OFP

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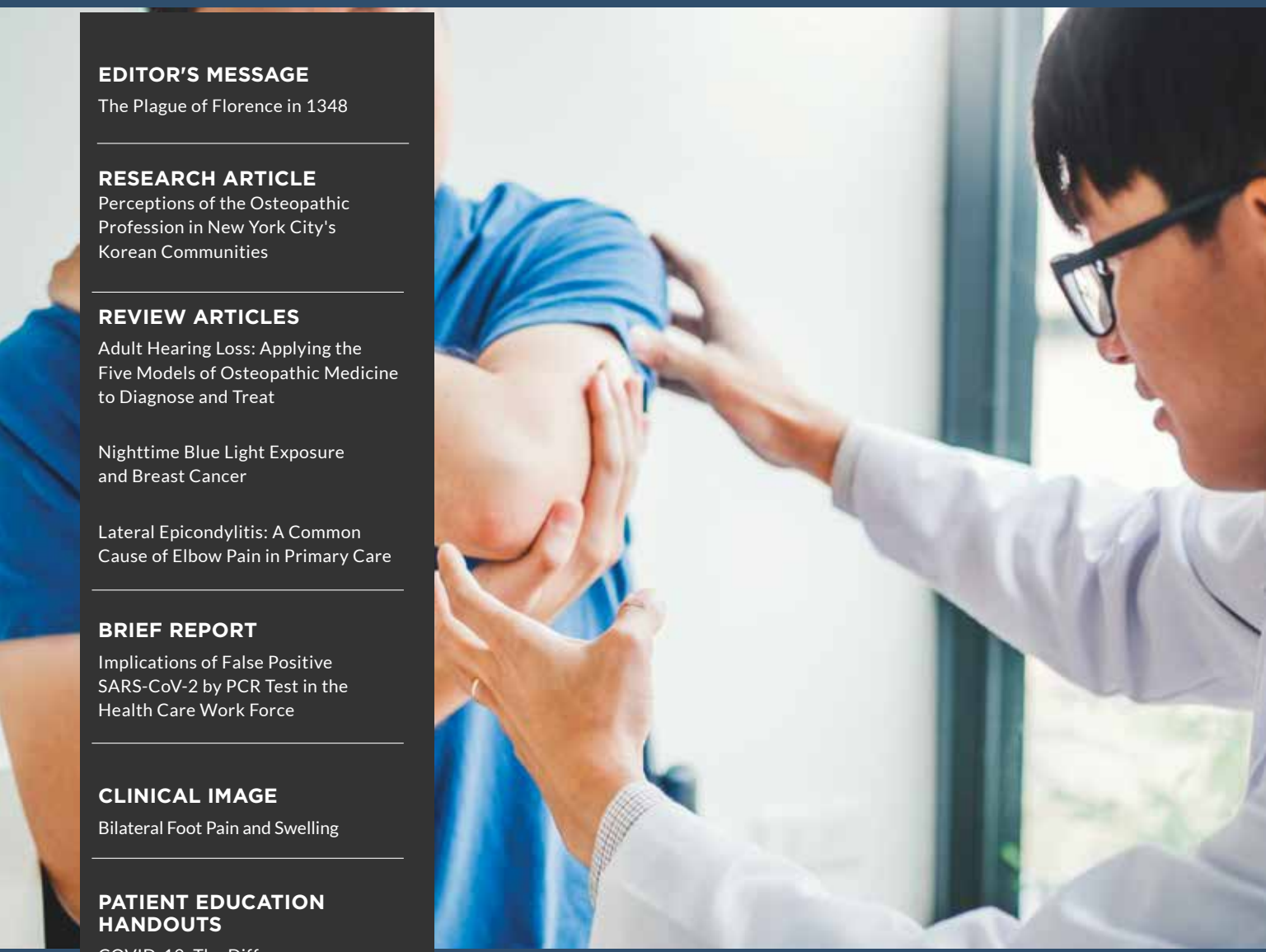

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koma.org

JANUARY 15–17, 2021
Iowa Society of the ACOFP
Midwinter Osteopathic Family Practice Conference
acofp-ia.org

JANUARY 19, 2021
Maine Chapter of the ACOFP
ME ACOFP Chapter Meeting
maineacofp.org

JANUARY 21–24, 2021
Missouri Society of the ACOFP
The Annual Winter Family Medicine Update
msacofp.org

FEBRUARY 5–7, 2021
Michigan Association of Osteopathic Family Physicians
MAOFP Winter Family Medicine Update
maofp.org

FEBRUARY 10, 2021
Arizona ACOFP
AzACOFP Annual Meeting and Social
az-osteo.org

FEBRUARY 12–14, 2021
Maine Chapter of the ACOFP
MOA Midwinter Symposium
maineacofp.org

FEBRUARY 13–14, 2021
North Carolina Society for the ACOFP
Winter CME Conference
nc-acofp.org

MARCH 10, 2021
ACOFP
Congress of Delegates
acofp.org

MARCH 11–14, 2021
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acofp.org

APRIL 23, 2021
Ohio ACOFP
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ohioacofp.org

APRIL 28–MAY 1, 2021
Pennsylvania Osteopathic Family Physicians Society
POMA Clinical Assembly
poma.org

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txacofp.org

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Kentucky Chapter of ACOFP
KOMA Annual Conference
koma.org

JUNE 11–13, 2021
Maine Chapter of the ACOFP
MOA Annual Convention
maineacofp.org

CME Resource: *Osteopathic Family Physician* Offers 2 Hours of 1-B CME

ACOFP members who read *Osteopathic Family Physician* can receive two hours of Category 1-B continuing medical education credit for completing quizzes in the journal. Visit the eLearning Center at www.acofp.org to access the quizzes.

EDITOR'S MESSAGE

The Plague of Florence in 1348

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

As I turn the page to a new year, I have had the opportunity to review some literature from years past— 650 years in the past to be more accurate. Giovanni Boccaccio's collection of novellas, the *Decameron*, was a classic of medieval plague literature. The writing presents the depiction of a disease that held a city under siege for years. While his writing vividly illustrates the mental, spiritual and physical tolls associated with the plague that spread through Europe in the 14th century (see excerpt below), it also captured the spirit of renewal and recreation in defiance of a decimating pandemic. He speaks of fragrant nose coverings, social distancing and public officials attempting to minimize transmission risk, making this classic prose resonate with our modern-day world. Despite the human suffering seen, the story paints a brighter picture describing the prescriptions for physical survival based upon psychological framing and the restorative power of structured rituals and human contact.

I hope you can enjoy this issue of the *Osteopathic Family Physician* and find time to read or revisit literature from the near or distant past!

"I say, then, that the years [of the era] of the fruitful Incarnation of the Son of God had attained to the number of one thousand three hundred and forty-eight, when into the notable city of Florence, fair over every other of Italy, there came the death-dealing pestilence, which, through the operation of the heavenly bodies or of our own iniquitous dealings, being sent down upon mankind for our correction by the just wrath of God, had some years before appeared in the parts of the East and after having bereft these latter of an innumerable number of inhabitants, extending without cease from one place to another, had now unhappily spread towards the West.

The condition of the common people (and belike, in great part, of the middle class also) was yet more pitiable to behold, for that these, for the most part, retained by hope or poverty in their houses and abiding in their own quarters, sickened by the thousand daily and being altogether untended and unsuccored, sickened by the thousand daily, died well nigh all without recourse."

The plague of Florence in 1348, as described in Boccaccio's *Decameron*. Etching by L. Sabatelli after himself. Wellcome Collection/Wikimedia Commons

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Official Notice to the ACOFP Membership

Proposed Amendments to the ACOFP Constitution & Bylaws

According to the Constitution of the American College of Osteopathic Family Physicians, Inc.

Article IX – Amendments: Section 1. This Constitution may be amended at any annual meeting of the Congress of Delegates by a three-fourths vote of the total number of delegates credentialed for voting, provided that the proposed amendment shall have been filed with the Executive Director of the College at least 60 days before the first day of the meeting of the Congress of Delegates and that the Executive Director shall have notified the membership of the College in writing of the proposed amendment at least 30 days preceding the first day of the meeting of the Congress of Delegates.

Section 2. All amendments to the Constitution shall not be effective until they are submitted to and approved by the Board of Trustees of the AOA.

The ACOFP Board proposes the following amendments to the Constitution to allow Medical Doctors (MDs) to be Active Members of the ACOFP, as recommended by the 2018 ACOFP Congress of Delegates. Approval of the amendments will be voted on at the ACOFP Congress of Delegates at its 2021 meeting. If adopted by the ACOFP Congress of Delegates, approval will be sent to the American Osteopathic Association Board of Trustees for approval. (New material in all caps and old material in strike out.)

CONSTITUTION OF THE AMERICAN COLLEGE OF OSTEOPATHIC FAMILY PHYSICIANS, INC.

ARTICLE II – MISSION & OBJECTIVES

Section 2. The objectives of the College are:

3. To support high standards of ongoing osteopathic education for family physicians;

5. To encourage and improve the educational opportunities for the training of family physicians in all branches of osteopathic medicine and surgery, including the osteopathic family medicine training programs WITH OSTEOPATHIC RECOGNITION STATUS;

ARTICLE IV – MEMBERSHIP

The membership of this College shall consist of osteopathic family physicians, ALLOPATHIC FAMILY PHYSICIANS and such other persons who have met the requirements of membership prescribed by the ACOFP Bylaws.

ARTICLE VII - BOARD OF GOVERNORS

Section 1. The Board of Governors shall be composed of the President, President-Elect, the Past Presidents for the preceding two years, Vice President, Secretary/Treasurer, six (6) Governors-at-large, one osteopathic RESIDENT GOVERNOR OR ALLOPATHIC Resident Governor IN OSTEOPATHIC FOCUSED EDUCATION AT A FAMILY MEDICINE RESIDENCY WITH ACGME OSTEOPATHIC RECOGNITION STATUS, one osteopathic Student Governor, and the Speaker of the Congress of Delegates, all to be selected as provided in the Bylaws. The Speaker has voice but no vote.

BYLAWS OF THE AMERICAN COLLEGE OF OSTEOPATHIC FAMILY PHYSICIANS, INC.

ARTICLE III – MEMBERSHIP

Section 1. Qualifications

An applicant for membership, except as provided herein, shall be a graduate of a college of osteopathic medicine approved by the COMMISSION ON OSTEOPATHIC COLLEGE ACCREDITATION (COCA) OR A GRADUATE OF A COLLEGE OF ALLOPATHIC MEDICINE APPROVED BY THE LIAISON COMMITTEE ON MEDICAL EDUCATION at the time of graduation and shall be licensed to practice medicine. Each applicant shall be of good moral character and shall conform to the ACOFP Code of Ethics.

Section 3. Active Members in Good Standing

The phrase "in good standing" shall describe only those active members whose dues and assessments are current, and who document CME hours consistent with the AOBFP OR AMERICAN BOARD OF FAMILY MEDICINE (ABFM) requirements, and who are in compliance with the ACOFP Code of Ethics. National officers, affiliate officers, and residency program directors must be members in good standing.

Section 3. Active Members in Good Standing

The phrase "in good standing" shall describe only those active members whose dues and assessments are current, and who document CME hours earned within a three-year period of educational programs consistent with the AOBFP OR AMERICAN BOARD OF FAMILY MEDICINE (ABFM) requirements, and who are in compliance with the ACOFP Code of Ethics. National officers, affiliate officers, and residency program directors must be members in good standing.

ARTICLE V – CONGRESS OF DELEGATES

Section 1. Composition

4. Each affiliate society shall be entitled to one voting medicine resident delegate who meets the following criteria.

(a) Be currently enrolled and in good standing in an AOA or ACGME residency program in the state which the delegate represents

(b) Be a member in good standing of the ACOFP affiliate society in the state (if such an affiliate society exists).

(c) Be a member in good standing with ACOFP.

ARTICLE VI – BOARD OF GOVERNORS

Section 2. Composition

A. The Board of Governors shall consist of the President, President-Elect, the Past Presidents for the preceding two years, Vice President, Secretary/Treasurer, six (6) Governors-at-large, one Osteopathic RESIDENT GOVERNOR OR ALLOPATHIC Resident Governor IN OSTEOPATHIC FOCUSED EDUCATION AT A FAMILY MEDICINE RESIDENCY WITH ACGME OSTEOPATHIC RECOGNITION STATUS, and one Osteopathic Student Governor as provided for in the Bylaws.

ARTICLE X – DEPARTMENTS AND COMMITTEES

Section 2. Qualifications of Committee CHAIRS AND Members

Committee chairs shall be OSTEOPATHIC PHYSICIANS WHO ARE active members of this College in good standing, or academic or associate members of this College, OR ALLOPATHIC PHYSICIANS WHO MEET THESE REQUIREMENTS AND HAVE COMPLETED OSTEOPATHIC FOCUSED EDUCATION AT RESIDENCY PROGRAMS WITH ACGME OSTEOPATHIC RECOGNITION STATUS. COMMITTEE MEMBERS SHALL BE OSTEOPATHIC OR ALLOPATHIC PHYSICIANS WHO ARE ACTIVE MEMBERS OF THIS COLLEGE IN GOOD STANDING, OR ACADEMIC OR ASSOCIATE MEMBERS OF THIS COLLEGE.

ARTICLE V – CONGRESS OF DELEGATES

Section 1. Composition

B. ONE VOTING DELEGATE AND ONE ALTERNATE DELEGATE SHALL REPRESENT THE RESIDENT MEMBERS OF THE AMERICAN COLLEGE OF OSTEOPATHIC FAMILY PHYSICIANS. THE DELEGATES SHALL BE APPOINTED ANNUALLY BY THE RESIDENT COUNCIL OF THE ACOFP. THE RESIDENT COUNCIL SHALL CERTIFY ITS DELEGATE AND ALTERNATE DELEGATE TO THE ACOFP EXECUTIVE DIRECTOR IN WRITING AT LEAST 30 DAYS PRIOR TO THE FIRST DAY OF THE ANNUAL MEETING OF THE CONGRESS OF DELEGATES.

Section 1. Composition

C. ONE VOTING DELEGATE AND ONE ALTERNATE DELEGATE SHALL REPRESENT THE STUDENT ASSOCIATION OF THE AMERICAN COLLEGE OF OSTEOPATHIC FAMILY PHYSICIANS (STUDENT ASSOCIATION OF THE ACOFP). THE DELEGATES SHALL BE APPOINTED ANNUALLY BY THE NATIONAL STUDENT EXECUTIVE BOARD. THE NATIONAL STUDENT EXECUTIVE BOARD SHALL CERTIFY ITS DELEGATE AND ALTERNATE DELEGATE TO THE ACOFP EXECUTIVE DIRECTOR IN WRITING AT LEAST 30 DAYS PRIOR TO THE FIRST DAY OF THE ANNUAL MEETING OF THE CONGRESS OF DELEGATES.

FROM THE PRESIDENT'S DESK

Diversity, Equity and Inclusion

Nicole Heath Bixler, DO, MBA, FACOFP
ACOFP President

When I was elected to the ACOFP Board of Governors in 2013, I "diversified" our Board by being a 39-year-old white female. At that time and until now, there have only been five women elected as Governor to the ACOFP Board in its 70-year history. Similarly, there has only been a handful under the age of 40, much less anyone with three children under 10.

At the time, my addition to the Board was significant for what it represented as a change in our specialty college's future leadership. I realize now that it was just one minor step in the direction that was needed—not only for ACOFP but also for our profession, the patients we care for and our collective communities.

In my tenure on the ACOFP Board, the faces of representation for our organization have changed more in the past eight years than it did in the previous sixty. There has been the first openly gay president, the first Asian American, the first and second Indian Americans, the first African American and the third and fourth female presidents. The Board currently spans five generations; lives in Florida, California and everywhere in between; and practices in rural and urban settings, as well as the Cherokee Nation. Our collective knowledge as family physicians has been augmented by our personal experiences as members of the communities who we identify with and serve.

