EDITOR'S MESSAGE
Sweet Summer

REVIEW ARTICLES
Highlights of the Updated 2016 ADA Standards of Medical Care in Diabetes
Osteopathic Considerations in the Management of Chest Pain
Osteopathic Considerations in Obstructive Pulmonary Disease: A Systematic Review
Treatment Options for Psoriasis

CLINICAL IMAGES
Periorbital Rash

PATIENT EDUCATION HANDOUT
Diabetes Update 2016
**2016 CALL FOR PAPERS**

Osteopathic Family Physician is the ACOFP’s official peer-reviewed journal. The bi-monthly publication features original research, clinical images and articles about preventive medicine, managed care, osteopathic principles and practices, pain management, public health, medical education and practice management.

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**CLINICAL IMAGES**

We are seeking clinical images from the wards that covers essential concepts or subject matter to the primary care physician. Please provide a brief synopsis of how the case presented along with 1-4 questions and approximately 1 page of education with reference to the image and questions.

**REVIEW ARTICLE TOPICS:**

- Advances in Skin Care Diagnosis & Treatment
- Anxiety
  (with OMT treatment component)
- Current Management of the Menopausal Woman
  (with OMT treatment component)
- Direct Primary Care: Emerging Practice Alternative
- Direct Primary Care: Legal Aspects
- Movement Disorders - Parkinson’s Disease, Essential Tremor, Restless Leg Syndrome (with OMT treatment component)
- Patient Engagement (Help define the science of engaged research, provide tangible examples of the impact of engaged research, or answer a question or controversy related to patient engagement.)
- Vaccinations: Getting Past the Misinformation & Reaching Patients
- Pediatric GI: Chronic Abdominal Pain Eval & Treatment
- Nausea with Vomiting
- Newborn Disorders & Nutritional Guidance
- Skin and Soft Tissue Infections: It's More than Just MSRA
- Insomnia
  (with OMT treatment component)
- Direct Primary Care: Emerging Practice Alternative
- Direct Primary Care: Legal Aspects
- Movement Disorders - Parkinson’s Disease, Essential Tremor, Restless Leg Syndrome (with OMT treatment component)
- Patient Engagement (Help define the science of engaged research, provide tangible examples of the impact of engaged research, or answer a question or controversy related to patient engagement.)

**EXAM SCHEDULE**

**CERTIFICATION & OCC (RECERTIFICATION)**

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<td>AOA OMEP Conference Anaheim, CA</td>
<td>April 1, 2016 Late fee through June 1</td>
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<tr>
<td>Family Medicine / OMT Certification / OCC Cognitive Exam</td>
<td>Electronic Testing Regional Sites</td>
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<td>Family Medicine / OMT Certification / OCC Performance Evaluation Only</td>
<td>ACOFP Annual Convention Kissimmee, FL</td>
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<td>AOA OMEP Conference Philadelphia, PA</td>
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Amy J. Keenum, DO, PharmD

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Larry W. Anderson, DO, FACOFP dist.

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Osteopathic Considerations in Obstructive Pulmonary Disease: A Systematic Review of the Evidence
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NOW SEEKING

CLINICAL IMAGES

This section showcases clinical images from the wards that cover essential concepts or subject matter to the primary care physician.

Each installment of “Clinical Images” comprises 1 or 2 medical images along with a brief synopsis of how the case presented along with 1-4 questions and approximately 1 page of education with reference to the image and questions.

Submissions should be submitted online at ofpjournal.com via our Scholar One publication process.
This month we serve up articles that relate to what we treat daily.

A review of the new American Diabetes Association guidelines appears this month. It brings a quick review of what we should be doing with a few changes. Setting goals for the individual is part of the new guidelines. Older patients, with shorter life expectancy may be at more risk of falling from hypoglycemia than from long-term risks of less than perfect Hba1c goals. One of the interesting points is that the eye exam can be done every 2 years if normal on 2 or more annual exams. This just makes sense, especially in well controlled, barely diabetic folks. This does not mean the insurance companies are on the same page. It has been said that it takes 9 months to birth a board question but how long does it take quality indicator monitors to get with the new guidelines?

Approaches to chest pain and COPD each have their own articles. Both discuss the underlying disease and the musculoskeletal components of the treatment with both osteopathic principles and manual treatments. COPD for example often involves coughing which leads to muscle pain and spasm. Chest pain can be from a primary musculoskeletal issue and the authors discuss evaluation and treatment.

Psoriasis diagnosis and treatment is reviewed. The article is well organized and easy to read. A patient of mine used a different treatment on each psoriatic plaque of his body to minimize exposure to steroids. Treatment can certainly be individualized to what works with the fewest side effects.

