus and potentially prevent URIs from occurring.³ One study found rinsing with saline promotes human gingival fibroblast migration and better wound healing in vitro.⁴ Another study found that the chloride ions provided by a saline rinse could provide immune cells with the proper ammunition to make hypochlorous acid, ultimately aiding in fighting off infection.⁵ These studies are not necessarily translatable to clinical data in the prevention of URIs with saltwater gargle but raise the question as to if there is physiologic evidence supporting the need for larger randomized controlled trials involving saltwater gargle and the prevention of URIs.

Many medical institutions recommend saltwater gargle for soothing sore throat pain, but whether this inexpensive and simple concoction can prevent URIs from occurring in the first place remains a question worth asking.⁶⁻⁸ The Mayo Clinic recommends ¼ to ½ teaspoon of table salt mixed with eight ounces of warm water for sore throat relief.⁸ After a literature review, three studies have been noted to be relevant in answering the question of whether a saltwater gargle is beneficial in patients with URIs. This paper intends to describe the findings of these studies, pitfalls of these studies and recommendations for future studies.

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METHODS

Databases searched in this literature review included PubMed®, the Cochrane Library and the Agency for Healthcare Research and Quality (AHRQ). Keywords used included “saltwater gargle,” “saltwater gargle prevention,” “saltwater gargle and prevention upper respiratory tract infection,” “saline gargle prevention upper respiratory tract infection,” “common cold prevention and saltwater,” “common cold prevention and saline,” “prevention of upper respiratory tract infection,” “prevention of upper respiratory tract infection by gargling” and “gargling for the common cold.” Inclusion criteria included clinical trials, reviews and systematic reviews. Exclusion criteria included case studies, books, documents and patents. Considerations in selecting literature included studies performed on human patients, randomization, sample size and the study’s goal to evaluate saltwater gargle on prevention of URI. The number of articles discussed herein is represented by PubMed® results, as Cochrane and AHRQ did not contribute to this search. The number of articles from searching “saltwater gargle” to “saline gargle prevention upper respiratory tract infection” was filtered from 30 to 16, respectively. Searching “saltwater gargle and prevention of upper respiratory tract infection” yielded the result of Study 1. The number of articles from searching “common cold prevention and saltwater” to “common cold prevention and saline” yielded three and seven results, respectively. None of these articles specifically addressed the effects of saltwater gargle on the prevention of URIs. The number of articles from searching “prevention of upper respiratory tract infections,” “prevention of upper respiratory tract infection by gargling” and “gargling for the common cold” yielded 14,321 results, 129 results and five results; respectively. Studies 2 and 3 appeared in this last group of searches and were deemed appropriate for the topic of this discussion as to focus solely on saltwater gargling and its effectiveness on the prevention of URIs. It should be noted that Study 3 also includes nasal irrigation along with gargling but was included in this study because of study design and use of gargling.

RESULTS

STUDY 1: Respiratory tract infections and its preventative measures among Hajj pilgrims, 2010: a nested case-control study

In this nested case-control study, researchers evaluated a cohort of 338 Iranian pilgrims to assess preventative measures and their effects on respiratory tract infections other than the common cold. Some of the measures evaluated included influenza vaccination, mask usage, personal prayer carpet and saltwater gargling. The outcomes measured included all respiratory tract infections other than common colds, including tonsillitis, pharyngitis, laryngitis, sinusitis, otitis media, bronchitis, pneumonia and influenza. The subjects infected were clinically diagnosed by a physician and data collection, including asking about the use of saltwater gargle at least once per day, was completed for that individual. At the time of diagnosis of the individual, two pilgrims in the same caravan were randomly selected as a control group not affected by the previously mentioned outcomes. Thirty-two of the 338 pilgrims were affected by respiratory tract infections other than

common colds. Using univariable logistic regression analysis, saltwater gargling was essentially effective against preventing respiratory tract infections with an odds ratio of 2.4 ($p=0.08$). This study claims that if conducted with a larger sample size, it may be concluded that lack of gargling with saltwater increases the risk of respiratory infections by 2.3 times. The study also notes that if rapid test diagnosis were to be used rather than clinical diagnosis alone, the overall accuracy of the study could see an increase.⁹

STUDY 2: Prevention of upper respiratory tract infections by gargling: a randomized trial

Gargling saltwater in Japan is often viewed as a routine hygienic routine capable of preventing URIs, but the clinical trials proving this are lacking. This randomized control trial took 387 healthy volunteers aged 18–65 and randomly assigned participants to the water gargling, povidone-iodine gargling and usual care (control) groups. Both gargling groups were suggested to gargle three times per day and were followed for 60 days. A total of 130 participants contracted URIs during this time. The incidence rate of the first URI was 0.26 episodes/30 person-days among control subjects and decreased to 0.17 episodes/30 person-days in the water gargling group. The povidone-iodine groups saw only a small decrease of 0.24 episodes/30 person-days. The incidence rate ratios against controls were 0.64 (95% confidence interval [CI]=0.41-0.99) and 0.89 (95% CI=0.60-1.33); respectively. The intervention groups were asked to complete a prescribed gargling diary every day. The form included frequency of gargling and hand washing and various URI complaints such as nasal symptoms, pharyngeal symptoms, bronchial symptoms and general symptoms. Baseline characteristics accounted for in the study were gender, mean age, residence (northern/central/western Japan), employment status, smoking habits, influenza vaccination and URI frequency in the preceding year. When the multivariate analysis was performed using Cox’s proportional hazard model, including other baseline factors, the results were essentially unaltered: the hazard ratios were 0.60 (95% CI=0.38-0.93) for water gargling and 0.88 (95% CI=0.58-1.34) for povidone-iodine gargling. Even when symptoms of those with URI were compared among groups, the saltwater gargling group seemed to have better attenuation of bronchial symptoms than the povidone-iodine group ($p=0.055$). The claim of this study is a 36% decrease in the incidence of URI among those who gargled tap water versus those who did not.³

STUDY 3: A pilot, open-labeled, randomized controlled trial of hypertonic saline nasal irrigation and gargling for the common cold

This pilot, non-blinded, randomized controlled trial compared hypertonic saline nasal irrigation and gargling (HSNIG) to standard care on healthy adults within 48 hours of URI onset to determine recruitment as a primary outcome. Secondary outcomes measured were acceptability and compliance with HSNIG, quality of life, duration of symptoms and viral shedding. Participants maintained a daily symptom diary until they recorded “not unwell” (e.g., score of 0) on two consecutive days or for a maximum of 14 days or until the individual needed further treatment for URI. The participants were given instructions on how to prepare the HSNIG and asked to record the number of times per day used and side

effects. A trial nurse collected mid turbinate swabs on day 0 and then taught participants how to collect the swabs themselves. On day 0, all samples were tested using PCR for the identification of the virus. Subsequently, the following days were tested in parallel, and the cycle threshold value (CT value) was converted to log₁₀ to estimate the change in viral shedding. The study did demonstrate the difference between baseline and end-point samples for the intervention group was larger than the control, but that this data was not statistically significant (although the study was not powered to detect differences in those measures). However, the claim is that participants who stopped HSNIG before day four had increased viral shedding and increased or stabilization of symptoms before symptoms resolved. These findings, along with decreased household contact transmission, raise the question of whether HSNIG could help reduce viral replication, shedding and transmission. This study also demonstrated a 36% decrease in over-the-counter medications in the treatment arm ($p=0.004$). Among participants not living alone, 35% fewer individuals in the intervention arm had household contacts developing URIs after them ($p=0.006$). This study demonstrated the ability to recruit and retain participants for a full trial of HSNIG with 3% HSNIG and reduce the duration of illness by 1.9 days ($p=0.01$).¹⁰

COMMENT

These studies have many shortcomings but also many promising takeaways for the conduction of future studies. They also lend some credibility for recommending saltwater gargle in the prevention and treatment of URI. One similarity between them included symptom diaries. Although they can be a subjective form of bias, symptom diaries can supplement more objective data, such as PCR in Study 3. Studies 1 and 2 used clinical diagnoses based on symptomology rather than rapid tests. Although rapid tests would increase the cost of these studies, they would also improve the accuracy and may benefit a larger study in the future. The use of both quantitative and qualitative PCR in Study 3 may eliminate the need for rapid tests. At the same time, add more objective data regarding viral shedding and identification of individual viruses.

The pathophysiologic mechanisms underlying saltwater gargle and possible prevention of URIs lacks conclusive evidence. However, studies are demonstrating physiologic and molecular changes that potentially aid in the prevention of viral propagation.^{4,5} These studies suggest that there is molecular and physiological evidence to support the need for future clinical trials in evaluating the effectiveness of saltwater gargle and URI prevention. Study 2 discusses the theory of essentially washing out pathogens from the pharynx and oral cavity during a viral incubation period with the potential of disrupting the propagation period of the virus. However, Study 2 also admits this theory remains questionable as evidence for this is lacking.⁷ Another proposed mechanism from Study 2 is the inactivation of viruses by chlorine added to the tap water. Sodium has also been noted to have antimicrobial properties and thus use of saltwater gargle rather than tap water would be a worthy future study.¹⁰

Economically, the use of saltwater gargle as a preventative measure could potentially be substantial. Study 2 claims that if

mere gargling with tap water could reduce URI incidence by up to 36%, as much as 200 billion Yen (\$1,869,071,600.00 USD) could be saved per year.^{3,11} Study 2 also addresses these economic issues in another paper.^{3,11} In the United States, URIs have resulted in an estimated increase of 12.5% inpatient visits per month during cold and flu season.¹² The common cold alone resulted in an estimated \$17 billion a year in 1997 related to physician visits, secondary infections and medication costs. An estimated \$25 billion in indirect costs from missed work because of illness or caring for a sick child has also been noted.² These studies show statistically significant evidence for saltwater gargle and the prevention of URIs, as well as several takeaways that can be used to construct larger studies evaluating a potentially economically impactful preventative technique.

These studies could all use larger sample sizes, blinding of participants and more objective data to increase the accuracy of results. Along with symptom diaries, more objective data could be obtained using PCR for qualitative and quantitative purposes. Although, the use of PCR in a study evaluating the prevention of URIs may not be as beneficial. Perhaps one could do a combination study measuring both prevention and duration of illness, using PCR to identify the virus at symptom onset and then subsequently tracking viral shedding while continuing the saltwater gargle. Study 3 also stated that human DNA testing for housekeeping genes would ensure samples collected for PCR were collected correctly. This would add to the accuracy of the study. However, Study 3 measured the duration of illness rather than prevention of the URI, the components of the study are still considered potentially relevant to prevention. The demonstration of a reduction in viral shedding could mean that prophylactically gargling saltwater theoretically has the potential to reduce the propagation of the virus in the incubation phase, ultimately preventing symptomatic URI. Study 3 did evaluate the combination of nasal saline irrigation with gargling but was still included in this review because of the study design and use of gargling.

CONCLUSION

Overall, the comparison and review of these studies demonstrate tremendous potential for larger randomized controlled trials evaluating the effectiveness of saltwater gargle in preventing and treating URIs. Each of these studies has shortcomings and promising conclusions that can be used to formulate future studies evaluating this economically feasible and potentially effective method for preventing and treating URIs.

Additionally, this review intends to offer a timely discussion pertinent to the current COVID-19 pandemic. Although notably the highest titers of SARS-CoV-2 have been detected in the nasopharynx, the entire upper respiratory tract still contains high amounts of the virus overall.¹³ Considering this, saltwater gargle remains a serious prevention and/or treatment option worth further evaluation and discussion. Recently, the same group that conducted Study 3 conducted a post-hoc secondary analysis evaluating the potential for hypertonic saline nasal irrigation and gargling as a potential treatment for COVID-19. As stated previously, Study 3 demonstrated a lower duration of illness in a subset of patients infected with other alpha and beta

coronaviruses. Although these interpretations must be visited with caution, the lack of current definitive treatment for COVID-19 calls for additional exploration of other potential treatments and/or preventative measures.¹⁴

TABLE 1.