In response to the events that have taken place in our country over the past year, I am proud to lead this Board in the continuation and expansion of our efforts in the realm of diversity, equity and inclusion. Our newly formed Task Force on Racism and Health has convened in three separate sub-committees, exploring the topics of governance, education and community outreach. Their collective efforts will guide our advocacy priorities to help address health disparities in vulnerable populations, align our educational offerings to reflect the need to teach core cultural competency and work with other stakeholders to expand the presence of a diverse family physician population to represent our communities. These are not new venues for the ACOFP.

Over the past several years, ACOFP has increasingly focused on this essential topic. ACOFP has passed policy through our Congress of Delegates that encourages the development of core curriculum guidelines in cultural diversity throughout the lifelong continuum of osteopathic medical education. Additionally, it has been supported to educate the public that all osteopathic family physicians should be evaluated by their skill and knowledge—not by their race, color, religion, gender, sexual orientation, gender identity or national origin. Our educational efforts from 2018–2020 included lectures on implicit bias, structural racism in medicine, strategies to enhance cultural competency and ethical dilemmas physicians face in everyday practice.

On a federal level, we have advocated for the recognition and inclusion of social determinants of health and their overarching impact on health care in policy making and the expansion of physician knowledge in population health. We have written letters to Congress to support legislation that protects the LGBTQI community from discrimination by insurance companies and health care workers. In November, the ACOFP Diversity, Equity and Inclusion Award was announced to recognize an osteopathic family physician who has made a significant contribution in these areas either in medical education or in clinical practice.

We see these efforts as the foundation for our future initiatives, and with any good foundation, there needs to be a mutual and respected understanding of the pillars that support that foundation. As I was preparing for this article, I consulted a wise colleague of mine. He alerted me to the concept of the "Platinum Rule," replacing the tried and true "Golden Rule" that we all learned in kindergarten.

The Platinum Rule, as coined by author Dave Kerpen, states: "Do unto others as they would want done to them." Since all people and situations are different, the Platinum Rule assures that you are doing what the other person wants done and afford a better outcome. In other words, when both sides are respectful and approach crucial conversations and interactions with understanding, it is much easier to come to a place of mutual respect.

When I reflect on where ACOFP is today, I believe we are embracing the definition of diversity, equity and inclusion. We have diversified our Board to include representation from various backgrounds, perspectives and experiences. We have been inclusive by amplifying the voices of the members and patients we represent while placing value on the human experience. We are striving to improve equity by addressing the barriers that exist for our patients to access needed resources.

These are not words that have a singular definition, as they are equally not achieved by a singular act. Hopefully, our work as an organization and your daily contributions as frontline physicians will continue to move our country to a place of healing, understanding, forgiveness and wellness.

Osteopathically yours,

Nicole Heath Bixler, DO, FACOFP

Nicole Heath Bixler, DO, MBA, FACOFP

LETTER TO THE EDITOR

RETHINKING PHYSICIANS' EMPATHY DURING THE OPIOID CRISIS

To the *OFP* Editor:

This letter will hopefully encourage colleagues to consider becoming more empathetic towards patients suffering from opioid addiction. After 24 years in private medical practice, I admittedly had developed a general disdain and cynicism for patients with addictive behavior and issues based upon my own experiences. Over the years, I had been duped, taken advantage of and robbed by patients suffering from addictions. But all that changed after I closed my practice to accept a teaching position in my specialty of neuromusculoskeletal and osteopathic manipulative medicine.

Due to a state and community-wide need for doctors in addiction medicine, the department I joined suddenly expanded to include chronic pain of all kinds and, as a teacher of musculoskeletal medicine, I was recruited as well. Though deeply skeptical, I moved forward with the department training and obtained my X-Waiver certification. Our practice makes every effort to keep patients despite contractual violations and has resources like intensive outpatient programs (IOPs), inpatient, ER and other options readily available. We started partnering with regional law enforcement to serve and care for our community and region, including the neediest and indigent. Additionally, we worked with federal grants to assist when available. Since joining the practice, my assumptions and prejudgments about our patients have all but disappeared.

The impact of a particular patient encounter helped reshape my thinking about the opioid crisis both personally and professionally. Earlier this year, my office was approaching closing time when a staff member informed me of a colleague's 42 year old female patient who was on the phone frantically begging to come in to refill her Suboxone® prescription. Attempting to comply with our strict office policy and standard opioid contract, the patient was already racing to our office for the mandated in-person visit. When you take a patient's history to learn what led someone to get to this point in their life, it is intellectually compelling as well as incredibly humbling. Each new patient I see with an addictive or pharmacologically compulsive past reveals a truly thought-provoking history regarding how they arrived at this particular time and place. I am required to ask a detailed query regarding patients' prior drug-of-choice; how they initially received the opioid; if it came with an official prescription (most of the time) or illegally; how much money they spent at the peak of their usage and how they obtained the drugs. Overwhelmingly and most unfortunately, the patient's story begins with an iatrogenic cause, but then indeed, a physician suggested an opioid initially before anything medically progressed. Subsequently, the patient begins spiraling downward.

My patient begins telling her story. She was only 16 years old when a gymnastic injury landed her in the family physician's office. This doctor referred her to the local orthopedic surgeon concerned she fractured her pelvis and handed her mother a script for 'pain meds' — Oxycodone. Over the next few years, other doctors continued prescribing her more and more opioids. At the height of her addiction, the patient took approximately 30 tablets a day of either 10/325 Oxycodone/Acetaminophen or Oxycodone HCL 10 mg and sold the excess to help pay for her habit. She stole money from her household and nearly destroyed her marital relationship, until her family's intervention sent her to an inpatient rehabilitation program. Over the next seven-plus years, they enlisted a new family physician, social workers and clergy who all helped guide her from the inpatient program to intensive outpatient programs and eventually to our outpatient detoxification program.

Our state-run detox program offers Suboxone® in a carefully regulated medication-assisted treatment center, along with a comprehensive adjuvant non-interventional pharmacologics, psychological and psychiatric staff, referrals to aqua/land physical therapy, unique adjuvant options such as osteopathic manipulative treatment (OMT) and diagnostic workups including imaging, EMG/NCVs. We also have supportive staff comprised of experienced recovery experts to help guide and positively reinforce patients as they traverse through outpatient rehabilitation.

Because of our program's training and support, I could accept this patient before me without judgment. She expressed through her tears how grateful she was to have someone take the time to get to know her. This experience left an indelible impression on me and helped redefine my preconceived notions. My primary care training taught initial rapport-building interview skills with various open-ended techniques. Moreover, my private practice experience and OMT's unique hands-on skills helped build compatibility and trust with these patients.

More than ever, during this opioid crisis, physicians should be making an effort to understand the mindset of a new generation of the pharmacologically dependent patient population with an addictive mentality. As physicians, an empathetic approach ensures we are truly providing comprehensive treatment for our patients.

David Abend, DO
Assistant Professor, Department of Osteopathic Manipulative Medicine, Rowan University School of Osteopathic Medicine, Stratford, NJ
Board Certified, Neuromusculoskeletal Medicine and Osteopathic Manipulative Medicine
Board Certified, Family Practice and Osteopathic Manipulative Treatment

RESEARCH ARTICLE

PERCEPTIONS OF THE OSTEOPATHIC PROFESSION IN NEW YORK CITY'S KOREAN COMMUNITIES

Justin Chin, DO[1]; Haeinn Woo, OMS-IV[2]; Diane Choi, OMS-III[2]; Emily Dube, MS[3]; Mikhail Volokitin, MD, DO[4]; Christine Lomiguen, MD[5]

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KEYWORDS:

Community Health

Korean

New York

Osteopathic Manipulative Medicine

Osteopathic Recognition

Objective: The purpose of this study was to assess knowledge of and barriers to osteopathic medicine in Korean communities in New York City.

Design: A cross-sectional study was designed in which a culturally appropriate survey in Korean and English versions was administered anonymously to measure community perceptions and knowledge of osteopathic medicine.

Setting: Data collection occurred in the municipal delineations for the Bayside neighborhood within the New York, New York borough of Queens.

Participants: Community members were selected using convenience sampling from high-density areas to participate. The survey included demographics, education level, health care habits and knowledge of the osteopathic profession.

Results: 105 surveys were conducted with 47 males and 58 females, with an average age = 66. only 14% (n=15) indicated knowledge about osteopathic manipulative medicine (OMM) and 9% (n=9) indicated knowledge of osteopathic physicians (DOs), with the primary language spoken at home (Korean) as the sole statistically significant factor in recognition of OMM and DOs among the study variables.

Conclusion: Compared to research on the general U.S. population, a general lack of knowledge of osteopathic medicine exists within New York City's Korean community. Although this difference may be ascribed to linguistics and ethnosociological factors, greater outreach and education is needed in urban minority communities to make immigrants aware of all health care resources available during the current shortage of primary care physicians in the U.S.

INTRODUCTION

In the U.S., a doctor of osteopathic medicine (DO) is a licensed medical professional with identical practice rights and privileges as an allopathic physician (MD.)[1] Recognition of DOs and osteopathic manipulative medicine (OMM) on an international level is varied; however, South Korea only gave practicing rights to DOs in 2018.[2,3] Even less is known about osteopathic medicine and health care as a whole in North Korea.[4] In both countries, western medicine is synonymous with allopathic medicine; this creates a scenario in which immigrant communities lack exposure and familiarity with DOs.[5,6] This can result in underutilization or distrust in the face of proven advantages and efficacy in OMM as diagnostic and treatment tools.[7-9]As many osteopathic medical schools emphasize the importance of primary care and addressing the needs of marginalized and underserved communities, the lack of awareness and lack of educational outreach regarding the osteopathic profession in marginalized communities may act as barriers to those attempting to seek care, especially in areas with a health care shortage.[10,11] With limited research on osteopathic medicine recognition in immigrant populations, this study aimed to develop a culturally-appropriate survey to assess osteopathic awareness in New York City's Korean communities.[12-14] Secondary objectives included identifying previous research and potential barriers in outreach in the Korean community and other minority groups.[15]

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This study aimed to investigate osteopathic awareness by assessing the familiarity of DOs and OMM in one of the nation's largest Korean diasporas, New York City, New York's Queens enclave. We hypothesized that greater osteopathic outreach and education needed to occur in Korean communities to increase access to primary care providers and alternative care options. This project expanded on previous frameworks on research in minority communities and characterized potential barriers that may hinder OMM access and, by extension, overall health care.[12,16]

METHODS

Participants

New York, New York has the highest number of Asian Americans in the U.S. with over 1.1 million across the five boroughs in the 2010 census.[17] Participants were located in known high-density locations of Korean and Korean Americans in the municipal delineations of the Bayside neighborhood within the New York City borough of Queens. According to the Asian American Federation's 2015 survey, about 70% of NYC's Korean residents were foreign-born and 60% lived in Queens, residing in Bayside's high-density neighborhoods.

Participants were informed, both verbally and with the inclusion of a cover letter, that participation was voluntary and responses required no identifiers to protect participants' anonymity. Minors, those who did not demonstrate a complete understanding of the basis of the survey and those who were unable to give informed consent, were omitted from this study. The Health Sciences Institutional Review Board approved this study for the Protection of Human Subjects (HSIRB #1777E).

Measures

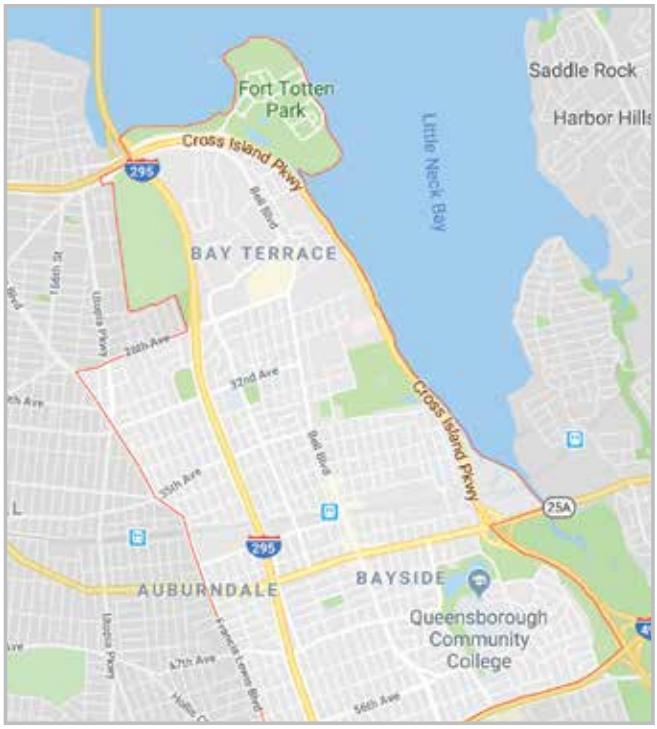
A twelve-question mixed multiple-choice and dichotomous (yes/no) survey was developed specifically for this study to measure osteopathic awareness. The survey was provided on paper in English and Korean. The survey included questions regarding demographics (age, gender, education level), language (primary language, English proficiency), health care habits (regularity of doctor visits, type of doctors visited), knowledge of OMM and a clinical scenario of low back pain (LBP), one of the most common reasons for doctor visits and one for which osteopathic manipulative treatment (OMT) has been shown to treat effectively, was provided to participants.[18,19]

Data Collection

Medical student researchers were located within the municipal delineations for the Bayside neighborhood within the New York, New York borough of Queens. They utilized convenience sampling in high-density areas, including major thoroughfares and parks (Figure 1), to obtain participants available for the study. All subjects were invited to participate with exclusion criteria of minors and those who were unable to consent to/understand the study. No other specific recruitment methodologies were utilized. No financial compensation or other incentive was provided to participants who voluntarily took the survey. Collection occurred over four consecutive days, May 28 through May 31, 2019.

FIGURE 1:

Data collection was done in the high-density population of Bayside, Queens, within the municipal borders.



Data Analysis

Survey data was scanned and a data spreadsheet was electronically created using a licensed version of Microsoft Excel, version 2016 (Microsoft Corporation, Redmond, WA). The data was subsequently coded for statistical analysis. Group comparisons were completed using Pearson's chi-squared tests ($\chi 2$ tests) of independence to examine the difference, if any, between health habits and demographics (age, sex, birth location, years in the U.S., primary language, English proficiency and education level), and awareness of the DO profession and knowledge of OMM. Statistical analysis was performed using the release version R-2.15.3.tar.gz of R: A Language and Environment for Statistical Computing, developed in Vienna, Austria, by the Core Team of the Foundation for Statistical Computing.[20]

RESULTS

A total of 105 participants were surveyed and included analyses of participant demographics versus familiarity with DOs and OMM. Forty-seven males and 58 females were included in the study with an age range of 27–92 and a mean age of 66±9.83. Of the 105 participants surveyed, only 14% (n=15) indicated knowledge about OMM and 9% (n=9) indicated knowledge of DOs, with demographics generally similar to the overall community. Detailed demographic data and results are displayed in Table 1.

In our study, knowledge of DOs and OMM was highest among English proficient participants, with a scattered distribution found

in other demographics. The primary language spoken at home was the sole statistically significant factor for whether participants had knowledge of DOs and OMM. In this category, Korean was the overwhelmingly predominant language for overall participants and subsequently those with and without knowledge of DOs and OMM (100%, p<0.0046, Table 1). Among the Korean community members surveyed, no significant difference in knowledge of DOs or OMM was present among groups when stratified based on sex, age, location of birth, number of years living in the U.S., level of education completed and self-assessed English proficiency (Table 1).