You may want to review pain management guidelines from the CDC March 2016; here primary care doctors take a big hit for controlled substance prescribing. There is no pain clinic prescribing controlled substances in my community how about yours? I would be happy to refer. It is challenge enough to treat the diabetes, hypertension and depression. Someone else can do better helping my patient with pain management? Where are you? Again, we try to do the best we can and for sure we can all try to do better.

We have had an uptick in submissions to the visual diagnosis column so after this issue we plan to run two per issue for a while.

Kids will be out of school soon and summer vacations underway.

Hope this one is your best vacation ever.
From an early age I knew I wanted to be a physician. With the exception of my father, I’m the fifth generation of physicians who all practiced medicine in North Georgia. I’m the first DO in my family. Becoming ACOFP’s newest President is a defining moment for me and that is what I would like you to reflect on in your life. We all have them – defining moments – a point in time that determines the course of our lives. A defining moment can be big or small. Maybe yours was when, as a child, you won a race or when you were bullied. Maybe as a student, you passed a big test or you failed a big test. Perhaps your defining moment was a failed romance.

One of my first defining moments happened when I was just 10 years old when I hurt my knee. My friend’s father, who was not a physician, tended to my knee. After he looked it over for some time, he said I’d be fine. At that moment, I thought he really cared about me. From that point on, I decided I would be a physician who touches his patients, who lets them know that he cares about them. To me, that’s what it is to be an osteopathic family physician.

Many years later, after I had become an osteopathic family physician, I had another defining moment. I had been in practice about 10 years when a five-year-old boy came in as a new patient for his annual checkup. I noticed a heart murmur. He said, “Do all the good you can. By all the means you can. In all the places you can. At all the times you can.”

But did you know that we all share the same, all-encompassing, defining moment? That defining moment, common to each of us, was the moment when we first heard these inspirational words, once spoken by the founder of osteopathy, Dr. A. T. Still, who said, “Let your light so shine that the world will know you are an osteopathic physician pure and simple, and that no prouder title can follow a human name.”

Similarly, Scripture tells us that Christ said “no one after lighting a lamp covers it with a jar or puts it under a bed, but puts it on a stand so that those who enter may see the light.”

I challenge you to be intentional about not hiding the light of osteopathy under a bushel. Rather, seek out someone for whom you can become a defining moment in their life – the defining moment, when – through you – they see the shining light of osteopathic medicine!

Sincerely,

Larry W. Anderson, DO, FACOFP dist.
ACOFP President

That’s why I asked Medal of Honor recipient, Colonel Bruce Crandall to be our Keynote Speaker at the ACOFP’s Annual Convention. I wanted him to share his defining moments that were captured in the movie, We Were Soldiers, but also for us to see how that moment shaped his life for the decades that followed.

You will have defining moments in your careers when you save a life, make a cancer diagnosis that everyone else has missed, or diagnose a heart attack with minimal symptoms. When you do, you will realize that all the studying, tuition and sacrifices that you have made will be worthwhile.

My theme this year as President is “DO All the Good You Can DO.” Everything starts and ends with being a DO. When you start each day, think about how you can “DO all the good you can do.”

The idea for my theme came from a partial quote from John Wesley, the leader of the Methodist movement, “Do all the good you can.”

He said, “Do all the good you can. By all the means you can. In all the ways you can. In all the places you can. At all the times you can.”

To all the people you can. As long as ever you can. In all the places you can. At all the times you can.

One of the areas where the ACOFP has made great progress is in engaging in the greater profession. This is directly related to our involvement in Family Medicine for America’s Health. Our participation in FMAH has opened doors in many different areas. We have become a part of “The Working Party” an organization of family medicine organizations that come together to tackle the broad issues facing family medicine. We have received invitations to join with organizations such as the Association of Departments of Family Medicine, the Association of Family Medicine Residency Directors, and the North American Primary Care Research Group. Participation with these organizations has allowed us to leverage our limited resources to provide a broader range of service to our members.

Another area where ACOFP has stepped up its game is in our Washington advocacy. This past May, Ryan McBride joined the ACOFP staff as Director of Legislative Affairs. Ryan’s previous work on Capitol Hill has served us well this year and ACOFP is developing an independent voice on legislative and regulatory issues. This increased visibility has lead to invitations to participate in White House events, roundtable meetings at the Brookings Institute and other prestigious organizations. Members of Congress, Congressional staffs, CMS, and other health care organization have begun actively seeking our input on important regulatory matters.