Comparison of the studies

STUDY	STUDY TYPE	SAMPLE SIZE	MAJOR FINDINGS	TAKEAWAYS FOR FUTURE STUDIES
1	Nested Case-Control	338	32/338 with URI. Univariable logistic regression analysis demonstrated the prevention of respiratory tract infections with a saltwater gargle. Odds ratio of 2.4 (p=0.08).	It needs a larger sample size. The diagnosis was made clinically (no use of rapid testing.) It did not include the common cold. Potential for subjective biases with use of symptom diary. Potential for recall bias.
2	RCT	387	130/387 with URI. The incidence rate of the first URTI was 0.26 episodes/30 person-days among control subjects. The rate decreased to 0.17 episodes/30 person-days in the water gargling group and 0.24 episodes/30 person-days in the povidone-iodine group.	It needs a larger sample size. The diagnosis was made clinically (no use of rapid testing.) Not blinded. Potential for subjective biases with a symptom diary. Tap water (not saline) was used.
3	Pilot, open-labeled, RCT	68	32/66 in the treatment arm. Duration of illness was lower by 1.9 days (p=0.01), over-the-counter medications (OTCM) use by 36% (p=0.004), transmission within household contacts by 35% (p=0.006) and viral shedding by $\geq 0.5 \log_{10}/\text{day}$ (p=0.04).	It needs a larger sample size. Not blinded. Potential for subjective biases with use of symptom diary.* Used combination nasal irrigation and gargling. Did not measure prevention of URI.

*WURSS-21 (Wisconsin upper respiratory tract symptoms survey) is a validated survey.

AUTHOR DISCLOSURES:

No relevant financial affiliations or conflicts of interest. If the authors used any personal details or images of patients or research subjects, written permission or consent from the patient has been obtained. This work was not supported by any outside funding.

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REVIEW ARTICLE

A REVIEW OF COVID-19 RECOVERY AND THE BENEFITS OF AN OSTEOPATHIC APPROACH

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KEYWORDS:

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Osteopathic
Manipulative Medicine

Osteopathic Medicine

Primary Care

ABSTRACT:

COVID-19 continues to be a major societal disruptor that threatens the wellness and health of millions of people worldwide. We rightfully celebrate the over 20 million survivors in the United States, yet, what constitutes actual recovery, as many face continuing repercussions of their illness? This paper reviews COVID-19, focusing on its sequela of acute respiratory distress syndrome (ARDS) and the accompanying intensive care unit stay, treatment options and its increased morbidity. Outlined is the importance of long-term, comprehensive care for post-infection patients, as well as the numerous barriers to adequate care. We suggest looking to doctors of osteopathic medicine to bridge the gaps in multifactorial care, including psychological and physical dysfunction. Osteopathic medicine is discussed as a potential benefit during this pandemic by reviewing its effectiveness in a previous pandemic. However, additional work must be conducted to improve awareness of needed care and delivery of that care.

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has rapidly made its presence known and has continuously changed how we live, learn and work. As we continue to undertake acute cases, we must also look toward life and health after COVID-19. The recovery process, however, remains largely unknown in circumstances of long-term complications. This paper examines how an osteopathic approach for the recovered patient can mitigate barriers of access and fragmented cross-specialty needs and provide osteopathic manipulation therapy (OMT).

Preparation should be taken to ensure awareness and education regarding long-term physical and mental complications of COVID-19. The multitude of complications may potentially fragment care, thus worsening hardships of geographic location, transportation and cost preventing patients from getting the care they need. We can reduce these barriers by educating and preparing doctors of osteopathic medicine in terms of potential complications, the comprehensive care needed and OMT techniques to incorporate.

One of the manifestations of COVID-19 to note is its decompensation into acute respiratory distress syndrome (ARDS).

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Treatment of ARDS is often invasive and complex, resulting in muscular, lymphatic and neurovascular complications. Numerous OMT techniques have been developed over the last century that can be utilized to target these complications. As examples, muscle energy techniques directly manipulate primary and secondary musculature, improving breathing mechanics; treating myofascial binding to promote circulation of white blood cells and cytokines by opening lymphatic and blood flow; and parasympathetic and sympathetic functions are targeted by techniques like suboccipital inhibition and rib raising, respectively, further improving breathing effort.

CORONAVIRUS DISEASE 2019

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), responsible for COVID-19, had its novel appearance in the city Wuhan of the Hubei province in China.¹ Like other strains of beta-coronaviruses before it, such as severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS), COVID-19 has become a household name since its initial report to the World Health Organization on December 31, 2019. A year later, in January 2021, there have been more than 20 million confirmed cases and over 360,000 deaths in the United States alone.²

Unfortunately, important questions regarding the virus's spread linger. At this time, viral RNA is measured to determine the presence of infection. However, there is no set level that deems a person "infectious." Scientists have found evidence that increased

viral load is connected with increased transmissibility as well as illness severity.^{3,4} Yet, complicating matters further, some asymptomatic patients have been found to have an elevated viral load, despite lack of presentation, and are the source of secondary infections. There is still much to be discovered regarding how the virus presents itself in its various manifestations.

Fortunately, most cases have been mild and patients recover, on average, within two weeks. Symptoms seem to appear at exposure day four or five and are divided into mild, defined as pneumonia without hypoxia; severe, which comes with hypoxia and involves >50% of the lung; and critical, which is complicated by respiratory failure, shock and multi-organ dysfunction.

Comorbidities, such as diabetes mellitus or hypertension, obesity defined as a BMI >30, age over 65 and male sex, are linked to increased severity, extending recovery up to six weeks. In those critical patients that require ventilation, mortality rates rise markedly.³ In all cases, predominant symptoms include fever and pneumonia.⁴ In critical cases, complications include the development of ARDS, arrhythmias and myocardial injury. To narrow down our approach, we will focus on ARDS. Dyspnea develops relatively late in the course of the illness—typically a week from initial presentation—and within two to three days of the onset, ARDS rapidly develops.

ACUTE RESPIRATORY DISTRESS SYNDROME PRESENTATION AND SEQUELAE

By definition, ARDS is “bilateral lung infiltrates and severe progressive hypoxemia in the absence of any evidence of cardiogenic pulmonary edema.”⁵ This is caused by an immense inflammatory response that damages the lungs’ epithelial and endothelia and allows edema to occur. In the case of COVID-19, this further compounds the reduced respiratory function present from pneumonia and requires swift responsive action.

The care of ARDS has evolved over the 10 months that the United States has faced the infection. Recommendations have varied from use or avoidance of bilevel ventilation, early- versus delayed-intubation, whether it is safe to use a high-flow nasal cannula and when to initiate mechanical ventilation regarding specific patient selection,⁹ while prone positioning, neuromuscular blockade and optimizing positive end-expiratory pressure have been recommended for adjunctive treatment.¹⁰ In cases of refractory hypoxemic ARDS, extracorporeal membrane oxygenation (ECMO) is advised.

Though recovery from ARDS is possible, many patients have longstanding morbidities. These patients face diminished quality of life and impairments in both cognition and mental health.¹¹ Executive function is the most common cognitive impairment, with 49% of patients exhibiting reduced ability to focus attention, multitask and plan. Severe depression, post-traumatic stress disorder and anxiety are also common. Of note, cognitive impairment can cause psychiatric impairment and vice versa. Further findings show a decline in vitality and social function in regard to relationship maintenance.¹²

The diaphragm, the main muscle in respiratory effort, is highly sensitive to injury. Inactivity of the diaphragm—as in mechanical ventilation—greatly impairs function, which is seen following the extubation.¹³ Within 24 hours of mechanical ventilation use, 64% of patients were diagnosed with diaphragmatic dysfunction, defined as <11 cmH₂O change in endotracheal pressure with phrenic nerve stimulation. With COVID-19, patients are typically intubated for 1–2 weeks or longer,⁶ increasing concern for dysfunction development. Diaphragmatic atrophy is also associated with inflammatory cell injury, a principle finding in ARDS.¹³

In cases of refractory hypoxemic ARDS where ECMO is used, unique complications may arise. ECMO, an artificial lung and circulatory system pump, has been shown to reduce ARDS mortality,¹⁴ but is an exceedingly invasive procedure. In these cases, vascular ischemia, peripheral artery disease and lymphatic disruption have been observed. Gangrene, infection and amputation may then follow.

Many complications remain as impediments for at least five years and resolve slowly.¹⁵ Increasingly concerning is that nearly a third of patients do not return to work and many of those who do return require a gradual transition. The large majority of those remaining unemployed are members of the older population. As we look toward COVID-19 recovery, this fact is important to keep in mind, as most severe and critical cases are observed in these older patients.

NEED FOR LONG-TERM CARE AND POTENTIAL BARRIERS

The need for extensive, long-term care is clear. Care must be initiated early,¹⁶ be “easily accessed, individualized, involve caregivers, provide more information about recovery...” and be integrated across multiple formats.¹⁷ It is also important to keep in mind that ARDS is just one manifestation of COVID-19 with still others to discover and discuss—again underscoring the need for comprehensive care.

The foundational barrier in achieving sufficient care after discharge is a lack of understanding complications and awareness of their commonalities. Impairments may go unchecked and/or worsen, leaving patients and families feeling isolated. Compounding the issue is the prevalence of mental illness among recoverees’ straining treatment requests.¹⁸ Physicians may then be unable to recognize and connect symptoms to a post-intensive care syndrome. At this time, there are no screening or assessment tools and no established best practices.

Multidisciplinary care is needed, encompassing physical, mental and cognitive health. Multiple appointments across different locations are often required. If a patient has limited transportation or suffers from a lack of geographic availability, as is commonly found in rural and underserved areas, he or she may opt out of seeking these services.¹⁹ Cost of care is also an important consideration with inadequate or non-existent health insurance. This group often delays seeking treatment due to cost, leading to poorer health states, delayed diagnoses and lower life expectancies. As a significant portion of post-ARDS patients do

not return to or need a gradual transition back into the workforce, the cost of care can weigh heavy in the mind.¹⁶

Another frequently cited barrier is the inability to find a provider with whom a patient feels as though he or she can trust and with whom he or she can communicate.¹⁹ These are vital for initial assessment, identifying gaps in care, working through obstacles or frustrations in the recovery process, monitoring progress and offering support and empathy to patients. Community engagement improves trust development, allows for greater cultural competency and connects community resources.²⁰

As we work toward transitioning into a stage of recovery, it is of the utmost importance to know the potential complications of the disease, the need for long-term care and the potential barriers to access. Though there are numerous interventions to consider and implement, our focus of this paper will be the use of doctors of osteopathic medicine and the applications of OMT.

PROPOSED INTERVENTIONS

Primary care doctors of osteopathic medicine can alleviate the fragmented care burden due to their training in recognizing and management of acute and chronic conditions, assessing mental health needs and performing OMT. Reviewing 100,000 cases from the 1918 influenza pandemic reveals that physicians implementing OMT reported only 2.5% of the losses of those performing traditional practices of the time.²¹ It is important to mention that there were no sound reporting systems at the time, making these numbers unverified.

Subsequent studies have offered support of the claims, however. One study saw a decreased length of stay when OMT was used adjunctively to antibiotics in pneumonia patients.²² Additionally, patients who received OMT following a coronary artery bypass graft reported reduced thoracic pain improving respiratory muscle movement and respiratory effort.²³ Another study showed improved peak expiratory flow in pediatric asthma patients from 7 L/min to 9 L/min following the use of OMT.²⁴

Studies have also demonstrated a subjective improvement. One group of participants felt a significant improvement in breathing effort after OMT, specifically with rib raising, compared to standard pulmonary rehabilitation.²⁵ Positive patient perception has also been shown in domains such as effectiveness, cognition, fatigue, emotion, comfort, recovery and therapeutic relationship, with most patients satisfied with their treatment.²⁶ Whether it be the physical treatment itself or the time spent with the patient during the treatments, there is evidence that OMT leads to positive outcomes.

There are multiple techniques in considering treatment for patients recovering from COVID-19. For physical recovery, doming of the thoracic diaphragm encourages the muscle back to its initial shape and, thus, back to baseline function.²⁷ Posterior rib raising and muscle energy both improve accessory respiratory muscle movement. Rib raising normalizes the sympathetic nervous system, enhancing chest wall mobility, while muscle energy directly treats the muscles by resolving the dysfunction.