TABLE 1:

Demographic characteristics of all participants compared with participants with knowledge of DOs and OMM knowledge of DOs and OMM

CHARACTERISTIC	ALL PARTICIPANTS (N=105)	ALL PARTICIPANTS (N=105)	WITHOUT KNOWLEDGE OF DOS (N=96)	P-VALUE	KNOWLEDGE OF OMM (N=15)	WITHOUT KNOWLEDGE OF OMM (N=90)	P-VALUE
SEX							
Male	47 (44.76%)	5 (5.56%)	42 (43.75%)	0.3854	7 (46.67%)	29 (32.22%)	0.5667
Female	58 (55.24%)	4 (4.44%)	54 (56.25%)		8 (53.33%)	61 (67.78%)	
AGE (Y)							
Median	66	62	67		63	67	
18–29	1 (0.95%)	0	1 (1.04%)	0.6891	0	1 (1.11%)	0.8232
30–39	2 (1.90%)	1 (11.11%)	1 (1.04%)		1 (6.67%)	1 (1.11%)	
40–49	8 (7.62%)	0	8 (8.33%)		0	8 (8.89%)	
50–59	12 (11.43%)	3 (33.33%)	9 (9.38%)		4 (26.67%)	8 (8.89%)	
60–69	38 (36.19%)	3 (33.33%)	35 (36.46%)		6 (40.00%)	32 (35.56%)	
70–79	23 (21.91%)	0	23 (23.96%)		2 (13.33%)	21 (23.33%)	
≥80	21 (20.00%)	2 (22.23%)	19 (19.79%)		2 (13.33%)	19 (21.11%)	
LOCATION OF BIRTH							
Republic of Korea	101(96.20%)	8 (88.89%)	93 (96.88%)	0.1764	14 (93.33%)	87 (96.67%)	0.4919
DPRK*	2 (1.90%)	0	2 (2.08%)		0	2 (2.22%)	
China	2 (1.90%)	1 (11.11%)	1 (1.04%)		1 (6.67%)	1 (1.11%)	
LENGTH OF TIME IN U.S. (YEARS)							
0–10	12 (11.43%)	1 (11.11%)	11 (11.46%)	0.4413	1 (6.66%)	11 (12.22%)	0.0751
11–20	20 (19.05%)	2 (22.22%)	18 (18.75%)		4 (26.67%)	16 (17.78%)	
21–30	20 (19.05%)	3 (33.34%)	17 (17.71%)		4 (26.67%)	16 (17.78%)	
31–40	45 (42.85%)	1 (11.11%)	44 (45.83%)		3 (20.00%)	42 (46.67%)	
≥41	8 (7.62%)	2 (22.22%)	6 (6.25%)		3 (20.00%)	5 (5.55%)	
HIGHEST LEVEL OF EDUCATION							
Elementary	7 (6.67%)	0	7 (7.28%)	0.1992	1 (6.67%)	6 (6.67%)	0.1112
High School	30 (28.56%)	1 (11.10%)	29 (30.21%)		8 (53.33%)	22 (24.44%)	
College	49 (46.67%)	4 (44.45%)	45 (46.88%)		6 (40.00%)	43 (47.78%)	
Graduate School	19 (18.10%)	4 (44.45%)	15 (15.63%)		0	19 (21.11%)	
ENGLISH PROFICIENCY							
No proficiency	11 (24.17%)	0	11 (11.46%)	0.0920	0	11 (12.22%)	0.0768
Yes proficiency	94 (75.83%)	9 (94.44%)	85 (88.54%)		15 (100%)	79 (87.78%)	
Basic	49 (26.37%)	2 (29.41%)	47 (55.30%)		4 (26.67%)	45 (56.96%)	
Conversational	39 (4.40%)	6 (%)	33 (38.82%)		10 (66.67%)	29 (36.71%)	
Fluent	6 (69.23%)	1 (70.59%)	5 (5.88%)		1 (6.66%)	5 (6.33%)	
PRIMARY LANGUAGE							
English	0	0	0	0.0046*	0	0	0.0484*
Not English	105 (100%)	9 (100%)	96 (100%)		15 (100%)	90 (100%)	
Korean	104 (99.05%)	8 (88.89%)	96 (100%)		14 (93.33%)	90 (100%)	
Mandarin	1 (0.95%)	1 (11.11%)	0		1 (6.67%)	0	

* Democratic People's Republic of Korea, official name of North Korea

Concerning the study participants' health care habits, no difference in knowledge of DOs or OMM was found between those who visited their doctor regularly versus those who did not see their doctor regularly (Table 2). Of those participants who regularly see their doctor, 88% reported seeing their family physician (Table 2).

Concerning the clinical scenario of lower back pain (LBP) presented to study participants, no participants indicated that they would see a DO compared to their family physician, chiropractor, acupuncturist or oriental medicine healer (Table 2).

TABLE 2:

Health habits of participants versus those with knowledge of DOs and OMM

QUESTION	ALL PARTICIPANTS (N=105)	KNOWLEDGE OF DOS (N=9)	WITHOUT KNOWLEDGE OF DOS (N=96)	P-VALUE	KNOWLEDGE OF OMM (N=15)	WITHOUT KNOWLEDGE OF OMM (N=90)	P-VALUE
DO YOU SEE A DOCTOR REGULARLY?							
Yes	79 (75.24%)	6 (6.67%)	73 (76.04%)	0.7861	12 (80.00%)	67 (74.44%)	0.6217
No	26 (24.76%)	3 (3.33%)	23 (23.96%)		3 (20.00%)	23 (25.56%)	
WHAT KIND OF DOCTOR DO YOU SEE?							
Family doctor	92 (87.62%)	8 (88.89%)	84 (87.5%)	0.6838	15 (100%)	77 (85.56%)	0.5878
OMM physician	0	0	0		0	0	
Chiropractor	4 (3.81%)	0	4 (4.17%)		0	4 (4.44%)	
Acupuncturist	6 (5.72%)	1 (11.11%)	5 (5.21%)		0	6 (6.67%)	
Oriental medicine	1 (0.95%)	0	1 (1.04%)		0	1 (1.11%)	
Physical therapy	1 (0.95%)	0	1 (1.04%)		0	1 (1.11%)	
Physician assistant	1 (0.95%)	0	1 (1.04%)		0	1 (1.11%)	
WITH LBP, WHAT DOCTOR WOULD YOU SEE?							
Family doctor	29 (27.62%)	2 (%)	27 (%)	0.8559	6 (40.00%)	23 (25.56%)	0.1654
OMM physician	0	0	0		0	0	
Chiropractor	25 (23.81%)	2 (%)	23 (%)		2 (13.33%)	23 (25.56%)	
Acupuncturist	21 (20.00%)	0	21 (%)		4 (26.67%)	17 (18.89%)	
Oriental medicine	21 (20.00%)	3 (%)	18 (%)		2 (13.33%)	19 (21.11%)	
Physical therapy	9 (8.57%)	2 (%)	7 (%)		1 (6.67%)	8 (8.88%)	
Physician assistant	0	0	0		0	0	

DISCUSSION

Among survey participants, there is a general lack of awareness of DOs and OMM in the Korean community in New York City's Queens Koreatown. The sole statistically significant factor appeared to be the primary language spoken at home, in this case, Korean, such that since no participants indicated other languages, this could be the reason for this finding. Compared to the inaugural study on awareness of DOs and OMM in New York City's Manhattan Chinatown, other factors such as age, English proficiency and education level were not statistically significant for the Korean community.[12] Before the aforementioned study, the decennial Osteopathic Survey of Health Care in America (OSTEOSURV) was the sole prognosticator for osteopathic recognition in the U.S. Released by the American Osteopathic Association in 1998, 2000 and 2010, Asian and Pacific Islander Americans are presumably included in the category of "Other (including >1 race)" and "Non-Hispanic," leading to a gross simplification and homogenization of this population in America.[13,14,21] Local, state and federal initiatives have validated the need for disaggregated data as a way of dissecting health trends and practices within Asian communities.[22,23] While the Chinatown study serves as a watershed for osteopathic research in minority communities; it cannot be a complete representation of the entire Asian and Pacific Islander racial group.[12] Unique sociohistorical and ethnolinguistic heritages separate Chinese and Korean communities, despite a shared experience of discrimination and struggle in America.[24] Therefore, translating the Chinatown survey into Korean was necessary to provide a targeted approach in contextualizing the lack of osteopathic awareness and potential barriers to outreach in the Korean community.

As with much of Asia and Oceania, OMM in Korea is a relatively new concept and branch of medicine in western medicine's larger pantheon. Founded in 1874, OMM was initially conceived as an alternative to traditional allopathic medicine.[25] In the same time period, the first western medical institution was opened in Seoul, in what would today be part of the Yonsei University Health System.[26] Similar to other East Asian groups in the sequential decades, western medicine, in the guise of allopathic medicine, has largely supplanted eastern and traditional Korean medicine; a set of practices that drew heavily from Sino-Japanese interactions as well as indigenous healers.[27,28] As with many Sino-Tibetan and Altaic families of language, semantic genericization of medical classifications and terminology have tended to defy native language schemas, resulting in an inability to capture the difference between osteopathic and allopathic medicine.[29] Jeongtong-uihag (정통의학) and its variants are used interchangeably with Western medicine to contrast itself from han-uihag (한의학) for traditional Korean medicine.[30,31] In recent years, efforts to expand osteopathic medicine in South Korea through international electives and academic partnerships have necessitated the neologism of jeong-gol uihag (정골 의학). However, it is a term that has yet to enter the vernacular of everyday usage.[32,33] Usage of jeong-gol uihag is further complicated as the terminology is applied equally to non-American practitioners of osteopathy whose philosophical roots mirror their American counterparts but lack the full scope of medical training.[1,34] Greater outreach and materials utilizing the jeong-gol uihag terminology can strengthen osteopathic recognition within the Korean community. With such a historical and linguistic context, greater outreach must be done to inform members of the Korean community of the American osteopathic profession.

Manual manipulation of the musculoskeletal system, however, is not unknown to the Korean community. Chuna (추나) is a traditional Korean medicine manipulation procedure that restores function and structural balance in a non-invasive manner and is applied to physical and psychiatric infirmities.[35,36] With a long-documented history in both Chinese and Korean texts, its methods and goals align fairly well with the osteopathic tenets espoused by its founder, Dr. A.T. Still.[37,38] Used in low back pain and other similar clinical scenarios, its usage is so prevalent that promotion and physician reimbursement is covered under the national insurance of South Korea.[39,40] Similarly, dosu (도수) describes a mix of chiropractic and physical therapy techniques aimed at stretching and relaxing targeted muscles while improving range of motion and body functions through musculoskeletal realignment.[41,42] Graphing this to modern osteopathic treatments, dosu combines post-isometric relaxation elements through muscle energy, functional positional release and high-velocity/low-amplitude thrust techniques with post-treatment patient exercise maintenance.[43] In South Korea, various providers administer chuna and dosu, ranging from orthopedic and pain management physicians to traditional Korean medicine practitioners and physical therapists.[29,39,40] Due to the similarity between OMM to existing Korean practices, survey participants easily understood osteopathic concepts and accepted its benefits when given information after the survey.

International licensure and practice rights continue to be a priority for the American Osteopathic Association (AOA), with recent efforts in the past decade to expand recognition and culminating in strategic global partnerships with the Osteopathic International Alliance and the Bureau of International Osteopathic Medicine.[2,3] In 2017, collaborations between the AOA, the Korean Society of Chuna Manual Medicine and Jaseng Medical Foundation fostered a greater understanding of osteopathic medicine with traditional Korean medicine.[40] This ultimately resulted in the Korean Ministry of Health and Welfare to allow osteopathic physicians to undertake licensing exams and be recognized as physicians.[2] Unfortunately, while having such successes abroad, limited outreach has been done in the U.S. to ethnic diasporas such as the Korean community.[12,14,44] Of note, most participants chose non-physician-based care (physical therapist, acupuncture, traditional medicine and chiropractor) in the clinical scenario of low back pain. Here, the observance of Koreans living near other Koreans helps to explain this result, as word-of-mouth plays a significant role in Koreans determining their primary mode of medical treatment.[45] Therefore, a multilayered approach and contextual/nuanced view are needed if osteopathic awareness and recognition occur in communities that lack exposure to the field.

With the broad implications of osteopathic awareness in the Korean community, this study has several limitations. The Korean community surveyed is but one of several high-density areas, with Manhattan's Koreatown enclave and New Jersey's Bergen County holding sizable numbers of Korean Americans who live and work in those locations. As the surveys were conducted mid-day, this survey may not be a true representation of osteopathic awareness in this large community. While the primary language spoken at home was the sole statistical significance, the study's confines presented challenges in determining the exact reason, as dialectical differences in the Korean language were not accounted for. Coupled with the familiarity between various Korean traditional medicine modalities and OMM, future studies could assess the effectiveness of OMM demonstrations/pamphlets on the willingness to see a DO, comparing multiple Korean communities in the tri-state area at varying times of the day or comparing osteopathic awareness across other Asian communities with a qualitative or mixed-method study.

CONCLUSION

There is a general lack of awareness of osteopathic physicians and osteopathic manipulative medicine in the Korean community in New York's Bayside Koreatown. Regardless of age, gender, country of origin, English proficiency or level of education, most participants did not recognize the profession, which may reflect the lack of outreach in ethnic minority communities. Despite OMM's proven efficacy on LBP, the majority of the Korean community surveyed did not know that OMM is a suitable option for conservative management. This study adds to research on osteopathic awareness in ethnic communities and may further potential outreach to develop specific programs in increasing their knowledge of the osteopathic field.

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REVIEW ARTICLE

ADULT HEARING LOSS : APPLYING THE FIVE MODELS OF OSTEOPATHIC MEDICINE TO DIAGNOSE AND TREAT

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KEYWORDS:

Hearing Loss

Lymphatic Treatment

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Somatic Dysfunction

ABSTRACT:

Hearing loss is a common complaint with extensive cognitive, physical, emotional, social and financial implications. Many adults are expected to present with varying degrees of hearing loss by the age of 60 to 69 years old that can be classified according to the cause into conductive, sensorineural and mixed. There can be associated symptoms, like tinnitus, vertigo and otalgia and/or abnormal behaviors such as social withdrawal and difficulty with interpersonal communication. Somatic dysfunctions can accompany hearing troubles and range from fluid problems such as fluids accumulation in the middle ear, lymphatic congestion of the head and neck, and structural dysfunctions in the eustachian tube, neck musculature, thoracic spine, ribs and the cranial rhythmic impulse in addition to other neurologic dysfunctions such as sympathetic hyperactivity and viscerosomatic changes. In this review, we provide several suggestions that may assist the osteopathic family physician in identifying the various causes behind the hearing loss, especially life-threatening or quality-of-life limiting causes. We will also provide an effective treatment addressing the cause of the hearing loss presentation and associated somatic dysfunctions, alone or in conjunction with other appropriately trained health care providers, based on the understanding of the five models of osteopathic medicine and how they can apply toward the anatomical and physiological components of adult hearing loss.

INTRODUCTION

The auditory system is an excellent illustration of structure and function. Each type of hearing loss is associated with many etiologies that can be conductive, sensorineural and mixed.[1] Conductive hearing loss will result from impedance of sound wave transmission to the inner ear. In contrast, sensorineural hearing loss occurs when the inner ear fails to transduce these waves into an electrical signal. Whereas mixed hearing loss is a combination of either type to differing degrees.[2] Hearing loss is a common problem many adults will face at some point, given its strong association with aging.[2] This is of utmost significance, given that different degrees of hearing loss can have substantial cognitive, emotional, social and financial effects.

The physician should take special care to be attentive to all those effects and aspects of the patient's health history and profile. The osteopathic family physician can address most hearing loss presentations, alone or in conjunction with other appropriately trained health care providers. However, osteopathic family physicians are also well suited for managing such patients' care, given their understanding of the five models of osteopathic medicine and how they can apply to adult hearing loss's anatomical and physiological components.

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EPIDEMIOLOGY

Within the United States, an estimated 30 million adults have some degree of hearing loss.[2] The prevalence of hearing loss increases with age, given that a remarkable 77% of adults 60 to 69 years old can be expected to have some degree of hearing loss.[3] Hearing loss can hinder activities of daily living, especially in the elderly, a population more susceptible to poorer quality of life. Hearing loss has also been associated with dementia, depression, debility, delirium, falls and mortality.[2] Nevertheless, improvement in life quality and physical function is attainable after amplification via cochlear implants.[3]

In younger age groups aging 20 to 69 years old, men are more susceptible to hearing loss and double the risk compared to females.[4] Non-Hispanic white adults are more likely to suffer from hearing loss than other ethnic groups, whereas non-Hispanic black adults have the least prevalence.[4] About 18% of adults who report five or more years of occupational exposure to very loud noise have speech-frequency bilateral hearing loss.[4] This latter type of hearing loss can be preventable.

PATHOPHYSIOLOGY

Hearing loss can be categorized into conductive, sensorineural and mixed hearing loss. In conductive hearing loss, the transmission of sound waves is impaired due to structural damage or an anatomical abnormality confined to the outer ear, cerumen impaction of the auditory canal and/or impairment of the ossicles found within the middle ear.[1] (Table 1) For example, elderly individuals with hearing aids are at risk for developing chronic otitis externa; hearing aids promote a dark, warm and alkaline environment ideal for bacterial growth, breakdown of the cerumen barrier, inflammation and edema of the outer ear skin, which subsequently leads to impaired transmission of sound waves.[5]

TABLE 1:

Differential diagnoses for hearing loss

CAUSE	TYPE OF HEARING LOSS	SPECIAL TESTING CONSIDERATIONS	FEATURES
OUTER EAR			
Otitis externa	Conductive	Otoscopy	Associated with trauma, swimming, hearing aids, other dermatologic conditions (psoriasis). A necrotizing type is associated with diabetes mellitus and the immunocompromised.[5]
Trauma/post-concussion syndrome	Conductive / Sensorineural / Mixed	Otoscopy	Fractures involving the inner ear will have both hearing loss and vertigo components
Cerumen	Conductive	Otoscopy	Cerumen is much harder and migrates much more slowly out of the ear canal in the elderly[1,68]
Exostosis	Conductive	Otoscopy	Firm, sessile, multinodular bony masses, associated with cold water exposure[69]
Osteoma of external ear canal	Conductive	Otoscopy	Found along tympano-squamous suture line, more medial to TM versus exostoses and solitary[70]
Squamous cell carcinoma	Conductive	Otoscopy, CT, MRI	Most common malignancy of EAC. May be mistaken for otitis externa on initial clinical inspection[71]
MIDDLE EAR			
Eustachian tube dysfunction	Conductive	Physical evaluation	Can predispose adults to acute otitis media and serous otitis media
Otitis media	Conductive / Sensorineural	Otoscopy, Tympanogram	Fluid prevents movement of the tympanic membrane[2]
Cholesteatomata	Conductive / Sensorineural	Otoscopy, CT, MRI	Desquamated, stratified, squamous epithelium expands and erodes into bony covering of the middle ear and inner ear[72]
Otosclerosis	Conductive / Sensorineural	Tympanogram	Stapes abnormally grows and eventually fixates, which leads to dysfunction[73]
TM perforation	Conductive	Otoscopy	Usually due to trauma from foreign bodies, barotrauma, acute otitis media and chronic otitis media[2]
INNER EAR			
Presbycusis	Sensorineural	Physical evaluation	Proposed mechanisms of injury are sensory and/or metabolic[6]
Labyrinthitis	Sensorineural	Physical evaluation	Inflammation of the inner ear labyrinth associated with nystagmus, nausea and vomiting.[2] Vestibular neuritis isn't associated with a hearing component.
Meniere Disease	Sensorineural /Fullness	Enhanced MRI, CT	Mostly unilateral, endolymphatic hydrops occurs secondary to obstruction of the endolymphatic sac or duct[74]

Noise exposure	Sensorineural	Physical evaluation	Can be temporary or permanent, depending on the intensity and duration of exposure. Proposed mechanism of disease is permanent loss of hair-cell ribbon synapses.[1,7]
Tumors of cerebellopontine angle	Sensorineural	Enhanced MRI, CT	Unilateral, i.e., schwannomas, meningiomas[2]
Ototoxic substances	Sensorineural	Physical evaluation, Drug levels	Usually bilateral, aminoglycosides, salicylates, cisplatin and other toxic agents to sensory hair cells[75]
SYSTEMATIC DISEASE			
Cerebrovascular accident	Sensorineural	Physical evaluation, CT, MRI	Infarction involving posterior circulation usually involving the anterior inferior cerebellar artery
Multiple Sclerosis	Sensorineural	Physical evaluation, MRI, lumbar puncture	Unilateral or bilateral, transient, rule out other conditions[1]
Hypothyroidism	Sensorineural	Physical evaluation	Usually bilateral

On the other hand, sensorineural hearing loss involves the cochlea, spiral ganglion neurons and more proximal auditory structures.[1] Age-related hearing loss (presbycusis) is the most common and symptoms usually manifest bilaterally. At a high frequency (≥ 2000 Hz), patients will usually experience notable hearing deficits.[1,6] Another common culprit is noise exposure and this happens via two mechanisms. One mechanism is sensory and may involve mechanical stress of intense sound pressure upon the inner ear's sensory hair cells. The second mechanism is metabolic and may involve the activation of stress-induced molecular pathways, including the generation of reactive oxygen species and excessive calcium.[1,7] Additionally, patients with inner ear pathology, i.e., schwannoma and Meniere's disease[8], usually report tinnitus or perception of noise or ringing in the ears.

Furthermore, hearing troubles can be associated with a plethora of structural dysfunctions in the eustachian tube (ET), neck musculature, thoracic and ribs, neurologic dysfunction that may include sympathetic hyperactivity and viscerosomatic changes, and, last but not least, fluid problems such as fluids in middle ear and lymphatic congestion of head and neck.[9] For example, ET dysfunction can show a poor response of tympanic membrane (TM) to insufflation, but hypertonicity in the posterior pharyngeal muscles, the medial pterygoid, and the digastric muscles and/or dysfunction of the hyoid bone may also play an important additional role in the presenting ET dysfunction.[10] Normally, the ET ventilates the middle ear with swallowing, sneezing and yawning. When the ET becomes blocked, i.e., an infection, pressure changes retract the TM. This can lead to transudate accumulation, otitis media with effusion (OME) and hearing loss.

Another dysfunction that should be investigated is related to the cranial rhythmic impulse (CRI). CRI continuous cycle of internal and external temporal rotation may assist in the ear's drainage.[11,12,13] Occipito-mastoid or spheno-squamous compression can lead to sustained internal rotation of the temporal bone; consequently, temporal bone dysfunctions can be a risk factor in cases of impaired hearing and vertigo through maintaining partial or complete closure of the ET. Unilateral internal rotation temporal dysfunction has been reported with otitis media in children and adults.[14] Various osteopathic manipulative techniques have been shown to be beneficial in treating patients with otitis media.[15,16,17]

STRUCTURAL CONSIDERATIONS

The temporal bone's petrous portion encases the middle ear and amplifies the sound waves received through the tympanic membrane via the bony ossicles.[18] The ET controls the pressure inside the middle ear and connects it to the lateral nasopharynx. Ciliated epithelial cells continuously deliver secretions from the middle ear to the nasopharynx. The ET has a lateral bony part fashioned by the petrous bone and the greater sphenoid wing and a medial cartilaginous part. Pharyngeal muscles, namely the Tensor veli palatini and salpingopharyngeus muscles, open the ET, while the levator veli palatini muscle and the palatine aponeurosis act to elevate the soft palate to seal the nasopharynx from the oropharynx when needed. An additional muscle worth mentioning is the sternocleidomastoid (SCM) muscle, which attaches to the mastoid process of the temporal bone, and the temporomandibular joint (TMJ) located anterior to the ear.[10,19]

The TMJ is a hinge joint formed by the head of the mandible and mandibular fossa of the temporal bone separated by a fibrocartilagenous articular disc. The lateral pterygoid muscle is attached to open the mouth.[20,21] The suprahyoid muscles, mylohyoid, geniohyoid and digastric muscles, open the mouth via a hinge-like movement, while the lateral pterygoid muscles provide a simultaneous anterior glide movement. The temporalis, masseter and medial pterygoid muscles close the mouth. Patients with TMJ dysfunction can find it difficult to open their mouth fully accompanied by a mandible shift to the side of dysfunction.

Sympathetic supply to the ear originates from spinal levels at T1–T4 accompanying the arterial supply, trigeminal nerve and gray rami communicate C1–C2.2[2,23] Sympathetic visceral afferent nerves and the trigeminal nerve convey somatovisceral reflexes to the structures of the head and neck and muscles of mastication and high cervical paraspinal musculature.[24] The facial nerve conveys the chorda tympani parasympathetic supply via the pterygopalantine ganglion to the ear, the upper respiratory tract, eye, palatine, submandibular and sublingual glands.[25,26] The facial nerve chorda tympani and its motor division run through the temporal bone's internal auditory meatus accompanied by the vestibulocochlear nerve.[27] Facial nerve parasympathetic fibers reach their target organs via the trigeminal, as well as the high cervical gray rami communicates.[28,29,30,31] Parasympathetic

innervation, motor innervation to the muscles of mastication, especially temporalis muscle and innervation to the high cervical paravertebral region carry parasympathetic viscerosomatic reflexes to different head and neck regions. Preauricular and postauricular lymph nodes receive lymphatic drainage from the ear, then drains through the thoracic inlet to the thoracic duct and right lymphatic duct.

CLINICAL EVALUATION

Patients will normally present with hearing impairment that is self-recognized and/or by others around them. There may be associated behaviors such as social withdrawal and difficulty with interpersonal communication. Sometimes there will be various associated symptoms, like tinnitus, vertigo and otalgia, which can be associated with specific SDs. (Table 2) Ask about the duration and laterality of hearing loss and whether it's fluctuating or progressive. Consider depression and dementia as a differential for hearing loss[2] and how age may impact hearing loss prevalence. The physician should take a holistic approach and adequately examine these complaints in addition to screening related anatomy and systems, i.e., posterior pharynx, medial pterygoid, cranium, TMJ, cervical and thoracic spine ribs, and TM insufflation. Ear position can be examined during the standing structural exam. Pain elicited from pulling on the pinna gently upward and posteriorly indicates otitis externa. Hypertonia in the cervical myofascial tissues can interfere with the lymphatic flow[32] and should also be excluded. Look for signs of inflammation that involves the ear and using otoscopy examine inner ear structure. The TM normally should be pearly white. Second, evaluate for motion by insufflation or a tympanogram. A hearing test is appropriate for specific complaints and suspected occupational troubles.

The SCREAM mnemonic stands for sudden hearing loss, cerumen impaction, auditory rehabilitation, education, assistive devices and medications.[2] (Table 3) According to SCREAM, if the patient was identified to have sudden idiopathic during clinical evaluation or suspected to be suffering from presbycusis, audiometry can confirm the hearing loss finding. If not emergent, consultation with an otolaryngologist should occur within one week. Yet given the many possible pathologies responsible for the different hearing loss types (Table 1), one must consider a broad differential and know who to consult appropriately.

The whispered voice test and tuning fork are common methods to diagnose hearing loss.[33,34] The former can screen hearing status; the latter can investigate the type and laterality of hearing loss if existent. In a normal Weber tuning fork test, the sound should be heard equally on both sides, but that can also be true if hearing loss is symmetrical. The Rinne tuning fork test can identify conductive hearing loss if the vibrating fork is heard louder when placed on the mastoid process contrasted with next to the ear. A prevalent cause for conductive hearing loss in adults is cerumen impaction. Patients might present with a persistent nonproductive cough if cerumen irritates the auricular branch of the vagus nerve or appear withdrawn and relatively unresponsive if the cerumen impaction cause diminished hearing.

Chapman's points, palpable tender sharp pinpoint nodular masses, if existent, can be used to facilitate diagnosis. Posterior Chapman tender points for middle ear infections may be found at the posterior aspect of the tip of the first cervical vertebra's transverse process.[35] In contrast, anterior Chapman tender points are located on the upper edge of the proximal clavicle as it crosses over the first rib. Table 4 lists Chapman points associated with head and neck structures.[36]

TABLE 2:

Symptoms associated with hearing loss

HEARING LOSS ASSOCIATED SYMPTOMS	POTENTIAL DYSFUNCTIONS
Tinnitus	• ER temporal bone, especially low pitched roaring noises • IR temporal bone, especially high pitched roaring noises • Temporomandibular disorders
Vertigo	• ER temporal bone • IR temporal bone
Referred Otalgia	• Dysfunctions from the teeth, tongue, tonsils, esophagus • TMJ dysfunction • Referred from cranial nerves V, IX and X • C1–2 spinal segments dysfunction • Trauma • TMJ joint inflammation • Dysfunctions of the head, neck and upper back regions • Stress, depression and fatigue • Habits such as gum and ice chewing[76]
Malocclusion, Bruxism, jaw clenching[77]	• TMJ dysfunction • Trigger points (especially in the pterygoids, masseter and digastric muscles) • Cranial dysfunctions • Stress-induced general muscle hypertonicity

TABLE 3:

SCREAM mnemonic

CONCERN	DESCRIPTION	EVALUATION
Sudden hearing loss	≥ 30 dB hearing loss at three consecutive frequencies over 72 hours	Rule out conductive hearing loss or a readily identifiable cause
Cerumen impaction	Occlusive cerumen	Perform otologic examination
Auditory rehabilitation	Improve hearing environment	Assess patient's and family's current knowledge and habits
Education	Provide the patient and his or her family with information about hearing loss, protection and management	Assess the patient's knowledge, beliefs and stage of change
Assistive devices	Technology to augment hearing, including over-the-counter devices	Determine whether the patient is a candidate for over-the-counter devices or if audiological testing for hearing aids is necessary
Medications	Evaluating and mitigating medications with toxicity	Determine the patient's current and past use of ototoxic medications

TABLE 4:

Chapman tender points for HEENT

CHAPMAN TENDER POINTS	STRUCTURE	LOCATION
Anterior	Nasal sinuses	Bilaterally 7 to 9 cm lateral to the sternum on the upper edge of the second ribs
	Pharynx	The first ribs 3 to 4 cm medial to where the ribs emerge from beneath the clavicles
	Larynx	The second ribs, 5 to 7 cm lateral to the sternocostal junction
	Tonsil	Between the first and the second ribs adjacent to the sternum
	Middle ear	The superior/anterior aspect of the clavicles just lateral to where they cross the first ribs[78]
Posterior	Posterior nasal sinuses, pharynx and larynx	C2, midway between the spinous process and the tip of the transverse process
	Tonsil	C1 midway between the spinous process and the tip of the transverse process
	Middle ear	Posterior aspect of the tips of transverse processes of C1

ET dysfunction can result from a variety of dysfunctions, i.e., myofascial trigger points (MTrPs) in the medial pterygoid muscle (Table 5), vagus nerve, IR temporal, torsion, side bending of SBS (sphenobasilar symphysis).[37,38] Certain disorders, for example, Meniere's disease, can be associated with specific temporomandibular, craniomandibular and cervical spine SD and can be linked to specific somatic movements.[39,40,41]

TABLE 5:

Myofascial trigger points (MTrPs)

SOMATIC DYSFUNCTION	MTrPs TECHNIQUE	POTENTIAL TREATMENT TARGETS
Travell trigger with EENT symptoms[37,79]	• Deep portion of masseter (upper most posterior angle of the masseter) • SCM clavicular head • Medial pterygoid • Occipitalis, according to Kellgren	• Ear pain, tinnitus and/or diminished hearing
ET dysfunction	• Medial pterygoid	• Ear fullness, unilateral tinnitus and hearing loss
TMJ disorders	• Masseter • Pterygoids • SCM clavicular head • Occipitalis • Digastric	• Dysfunction of eye, ear, nose and throat • Deep ear pain • Hearing loss
Low roaring tinnitus	• Masseter	Can vary when jaw is opened
Ear stiffness	• Medial pterygoid	Inability of tensor veli palatine to move medial pterygoid and associated fascia and open ET[10,30]

Furthermore, the physician should seek to identify any possible increased number of cranial strain patterns.[42] Cranial vault hold can assess the primary respiratory mechanism and general cranial movement[30,43,44] and identify temporal bone dysfunction, unilateral or bilateral. Temporal bones closely relate to one another and the skull base's midline bones, the sphenoid and the occiput. A protruding ear may indicate an externally rotated temporal bone. The temporal bones externally rotate accompanied by spheno-occipital flexion and internally rotate with extension. The physician should also look for SCM hypertonicity, which may facilitate a dysfunctional internal rotation of the temporal bone.[10]

On the other hand, a fronto-occipital hold is particularly useful when assessing the SBS. For instance, the restriction of temporal external rotation could suggest the SS pivot's motion restriction, a common finding with ENT complaints such as ear pain and jaw pain. It may result from the medial or lateral pterygoid muscle's facilitation, which crosses the suture at its bevel and refer pain to the ear and face.[45] Another example is unilateral petrojugular synchondrosis motion restriction commonly associated with vertigo suggested by the paradoxical motion of a temporal bone (the temporal moves into internal rotation with occipital flexion). Anterior occiput dysfunction and anterior atlas dysfunction produce ipsilateral pain in the region of the ear and behind the eye, respectively.[28] Upper respiratory symptoms may result from dysfunction involving the base of the skull and face.