Impairments in the lymphatic and parasympathetic nervous systems should also be included. Lymphatic techniques include thoracic inlet myofascial release, supine thoracic diaphragm release and the thoracic or pedal lymphatic pumps to mobilize lymph throughout the body. Studies show improved lymphatic delivery of antibodies and cytokines via lymphatic-focused techniques. Suboccipital inhibition is used to target the vagus nerve normalizing parasympathetic tone. In its normalization, the number of goblet cells and secretion thickness is reduced.²⁸ While not an exhaustive list, physicians should consider each patient's individual needs and structural dysfunction, providing tailored treatment to maximize benefits and provide care that could improve outcomes, minimize complications and increase patient satisfaction. However, several factors are limiting widespread use. As of 2016, only 8.5% of the 953,695 physicians in the United States are osteopathic physicians,²⁹ and one survey found that over half of these physicians use OMT on less than 5% of their patients.³⁰ Even when patients do receive osteopathic manipulation, it is often solely for musculoskeletal complaints, rather than to improve internal organ function. In one medical center, most OMM consults over a six-month time frame were for musculoskeletal complaints and newborn feeding difficulties.³¹

While many barriers to care should be addressed and further data collected to uncover additional benefits of OMT during this pandemic, physicians must consider the benefits of osteopathic medicine when treating patients who have recovered from the immediate effects COVID-19. The tenets of osteopathic medicine focus on the mind, body and spirit, all of which are affected by this disease and hospitalization process.

DISCUSSION

Given the current pandemic weighing in on an already stressed environment, implementing OMM into regular practice may prove difficult at first. This is especially true in a busy office setting. In spite of this, one should institute how this implementation is to be taken on. It has been shown that a 10-minute office visit resulted in improved breathing of asthmatic patients.³² The study also found that simple, repeated techniques to be performed at home further improved breathing. This points toward appointments of 10 minutes in weekly to bi-weekly intervals, alongside home treatments, would be sufficient for most patients. The time between appointments may be increased with the assessment of patient comfort and improvement.

This process, however, must be taken with care to continue protecting health care personnel. The U.S. Centers for Disease Control and Prevention (CDC) regularly update recommendations regarding patient care. These include implementing telehealth when possible, masking and universal protocol for each person entering a facility, limited entry into facilities, screening for signs and symptoms of COVID-19 and assigning patients to exam rooms with doors closed to maintain physical distancing.³³ These measures should continue to be followed, despite a prior infection, given the possibility of re-infectivity. Though the CDC reports a lower risk of re-infectivity in the first 90 days based on prior studies of HCoV-OC43, continued suspicion and vigilance is vital in protecting personnel.

TABLE 1.

Osteopathic techniques to lessen structural issues

TECHNIQUE	DESCRIPTION ³⁵	INDICATION
<i>Doming of the thoracic diaphragm</i>	Place hands below the costal margin and pressure on the diaphragm is held throughout inhalation, encouraging its natural shape.	Improves muscle to return to baseline function
<i>Posterior rib raising</i>	Apply pressure to rib heads via the pads of the finger in a rhythmic motion.	Indirectly treats accessory respiratory muscle function via sympathetic normalization
<i>Intercostal muscle energy</i>	Place the patient in correct positioning regarding inhalation and exhalation dysfunction, target dysfunction rib, and encourage movement toward the restriction.	Directly treats accessory respiratory muscle function
<i>Thoracic inlet myofascial release</i>	Apply whole-hand contact, applying enough pressure to engage the myofascial, induce movement in three planes to gauge restriction and until tightness releases.	Lymphatic mobilization with antibody and cytokine delivery
<i>Thoracic diaphragm release</i>	Apply whole-hand contact, applying enough pressure to engage the myofascial, induce movement in three planes to gauge restriction and until tightness releases.	Lymphatic mobilization with antibody and cytokine delivery
<i>Thoracic lymphatic pump</i>	Administer rhythmic pressure overlying the sternum in an inferior motion allowing for passive recoil.	Lymphatic mobilization with antibody and cytokine delivery
<i>Pedal lymphatic pump</i>	Administer rhythmic pressure at the feet in a superior motion allowing for passive recoil.	Lymphatic mobilization with antibody and cytokine delivery
<i>Suboccipital inhibition</i>	Place pads of the fingers just inferior to the nuchal line in a way that gently lifts the head, so its weight rests entirely on the fingers, held until relaxation is achieved.	Pulmonary goblet cell and secretion thickness normalization via to parasympathetic system
<i>Demonstrations of these techniques can be found at https://www.acofp.org/acofpimis/acofporg/apps/OMT/index.html</i>		

Policies and protocols should also be established regarding potential exposures. In this, further exposures are mitigated. During scheduling, ensuring patients are educated on symptoms to watch out for before arriving for their appointment is also needed for this mitigation.

Newly recommended is establishing a post-vaccine protocol, advising staggered scheduling for vaccination and scheduling vaccination before 1–2 off days.³⁴ These recommendations are made due to the possibility of mistakenly considering post-vaccination signs and symptoms as developing active COVID-19 infection, thus reducing unnecessary isolations and affecting patient care and stressing an already stressed system.

CONCLUSION

While challenges persist, comprehensive care for post-COVID-19 patients provided by osteopathic physicians could lessen structural and psychological issues. Encouraging education over and reviewing the suggested techniques and sharing these techniques with fellow primary care providers will prepare the field for these upcoming encounters. It is important to note that

this paper largely deals with the conceptual and is based on prior pandemics. More research is needed to assess how these patients may best be aided in their recovery. As COVID-19 continues to leave its mark on history, we must work to alleviate the mark it leaves on our patients.

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REVIEW ARTICLE

HEEL PAIN WITH AN OSTEOPATHIC COMPONENT

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Family Medicine

Heel Pain

MSK Foot

Osteopathic Medicine

ABSTRACT:

Family medicine is a field that is exposed to a large amount of musculoskeletal complaints. More than 100 million people present with musculoskeletal disease annually in the United States. This translates to over \$320B in healthcare costs per year. Due to these astonishing numbers, it is imperative that family medicine physicians, who typically make up the first line of management, properly identify the many causes of musculoskeletal pain. Heel pain is a common complaint of patients seeking professional care. Due to the complex anatomy of the foot, identification and proper management can be challenging and thus prolong care. The present article reviews the anatomic structure, clinical evaluation, differential diagnoses and diverse treatment with an osteopathic approach surrounding the foot and ankle.

INTRODUCTION

In the United States, more than 100 million people suffer from musculoskeletal disease annually, representing nearly one in every three persons. As for adults over 18 years of age, 17–42% experience foot pain, with an upsurge in prevalence as age increases.¹ Family medicine trained physicians encounter the bulk of musculoskeletal complaints, as they are typically referred to as the gatekeepers in health care. According to recent medical school research in 2015, musculoskeletal focused rotations were offered in only 34% of medical schools, based on the curriculums of programs listing on the American Association of Medical Colleges website.² Then, a study based out of Michigan State University in 2018 revealed that only 54% of the students surveyed thought their musculoskeletal education was adequate.³ Due to the annual number of musculoskeletal injuries and the potential for an exponential increase in the incidence in the future, musculoskeletal pathology should be an area of study reviewed.

This paper will review the epidemiology of heel pain, anatomy of the hindfoot, etiologies in adults, clinical approach and management in a family practice setting. The clinical approach will be based on osteopathic practice and principles. Osteopathic manipulative treatments will be discussed that can be used to treat common heel pain pathology.

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Anatomy Review

The foot and ankle are complex specialized anatomic structures working in a synchronized fashion to provide function and weight-bearing stability. The foot can be divided into three sections: the hindfoot, midfoot and forefoot. For the purpose of this article, we will emphasize the structures of the hindfoot.

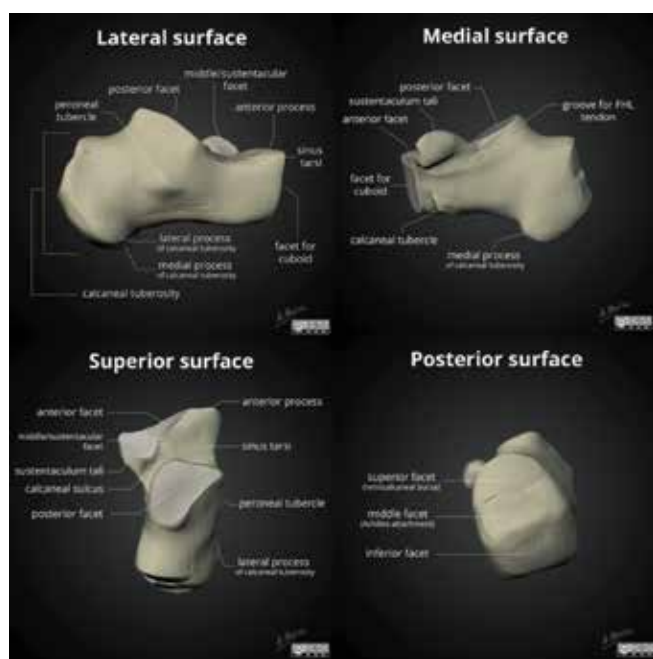
The hindfoot is the most proximal portion of the foot and it consists of two main bony structures, the talus and calcaneus. These structures contribute to inversion and eversion of the foot via the subtalar joint. The other joints of the hindfoot are the transverse tarsal, calcaneocuboid and calcaneonavicular joint. The collaboration of all three joints allows for proper stability and flexibility during gait. When the subtalar joint is inverted, the transverse tarsal joint is locked and allows for stable toe push-off. When the subtalar joint is everted, the transverse tarsal joint unlocks and allows the foot to stabilize to accommodate heel strike.⁴

The calcaneus provides the skeletal framework of the foot. Located inferior to the talus, the calcaneus is positioned along the midline axis of the foot to aid in stability. The surface anatomy of the calcaneus has multiple facets and structures that serve as attachments for fascia, tendons and ligaments. Located on the superior surface are two large facets that are the sites for tarsal articulation with the talus. In between the facets is the calcaneal sulcus, in which congruence with the tarsal sulcus forms the sinus tarsi. The sinus tarsi is a significant structure of the hindfoot, composed of several neurovascular structures, ligaments and fat. Located on the inferior or plantar surface is the calcaneal tuberosity, for which the plantar aponeurosis attaches. The medial and lateral sides of the tuberosity run the abductor hallucis and abductor digiti minimi tendons, respectively. The medial surface

hosts the sustentaculum tali. On the inferior aspect of this bony protrusion exists a groove containing the flexor hallucis longus tendon. The lateral surface is the site of the peroneal tubercle, which supports the peroneus brevis and peroneus longus tendons and a small protuberance for the calcaneofibular ligament attachment. The anterior surface contains the facet for articulation with the calcaneocuboid joint. Finally, on the posterior surface of the calcaneus is the calcaneal tuberosity, to which the Achilles tendon attaches.^{4,5,7} (Figure 1.1) The calcaneus receives its blood supply from anastomosis between branches of posterior tibial and fibular arteries. Branches of the posterior tibial and sural nerves innervate the structures that pass along the calcaneus.⁶

FIGURE 1.1:

Anatomy of Calcaneus

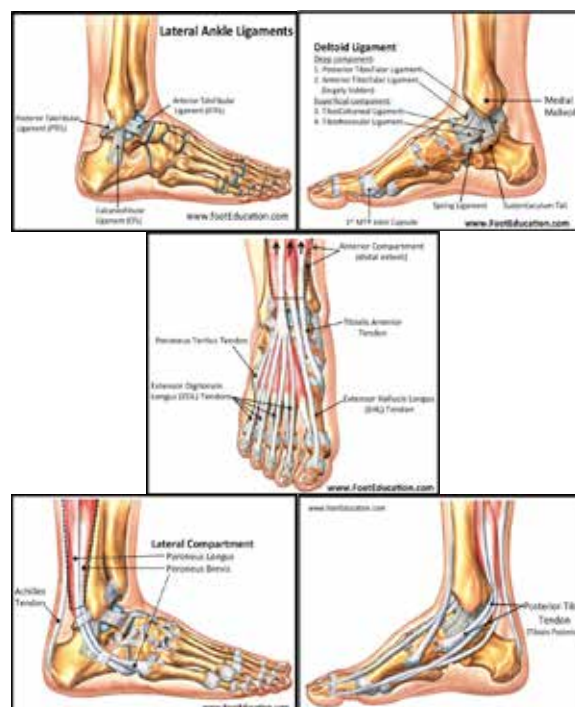


The second bone of the hindfoot, the talus, is a major contributor to foot biomechanics. It is responsible for distributing the downward forces transmitted from the body when erect or in motion. This saddle-shaped tarsal bone articulates with the calcaneus, navicular and tibia and fibula to form the ankle joint. Although the talus doesn't have any tendon insertions, it has multiple ligamentous attachments that provide stability to the ankle. The largest ligament is located on the medial side and is called the deltoid complex ligament (DCL). The DCL is composed of superficial and deep ligament components. The superficial posterior tibiotalar ligament (SPTL), tibio calcaneal ligament (TCL), tibiospring ligament (PTTL), tibionavicular ligament (TNL), posterior tibiotalar ligament (PTTL), deep tibiocalcaneal ligament (dTCL) and anterior tibiotalar ligament (ATTL). The collaboration of the ligaments in the DCL aid in the restriction of talar eversion and posterolateral translation and abduction. The other main ligament on the medial side of the talus is the spring ligament which participates in maintaining the longitudinal arch of the foot. On the lateral side of the talus, attachments of the anterior talofibular ligament (ATFL), which is the most common sprained

ligament in foot inversion injuries and the posterior talofibular ligament. It is important to mention that the posterior tibial tendon runs posterior to the medial malleolus and inserts on the navicular but plays an integral role in foot plantarflexion, inversion and supination. The talus receives blood supply primarily from a coalition of the posterior and anterior tibial artery and peroneal artery. Due to the lack of muscle attachments to the talus, it lacks the potential for secondary blood supply. Thus, increasing the risk of avascular necrosis in traumatic displaced fractures. The structures surrounding the talus are innervated by the posterior tibial and saphenous nerve on the medial side and branches of the peroneal nerve on the other sides.^{5,6,7} See Figure 1.2: Anatomy of Hindfoot for visualization of key structures that make up the hindfoot.

FIGURE 1.2:

Anatomy of Hindfoot



Osteopathic Approach

The philosophical approach of osteopathy is heavily reliant on the entire patient's principles, models, and well-being. A.T. Still emphasized the importance of the musculoskeletal system in relation to the entire body's function and unity, and compared the human body to a machine that it is subject to mechanical laws. He hypothesized that by returning structures to their natural position, the body would function in equilibrium. Four principles or tenets define the foundation of osteopathy: 1) the body is a unit of mind, body and spirit, 2) it has its own self-protecting and self-regulating mechanisms, 3) structure and function are reciprocally interrelated and 4) treatment considers the preceding three principles.^{8,9} In other words, it is an integration

of physical, psychological, social and spiritual components that influence the health and wellbeing of the person. The human body is constantly adapting to maintain equilibrium. One of the major regulating mechanisms is reliant on the neurological system. Transmission of nociceptor pain signals in the foot has both efferent and afferent pathways, thus enabling the ability to experience various forms of pain. Two of the main categories for classification are physiologic and pathologic pain. Physiologic foot pain enters from an acute response to injury, while pathologic foot pain comprises a dysfunctional nervous pathway such as neurogenic or inflammatory foot pain.¹⁰ Due to neural plasticity, or the ability of neurons to self-regulate, there are changes in pain perception and functional compensation over time. In the case of heel pain, it can precipitate dysfunction in gait and result in structural compensation by altering the biomechanics of the rest of the body.

According to osteopathic philosophy, the human body is a complex figure composed of many interconnections that complement each other and work synchronously to achieve function and well-being.^{5,10,11} The structural and functional relationships can be categorized into five models. The biomechanical model encompasses the skeletal framework of the body and the mechanisms that influence dynamic function. The respiratory/circulatory model corresponds to the intercellular and intracellular interactions of nutrients, oxygen and cellular waste. The neurological model focuses on the influences of the autonomic nervous system on the somatic and visceral systems. The bioenergetics model recognizes the molecular metabolism of energy and its response to various stresses. Finally, the biopsychosocial model focuses on the wellbeing of the patient. In 1980, George Engel proposed the biopsychosocial model to the osteopathic philosophy.¹² The patient's individual emotional and physiological influences can significantly affect their disease progression. This includes, but is not limited to, environmental stressors, socioeconomic factors and psychological factors.¹³

In the previous section, we discussed the anatomy of the hindfoot. The structures situated in that area contribute significantly to the biomechanics of the gait cycle and maintaining postural stability. With the calcaneus being the primary site of impact during the gait cycle and its associated joints being responsible for weight distribution, it is reasonable to assume that heel pain will affect the rest of the body. With the biomechanical model in mind, heel pain during gait results in alterations in the normal physiologic cycle.¹⁴ Compensations to avoid pain can result in additive stress to other joints like the knees, hips and back. Abnormal mechanics can lead to an increased risk of injury. Regarding the biopsychosocial model, patients who have suffered lower extremity injuries are associated with anxiety and depression.^{15,16}

Epidemiology & Risk Factors

In the general population, the prevalence of heel pain is 9.6%.¹⁷ Due to the extensive list of diagnoses possible involving the nonspecific complaint of pain, correctly recognizing and treating the etiology of heel pain can be delayed. This can lead to prolonged discomfort, social suppression in terms of anxiety and depression, and even functional disability.^{15,16,17} According to the Manchester Foot Pain and Disability Index, 98.4% of adults

older than 50 years old experienced some days of disability from foot pain, and 74.2% reported most days.¹⁸ Although adults over the age of 50 are the leading population presenting with heel pain, 28.6% of patients were 18–44 years old, and 7.7% were younger than 18.¹⁸ In the younger patients, about 10% were athletes that participated in running intensive sports, like soccer, cross country and basketball.¹⁹ Other factors that have a higher predominance to heel pain are the female sex, increased BMI, manual labor occupations, disrupted biomechanics and anatomic abnormalities.^{20,21,22}

Clinical Evaluation

A thorough history and physical exam are essential for correctly identifying the diagnosis. According to a study, 66% of clinicians correctly identified the diagnosis on history taking alone.²³ Patients typically present to the clinic with heel pain, complaining of localized pain at the heel, swelling, stiffness or difficulty ambulating.²⁴ A family physician should cover an extensive list of questions during the patient encounter. A family medicine physician's focused approach to establish a thorough history is summarized in Figure 2.

FIGURE 2:
Family medicine approach to history taking in patients presenting with heel pain.

PAIN ASSESSMENT	
Location	Diffuse or localized to a specific spot
Chronicity/Onset	Acute or chronic, when did the pain begin?
Quality	Sharp, achy, pull, burning
Severity	Pain scale 1- 10 at rest, weight bearing, and during activity
Radiation	Does the pain spread distally or start proximally?
Aggravating factors	Weight bearing, walking, running, jumping, sport activity, shoe wear, stairs, uneven grounds, how long can you perform the activity before becoming symptomatic?
Relieving factors	Non weight bearing, ice, heat, NSAIDS, stretching, osteopathic manipulative medicine, shoe wear
Timing	Better or worse at any time of day, morning, night, does the pain disrupt sleep?
SWELLING ASSESSMENT	
	Unilateral, bilateral
	Precipitated by activity
	Duration of swelling
	Severity: site specific, extension into foot, ankle, or calf
	Any skin changes: ulceration, erythema, ecchymosis
ACTIVITY ASSESSMENT	
	Any new exercise or training regimens: describe how you progressed with intensity Sports participation?
	Shoe wear: new, old, support
	Occupation: active or sedentary

FIGURE 2 CONT'D:

TRAUMA ASSESSMENT	History of trauma? Previous experience of this pain? If so, where you seen by a physician? What was the diagnosis and management? Did the treatment help? Was there any imaging done? Of what?, When?, Did you bring them? Secondary joint pain: hips, knees, ankles
MEDICAL HISTORY ASSESSMENT	Diabetes/peripheral neuropathy Peripheral vascular disease/cardiac history Rheumatologic disease: Lupus, Rheumatoid arthritis, inflammatory arthropathy Low back pain, sciatica, radiculopathy Previous surgeries? Medications? Allergies? Family history of heel pain or skeletal deformities? Activity level
RED FLAGS	Neoplasm Spinal neuropathy B-symptoms: night sweats, unwarranted weight loss Incontinence, lower extremity weakness, numbness

The physical exam begins the moment the patient walks back from the waiting area to the exam room. If possible, observing a patient’s gait from chair rise in the waiting room to sitting on the exam table can provide helpful information. For this article, an assessment of only the heel will be discussed. All examinations of extremities should be compared to the contralateral side for accurate assessment. To accurately assess the heel, the patient should remove any shoe wear and socks.

The clinician should start with an inspection of the footwear. Analyzing wear patterns on the patient’s shoes and calluses on the feet can provide subtle indicators of abnormal gait and potential heel complications. Patients with a valgus hindfoot alignment are associated with an increase in stress applied to the Achilles tendon.²⁵ A neutral hindfoot alignment demonstrates a more uniform wear pattern, while a valgus and varus alignment demonstrates predominantly lateral and central wear patterns respectively.^{25,26} Once inspection of shoe wear patterns is completed, the clinician should transition to inspecting the lower extremities in the erect position. Alignment should be assessed, noting any pelvic tilt and knee varus or valgus. Inspection of the foot arches while the patient is weight-bearing can demonstrate if the patient has anatomic deformities, such as pes plantus or pes cavus. Finally, inspect all heel surfaces, assessing for any signs of deformity, edema or ecchymosis.

Palpation of key anatomic structures should start proximally on the lower extremity and work distally. Table 1 outlines a list of key structures that should be palpated during a foot and ankle exam. All surfaces of the foot should be evaluated for tenderness and assessment in temperature, pulses and sensation bilaterally. To accurately examine the foot and ankle structures, a clinician should develop their systematic order of palpation that is reproducible in all scenarios.

TABLE 1:

Systemic order for palpating key structures during a heel exam.

SURFACE	STRUCTURES
Lower leg	Proximal fibular head, popliteal region, gastrocnemius muscle
Dorsal	Ankle mortise, anterior inferior tibiofibular ligament, tibialis anterior, extensor hallucis longus, extensor digitorum longus
Lateral	Lateral malleolus, peroneal tendons, sinus tarsi, anterior talofibular ligament, calcaneofibular ligament, calcaneocuboid joint, cuboid bone, base of 5th metatarsal
Medial	Medial malleolus, tibiocalcaneal ligament, tibionavicular ligament, navicular bone
Posterior	Achilles tendon, retrocalcaneal bursa, subcutaneous bursa, calcaneal, posterior tibiotalar ligament
Plantar	Calcaneal tuberosity, calcaneal fat pad, plantar fascia

When a patient presents with foot and ankle pain, it is always a good idea to explore Ottawa Rules for fracture assessment. The rules for the ankle state that a clinician should order radiographs if one of the following are met: pain on palpation at the tip or posterior edge of the lateral and/or medial malleolus, or the patient is unable to bear weight for four consecutive steps. The rules for the foot specify for pain on palpation to the base of the 5th metatarsal, navicular, or inability to bear weight for four consecutive steps. Although these rules are designed to prompt the clinicians’ suspicion for fracture, standing radiographs of feet can provide additional information indicating other etiologies of heel pain.

The clinician should perform both active and passive movement and muscle strength testing bilaterally for comparison. The physical examination techniques and special tests for heel pain are described in Tables 2 and 3, respectively.²⁷

TABLE 2:

Physical examination techniques for heel pain

Ankle Range of Motion

MOTION	NORMAL RANGE (DEGREES)
Dorsiflexion	0 – 20
Plantar Flexion	0 – 50
Inversion	0 – 35
Eversion	0 – 15
Supination (inversion, adduction & plantar flexion)	0 – 60
Pronation (Eversion, abduction & Doriflexion)	0 - 30



Muscle Strength Grading System

GRADE	EVALUATION
0	No muscle activation
1	Trace muscle activation
2	Muscle activation with gravity eliminated, full passive range of motion
3	Muscle activation against gravity, full active range of motion
4	Muscle activation against some resistance
5	Muscle activation against full resistance

Muscle Function Analysis

MUSCLE	PATIENT POSITION	CLINICIAN MANEUVER
Extensor digitorum longus/brevis	Extension of digits 2 - 5	Isolate tendon by stabilizing the digits at the metatarsophalangeal joints, flex digits against resistance
Extensor hallucis longus/brevis	Extension of hallux	Isolate tendon by stabilizing the hallux at the metatarsophalangeal joint, flex hallux against resistance
Flexor digitorum longus/brevis	Flexion of digits 2-5	Isolate tendon by stabilizing the digits at the metatarsophalangeal joints, extend digits against
Flexor hallucis longus	Flexion of hallux	Isolate tendon by stabilizing the hallux at the metatarsophalangeal joint, extend hallux against resistance
Gastrocnemius, Soleus, Plantaris	Ankle plantar flexion	Dorsiflex against resistance, special tests to differentiate
Peroneal longus/brevis	Ankle eversion and plantar flexion	Medial force applied on lateral foot against resistance, palpate tendons posterior to lateral malleolus
Tibialis anterior	Ankle dorsiflexion	Plantar flex against resistance, palpate tendons on dorsum of foot
Tibialis posterior	Ankle inversion and plantar flexion	Lateral force applied on medial foot against resistance, palpate tendons posterior to medial malleolus

Gait Analysis

Normal gait analysis: ability to walk heel to toe without limp or compensation. Able to support weight walking on tip toes and then on heels.		
GAIT TYPE	EXAMINATION	EVALUATES
Tip toe		Tibialis posterior, Achilles tendon, posterior impingement, S1/S2 nerve root
Heels		Calcaneal fracture, plantar fasciitis, tibialis anterior, anterior impingement, L4/L5 nerve root

Hindfoot Alignment











Normal alignment: from anterior, should not visualize medial calcaneal fat pad. From posterior, should not see more than 4th & 5th digits laterally		
SIGN	EXAMINATION	EVALUATES
Peek-a-boo		Calcaneal varus, potential pes plantus
Too many toes		Calcaneal valgus, potential pes cavus

TABLE 3:

Special tests for heel pain.