TREATMENT

An osteopathic approach should be used to holistically address the patients' body, mind and soul and investigate their specific nutritional needs and functional capacity. Next, the physician should consider all possible diagnoses and take adequate time to discuss risk factors and patients' treatment plans. Moreover, the physician should separate causes that can be life-threatening or limit life quality to a great degree. Effective treatment will be directed towards the cause behind the hearing loss and associated somatic dysfunctions (SDs). For example, a counterstrain technique is preferred if pterygoid muscles trigger points aren't the cause behind the TMJ, SD and will be more effective in opening the ET. On the other hand, a Galbreath technique may aggravate the joint in such a scenario and better be avoided.

Osteopathic manipulative treatment (OMT), including those intended for prevention, should be integrated with simultaneously disease-focused approaches to hearing loss to yield the greatest benefit. Previously the otolaryngologist Teachey found that MTrPs were responsible for over 40% of complaints in a series of 250 patients whose complaints varied between pain, headaches or ear, nose, throat symptoms.[46] MTrPs can be aggravated with cold and emotional stress. When treated, they can help in complaints such as hyperacusis, hypoacusis, auricular FB sensation, "blocker" ears, hearing loss, tinnitus and dizziness with normal otolarnygic and audiometric studies. (Table 5)

OMT should address structural, autonomic and fluid aspects of the dysfunction. Generally soft tissue techniques, i.e., muscle energy, soft tissue stretching, myofascial release, are most suitable for dysfunctions due to soft tissue tension. Myofascial dysfunction in pharyngeal and laryngeal muscles can again respond well to OMT, like the Galbreath technique. Normally these muscles are responsible for yawning and swallowing that open the eustachian tubes and are innervated by glossopharyngeal and vagus nerves. Finger surgery, a direct digital technique, can release nasopharyngeal adhesions around the eustachian tubes through its direct gentle pumping action.[47] Eustachian tube dysfunction can predispose to otitis media, especially in children whose ET is shorter and more horizontal than adults.[48,49,50] ET dysfunction responds well to the treatment of SDs affecting the cranium, cervical and thoracic spine, medial pterygoid muscle, cervical fasciae and sacrum. Extensive OMT involving the diaphragm, pelvis and even the lower extremities, may be required in select cases.

The sympathetic component in the form of facilitated thoracic dysfunction or Chapman's points should also be addressed. Posterior Chapman's points should be treated first and then residual tender anterior points can be gently treated with soft tissue. Counterstrain and facilitated positional release are the best options to reduce neural reflex activity. High-velocity low-amplitude thrust (HVLA) and low-velocity/moderate-to-high-amplitude articulation procedures may address dysfunctional articular mechanics. OMT sessions should be spaced out, and its amount increased incrementally, according to the patients' response, especially for slow responders[51], i.e., elderly, to prevent a rebound reaction OMT. Acceptable rebound reaction can typically last 12–48 hours after the first or second treatment. It can vary from slight fatigue to an intensified sense of pain and can readily be produced by soft tissue techniques.

OMT can be specifically beneficial and cost-saving for challenging diseases like Meniere's diseases,[52] whose patients may seek benefits from complementary and alternative approaches.[53,54,55] Korr *et al*. revealed an improvement in 79% of Meniere's patient's cases treated with OMT.[56] Adamek K. *et al*. demonstrated a significant impact on various symptoms like hearing loss, vertigo, aural fullness and tinnitus with three weekly visits.[57] Even in comparable scenarios that seems to preclude improvement with OMT, the biopsychosocial model can still be utilized to relieve anxiety, stress and tension. Hereby, we will list several specific osteopathic considerations regarding osteopathic models that may be addressed when managing a patient with hearing loss.

Biomechanical model considerations

The physician can initiate his treatment with various soft tissue techniques to induce patient relaxation and reduce patients' guarding during further OMT and promote the doctor-patient relationship. Soft tissue techniques, such as suboccipital release, supine traction and various fulcrum techniques, can promote circulation to the region by local physical and thermodynamic effects or somatic-somatic or somato-visceral reflexes to improve circulation in a distal area. Venous and lymphatic drainage can be potentially induced to reduce local and/or distal swelling and edema and boost immune response, local tissue nutrition, oxygenation and removal of metabolic wastes. Like in all other OMT, dexterity holds the utmost significance. For example, when performing traction techniques in patients with TMJ dysfunctions, place your hands on the forehead instead of the mandible.

Respiratory-circulatory model considerations

Lymphatic techniques should be used in a stepwise fashion to address associated thoracic/costal, upper lumbar SDs or lymphatic congestion in the ENT region. (Table 6) For example, myofascial release (MFR) techniques can be used to release thoracic inlet myofascial restrictions. Muscle energy techniques (MET) can be directed at the cervicothoracic junction as well. Cervical MET may improve local circulation and respiratory function.[58,59,60,61]

Additionally, a post-isometric relaxation technique can be used to address trapezius muscle hypertonicity, SCM dysfunction and cervical SD. Reciprocal inhibition is useful for any associated SCM spasm (acute torticollis). Acute oculocephalogyric reflex, another MET, can be combined with any of the cervical METs.

Second, balanced ligamentous tension (BLT) and ligamentous articular strain techniques can also address lymphatic congestion or local edema in the cervical region, i.e., occipitoatlantal (OA, C0–C1) dysfunction, atlantoaxial (AA, C1–C2) dysfunction, C2–C7 dysfunctions.[30,62,63,64] Third, articulatory and combined techniques can address both the circulatory and lymphatic congestion and articular and myofascial SDs arising from the restricted motion of C2–C7 dysfunctions.[30,65,66] Articulatory techniques are particularly useful in the frail or elderly. In cases of hearing loss, OMT can address both the ear and associated SDs, i.e., sinusitis. Reevaluate the cervical range of motion (ROM) and TART diagnostic parameters of the dysfunction to determine the technique's effectiveness. Decreased muscle tone and improved body carriage are signs of successful treatment.

Neurological model considerations

Cranial manipulative techniques are indicated in common complaints from patients with hearing loss such as headaches, vertigo and tinnitus, otitis media with effusion and serous otitis media, TMJ dysfunction and sinusitis. (Table 7) Throughout OMT, continuously note the amplitude, rate and regularity of the CRI. Techniques directed at cranial dysfunctions aim to synchronize cranial torsions, temporal bone external and internal rotations, normalizing flexion and extension of the sphenobasilar symphysis and removing areas of dural strain.[67]

CONCLUSION

Hearing loss in adults has a wide range of causes and can be a common presentation for the osteopathic family physician. Identifying the specific cause behind the hearing loss should be the first step towards effective, successful management. After excluding serious conditions, adjunct OMT can be a useful addition to a complete holistic approach. The five osteopathic models can address the causes precipitating the presenting condition, associated dysfunctions and disability, and preventive measures.

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TABLE 6:

Lymphatic techniques[82,83]

TECHNIQUES	SOMATIC DYSFUNCTION	POTENTIAL TREATMENT EFFECTS
• Thoracic inlet fascial release	• Clavicular SD • Upper thoracic SD • Ribs SD	• Reduce sympathetic facilitation upon the head and neck • Improve respiratory motion • Improve lymphatic drainage
• Myofascial release • Counterstrain • Still technique • Muscle energy • High-velocity, low-amplitude (HVLA)	• Upper thoracic SD • Ribs SD	• Reduce sympathetic facilitation to head and neck • Improve lymphatic drainage
• Myofascial release • Counterstrain • Still technique • Muscle energy	• Anterior neck dysfunction • Laryngitis • Pharyngitis • Anterior cervical arches • Cough	• Address hyoid, omohyoid, SCM, anterior vertebral dysfunctions • Improve lymphatic drainage • Decrease tension on the eustachian tubes
• Still technique • Muscle energy	• Cervical spine SD	• Address mechanical, sympathetic and fluid components
• Ruddy's resistive duction techniques	• General congestion	• Relieve symptoms • Decrease general swelling by use of muscular pumps to move lymphatic fluids from areas of congestion
• Fronto (facial) temporomandibular drainage & effleurage	• Frontal region • Mandibular region	• Relieve symptoms • Improve lymphatic drainage
• Cervical chain drainage ("milking")	• Ear region • Otitis media • Otitis externa	• Improve lymphatic drainage • Do not perform directly over painful, indurated lymph nodes
• Traction on the pinna	• Ear region • Otitis externa	• Improve function of the eustachian tube • Decongest the middle ear • Involve an abrupt application of force that can be very painful, more appropriate for adults than for children
• Auricular drainage	• Ear region • Otitis media • Otitis externa	• Relieve symptoms • Improve lymphatic drainage
• Galbreath technique (mandibular drainage) [80,81] • Muncie finger surgery	• ET dysfunction	• Stretch the medial pterygoid muscles and overlying fascia • Encourage eustachian tube opening • Drain the eustachian tube • Care must be taken in patients with active TMJ dysfunction (e.g., painful click) with severe loss of mobility and/or locking
• Submandibular release • Suboccipital release	• Tongue • Salivary glands • Lower teeth • TMJ SD	• Relieve symptoms • Enhance fluid drainage • Restores normal vagal tone • Address spasm and hypertonicity of the cranial base
• Maxillary drainage, effleurage	• Maxillary sinus	• Myofascial massage to stimulate drainage of the surrounding tissues, relieve pressure within the sinus
• Alternating nasal pressure/ frontonasal distraction	• Ethmoid sinus	• Myofascial massage help stimulate drainage of the surrounding tissues to relieve pressure within the sinus
• Trigeminal stimulation technique & effleurage	• Trigeminal nerve • Supra orbital, infra orbital & submental foramina	• Thinning of the secretions • Constriction of the vessels allowing for increase in sinuses drainage

TABLE 7:

Neurologic model osteopathic manipulative treatments

TECHNIQUE	SOMATIC DYSFUNCTION	POTENTIAL TREATMENT EFFECTS
• Unilateral temporal rocking	• External or internal temporal rotation	• Treat temporal external/internal rotation SD
• Temporal BMT	• Externally rotated temporal bone	• Address low pitched roaring tinnitus • Address dural strains, lack of motion and swelling • Address dry eyes, reduced salivation and hyperacusis
• OA and/or vagus	• Temporal bone dysfunction	• Address unilateral tinnitus and hearing loss
• Sutural spread	• Restricted cranial sutures	• Release a restricted cranial suture (i.e., occipitomastoid suture)
• Compression of the fourth ventricle	• Parasympathytic outflow, pain, anxiety	• Augment the healing capabilities of the patient • Relax the patient • Improve the motion of the CRI
• Sphenopalatine ganglion procedure and effleurage[28]	• Pterygoid fossa congestion	• Improve autonomic and fluid functions • Decongests pterygoid fossa indirectly • Normalize the function of the eustachian tube • Relax the medial pterygoid muscle • Enable the tensor veli palatini muscle to functionally open the eustachian tube
• Counterstrain to medial pterygoid (jaw angle point) & Masseter [84,85,86]	• Head/cranium and/or cervical region	• Target pain in the neck, face, jaw, ear or temporomandibular joint[85,87]
• Counterstrain to midline PC3 spinous process	• Cervical spine	• Aim at suboccipital headache, earache, tinnitus and/or vertigo[85,87,88]
• Posterior Chapman's points	• Sympathetic outflow	• Improve reflexes to and from the head, eyes, ears, nose and throat • Modify sympathetic outflow
• Sacral and/or coccyx SD techniques • Vibratory percussion hammer techniques	• Ganglion impar dysfunction	• Release the ganglion impar to optimally function and communicate with thoracic sympathetic chain • Release tension in the cervical and upper thoracic spine due to sacral and/or coccygeal restrictions • Help with associated chronic otitis media

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REVIEW ARTICLE

NIGHTTIME BLUE LIGHT EXPOSURE AND BREAST CANCER

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KEYWORDS:

Estrogen

Hypothalamus

Melatonin

Nighttime Blue Light

Pineal Gland

ABSTRACT:

The purpose of this article is to provide background information and the current understanding of a less familiar cause of female breast cancer; exposure to ultraviolet light at night. Breast cancer is a common disease that causes significant morbidity and mortality in women. There are several risk factors for breast cancer, most of which are genetic and environmental in nature. An often-overlooked risk factor is exposure to blue light during night shift work, which decreases melatonin production. One of the many cancer-preventing properties of melatonin is to limit estrogen production. Increased lifetime exposure to estrogen is a well-known cause of breast cancer. Awareness of nighttime blue light exposure as a breast cancer risk factor by women doing night shift work and those exposed to nighttime light via smartphones and laptops, is essential information to know so that protective measures can be taken.

INTRODUCTION

This article intends to increase awareness of night light exposure as a risk factor for female breast cancer. Breast cancer is the second most common type of cancer for women living in the United States. In 2019, it was estimated there were 268,600 new cases and 41,760 deaths due to breast cancer.[1] Although the exact cause of breast cancer is unclear, several risk factors increase the likelihood of developing the disease. The lifetime risk of an American woman getting breast cancer is around 12%. About half of all cases occur in women with no known risk factors. Commonly mentioned risk factors include increasing age, genetic mutations (i.e., BRCA1, BRCA2), family history, obesity, alcohol consumption, smoking, radiation exposure, having the first child over 30-years-old, menopause onset later in life and post-menopausal hormone therapy.[2] Another potential lesser-known risk factor is the exposure to nighttime blue light, limiting normal melatonin production by the pineal gland.[3,4] This latter risk factor is considered in this article.

METHODS

Using PubMed® and Google, a thorough search of medical literature focused on exposure to night light as a risk factor for breast cancer development and its pathophysiological basis was undertaken. Emphasis was placed on recent scientific medical discoveries to link new epidemiological findings toward trends found in the modern workplace environment and how this impacts risk factors for developing this disease. An effort to identify potential clinical solutions to these epidemiological and pathophysiological causes for breast cancer was also examined.