TEST	MANEUVER	ABNORMAL	EVALUATES
Anterior Draw		>1 cm of anterior translation, laxity	Ankle sprain, specifically the ATFL
Calcaneal Squeeze		Pain	Calcaneal stress fracture
Coleman Block		Heel will remain in varus position	Flexibility of hindfoot (rigidity)
Silfverskiold		Greater degree of dorsiflexion in the ankle when knee is flexed to 90 degrees	Differentiates gastrocnemius muscle tightness from soleus
Talar Tilt		Laxity of talus, pain	Sub-talar motion
Thompson's		Lack or reduced plantar flexion of the foot	Achilles tendon function
Tinel's		Pain, numbness	Tarsal tunnel nerve entrapment
Windlass		Plantar fascia pain with limited MCP extension	Plantar fasciitis

Establishing a Diagnosis

Obtaining a thorough history has always been a fundamental component of the diagnostic approach. There is no reason to dissociate from that principle when trying to determine heel pain etiology. Following a step-by-step physical exam approach will

help narrow the broad differential. Table 4 demonstrates a variety of possible causes of heel pain that a primary care physician may encounter. Figure 3 was designed to aid in the differentiation of musculoskeletal etiologies, while Figure 4 aims at alternative causes.

TABLE 4:

Differential Diagnosis, presentation, and treatment for heel pain complaints

HEEL SURFACE	ETIOLOGY	CLINICAL PRESENTATION	DIAGNOSTIC FINDINGS	TREATMENT
Medial	Flexor digitorum longus tendinopathy	Overuse injury, running on uneven surfaces such as sand	Tenderness along flexor digitorum longus tendon	Activity modification, rest, NSAIDs, PT
	Flexor hallucis longus tendinopathy	Overuse injury, repetitive push off and plantar flexion "dancers tendonitis"	Tenderness along flexor hallucis longus tendon	Activity modification, rest, NSAIDs, PT
	Posterior tibial dysfunction	Pain posterior to medial malleolus extending along medial arch	Pes Plantus, tenderness along posterior tibial tendon	immobilization for 6 weeks, rest, NSAIDs
	Tarsal tunnel syndrome	Nerve entrapment secondary to overuse injury, gradual onset of pain, paresthesia or burning sensation	Positive Tinel's test along posterior tibial tendon, electromyography, MRI	RICE, NSAIDs, immobilization, orthotics, surgery
Lateral	Peroneal tendonitis	Pain and swelling, exacerbated when rising onto the ball of the foot	Tenderness to palpation; reproducible symptoms upon active resisted eversion	Activity modification, rest, NSAIDs, PT, surgery
	Sinus tarsi syndrome	Pain with weight bearing and activity on uneven surfaces	Tenderness to palpation of sinus tarsi area and talar tilt	Activity modification, rest, NSAIDs, orthotics, corticosteroid injections, surgery
Plantar	Calcaneal stress fracture	Overuse injury, sudden increase in activity level, pain with activity	Tenderness at site, +/- X-ray findings, MRI demonstrate increased signal at site	Activity modification, rest, limit weight bearing, NSAIDs, shoe wear change/ orthotics
	Heel spur	Pain with prolonged activity, chronic plantar fasciitis	X-ray demonstrates enthesophytes	Activity modification, rest, NSAIDs, orthotics
	Heel pad syndrome	Dull achy pain	Tender to palpation in the middle of the heel	Shoe wear modification, heel cups, NSAIDs, RICE
	Nerve entrapment	Paresthesia with activity	Positive Tinel test over plantar nerves	Stretching, NSAIDs, activity modification
	Neuroma	Burning or numbness sensation, pain radiating to the ball of the foot, feels like there's a "pebble in your shoe"	Reproducible symptoms; Ultrasound demonstrating a hypochoic mass parallel to metatarsals	Shoe modification (wide shoe box), metatarsal pad, corticosteroid injection, surgery
	Plantar fasciitis	Pain with first steps	Tenderness along plantar fascia	Activity modification, stretching, rest, corticosteroid injection
Posterior	Achilles tendinopathy	Trauma - jumping, laceration; acute/chronic - pain with activity	Positive Thompson test, palpable gap in tendon chronic injury- thickened Achilles tendon	Rupture - ortho referral; tear - slight plantar flexed cast; acute and chronic injury - activity modification, rest
	Bursitis	Pain, edema, erythema surrounding the Achilles	Tenderness Retrocalcaneal - behind Achilles tendon, subcutaneous along calcaneus	Activity modification, RICE
	Haglund deformity	Pain at the superior aspect of the posterior calcaneus	X-ray demonstrate deformity, abnormal bony structure in heel	Activity modification, RICE, NSAIDs

FIGURE 3:

Heel pain algorithm

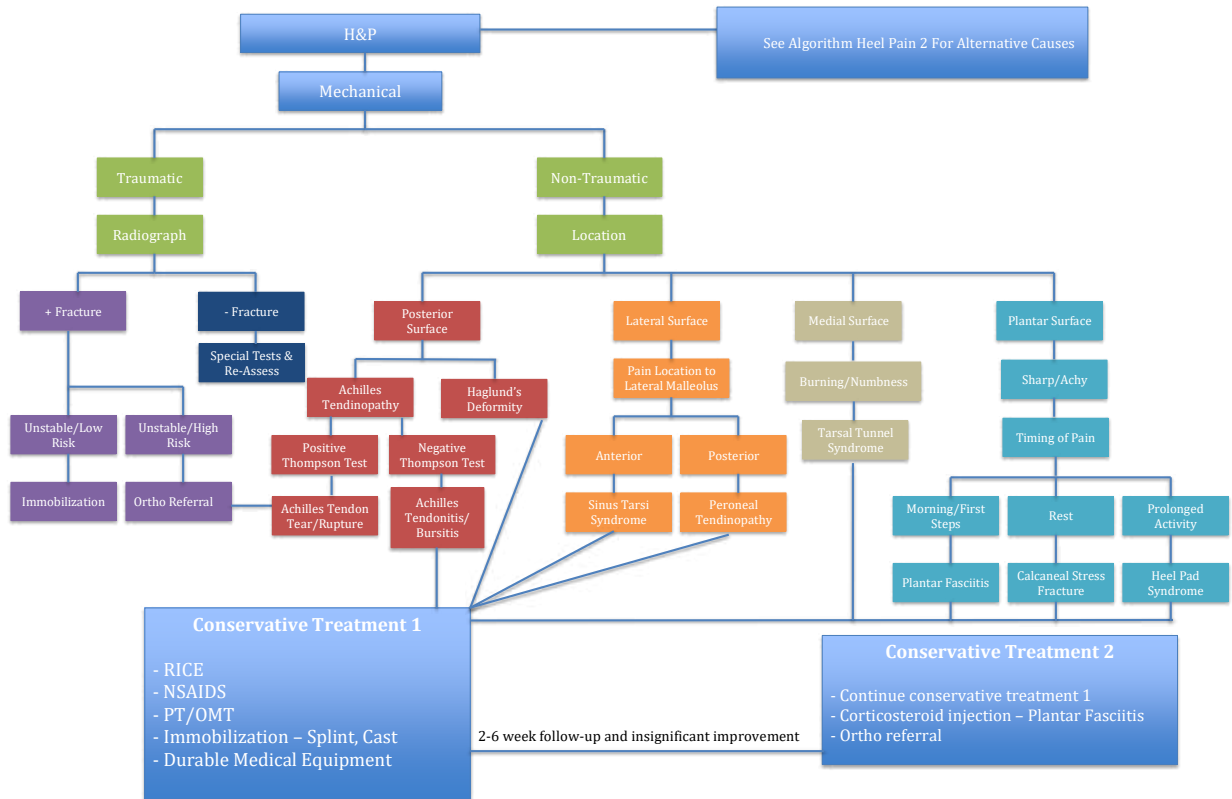
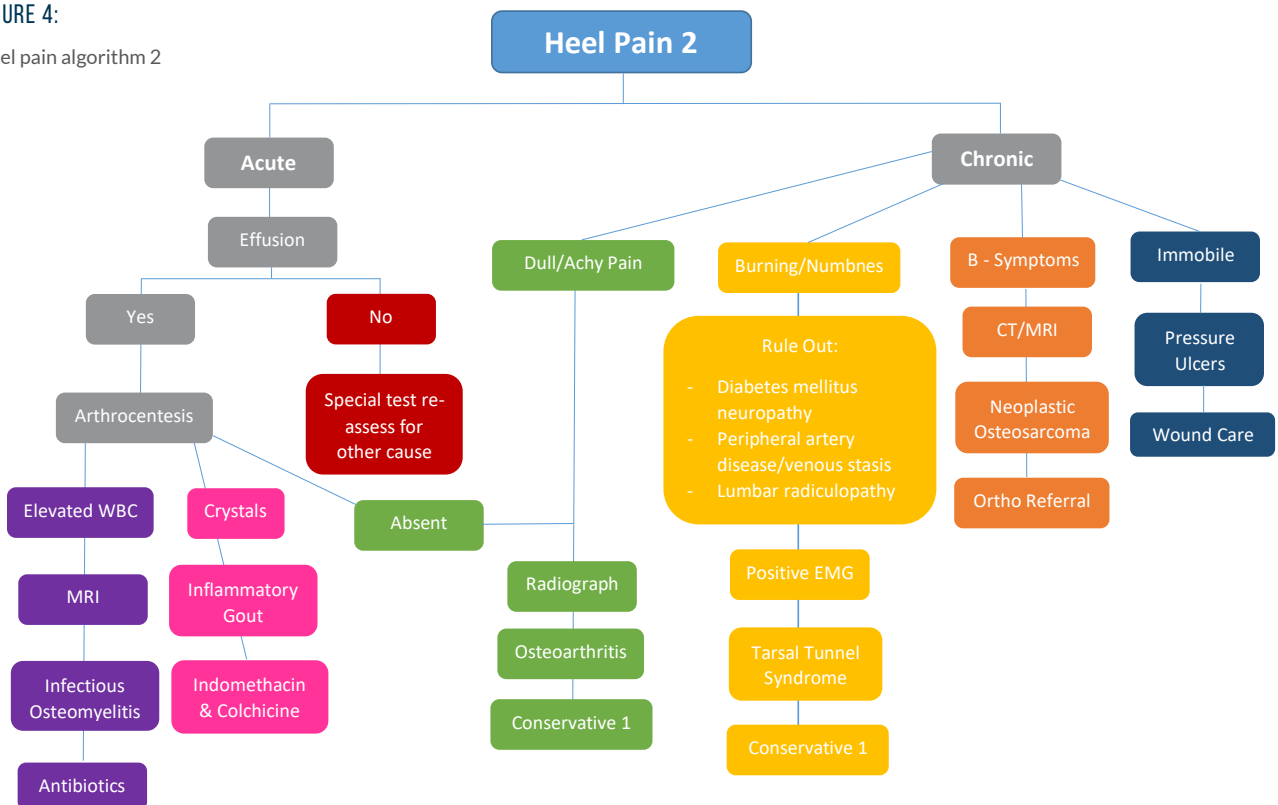