LITERATURE REVIEW

Pathophysiological Mechanism of Exposure to Nighttime Blue Light

An often overlooked breast cancer risk factor is nighttime exposure to short-wavelength visible light in the blue range (LAN), especially that emitted from smart devices and laptop computers.[5] Overexposure to LAN interrupts the circadian rhythm, which interferes with melatonin release by the pineal gland.[4,6] Melatonin reduces estrogen production by influencing the hypothalamus-pituitary-ovary axis. High levels of estrogen and low levels of melatonin have been implicated in the development of breast cancer.[7,8] Serum levels of melatonin and estrogen are modulated, as shown in Figure 1. In the absence of light, neurons originating in the paraventricular nucleus of the hypothalamus (PVH) send a tonic signal stimulating preganglionic sympathetic neurons in the thoracic spinal cord. These fibers synapse on postganglionic cells in the superior cervical ganglion, which then project to the pineal gland stimulating production and secretion of melatonin. Alternately, in the presence of light, a small population of photosensitive retinal ganglion cells is activated, which stimulates the suprachiasmatic nucleus of the hypothalamus (SCN). The SCN has an inhibitory effect on PVH neurons, resulting in decreased secretion of melatonin.

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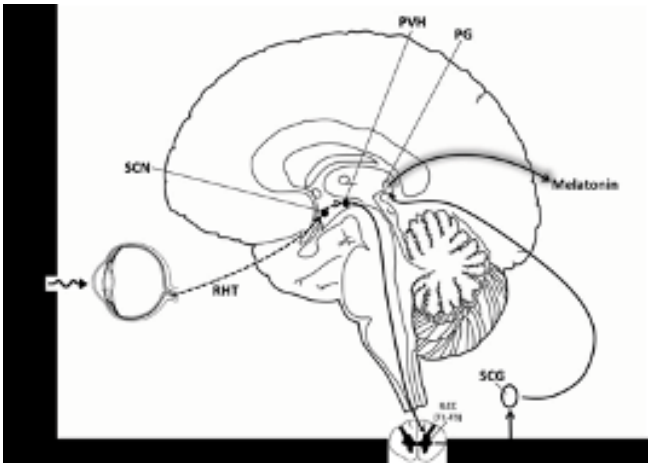
FIGURE 1:

Melatonin production pathway



Under normal (dark) conditions, the PVH sends tonic signals to the ILCC. Here, neurons ascend to the SCG, which projects to the pineal gland, where melatonin is produced and secreted (solid lines). Upon exposure to nighttime blue light, a unique subset of retinal ganglion cells is activated, which project to the SCN (via the RHT). The SCN projects too and inhibits the activity of the PVH (broken lines). RHT = retinohypothalamic tract; SCN= suprachiasmatic nucleus; PVH = paraventricular nucleus of the hypothalamus; ILCC = intermediolateral cell column; SCG = superior cervical ganglion; PG = pineal gland

Melatonin inhibits estrogen production by regulating enzymes involved in estrogen synthesis, thus acting as a selective estrogen enzyme modulator (SEEM).[9,10] The cancer-preventing effect of melatonin is due to a net reduction of estrogenic effects on breast cancer cells.[11] Estrogens are important in many aspects of malignancy; these include cell proliferation, metastasis, angiogenesis and immune evasion. Melatonin has been shown to mitigate all of these processes in the presence of estrogen.[10] Further, melatonin decreases the motility and invasive capabilities of breast cancer cells in vitro. This is due, at least in part, to melatonin's influence on certain cell surface adhesion molecules. Increased cell adhesion prevents potentially metastatic cells from becoming invasive. Estrogen has the opposite effect by downregulating adhesion molecules, thus increasing the invasive potential of the cell. It is possible that this could be another mechanism by which melatonin reduces the incidence and growth of breast cancer.[11]

Calcification of the Pineal Gland and Melatonin Production

The pineal gland is a conical organ positioned in the brain's geometric center (quadrigeminal cistern), weighing on average 150 mg. The pineal gland has a high propensity for calcification (PGC), which may begin as early as three years of age, whereas by 60 years-old, the incidence of PGC increases to greater than 70% in all populations studied worldwide.[12,13] Considering the myriad effects of melatonin on the human body, PGC's impact on melatonin production has naturally been the focus of numerous studies. Although the findings do not always agree, most evidence strongly suggests that PGC reduces melatonin levels.[14,15] Further, it has been demonstrated that PGC is correlated with an increased incidence of breast cancer in women.[16] Assessing PGC through imaging may provide additional information about preventing the development of breast cancer and/or predicting potential tumor growth post-diagnosis.

Epidemiological Linkage to Risk Factor

Many studies have focused on nighttime light exposure and the incidence of breast cancer. Female subjects assessed for breast cancer development include those who work at night in factories, as doctors, nurses and police officers. Table 1 shows that in all scenarios, these women have a higher incidence of breast cancer.[17-22] Further, women who live in areas with high levels of light (i.e., in the presence of neon and/or street lights) experience a higher likelihood of developing breast cancer. Somewhat predictably, blind women have a reduced incidence of breast cancer, presumably due to higher melatonin levels.[23,24] The literature review identified a few studies that found little or no connection between circadian rhythm disruption and breast cancer.[25,26] Investigators employing a large cohort study using serial questionnaires concluded that most populations with night light exposure histories did not experience an increased incidence of breast cancer. However, the authors did acknowledge that a small number of groups with different exposure histories did experience an increase in the development of the disease.[25]

A group of 27 scientists recently met at the International Agency for Research on Cancer to evaluate the carcinogenicity of night shift work (note that exposure to night light outside the context of shift work was not considered). The agency determined that a positive association exists between night shift work and breast cancer prevalence, although confidence in their conclusion was impacted by variation in the individual study parameters.[27,28] Additionally, other studies show as much as a 73% increase in the disease when comparing the lightest and darkest communities within a small geographic area.[29] These contradictory results are likely due to variation in the investigative designs. A major difficulty in determining the true impact of night light exposure is that authors conduct their studies using different parameters; for example, age, number of children, nulliparous or parous, length of exposure (shift length, years on the job) and light wavelength intensity may or may not be considered in a given study.

As more studies are conducted, it has become clear that other factors confound the likelihood of developing breast cancer as a function of circadian rhythm disruption. For example, flight attendants with three or more children and late-shift workers with longer periods of exposure to night light are more likely to develop breast cancer.[30] Another factor to consider is that breast maturation occurs through several stages, some of which may be more sensitive to carcinogens and/or melatonin levels. This might explain why studies have shown disparities in breast cancer incidence in younger versus older night shift workers.[31] It is especially important that women with other known risk factors (such as those with BRCA mutations) recognize the increased probability of developing breast cancer when also working late shifts.[32] Also, it is well-documented that obesity promotes the development of breast cancer.[33,34] The breast cancer risk of women classified as obese may be reduced by melatonin and through mechanisms that decrease body fat, inhibit heightened aromatase expression and counteract the oncogenic effects of

elevated leptin levels.35 Another connection is that the pineal gland volume of obese individuals is, on average, significantly smaller than that of lean subjects.36 This data implicates a mechanism that would explain how obesity, melatonin decline and breast cancer are related.

TABLE 1:[17-22]

Night shift occupation and increased incidence of breast cancer

OCCUPATION	INCREASED INCIDENCE OF BREAST CANCER
Flight attendant	32.4%
Nurses	58.0%
All night shift occupations	3-5% increased incidence/5 years

Clinical Management Strategies

Given that decreased melatonin levels are linked with a higher incidence of breast cancer, clinical avenues of management are needed to address this issue. Direct management can be made by administering melatonin to supplement deficiencies, which, in this case, might decrease the risk of breast cancer. Problematically, studies have shown tremendous variation in the quality of over-the-counter melatonin supplements that must be considered by the physician when prescribing melatonin.[37] Additionally, indirect preventive measures to lessen the incidence of breast cancer can be utilized by reducing electronic device use at night, blocking measures such as anti-blue light glasses or screen covers; and utilizing good nighttime sleep practices/hygiene to minimize blue light exposure.[4,38,39] In support of the use of blue light blocking glasses, at least one study has shown they prevent nocturnal melatonin suppression while having no adverse effects on shift work performance.[40]

CONCLUSION

Numerous studies have suggested that melatonin, naturally produced and exogenously supplied, acts as an anti-tumor agent against several cancers, including those of the breast, ovary, prostate and skin. The incidence of breast cancer increases in women who do late shift work due to exposure to nighttime blue light. This is linked to decreased melatonin production through neuronal pathways projecting to the pineal gland (the site of melatonin production). Essentially all studies reporting on the relationship between nighttime light exposure, melatonin levels and breast cancer employ methods and subjects that are considerably disparate. These discrepancies include age, genetic predisposition, a variation of nighttime light exposure (i.e., hours exposed/night, years on the job, light intensity), number of children, pre- or post-menopausal, obesity, smoking, etc. Designing and implementing a long-term study accounting for as many variables as possible would yield an enormous amount of information regarding breast cancer incidence as it is associated with the numerous combinations of risk factors.

In the clinic, we suggest that the patient's health care provider inquire about any habits that would expose her to nighttime blue light, such as employment schedule, use of technological devices, sleep environment and sleep schedule. These risk factors should be collectively considered when discussing the overall breast cancer risk with the patient. Further, alerting female patients to the unforeseen risk factor of exposure to nighttime blue light could make an important difference in many women's future health.

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REVIEW ARTICLE

LATERAL EPICONDYLITIS: A COMMON CAUSE OF ELBOW PAIN IN PRIMARY CARE

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Lateral epicondylitis (LE) is an overuse injury of the lateral elbow. LE is caused by repetitive motion leading to micro-injury of the wrist extensor muscles that originate along the elbow's lateral aspect. Although LE is commonly referred to as "tennis elbow" many cases are observed in non-athletes. Due to its prevalence in the general population, primary care physicians must be prepared to diagnose and treat LE. Physicians should look for a history of repetitive activities involving patient's jobs or recreational activities. Exam findings are characterized by pain and tenderness just distal to the lateral epicondyle of the humerus. Resisted movement with an extension of the wrist will typically elicit pain. Ultrasonography is considered the imaging modality of choice for diagnosing LE. Standard radiographs and magnetic resonance imaging (MRI) may be helpful. However, diagnosis can usually be made by history and physical examination alone. Most cases of LE respond favorably to conservative therapy. There are several nonoperative options for treatment, but a combination of non-steroidal anti-inflammatory drugs (NSAIDs) and physical therapy that utilizes eccentric muscle stretching is considered first-line. Osteopathic manipulative medicine is also useful in the treatment of LE. Muscle energy (ME) and joint mobilization techniques have been shown to be particularly effective. If non-surgical therapy fails, surgical intervention may provide patients with an additional benefit. This article will review some of the treatment options described above and discuss other diagnostic and therapeutic considerations relevant to LE's management in the primary care setting.

INTRODUCTION

Lateral epicondylitis (LE) is a common cause of lateral elbow pain.[1–4] It is often referred to as "tennis elbow" due to its prevalence among beginner tennis athletes learning the one-handed backhand. Despite its reputation for affecting tennis players, the majority of LE cases are observed in non-athletes.[5,6] LE frequently develops as a work-related injury that occurs in jobs requiring repetitive manual labor or keyboard typing.[1,7–9] LE has been estimated to affect about 1 to 2% of the adult population[2] and tends to occur in men and women equally, with a peak incidence between 35 and 55 years of age.[10,11] The prevalence of LE among the general population makes it a commonly seen condition in most primary care offices.[12,13] Due to its tendency for prolonged recovery, LE has been shown to account for significant amounts of lost recreation time, decreased quality of life and frequent work-related disability claims.[14] Thus, the diagnosis and effective treatment of LE is an important component in family physician practices.

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Proper management of LE is dependent on a thorough understanding of the underlying etiology and pathophysiology of the condition. As its name implies, LE's injury and pathology are typically localized to the musculotendinous attachments at the lateral epicondyle of the humerus. Although several muscles originate at the lateral epicondyle, the extensor carpi radialis brevis (ECRB) is the most commonly cited structure responsible for the symptoms of LE.[15–17] The primary function of the ECRB is extension and abduction of the wrist. High force, heavy loads, and repetitive or awkward motion in wrist extension and abduction can lead to microtrauma of the ECRB. Cumulative microtrauma may cause a transient inflammatory response in the acute phase and development of angiofibroblastic hyperplasia in more chronic presentations of LE.[18]

HISTORY

A detailed history of presenting illness is the first step to separating LE from other common lateral elbow pain causes. Other differential diagnoses to consider include radial tunnel syndrome/posterior interosseous nerve syndrome, osteochondritis dissecans, radiohumeral synovitis, radiohumeral bursitis, posterolateral elbow instability and referred pain from the cervical or upper thoracic spine.[19,20] Physicians should ask about the duration of the patient's symptoms, exacerbating factors, recreational activities or sports, and previous history of elbow injury.[21] Determining the patient's hand dominance and occupation may also provide valuable clinical information.

A history of repetitive activities typically precedes LE. Recent changes in duration and intensity of sports training or changes in duties or equipment at work must be considered. The onset of pain may be insidious or acute and pain severity ranges from mild to incapacitating. Patients will typically localize their pain as just distal to the lateral humeral epicondyle, sometimes with radiation into the proximal forearm. Pain may be present at rest and worsened with daily activities that involve wrist extension or gripping.[20]

PHYSICAL EXAM

A comprehensive physical exam is often sufficient to diagnose LE without the need for additional tests or imaging. The physical exam should evaluate the complete upper extremity kinetic chain, including the cervical and thoracic spine, shoulder and scapula. The exam should also include a neurovascular assessment of the affected limb.[4,22] Once referred pain, biomechanical abnormalities of the kinetic chain and neurovascular conditions have been excluded, the exam should shift focus to the elbow and wrist.

Inspection of the elbow typically lacks obvious evidence of injuries such as swelling or ecchymosis. Tenderness to palpation is usually appreciated at, or just distal to, the origin of the ECRB and is considered a hallmark finding for LE.[14, 23] Range of motion and muscle strength of the elbow and wrist should be assessed, as grip strength may be diminished due to pain.[20]

DIAGNOSIS

The diagnosis of LE is mainly one of clinical suspicion. A thorough history and physical exam are typically all that is needed to make this diagnosis. The Thomsen test may be helpful when evaluating a patient with lateral elbow pain. This test involves flexing the shoulder to 60º, extending the elbow, pronating the forearm, extending the wrist to 30º and then asking the patient to further extend the wrist against pressure applied to the dorsum of the patient's hand.[4] Pain with this maneuver is considered a positive result. The chair test may also help narrow the diagnosis. This test involves lifting a chair with the forearm pronated and the elbow extended. A positive chair test occurs when the patient experiences pain at the lateral epicondyle.[24]

Other provocative tests such as the Cozen, Mill and Maudsley tests are commonly used in clinical practice to diagnose LE. They are all considered positive if they reproduce lateral elbow pain.[25] None of these tests are superior to the others and their diagnostic utilities are still under investigation.[26] No single physical exam technique can be used to diagnose LE by itself. All elements of the history and physical exam should be considered before determining a final diagnosis. If the history and physical exam are inconclusive, imaging can provide additional information to assist in the diagnosis of LE.

Imaging

While the gold standard diagnosis of LE is essentially based on a good history and physical examination, some imaging studies may be beneficial to confirm the diagnosis of LE and exclude potential alternative diagnoses. Radiographic images and ultrasound may be helpful in establishing the clinical diagnosis and extent of the injury. MRI is not needed initially.[27]

Antero-posterior and lateral radiographs of the elbow, while most commonly read as normal, can show calcifications along with the epicondylar tendons. Radiographic imaging can rule out a fracture, dislocation and prior trauma. Ultrasonography is the standard first-line investigation, as normal findings can rule out the diagnosis of LE.[28] Abnormal findings on ultrasound that indicate LE include tendon thickening or thinning and calcifications. Power doppler images may show neovascularization in the area of increased pain. The diagnosis of LE should be questioned with the absence of these findings. However, this diagnosis method will have varying sensitivity and specificity, depending on the operator's experience.