FIGURE 4:

Heel pain algorithm 2



Medical Management

For most musculoskeletal pathology and specifically heel pain, conservative therapy is typically a sufficient course of management. Conservative therapy consists of a combination of both pharmacologic and mechanical management. The pharmacologic aspect aims at managing pain and inflammation. When deciding which analgesics or anti-inflammatories to use, consider the duration of the management. For acute conditions, non-steroidal anti-inflammatory drugs (NSAIDs), such as over-the-counter ibuprofen (Advil), naproxen (Aleve) or prescription meloxicam (Mobic), may be used. Extended duration and inappropriate use of NSAIDs can result in gastrointestinal irritation, kidney injury and bleeding.²⁸ For chronic conditions, acetaminophen (Tylenol) or a selective COX-2 inhibitor, such as celecoxib (Celebrex), may be a safer option. Opioids should be avoided in acute injuries, as they are not typically part of the management guidelines. In a recent study involving the prescription of opioids following ankle sprains, Finney *et al.*, determined that primary care physicians were the second-highest specialty prescribing opioids to previous non-users within seven days of diagnosis. They also determined that 8.9% of those opioid-naive patients continued to use opioids more than 90 days post-diagnosis.²⁹ Since a majority of the heel pain etiologies encountered by family medicine physicians are treatable with conservative management, there is no indication for opioid medication use. Peripheral nerve pain can be described as burning pain or numbness in the feet. Although the complete list of etiologies are not expressed in this article, first-line medications such as gabapentin (Gralise®), pregabalin (Lyrica®), amitriptyline (Elavil®), duloxetine (Cymbalta®) or venlafaxine (Effexor®) can be used.³⁰

A major component within conservative management is restoring alignment while strengthening and stretching contributory muscles. Physical therapy and/or osteopathic manipulative treatment is the mainstay treatment modality used to address these components. Also, immobilization and orthotic devices play a significant role in correcting alignment, maintaining stability, restricting mobility, shock absorption by offloading pressure and providing protection. There are a variety of immobilization devices that range from over-the-counter aids to custom-made orthotics. A descriptive list of appropriate devices is outlined in Table 5.³¹ Appropriate shoe wear has also been shown to improve pain and function.³²

TABLE 5:
Immobilization devices

TYPE	IMMOBILIZATION DEVICE	INDICATION	PHOTOGRAPH
Splint	Airheel	Achilles tendinopathy Plantar Fasciitis	
	Night splints	Plantar Fasciitis	
	Lace up Brace	Ankle sprain	
Ankle Foot Orthoses (AFO)	Static	Neuromuscular disorders	
	Hinged	Neuromuscular disorders	
	Richie Brace	Posterior tibial tendon dysfunction Peroneal tendinopathy Lateral ankle instability	
Molded Ankle Foot Orthoses (MAFO)	Arizona Brace	Posterior tibial tendon dysfunction Tibialis tendonitis Talocalcaneal varus or valgus	
Controlled Ankle Movement (CAM)	Short/Tall boot	Achilles tendinopathy Peroneal tendonitis Fracture/post-surgical	

If conservative management fails, the use of intramuscular NSAIDs and corticosteroid injections have been shown to provide short-term relief but do not address the underlining pathology.³³ Ketorolac (Toradol[®]), an NSAID that can be administered as an intramuscular injection, has been shown to provide adequate relief of musculoskeletal pain. Before use, the renal function needs to be assessed, and duration is limited to five days, due to increased risk for gastrointestinal bleeding and colitis.³⁴ Corticosteroid injections are typically a combination of a steroid, for example, triamcinolone (Kenalog[®]) and an analgesic, such as lidocaine. The onset and lasting effects of intraarticular corticosteroid injections vary among patients. Corticosteroid injection therapy can cause atrophy of the heel pad, tendinopathy, bone demineralization and blood sugar elevation and thus should be limited to no more than three per year per joint. Corticosteroid injections have limited use in heel pain other than subtalar osteoarthritis or plantar fasciitis. Injections should never be placed in the Achilles tendon or other tendons in the foot, as it has been linked to causing weakening and rupture of the tendons.³⁵ An increasingly popular treatment option to treat a variety of musculoskeletal pathologies is the use of platelet-rich-plasma (PRP) injection therapy. PRP utilizes the body's natural growth factors and cytokines derived from host platelets to precipitate recruitment and proliferation of stem cell adhesion and angiogenesis.³⁶ A systematic review on corticosteroid injections for plantar heel pain published in 2019 determined that in the short term, corticosteroid injections were superior at pain reduction and improved function score when compared to PRP injections but the opposite in long-term outcomes.³⁷ An orthopedic referral should be considered when the patient continuously fails conservative management, symptoms worsen or the diagnosis results in an unstable function.

Role of Osteopathic Manipulative Treatment in Heel Pain

Correctly identifying the primary cause of heel pain can be difficult to pinpoint. The differential can be extensive, thus making treatment decisions more challenging. The incorporation of an osteopathic assessment and treatment can provide additional benefits. In cases presenting with vague pain and minimal findings on physical exam, osteopathic structural exams can hint at potential causes of discomfort. Osteopathic manipulative treatments emphasize the re-alignment and stretching of muscles to provide pain relief. For this article, the focus will be tailored to plantar fasciitis. In primary care, the most common cause of heel pain, accounting for about 60% of encounters, is plantar fasciitis.³⁸ The etiology of plantar fasciitis is predominantly secondary to overuse. It typically occurs in runners and people who spend excessive time on their feet. The repetitive cycle of elongating and shortening can cause degeneration of the fascia with potential microscopic tears. Tight gastrocnemius muscles and foot drop are two conditions that apply significant strain on the plantar fascia. With the foot having limited dorsiflexion capabilities, the plantar fascia is exposed to additional loading forces.³⁸ Plantar fasciitis is diagnosed clinically with the patient complaining of pain upon the first steps of the ambulation after a period of inactivity. The pain is typically described as a sharp pain located around the anteromedial portion of the plantar surface on the heel. Plantar fasciitis is typically treated conservatively, representing about

90% of the cases.³⁸ Osteopathic manipulative medicine can be beneficial in the recovery from plantar fasciitis and reduce foot and ankle edema.³⁹ Identifying and treating tight calf muscles with muscle energy or myofascial techniques can provide some biomechanical relief. Stretching of the gastrocnemius muscle has been shown to reduce the strain placed on the Achilles tendon and the plantar fascia.⁴⁰ Counterstrain techniques applied to the plantar fascia have also shown to have immediate improvements in cases of plantar fasciitis.^{41,42} By placing the plantar fascia in a position of relaxation and maintaining that position for 90 seconds allows for the neuromuscular spindle to reset. This biomechanical mechanism educes relaxation of the influencing muscles that are affected. A list of potential osteopathic manipulative treatments are listed in Table 6 for reference.⁴

TABLE 6:
OMT techniques for heel pain

TECHNIQUE	REGION	DIAGNOSIS	PHYSICAL FINDINGS
		Anterior fibular head	Foot inversion and adduction, lower leg external rotation
		Posterior or fibular head	Foot eversion and abduction, lower leg internal rotation
	Ankle	Dorsiflexion	Dorsiflexion of foot
		Plantar flexion	Plantar flexion of foot
	Foot	Calcaneal eversion	Eversion of the calcaneus
		Calcaneal inversion	Inversion of the calcaneus
		Subtalar abduction	Talus abducted on calcaneus
		Subtalar adduction	Talus adducted on calcaneus
Counterstrain	Knee	Gastrocnemius tender point	Lateral and medial attachments in the inferior aspect of popliteal fossa
	Ankle	Medial ankle tender point	Inferior to medial malleolus
		Lateral ankle tender point	Inferior to lateral malleolus
	Foot	Calcaneus tender point	Distal end of calcaneus on the plantar surface of the foot
		Talar tender point	Anteromedial ankle, deep to talus
Facilitated Positional Release	Ankle	Midpoint and medial ankle	Ankle stiffness and muscle hypertonicity
Articulatory	Knee/Ankle	Combined knee and ankle long-axis extension	Ankle stiffness

TABLE 6 CONT'D.:

OMT techniques for heel pain

TECHNIQUE	REGION	DIAGNOSIS	PHYSICAL FINDINGS
High Velocity Low Amplitude (HVLA)	Knee	Anterior fibular head	Pain on the lateral side of knee
		Posterior fibular head	Pain on the lateral side of knee with neurologic symptoms along peroneal nerve
	Ankle	Ankle eversion	Flat foot, pain on medial side of ankle
		Ankle inversion	High arch, pain on lateral side of ankle
		Tibiocalcaneal	Ankle pain and stiffness
Myofascial Ligamentous Release	Knee	Gastrocnemius	Hypertonicity of the gastrocnemius muscle, limited dorsiflexion of the foot
	Ankle	Achilles Tendon	Swelling surrounding the Achilles tendon
	Foot	Plantar Fascia	Pain and hypertonicity of the plantar fascia

CONCLUSION

Primary care physicians are presented with a substantial amount of musculoskeletal complaints. Due to the extensive possibilities, proper identification and management of heel pain can be challenging. Reiterating and establishing a strong foundation in the examination and assessment of foot pain is strongly encouraged. Since the majority of these conditions can be treated conservatively, an osteopathic approach to care can be effective. The osteopathic philosophy and the application of its various models provide an additional tool in the diagnosis and treatment of reported heel pain.

AUTHOR DISCLOSURES

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BRIEF REPORT

SUBSTANCE-INDUCED PSYCHOSIS IN THE GERIATRIC POPULATION: OVERVIEW ON SCREENING AND TREATMENT

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KEYWORDS:

Geriatrics

Screening

Substance Abuse

Treatment

ABSTRACT:

As our elderly population represents an increasing percentage of the overall population, more healthcare resources are spent treating this population. One of the overlooked issues is substance use in this population and its complications. This population is often not forthcoming with psychoactive medical issues, yet many of them came into adulthood in a time when substance use was widespread. This article will discuss the epidemiology of this population, a case of substance-induced persecutory delusion and the availability of screening methods and treatment options.

INTRODUCTION

According to the DSM-V, substance use disorder is a cluster of cognitive, behavioral and physiological symptoms demonstrating that a person continues to use that substance despite several substance-related problems.¹ The abrupt discontinuation of drug use can lead to both affective (e.g., dysphoria, anxiety, anhedonia) and somatic withdrawal signs likely from an interplay involving neurotransmitters, such as dopamine and glutamate, as well as endogenous opioids like dynorphin.^{2,3,4} In previous generations, older adults have not demonstrated a strong prevalence for alcohol abuse or illicit substance use compared to younger adults.⁵ However, there is a growing concern that “baby boomers,” defined as individuals born between 1946 to 1964, will change this trend.⁶ The baby boomer population is distinct in that they reached adulthood in the 1960s and 1970s, a time in American history when substance use was becoming more socially acceptable.⁷ In 1979, approximately 27% of baby boomers—almost 14 million people—reported using some form of illicit substance in the past month.⁷ According to the 2019 U.S. Census Bureau, current baby boomers, aged 56–76, comprise approximately 23% of the current population.⁸ Given the existing size of this generation, as well as longer life expectancies, it is estimated that the number of older adults will increase from 40.3 million to 72.1 million between 2010 and 2030.⁵ Data from the Treatment Episode Data Set-Admission (TEDS-A) demonstrated a trend of increasing substance use in the elderly population in facilities using public funding.^{9,10} Based

on information gathered from the 2002–06 National Survey on Drug Use and Health (NSDUH), it was projected that the number of individuals 50 or older with diagnosed substance use disorder would increase from 2.8 million to 5.7 million by the end of 2020.⁶ This growing number is concerning, as the global number of deaths related to drug use is also rising.¹¹ The number of deaths related to drug use increased by 60% between 2000–15.¹¹ Of the deaths caused by drug use in 2015, 39% were related to people aged 50 or older.¹¹

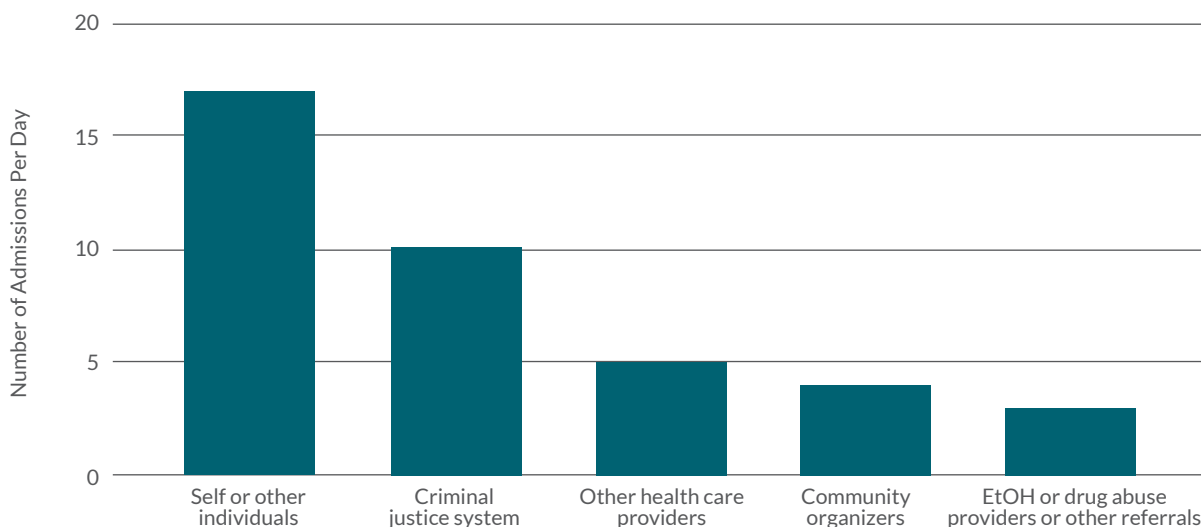
The Substance Abuse and Mental Health Services Administration (SAMHSA) data showed that most admissions aged 65 or older were initiated by patients self-reporting adverse events or involuntarily by the criminal justice system (Figure 1).¹² It is speculated that the difficulties in identifying geriatric patients with substance use stems from various reasons. One is low suspicion among healthcare professionals because providers may be confusing substance use effects with other age-related changes and comorbidities.⁶ Another reason is the stigma and shame surrounding substance use led to low reporting.⁶ Lastly, there is generally low awareness of this social problem in the community.¹¹ Increased awareness and outpatient screening protocols may increase the detection of elderly patients with substance abuse. Early detection can lead to the initiation of appropriate referrals in the primary care setting, avoiding hospitalization. This may entail more diagnostic work-up, but it may decrease admissions and complications, lowering overall healthcare costs.

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FIGURE 1:

Number of admissions aged > 65 admitted to substance abuse treatment on an average day (SAMHSA, 2012)



This data reported from the Substance Abuse and Mental Health Services Administration in 2012 reflects how many admissions on an average day were related to substance abuse in the geriatric population. These admissions occurred in various ways, typically through self-reporting, but also through the use of the criminal justice system, other healthcare providers, and more.

Illustrative Case

A 61-year-old Caucasian male was admitted to the psychiatric unit with persecutory delusions and hallucinations. The week before admission, he started to see “men outside his windows at both stories of his house” holding pictures of a bird with its tongue pulled out and cut. The patient saw the men come into his house, so he ran and hid in an empty shed. He fired his guns out of the shed and nearly hit a real man from across the street. Police arrested the patient for attempted homicide and possession of illicit substances. He was taken to a community mental health clinic and then sent to the emergency room for further medical evaluation. The evaluation included a complete blood count (CBC), comprehensive metabolic panel (CMP) and neuroimaging. These were unremarkable, and he was admitted to the psychiatric unit. A urine drug screen was not ordered at either of the initial facilities; however, it was ordered in the psychiatric unit and was positive for amphetamine, methamphetamine and marijuana. After admission to the psychiatric unit, the patient admitted to using marijuana, cocaine and methamphetamines 10 days before admission. His wife reported seeing the patient use some unknown substances. The patient did not report past psychiatric history, but he admitted to using marijuana as a teenager. The patient reported sobriety most of their adult life until a DUI 5–6 years ago. The patient has a brother with methamphetamine use disorder. No hallucinations during the inpatient stay were witnessed or reported. His persecutory delusion cleared on day two of admission, and he was discharged with outpatient follow-up with the community mental health clinic on hospital day three.

Discussion

This case demonstrates the dire consequences possible with cases of undiagnosed substance use disorder in the geriatric population.

The patient has a well-known history of substance use in his youth; however, due to the low suspicion of healthcare professionals and his ability to fulfill his social and family obligations, per his wife’s collateral information, his substance use had gone undiscovered for years. Even in the emergency room, a CT of the head was done as part of the initial assessment for his psychosis; however, a urine drug screen was not done. Based on his age at presentation, drug use was not likely considered in the differential.

Screening should be utilized when the elderly visit their primary care office, such as it is under the Florida Brief Intervention and Treatment for Elders (BRITE).¹³ BRITE is a state program for elderly individuals with substance use disorders to screen, intervene, treat and refer patients to various services.¹³ Awareness needs to be increased in healthcare workers and facilities with the most contact with the elderly. This includes pharmacies, senior centers, home health services, visiting nurses, social workers and assisted living communities. Greater awareness of geriatric substance use may promote early detection, intervention and prevention, decreasing hospital hospitalizations. In addition, if admission is required, it will be from healthcare providers and community organizations, instead of the criminal justice system.

In addition to BRITE, there are other screening programs and tools, such as Screening, Brief Intervention and Referral to Treatment (SBRIT). This is an evidence-based practice that emphasizes universal screening in healthcare settings, followed by focused interventions for those with substance use disorders and those at risk for developing an addiction.¹⁴ When compared to BRITE, it was demonstrated that SBRIT could be extended as a non-medical service for older adults dealing with substance use.^{13,14} Tobacco, alcohol, prescription medication and other substance use (TAPS) is a two-component, new screening tool that has been developed by the National Institute on Drug Abuse (NIDA).¹⁵⁻¹⁸

The first component (TAPS-1) is a four-item screen for tobacco, alcohol, illicit drugs and prescription drugs' nonmedical use. If an individual screens positive on TAPS-1 (e.g., gives a response other than "never"), the tool proceeds to the second component (TAPS-2), which consists of brief substance-specific assessment questions through which the patient is assigned a risk level for that substance.¹⁵ Risk levels range in severity from "problem use" to the more severe "substance use disorder."¹⁵ The U.S. Preventive Services Task Force (USPSTF) published a final recommendation regarding unhealthy drug use in adults age 18 years or older. The USPSTF concludes that there is a moderate net benefit (Grade B) to unhealthy drug use screening in adults age 18 years or older when effective treatment and appropriate care can be offered or referred.¹⁹

Regarding treatment, there are various pharmacologic and psychosocial therapies, as seen in Figure 2. Many pharmacological therapies that combat substance use lack the research to consistently determine efficacy in the geriatric population. Disulfiram, an agent that can reduce cravings for alcohol, has been shown to have a cardiotoxicity risk for the elderly.²⁰ Varenicline, a nicotinic agonist that has been used for smoking cessation, has also been shown to reduce alcohol use.⁵ Acamprosate with an unspecified mechanism of action that appeared to decrease glutamate action and to increase GABA action helps with alcohol abstinence maintenance.²¹ Nalmefene, a mu and delta-opioid receptor antagonist and kappa-opioid receptor partial agonist, assists in reducing alcohol consumption by reducing the effects of alcohol experienced by the consumer.²¹ Bupropion S.R., a selective norepinephrine dopamine reuptake inhibitor, shows efficacy in smoking cessation as well.^{21,22} Then, there is also nicotine replacement therapy (NRT) through patch, gum or lozenges.²³ For opioid use disorder, there are several FDA-approved medications like methadone, buprenorphine and naltrexone.^{22,24} Naltrexone not only helps with opioid dependence but also with alcohol dependence.²¹ Finally, there is ongoing research regarding immunotherapy for substance use disorder. Anti-drug vaccines, anti-drug monoclonal antibodies and anti-drug monoclonal antibodies derivatives are currently being developed for methamphetamine, cocaine and heroin.²⁵

There are also various forms of psychotherapy researched for substance use disorders. Cognitive behavioral therapy (CBT) helps with relapse-prevention skills coping skills, and adaptive behaviors.^{20,26-27} CBT has demonstrated superiority for cannabis use and nicotine use disorders when compared to other psychosocial intervention. Mindfulness-oriented recovery enhancement (MORE) has demonstrated the benefit in decreasing the desire for opioid use and statistically significant reductions in patient's pain severity and pain interference.²⁸⁻³⁰ Contingency management is an adjunct to CBT, helping with treatment retention.^{16,23,31-34} Motivational interviewing (MI) and motivational enhancement therapy help address the underlying ambivalence toward change and gain commitment to make and maintain healthy behaviors.²³ In limited case studies, CBT and MI have been seen as effective tools for coping with prescription sedative abuse.³⁵ Recorded music expressive arts (RMEA), a form of music therapy, has shown some benefits in adolescence dealing with inhalant abuse and may provide an adjunctive tool in the elderly population.³⁶ Family

therapy helps with relationships and the interaction between family members.²⁰ Brief interventions designed to counsel the patient when the substance use is not considered serious and community reinforcement and family training (CRAFT) have been recommended for hallucinogen use, such as lysergic acid diethylamide (LSD).³⁷ The most reviewed psychotherapy is the 12-Step Program.²⁰ In addition, there is a matrix model that combines CBT, MI, family participation and the 12-Step Program.²⁰

FIGURE 2:

Treatments for various substance use disorders ^{5,20,22-37}

SUBSTANCE	PSYCHOSOCIAL TREATMENTS	PHARMACOLOGIC TREATMENTS
Alcohol	Motivational enhancement therapy (MET), cognitive behavioral therapy (CBT), abstinence-based contingency management (CM)	Disulfiram Varenicline Acamprosate Naltrexone Nalmefene
Cannabis	Motivational enhancement therapy (MET), cognitive behavioral therapy (CBT), abstinence-based contingency management (CM)	~
Hallucinogens	Brief interventions, community reinforcement and family training (CRAFT)	~
Inhalants	Recorded music expressive arts (RMEA)	~
Opioids	Cognitive behavioral therapy (CBT), mindfulness-oriented recovery enhancement (MORE)	Methadone Buprenorphine Naltrexone Immunotherapy (future)
Sedatives/hypnotics, anxiolytics	Motivational enhancement therapy (MET), cognitive behavioral therapy (CBT)	~
Stimulants	Cognitive behavioral therapy (CBT), abstinence-based contingency management (CM)	Immunotherapy (future)
Tobacco	Cognitive behavioral therapy (CBT)	Varenicline Bupropion S.R. Nicotine replacement therapy (NRT)

CONCLUSION

Substance abuse in the elderly is a developing concern that will continue to grow as the population ages while the suspicion of drug use in this population is low. With the current awareness and guidelines that providers follow today, substance abuse may continue to go unnoticed, causing a significant financial burden to the annual cost of health care and, most importantly, unnecessary complications to the patient and stress to the family. Screening metrics, such as BRITE, SBRITE and TAPS, can provide cost-effective tools to screen for in this population. Given the limited data on pharmacological intervention in the geriatric population, different psychotherapies may provide an effective first-line treatment.

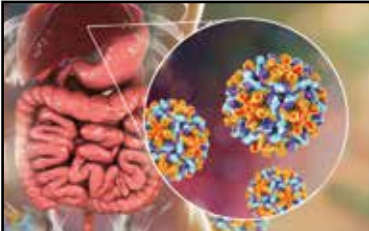
AUTHOR DISCLOSURES

No relevant financial affiliations or conflicts of interest. If the authors used any personal details or images of patients or research subjects, written permission or consent from the patient has been obtained. This work was not supported by any outside funding.

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CLINICAL IMAGE

NON-HEALING LEG LESION

Melissa Hubley, DO, PGY-3

Tower Health Reading Hospital Family Medicine Residency, Reading, PA

INTRODUCTION

A 58-year-old female with a past medical history significant for end-stage renal disease on hemodialysis and type 2 diabetes mellitus presented to the emergency room with cough and fatigue that was attributed to a viral upper respiratory tract infection and missed dialysis sessions. However, she was incidentally noted to have a one-week history of a painful, non-healing lesion on the right leg. (Figure 1) The patient denied any history of trauma or injury preceding the development of the leg lesion. Additionally, she denied fever, as well as redness or warmth of the affected leg. Physical examination was significant for two large, violaceous plaques with irregular borders on the posterior calf. A small central eschar was noted in the proximal lesion. The skin was otherwise intact. No notable erythema or exudate was surrounding the lesion. Bloodwork done in the emergency room demonstrated a white blood cell count within normal range.