Magnetic resonance imaging, being more reproducible and less operator dependent, will yield more consistent results than an ultrasound. The MRI will show increased signal on T2 weighted images at the epicondylar tendon enthesis. Extension of the increased signal to the adjacent soft tissues indicates peripheral edema. The severity of tendon fissure and injury can also be assessed by using an MRI.[29] In the past, study results have varied regarding whether structural lesion severity on an MRI correlated with symptom severity.[30] However, more recently, a study in 2015 showed a positive correlation between patient-rated tennis elbow evaluation scores and the severity of MR signal changes.[31] Lastly, MRI can also rule out concomitant lesions, such as synovial folds and injuries to the lateral collateral ligament.[32] Other alternative diagnoses that can be visualized with MRI include humeroradial osteoarthritis, osteochondritis dissecans, foreign body, inflammation of the anconeus, inflammatory joint disease or radial tunnel syndrome.

TREATMENT

Treatment recommendations for LE can vary based upon the level of pain, duration of injury, patient desires and comorbidities. Research has shown that LE may resolve spontaneously without treatment within one to two years.[33] Knowing this timetable can help both the physician and the patient determine the best treatment plan. Patient expectations regarding the time to heal should be considered. Several different nonoperative treatment strategies have been shown to be effective for LE. The time at which to refer a patient for surgery is still an unanswered question. There is no clear evidence pointing towards a precise timeline for surgical treatment. It is reasonable to recommend surgery as a treatment after a patient has had an inadequate response to conservative treatments for greater than six months to one year.[34]

Nonsurgical

Newly diagnosed LE can be treated with various nonoperative modalities, some of which can take an osteopathic approach. Treatment options include activity modification, ice, NSAIDs, physical therapy, bracing, osteopathic manipulation, topical nitric oxide (NO), ultrasound therapy, extracorporeal shock wave therapy, corticosteroid injection, dry needling, autologous blood injection (ABI) and platelet-rich plasma injection (PRP). Because of the large variety of treatment modalities, treatment choice can be tailored specifically to individual patient presentations.

Topical NSAIDs may be more effective than placebo for reducing pain and the evidence for oral NSAID use is conflicting.[35] As for physical therapy, a study by Smidt *et al*. randomized patients to corticosteroid injections, physiotherapy or no treatment other than analgesics.[36] At one year, outcomes were only slightly better in the physiotherapy group than the remainder. Thus, physiotherapy may be superior to other treatments for patients willing to put in the time and effort needed for physical therapy.

Several studies have demonstrated greater pain relief to eccentric muscle stretching over concentric, isometric and isokinetic techniques. Specifically, Tyler *et al*. found a significant benefit of eccentric exercise to isotonic extensor exercises. Participants in both groups received a multimodal program of stretches, ultrasound, friction massage, heat and ice. A majority of the participants reported greater pain relief and functional improvement with eccentric stretching.[37] Augmented rest through active bracing may also aid in pain relief. The wrist extension splint has been shown to allow a greater degree of pain relief than the forearm strap brace for patients with lateral epicondylitis.[9]

Several manipulative techniques can be used for the treatment of LE. In one study, ME techniques led to greater improvement of pain, strength and function in chronic LE following 52 weeks of treatment compared to corticosteroid injection.[38] This treatment was focused on ME to the extensor tendons of the forearm. It is thought that the treatment of a posterior radial head may also help relieve some pain. Myofascial release has been shown effective in improving pain, functional performance and grip strength in patients with chronic LE over four weeks of treatment.[39] Mill's manipulation and other joint mobilization techniques have been thought to be effective in the past. Recent studies have shown that some joint mobilization techniques do positively affect both pain and function compared with control groups.[40]

The application of topical nitric oxide (NO) has been shown to improve pain in LE patients. In animal models, the addition of NO improved tendon healing, suggesting that exogenous NO to an area of tendon damage may support tendon recovery.[41] In a randomized clinical trial, the application of 1.25mg topical glyceryl trinitrate every 24 hours showed statistically significant improvements in pain scores over a six month treatment period. It is important to note the potential side effects of topical vasodilators. Adverse effects within studies using NO derivatives include severe and persistent headache, dermatitis rash and facial flushing.[42] As with all vasodilators, symptomatic hypotension can be a possible adverse effect when prescribing topical NO.

Ultrasound therapy has been thought to have thermal and mechanical effects on the target tissue leading to increased metabolism, circulation, extensibility of connective tissue and tissue regeneration. However, there has been insufficient evidence to support or refute its benefit for LE compared with other treatment modalities in available studies.[43] Similarly, there has been no firm evidence to support treatment with shockwave, laser, nerve stimulation or pulsed magnetic wave therapies.[44]

Corticosteroid injections, dry needling, ABI and PRP, while more invasive, have also been used as nonsurgical treatments for LE. Corticosteroid injections have been shown to provide pain relief in the short term. However, as with all steroids, side effects can lead to treatment failure and should not be used in the long term.[36] Dry needling is thought to promote local blood supply and inflammation in the short term leading to increased healing over some time. Lastly, ABI and PRP are newer treatment methods that have shown promising results. The majority of the available data is favorable, with many reporting better pain outcomes than corticosteroid injections and physiotherapy.[44] Initially thought to be equally effective in improving pain scores, PRP is now thought to be superior to ABI for the short-term treatment of chronic LE.[45]

Surgical

There have been several surgical techniques developed over the years to provide relief for LE. There is no one procedure recommended over another and outcomes after treatment with surgery versus nonoperative modalities have not been adequately compared. One report indicated if the initial physician evaluation is with a surgeon rather than a non-surgeon, the likelihood of receiving surgical treatment is 12 times higher.[46] Identifying certain risk factors for failure of nonoperative treatment may help select patients for surgery earlier in the treatment timeline. These risk factors include older age, obesity, smoking, receiving workers' compensation, radial tunnel syndrome, prior corticosteroid injection, splinting, orthopedic surgery and the use of psychoactive medications.[3] However, since there is no clear evidence identifying when surgical treatment is indicated, it has become reasonable to recommend surgery as a treatment after a patient has had an inadequate response to nonoperative treatments for more than six months to one year.[34]

Today's most widely used open surgical procedure involves excision of the degenerative fibrous tissue within the extensor carpi radialis brevis at the epicondylar enthesis, as described by Nirschl and Pettrone.[16] Formerly, this procedure was combined with a bone decortication step to increase blood supply to the region. However, this was abandoned due to greater post-operative pain.[47] It has been suggested that the excision procedure performed by Nirschl and Pettrone may be partially successful due to unknowingly performing a lateral denervation procedure as well.[48] Denervation of the lateral epicondyle by blocking or transecting the posterior branches of the posterior cutaneous nerve of the forearm was shown to be effective in relieving pain in 80% of patients with chronic lateral epicondylitis.[49] Therefore, these procedures have been thought to have something in common.

Arthroscopic procedures have been described as well. These have led to the development of several minimally invasive percutaneous methods. Combinations of percutaneous methods and PRP injections have also been shown to be of some benefit. In one study, investigators reported an earlier return to work time than an open surgical procedure.[50]

There is not one surgical procedure currently available that has been shown to be statistically superior to another. A recent literature review by Pierce *et al*. compared information on 848 open surgery, 578 arthroscopic surgery and 178 percutaneous cases.[51] Satisfaction and complication rates were similar in all three groups.

CONCLUSION

In summary, LE is a common cause of elbow pain in the primary care setting. LE is an overuse injury caused by repetitive wrist extension and gripping and typically occurs in individuals who participate in jobs or activities that require these movements. The injury is characterized by microtrauma to the ECRB, causing reproducible pain over the lateral elbow and pain with resisted wrist extensor muscle movements. A diagnosis of LE can usually be made by a comprehensive history and physical examination alone. Imaging studies, such as ultrasonography and MRI, can provide supplemental diagnostic information. LE typically responds well to nonsurgical therapies. First-line treatment is a combination of ice, activity modification, topical NSAIDs and physical therapy that focuses on eccentric muscle stretching. Osteopathic manipulation is another useful modality that has shown promising results. Newer options, including ABI and PRP, have shown positive results and should be considered when constructing a patient's treatment plan. Surgical interventions are rarely needed, but some operative procedures may be beneficial when nonsurgical treatments fail.

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BRIEF REPORT

IMPLICATIONS OF FALSE POSITIVE SARS-COV-2 BY PCR TEST IN THE HEALTH CARE WORK FORCE

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KEYWORDS:

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ABSTRACT:

The novel nature of the SARS-CoV-2 virus inherently creates a paucity of reliable and validated data. Implementing evidence-based and data-driven protocols have been exceedingly difficult. As new information is released and integrated into the complex system, the health care delivery workflow must adapt. Incorporating changes on a frequent, if not daily basis, has led to confusion, frustration and loss of confidence among clinicians across the nation. This report illustrates the negative impact that false-positive COVID-19 results can have on the health delivery workforce and the emotional implications that false-positive results cast on health care providers

INTRODUCTION

Mark Twain once said, “Facts are stubborn things, but statistics are pliable." This statement rings a note of truth in the current COVID-19 pandemic, which has undoubtedly changed the landscape of health care delivery. The novel nature of the SARS-CoV-2 virus inherently creates a paucity of reliable and validated data. Implementing evidence-based and data-driven protocols has been exceedingly difficult, if not impossible. As new information is released and integrated into the complex system, the health care delivery workflow must adapt. Incorporating changes on a frequent basis has led to confusion, frustration and loss of confidence among clinicians across the nation. This report illustrates the negative impact that false-positive COVID-19 results can have on the health delivery workforce and the emotional implications that false-positive results cast on health care providers.

The COVID-19 pandemic has affected the very core of human existence. Health care workers are at the front and center of this phenomenon. The spotlight affixed to the health care workers has illuminated many of the obstacles in providing care for patients with COVID-19. It has also highlighted the burdens of delivering care with limited treatment options and increased personal risk of disease contraction. A current Centers for Disease Control and Prevention (CDC) report highlights the disproportionately increased risk of infection contraction for health care workers, as they account for about 11% of the COVID-19 infections in the United States.[1] These combined features are translating to various levels of psychological strain that may last long after the COVID-19 pandemic has abated.[2] Health care institutions are taking extra measures to ensure the staff's safety through personal protective equipment (PPE). Due to shortages in PPE supplies, algorithms have been developed to ration PPE. Risk stratifications patient testing/screening for SARS-CoV-2 by reverse-transcription polymerase chain reaction (RT-PCR) is also a critical element of the hospital's response.[3] The standard procedure for patients showing symptoms or those who test positive includes the immediate institution of a rigid isolation protocol with corresponding recommendations for specific PPE. Health care workers suspected of exposure may be required to be tested and quarantined.[1,3] However, little attention has been paid to the potential frequency and impacts of false positives in the health care workforce.

QUALITY OF TESTING

Currently, minimal data is assessing the quality assessments of RT-PCR assays of this RNA virus. All the current RT-PCR assays used have received emergency use authorization from the FDA. Due to the time constraints and need for testing, there has been no way to complete the usual rigorous validation testing. The estimates provided by the supplier may not accurately provide the false-positive rates and estimates in relation to population prevalence and asymptomatic ratio. The CDC RT-PCR diagnostic panel contains three primer-probes that evaluate for two virus nucleocapsid genes and the human Rnase P gene to detect human nucleic acids.[4] A sensitive test will correctly identify people with the disease. Sensitivity measures correct positive results. If a check is 90% sensitive, it will accurately identify 90% of infected people—called a true positive. However, 10% of infected and tested people would get a false negative result—they have the virus, but the test says they don't.

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A specific test will accurately identify people without the disease. Specificity measures the correct negatives. There is prior knowledge that results from RT-PCR using primers in different genes can be affected by viral RNA sequence variation. False negatives can be resultant of genetic diversity and the rapid evolution of this novel coronavirus. Additionally, the specimen collection source can have implications for affecting the sensitivity and specificity of PCR testing.[5] Wang et al. completed an analysis of 205 symptomatic known COVID-19 patients, including over 1000 specimen samples from various collection sources. They demonstrated that bronchoalveolar lavage fluid specimens showed the highest positive rates; this is improved accuracy from the current widely tested nasopharyngeal swabs. There is also variability in primer's ability to utilize specimens from different sources.

Due to the clinical implications of false negatives, much of the discussion around testing focuses on these concerns. Similarly, much of the conversation regarding testing is around sensitivity; this is because PCR related testing usually has near-perfect specificity. The primer design selection for the genomic sequence of SARS-CoV-2 aids in the accuracy and reliability of the positive results with reported in-vitro analytical specificity of >98%. Despite this, false positives are still possible. They can arise from several technical errors and reagent contamination. The most common included contamination with previously amplified DNA. This can carry implications when screening healthy, asymptomatic patients. Clinical decision making is impeded by assuming all positive results are correct.[5,6]

DISCUSSION

Responses and protocols for COVID-19 are similar across counties, states and countries, but the disease prevalence of COVID-19 is varied. In areas of low prevalence, false positives are more likely than in areas with more disease.[4,5] High false-positive rates are typical of RT-PCR assays of RNA viruses, which may not be as reliable for testing varied prevalence. The CDC recognizes that in the absence of SARS-CoV transmission worldwide, the probability that a positive test result will be a "false positive" is high. To decrease the possibility of a false-positive result, testing should be limited to patients with a high index of suspicion for having SARS-CoV disease.[7]

Failure to recognize the implications of the frequency of false positives and the consequent unreliability of positive test results could result in 1) unnecessary removal of frontline health care workers from service for quarantine; 2) myopic focus on COVID-19 patients and development of bias that results in decreased attention to other pathologies; 3) delay in treatment; 4) increase burn rate of PPE unnecessarily due to misinterpretation of positive result; 5) psychological effects on the health care force and their families. The implications of each of these and the proposed mitigation processes will be discussed.

The CDC quarantine recommendations for health care workers who have had actual or possible contact with infected patients without proper personal protective equipment (PPE) has been dynamic. This includes asymptomatic patients who have tested positive with RT-PCR assays.[1] This has caused a rapid surge in the number of health care workers placed on self-quarantine. At a single hospital in California, more than 200 workers were forced to go under quarantine due to their possible exposure to a COVID-19 positive patient, who officials believe to be the first documented case of community transmission in the U.S. When this patient was eventually transferred to a tertiary medical center, an additional 90 or more workers who might have exposure were placed under quarantine.[4,5] The conspicuous implications of numerous health care workers under quarantine leave a shortage of available personnel needed to care for the sick. Some hospitals require multiple negative RT-PCR tests for their employees before returning to work.

Unclear efficacy and exact specificity of the test becomes an additional barrier to caring for the ill and meeting the increasing demand for health care workers during this pandemic.[4,5] Moreover, real-time RT-PCR does not discriminate against viable versus neutralized virus leads to higher false-positive rates, which causes further delays in quarantined health care workers' return to the workforce.[4] There is a strong sentiment across health care institutions that reexamine this policy as it can affect staffing levels and, overall, impede the health care delivery capacity. It is simply not sustainable to provide appropriate care to patients during this difficult time with a health care workers' shortage.

Routine use of surgical face masks and the addition of protective eyewear with goggles or face shield helps prevent exposures and the need for self-quarantine but adds an additional layer of discomfort to staff. Next, the positive COVID-19 test leads to a myopic focus on COVID-19 rather than comprehensive care required to accurately identify and treat other diagnoses promptly. This is especially true when there is a compromised workforce to provide comprehensive care. There is already a shortage of health care workers due to the growing number of hospitalized COVID-19 patients. Physicians are trained to treat patients, not as a diagnosis. Even under optimal circumstances, it is often challenging to deliver complete care, especially with complex, critically ill patients.

Most institutions limit the number of patients the health care providers are assigned to, depending on the acuity of care that the patient requires. At our institution, ICU nurses are capped at a maximum of two patients, while medical/surgical ward nurses are assigned to a maximum of four patients during any given shift. On the other hand, physicians do not have as well-defined limitations on how many patients they can treat. This can lead to upwards of 20 patients for physicians.[8] However, with the additional workforce in quarantine due to positive COVID-19 tests, the ratio of available health care workers to inpatients is rapidly decreasing.[8,9] This limits the time allotted to each patient, which may lead to compromises in providing comprehensive care.