FIGURE 1:

Right posterior calf lesion on initial presentation



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Three weeks later, the patient was re-admitted to the hospital with multifocal pneumonia. During this admission, she was found to have worsening of her right posterior calf lesion. (Figure 2) Physical examination revealed that a majority of the distal lesion was now encased in necrotic, black eschar. As before, there was no significant warmth to the touch, erythema or purulent exudate of the lesion. The radiograph was negative for bony destructive changes.

FIGURE 2:

Right posterior calf lesion three weeks later



QUESTIONS:

1. What is the most likely diagnosis?

- A. Squamous cell carcinoma
- B. Venous ulcers
- C. Calciphylaxis
- D. Pressure ulcers

2. Which patient population is at the highest risk for this diagnosis?

- A. End-stage renal disease
- B. Congestive heart failure
- C. Coronary artery disease
- D. Diabetes mellitus

3. What is the treatment of choice for this condition?

- A. Warfarin
- B. Intravenous sodium thiosulfate
- C. Vitamin D
- D. All of the above

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- D. All of the above

ANSWERS:

1. What is the most likely diagnosis?

Correct Answer:

C.) Calciphylaxis

The most likely diagnosis for this patient's leg lesion is calcific uremic arteriolopathy or calciphylaxis. Calciphylaxis is a rare syndrome seen primarily in patients with end-stage renal disease, characterized by areas of intense pain and ischemic necrosis of the subcutaneous fat and dermis.¹⁻³ Calcification of arterioles and capillaries in these regions is thought to lead to chronic ischemia. Clinically, this presents as changes to the overlying skin. Lesions can initially present in various ways but rapidly progress to characteristic necrotic ulcers with black eschars.^{1,4-6} In this patient, medical history and the unique physical appearance of the lesions are suggestive of calciphylaxis.

Differential includes cellulitis, skin carcinoma, venous ulcers, arterial ulcers, pressure ulcers, diabetic ulcers and pyoderma gangrenosum. There was no leukocytosis, erythema/warmth or purulent exudate on examination suggestive of cellulitis. Squamous cell carcinoma typically appears as a smooth or hyperkeratotic papule/plaque with central ulceration in a sun-exposed region.⁷ The location in this patient would be atypical for a squamous cell carcinoma. Melanoma presents in a variety of ways and is beyond the scope of this current article. Venous ulcers are often irregular, shallow and located over bony prominences, such as the medial malleolus.⁸ In this patient, the lesion was located on the posterior calf, not a typical location of a venous ulcer.

Additionally, the patient was ambulatory upon presentation, making pressure ulcers of the posterior calf unlikely. This patient had diabetes, so diabetic ulceration was on the differential. However, one would expect a diabetic ulcer to develop on the plantar aspect of the foot, likely in the setting of extensive callus formation.⁹ The history provided in this case did not fit this description.

Similar to this patient's lesion, arterial ulcers can produce eschars; however, this patient did have palpable pulses. Notably, throughout several admissions, the patient underwent a comprehensive vascular evaluation with no significant findings seen in the ipsilateral extremity.

2. Which patient population is at the highest risk for this diagnosis?

Correct Answer:

A.) End-stage renal disease

Calciphylaxis is most often seen in patients with end-stage renal disease, although it can occur in earlier stages of chronic kidney disease and occasionally patients with normal renal function.¹⁻³ Diabetes mellitus is also a risk factor for calciphylaxis,^{1,10} but it is not as strongly associated with the condition as end-stage renal disease. Notably, calciphylaxis is rare; even in patients with risk factors, most never develop the condition.¹

3. What is the treatment of choice for this condition?

Correct Answer:

B.) Intravenous sodium thiosulfate

Although treatment remains under investigation, sodium thiosulfate is often given in the treatment for calciphylaxis.^{1,6,11} Warfarin is associated with an increased risk of developing calciphylaxis and should be discontinued.^{6,10} Additionally, vitamin D supplementation should be stopped during treatment.¹

DISCUSSION

Calciphylaxis, or calcific uremic arteriolopathy, is a rare, life-threatening syndrome that primarily affects patients with end-stage renal disease.¹⁻³ Although the exact pathogenesis is unknown, in calciphylaxis, calcification of arterioles and capillaries in the subcutaneous fat and dermis leads to chronic ischemia.¹ Subsequent endothelial injury and microthrombosis cause further occlusion of associated vessels. This presents clinically as painful, ischemic skin lesions. Lesions can initially present in various ways, including induration, livedo reticularis or violaceous, plaque-like subcutaneous nodules.⁴⁻⁶ These initial lesions classically progress to necrotic ulcers with black eschars.^{1,4-6}

Calciphylaxis is rare, with an annual incidence of 35 per 10,000 patients on hemodialysis in the United States.¹⁰ Risk factors include end-stage renal disease, diabetes mellitus, female sex, obesity, hyperphosphatemia, hypercalcemia, hyperparathyroidism and warfarin use, among others.^{1,6,10}

However, most patients with risk factors do not develop calciphylaxis. It is thought that an inciting event in patients with underlying risk factors likely triggers the development of calciphylaxis, such as repetitive trauma from subcutaneous injections.¹⁰ However, in many cases, no clear trigger is identified.¹

Diagnosis may be made via clinical suspicion alone in patients with classic presentation. Skin biopsies may be used to confirm clinical suspicion; however, this practice is often discouraged due to the risk of developing new non-healing ulcers and sampling error.⁶

Treatment remains under investigation. Modalities include wound care, pain control and infection prevention. Additionally, correction of abnormal calcium and phosphate levels should be undertaken, including stopping vitamin D supplements, intensifying dialysis regimens and using low/non-calcium-containing phosphate binders.^{1,6} Warfarin should also be held and vitamin K supplementation considered.

Although there are no approved therapies for calciphylaxis, one medication often given in the treatment of calciphylaxis is sodium thiosulfate. Sodium thiosulfate works by increasing the solubility of calcium.¹¹ It is administered intravenously at the end of every hemodialysis session. Efficacy has been demonstrated in case studies, but randomized controlled trials are currently under investigation.¹

Despite advancements in treatment, calciphylaxis remains a life-threatening syndrome with high morbidity and mortality. The one-year mortality rate is estimated to be 45–52% in those with end-stage renal disease.^{8,10,12}

CONCLUSION

In this case, nephrology was consulted and the patient was started on intravenous sodium thiosulfate. Calcium-based medications were held. Biopsy was not recommended due to the risk of poor wound healing. Due to the development of metabolic acidosis, sodium thiosulfate was later replaced with an intralesional form administered by vascular surgery. Wound care also followed the patient throughout admission, and she remained on a pain regimen for symptomatic relief.

Unfortunately, despite aggressive treatment, the patient had minimal improvement on the sodium thiosulfate and ended up being re-admitted multiple times over several months for uncontrolled pain and later infection. Ultimately, the ulcer continued to progress, leading to wasting the limb, loss of ambulation and an above-the-knee amputation approximately five months after the initial presentation. A few months following amputation, the patient opted to pursue hospice and stop dialysis.

Calciphylaxis is a rare, life-threatening syndrome with a very high mortality rate and limited treatment options. The purpose of this photographic clinical case is to aid in the early identification and treatment of this rapidly progressive syndrome.

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PATIENT EDUCATION HANDOUT

Plantar Fasciitis: How OMT can Help

Juilett Kostanjevec, DO, PGY-2

Ronald Januchowski, DO, FACOFP, Editor • Paula Gregory, DO, MBA, CHCQM, FAIHQ, FACOFP, Health Literacy Editor

Plantar fasciitis is inflammation of plantar fascia, which is a tissue that extends from the heel of your foot to the ball of your foot. The fascia's purpose is to absorb and distribute the various stresses placed on the foot from walking, running and jumping. If the fascia becomes irritated or inflamed, it can cause a stabbing-like pain near your heel that is typically worsened throughout the day.

OMT TREATMENT

Osteopathic manipulative treatments (OMT) are hands-on techniques performed by osteopathic physicians to help alleviate pain and treat multiple disease processes by increasing mobility and encouraging your body's natural tendency toward self-healing. Overall, OMT is a gentle, non-invasive and painless treatment option.

In plantar fasciitis, OMT is used to manipulate the bones and connective tissues in the foot to help improve alignment, more effective weight-bearing and stretching of the fascia through different mechanisms. Below is a list of some examples:

- **Counterstrain:** The physician will point your toes downward until the pain in your heel is significantly reduced, then they will hold this position for 90 seconds.
- **Muscle energy:** The physician will place your foot in a certain position and will have you exert a brief flexion of the foot that helps target specific muscle groups in your foot that need to be stretched and relaxed.
- **Myofascial release:** The physician will engage and hold tissues in a specific position to either generate or alleviate tension in the tissues.

WHERE TO GET OMT TREATMENT

You will need to locate a doctor of osteopathic medicine (DO) to obtain OMT. These are physicians who attended four years of medical school and have additional medical training to perform OMT.

OTHER TREATMENT OPTIONS

There are many different treatment options for plantar fasciitis, including stretching, ice therapy, massage, foot orthotics, modification of your footwear, nighttime splinting, shock wave therapy, anti-inflammatory medications, such as a cortisone injection, and surgery.

If you have any questions about plantar fasciitis or believe you may have it, please contact your primary care physician. In case of any emergency, you should call your doctor or 911 immediately.

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PATIENT EDUCATION HANDOUT

Heel Pain: Common Causes and When to See a Doctor

Franklin Berkey, DO; Marina Jeffery, DO

Ronald Januchowski, DO, FACOFP, Editor • Paula Gregory, DO, MBA, CHCQM, FAIHQ, FACOFP, Health Literacy Editor

Heel pain can have several different causes. The most common causes include:

- **Plantar fasciitis** are small tears and inflammation in the connective tissue between the heel and ball of the foot, often from walking, running or jumping. The pain is typically worse first thing in the morning or after prolonged periods of rest.
- **Achilles tendonitis** is inflammation of the connective tissue that attaches your calf muscle to your heel, causing pain at the back of the heel. Similar to plantar fasciitis, it is often caused by starting a new exercise program too quickly.
- **Heel bursitis** is a swelling of the bursa (a fluid sac designed to cushion the back of the heel) usually caused by pressure from shoes. The swelling is in the back of the heel and is sometimes tender to the touch.
- A **heel spur** is a bony growth that develops around the heel bone, often caused by ill-fitting shoes or repeated stress to the foot. Depending on the location, it can sometimes cause pain with walking.
- A **stress fracture** is a “crack” in a bone, often due to overuse or trauma.

HOME TREATMENT OPTIONS

If you have heel pain, **limit activities** that cause repeated trauma to the heel. This includes activities and sports that involve walking, running and jumping.

Icing reduces inflammation and pain. Ice packs can be purchased or made by putting ice in a plastic bag. Wrap the bag in a towel and mold it to the painful area of the foot. Use the ice pack for 20 minutes up to four times daily. Applying ice to your heel after exercising, stretching and working will also help with symptoms.

Over-the-counter **non-steroid anti-inflammatories (NSAIDs)**, such as ibuprofen (Advil) and acetaminophen (Tylenol), can also help. Check with your doctor to see if it is OK for you to take these medications.

TREATMENT OPTIONS

Your osteopathic family physician can diagnose the cause of your heel pain with a thorough history and physical exam, along with appropriate testing. If you note worsening swelling or redness, fevers over 100.4 degrees Fahrenheit or inability to stand on the affected foot, you should see your doctor.

FIGURE 1:

Stretching techniques to help plantar fasciitis and Achilles tendonitis.



Sit on a chair with your feet on the floor. Place a tennis ball under your foot and roll it over the ball to massage the underside of your foot. You can also do this with a frozen water bottle.



To stretch your Achilles tendon, keep both feet flat and use your outstretched arms to lean against a wall. You should feel stretching in the leg farther from the wall.



Using a towel, wrap the top of your foot and pull back with your hands. You should feel stretching in the bottom of your foot and the back of your heel.

SOURCE(S): American Family Physician, Osteopathic Family Physician, Up-To-Date®

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