Moreover, patients who are COVID-19 positive or sick enough to be hospitalized are more likely to have other comorbidities. Heightened focus on COVID-19 positive status, even in false-positive patients, unintentionally creates a bias and deters attention from promptly diagnosing other pathologies.

Delay in properly diagnosing patients leads to delay in treating them. This causes an increase in morbidities and mortalities that may have been preventable with an adequate number of health care workers. In trauma, the golden hour is referred to as "the period following a traumatic injury during which there is the highest likelihood that prompt medical and surgical treatment will prevent death."[10] Delaying inappropriate treatment can have an unfavorable impact, especially in high acuity illnesses that require timely intervention. Currently, the workforce is overwhelmed with a surplus of patients requiring health care workers to spread themselves too thin to treat patients.[9] Being able to recruit quarantined health care workers due to false-positive tests would alleviate some burden off the active duty workers. This, in turn, would eliminate further delays in treatment and prevent poor outcomes.

There is already a well-known shortage of PPE nationwide, with many institutions scavenging to fulfill their supply needs.11 Many rely on community donations, makeshift PPEs and even improper reuse to protect their health care workers as well as their patients. False-positive tests further devastate the shortage issue. Misinterpretation of a positive result increases the burn rate of PPE unnecessarily. Whether a patient is falsely positive or truly positive, contact, droplet and airborne precautions become effective immediately when caring for the patient. This means that any health care personnel must observe full PPE, which includes face shield/goggles, N95 or higher respirator, isolation gown and gloves.[3,11,12] The interdisciplinary team entails doctors, nurses, nursing assistants, pharmacists, registered dieticians, social workers, case managers and physical/occupational therapists, among many other members. Even if we limit direct physical contact with the COVID-positive patients, nurses and doctors (at a minimum) are required to assess patients and provide bedside care at least several times daily. This adds to the number of PPE wasted on patients who may not have the COVID-19 virus. Not only that, putting on and taking off PPE is very time consuming and further contributes to the shortage of the workforce previously mentioned above.

Lastly, the negative psychological ramifications of false-positive tests have on health care personnel and their family members are endless. It is not uncommon for us to encounter news articles about health care workers staying in hospital call rooms or other temporary housing, including tents set up in their garages to avoid exposing their families to the potential risk of contracting the virus. The fear is further intensified if that health care worker was exposed to a positive patient or ended up with a false-positive test. A cross-sectional study conducted in Spain revealed that out of 3,480 people who participated in an online survey, 18.7% revealed depressive, 21.6% anxiety and 15.8% PTSD symptoms.[2] Severe manifestations can even lead to sleep disturbances and suicidality. Besides the apparent mental distress caused by directly caring for the ill, false-positive tests keep health care workers out of the workforce with the current protocol. This often entails being without paid time off. This can place a financial burden on health care workers, especially those who have family members who are financially dependent on these workers' hourly wages.

SOLUTIONS

So how can we mitigate the negative consequences false-positive COVID-19 tests impose on our already compromised workforce? First and foremost, it is crucial to establish a regimented protocol that is universal across all institutions. Given the constant emergence of new data regarding the novel virus, guidelines are viewed more like suggestions than stringent rules. Even within the same institution, regulations regarding exposure to asymptomatic COVID-positive patients vary case by case basis. Health care workers' quarantine status depends on multiple factors, including PPE applied during exposure, symptomology, duration of exposure and the consulting infectious disease professional on the case.

What we need is a multi-step screening tool involving multiple laboratory tests to increase specificity. It would be more beneficial if the screening tests utilized have a rapid turnover rate so that the duration of quarantine can be as minimal as possible. Another solution would be to limit the number of team members in direct contact with patients until their COVID-19 status has been verified. New data surrounding the virus is continually developing, which will help us better handle this pandemic. Lastly, we propose sufficient resources for mental health and financial support options, including counseling, support groups and disability insurance coverage. Health care workers are the backbones of our communities and are crucial to combating and navigating through the pandemic. We must be sensitive and cognizant of the psychological burden COVID-19 may impose to protect our frontline workers so that they can continue to fight and take care of our patients.

It is incredibly important that we are aware of available data regarding COVID-19 and consider that one size does not fit all, particularly if its prevalence is varied. Statistical analyses in a clinical setting are paramount when making decisions for the already overstretched workforce. Additionally, the discussion must continue on the validity and reliability of data to make sound clinical decisions.

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CLINICAL IMAGE

BILATERAL FOOT PAIN AND SWELLING

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INTRODUCTION

A 42-year-old female presents with a four-month history of bilateral foot pain and swelling. She admits to frequently walking outdoors in sneakers with holes in the bottom, which allow her feet to get wet, but never thoroughly dry out. Over the last month, she has noticed worsening pain, which she describes as throbbing and burning, development of a foul smell to her feet and discoloration of the plantar aspects of the feet. (Figure 1,2) She denies weeping or drainage, trauma, excessive exposure to cold temperatures, fevers or chills. She admits to noncompliance with oral metformin for a past medical history of type II diabetes.

FIGURE 1:
Bilateral plantar feet

FIGURE 2:
Left plantar foot

QUESTIONS:

1. What is the most likely diagnosis?

A. Chilblains

B. Frostbite

C. Frostnip

D. Trench foot

E. Diabetic foot ulcer

2. What is the best initial treatment?

A. Amputation

B. Rest, ice, compression and elevation

C. Intravenous antibiotics

D. Removing damp clothing and apply warming packs

E. Massage of the area

ANSWERS:

1. What is the most likely diagnosis?

Correct Answer:
D) Trench foot

The patient was experiencing four months of bilateral foot pain and swelling. During this period, she allowed her feet to get damp frequently. The history and physical exam findings are consistent with trench foot. Chilblains are due to exposure to low temperatures and develop within 24 hours of cold exposure.[1] Chilblains typically involves the toes and there is local cyanosis and pruritis.[1] Frostbite is caused by direct damage of an area of tissue due to direct exposure to cold temperatures and the deterioration and necrosis from dermal ischemia.[2] Frostnip is a precursor to frostbite. It is superficial freezing of the skin that leads to a reversible injury.[3] The patient had no distinct event of exposure to cold temperatures and the patient's physical exam findings are not consistent with frostbite or frostnip. The patient has a history of type II diabetes and is noncompliant with medications; however, a diabetic foot ulcer would present as a distinct area of ulceration.

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2. What is the best initial treatment?

Correct Answer:
D) Removing damp clothing and apply warming packs

All answers are possible treatments for trench foot. However, the best initial treatment for this disease is to remove the causative factor.[3] In addition to removing the damp clothing, the area should be washed and have warming packs of 102 degrees to 110 degrees Fahrenheit applied.[4] Amputation would be indicated if conservative treatment failed and the patient developed gangrene. Amputation is performed to reduce the risk of sepsis and death.[5] Rest, ice, compression and elevation (RICE) therapy is commonly used for acute injuries.[6] Rest and elevation of the wound are encouraged to prevent new wounds of the area, although removing the damp clothing would be the best initial treatment.[5] Intravenous antibiotics would be used if there is a concern for infection; however, infection is not the cause of trench foot. Massage of the area should be avoided because of the fragility of the skin.[5]

DISCUSSION

Trench foot is a type of immersion foot syndrome due to exposure to cold, wet conditions without immersion or actual freezing.[5] It was first popularized in case reports beginning with World War I.[7] Soldiers would spend a significant amount of time in trenches that were cold, damp and unhygienic.[8] There are several cases each year due to chronic conditions, sporting activities, advanced age and self-neglect.[9] Other types of immersion foot syndromes include tropical immersion foot and warm water immersion foot.[5]

Trench foot develops in three distinct phases.[10] These include pre-hyperemic, hyperemic and post-hyperemic.[11] The initial pre-hyperemic stage of trench foot usually lasts hours to days and includes erythema, diminished pedal pulses, numbness and a cold-like feeling.[10] The second stage is the hyperemic stage, which can last two to six weeks.[10] In the hyperemic stage, erythema and burning may worsen, as well as progressive edema developing in the affected foot due to vasomotor disturbances.[10] In the final post-hyperemic stage, hyperhidrosis, hyperesthesia and joint stiffness can occur and last for months.[10] Trench foot is a nonfreezing tissue injury, although wet and cold conditions independently can create a suitable environment for trench foot to occur.[12] Therefore, both removing wet garments and rewarming the limb is necessary during initial management.[12] During rewarming, a particular sequence of events occurs. First, the skin becomes edematous, erythematous and hot.[1] Then a burning sensation develops and progressively worsens.[1] The final step that occurs is blistering and the possibility of developing a local gangrene reaction.[1] If there is a recurrence of trench foot, permanent sequelae may ensue.[4] If the series of events affect the same portion of skin repeatedly, the patient may create permanent paresthesia of the skin and hypersensitivity to cold temperatures.[8] Other symptoms that may occur are a decaying odor originating from the extremity's foot and cyanosis.[8]

Several environmental and nonenvironmental conditions can predispose an individual to developing trench foot. The most likely condition is inadequate protection from the environment with cold temperatures, wetness and poor sanitation.[13] Another predisposing factor is standing in one spot for extensive periods, which impedes proper circulation throughout the foot.[7] Both cold temperatures and moist settings constrict vasculature, which inhibits proper nutrient and oxygen supply to tissue.[7] Over time, chronic deprivation of blood flow can lead to gangrene, nerve damage and muscle damage.[13] Trench foot preferentially damages large myelinated nerve fibers, sparing both small myelinated nerve fibers and nonmyelinated fibers.[14] Within those large myelinated nerve fibers, the damage is often seen in the fine terminal cutaneous nerves.[14] Large myelinated damage also leads to weakness, wasting, impaired vibration, loss of proprioception and loss of reflexes, all of which decrease quality of life and impact daily living activities.[15] Chronic conditions such as diabetes mellitus, Raynaud's disease, sickle cell disease and hypothyroidism are diseases that can create predispositions to trench foot.[16]

Treatment for trench foot is directed at creating a suitable setting for tissue health by removing the offending factors and creating a more favorable circulation environment.[16] Primary treatment includes removing wet socks or shoes, cleaning the foot and drying the foot thoroughly.[16] Elevating the feet and refraining from ambulation may assist in the recovery process.[13,15] Warming the feet slowly by using blankets or warming packets is beneficial.[13,16] Rapid rewarming must be avoided in trench foot cases.[12] During the rewarming process, the foot's skin may become erythematous, xerotic and tender.[1] In some cases, secondary bacterial and yeast infections may occur.[4] Rarely, severe cases develop in which feet develop into a greenish-black discoloration, accompanied by blisters, which can indicate emerging gangrene.[13] Analgesia is an important factor to consider while treating a patient with a nonfreezing cold injury such as trench foot. Opioid analgesics and NSAIDs are suitable in providing adequate pain relief.[12] Amputation is necessary if secondary infection is severely extensive but rarely indicated if early recognition of symptoms occurs.[16]

The prevention of trench foot is very important, especially in homeless populations or post-natural disasters.[17] Maintaining proper sanitation by cleaning the feet and allowing them to air-dry can decrease the risk of trench foot.[1] Refraining from cold temperatures for long periods can also reduce the risk of development.[12,13] Avoidance of poor circulation in the lower extremities by moving the feet regularly and elevating them whenever possible can also reduce the trench foot's risk. [16,17]

Trench foot can mimic other foot conditions such as frostbite and chilblains (Table 1). Unlike frostbite and chilblains, trench foot can occur in temperatures well above freezing, potentially as high as 60 degrees Fahrenheit.[1] Chilblains occur in dry and cold settings.[12] Additionally, initial clinical presentation differs between trench foot, frostbite and chilblains. Trench foot has painful skin and pruritus, with a mild feeling of coldness.[1] Frostbite is more likely to present as paresthesias with unusually firm, cool and discolored skin.[1] Chilblains presents similarly and may exhibit a burning sensation, dry skin, cracking and possible ulceration.[1] Treatment for all conditions includes removing underlying agents, rewarming the foot and providing proper analgesia.[1] The health practitioner must be very thorough with the history, complaints and physical examination to form a proper diagnosis.

TABLE 1:[1,2,3,13]

Comparison of trench foot, frostbite and chilblains

TRENCH FOOT	FROSTBITE	CHILBLAINS
Painful skin/itching	Paresthesias	Burning sensation of skin
Cold and blotchy skin	Unusually firm skin	Red, white and blue blotching of skin
Heavy feeling of foot	White or grayish skin color	Intense itching
Redness upon rewarming	Lack of sensation in affected area	Dry skin with cracking
Blisters, gangrene	Blisters, gangrene	Ulceration

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PATIENT EDUCATION HANDOUT

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The Differences Between COVID-19 Tests

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As COVID-19 has been around longer, testing has rapidly grown into two main types: viral testing and antibody testing. It is important to know the differences in these tests and what the results mean.

VIRAL TESTING

If you are showing signs of COVID-19, you typically get tested by your primary care provider. This test is performed by inserting a swab through the nose to get a sample of your nasal secretions. This is considered a "viral test" because it detects if the COVID-19 virus is currently present. If it is positive, then you currently have an active COVID-19 infection. There is a rapid test that gives results in about an hour and one that is sent to a lab that returns results in 1–2 days. If you think you are showing symptoms of COVID-19, contact your health care provider, who will determine if you qualify for testing.

ANTIBODY TESTING

Antibodies are a part of the immune system that fight off infection. When a person is infected with a virus or bacteria, antibodies are made that fight that specific infection. COVID-19 antibody testing is a blood test that checks for COVID-19 antibodies and will confirm if you have ever had COVID-19. It is not used if you currently have COVID-19 symptoms. This test may be used to monitor those individuals who have had a positive viral test. Research is still ongoing to prove that those with COVID-19 antibodies are immune to the virus. Ask your health care provider if there is antibody testing available for you.

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SOURCE(S): *The Center for Disease Control and Prevention*

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Why Does My Elbow Hurt?

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CAUSES OF ELBOW PAIN

Tennis Elbow (Lateral Epicondylitis)

Tennis elbow is one of the most common causes of elbow pain. It is a type of tendinitis or inflammation of the tendons. Although it is called tennis elbow because it happens with the motions of playing tennis, it is most commonly caused by overusing the elbow. Most people notice they have pain when shaking hands and pain with pressing on the outside of the elbow. It may also cause decreased grip strength or pain with bending your wrist back.

GOLFER'S ELBOW (MEDIAL EPICONDYLITIS)

Golfer's elbow is less common than tennis elbow, but it is also a type of tendinitis. It can happen with the motion used to swing a golf club, but happens more often with general overuse. With golfer's elbow, there is pain on the inside of the elbow. There may also be pain with lifting and bending your wrist down.

OLECRANON BURSITIS

A bursa is a fluid filled sac that helps provide padding around a joint. Olecranon bursitis causes pain and swelling over the back of the elbow when the bursa becomes inflamed. Olecranon bursitis is usually caused by putting a lot of pressure on the back of the elbow. There are typically no problems with full movement of the elbow because the bursa is located at the back of the elbow. Your elbow may become infected and cause fevers and chills.

FRACTURES

You can break (fracture) any of the three bones that make up your elbow joint. Fractures of the elbow happen most when falling forward and bracing the fall with your arms. With fractures, the elbow may be bruised or swollen. Fractures are diagnosed with an x-ray.

ARTHRITIS

Arthritis is the inflammation of a joint. With arthritis, there may be pain and difficulty fully moving the elbow. There are many types of arthritis, but it is most commonly caused by wear and tear on your joints.

WHEN TO VISIT YOUR DOCTOR

You should see your doctor if you have:

- Pain that does not improve with rest and ice after 3-5 days
- Worsening swelling, redness or bruising of your elbow
- Problems moving your arm
- A fever or chills with your elbow pain

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