Sincerely,

Larry W. Anderson, DO, FACOFP dist.
ACOFP President

FROM THE PAST PRESIDENT’S DESK

DO All the Good You Can DO
Larry W. Anderson, DO, FACOFP dist. 2016 - 2017 ACOFP President

My Year as President
Kevin V. de Regnier, DO, FACOFP dist. Immediate Past President

FROM THE OUTGOING PRESIDENT’S DESK

Kevin V. de Regnier, DO, FACOFP dist. 2015 - 2016 ACOFP President

Sincerely,

Kevin V. de Regnier, DO, FACOFP dist.
Immediate Past President

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Highlights of the Updated 2016 American Diabetes Association Standards of Medical Care in Diabetes

Neil Skolnik, MD,1 Kim Pfotenhauer, DO,2 Eric Johnson, MD,3 Florence Warren, DO, PGY-2,4 & Jay H. Shubrook, DO, FACOFP5

1 Temple University School of Medicine, Philadelphia, PA
2 University of North Dakota, Grand Forks, ND
3 Abington-Jefferson Health, Abington, PA
4 Touro University, Vallejo, CA

Diabetes has become a national epidemic. Nearly 50% of American adults have either prediabetes or diabetes.1-3 Further if trends continue, by 2050, 1 in 3 American adults will have overt diabetes.2 The American Diabetes Association (ADA) publishes annual Standards of Medical Care in Diabetes in the January supplement of Diabetes Care.4 This review will highlight key features of the Standards of Care and report on changes and new updates to the guidelines.

The ADA has published the Standards of Care since 1989. The Standards cover the spectrum of care, from screening and diagnosis to management and risk reduction. The ADA strives to be transparent in the development of its evidence-based guidelines, following the Institute of Medicine recommendations. Each year, the ADA’s Professional Practice Committee does a systematic MEDLINE search to find new evidence or clarify prior recommendations. This multidisciplinary committee also receives feedback from the larger clinical community. The committee assigns each recommendation a rating of A, B, C, or expert opinion E, depending on the quality of evidence.

WHAT IS NEW?

A new section has been added to the Standards, “Obesity Management for the Treatment of Type 2 Diabetes.” Recommendations include the comprehensive assessment of weight in diabetes and treatment of overweight/obesity with behavior modification and pharmacotherapy. This section also includes a new table of currently approved medications for the long-term treatment of obesity. Bariatric surgery as a treatment for severe obesity has also been added to this section.

To reflect the changing role of technology in the prevention of type 2 diabetes, a recommendation was added encouraging the use of wearable activity monitors to help monitor and promote physical activity. Other changes include adding a new table of currently approved medications for the long-term treatment of obesity and bariatric surgery as a treatment for severe obesity.

WHAT HAS CHANGED?

Diabetes screening recommendations have been clarified. All adults should be screened for type 2 diabetes beginning at age 45 years, regardless of weight. Testing is also recommended for asymptomatic adults of any age who are overweight or obese and who have one or more additional risk factors.

To reflect new evidence on CVR risk among women, the recommendation to consider aspirin therapy in women age >60 years has changed to include women age ≥60 years. A recommendation was also added to address antithrombotic use in patients age <50 years with multiple risk factors.

A1C recommendations for pregnant women with diabetes have changed, from a recommendation of <6.0% to a target of 6.0–6.5%.

TABLE 1: Diagnostic criteria for diabetes and prediabetes

<table>
<thead>
<tr>
<th>Condition</th>
<th>FPG</th>
<th>A1C</th>
<th>OGTT</th>
<th>RPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 100 mg/dL</td>
<td>&lt; 5.7%</td>
<td>&lt; 140 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Prediabetes</td>
<td>100 - 125 mg/dL</td>
<td>5.7% - 6.4%</td>
<td>&lt; 140 - 199 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>≥ 126 mg/dL</td>
<td>≥ 6.5%*</td>
<td>≥ 200 mg/dL*</td>
<td>≥ 200 mg/dL*</td>
</tr>
</tbody>
</table>

*In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.

**Only diagnostic in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis.

Keywords: Diabetes, Prediabetes, Guidelines, Insulin, Obesity

**Selected medications also have been shown to reduce the progression from prediabetes to diabetes. These include metformin, alpha-glucosidase inhibitors, orlistat and thiazolidinediones. Currently, no medication is FDA-indicated for the prevention of type 2 diabetes.

Diabetes self-management education & support

All people with diabetes should receive comprehensive diabetes self-management education and support (DSME/S). This should be repeated as needed as the disease progresses or as new skills are needed to manage diabetes (such as insulin injection therapy). DSME has been shown to improve clinical outcomes and quality of life in people with diabetes and this education can result in cost savings to the patient and health care system.

Despite the benefit of receiving DSME, only 6.8% of individuals with newly diagnosed type 2 diabetes with private health insurance participated in DSME/S within 12 months of diagnosis.4 Only 4% of Medicare participants received DSME/S and/or Medical Nutrition Therapy (MNT).4

Physical activity

All adults with prediabetes and diabetes should be encouraged to perform at least 150 minutes of moderate intensity physical activity each week. Children with prediabetes and diabetes should perform at least 60 minutes of physical activity per day. This activity should be of at least moderate intensity and can be broken up into smaller segments of time.

Glycemic targets

The decision of the target glucose must be individualized to the patient. Most adults should be treated to an A1C of <7.0%. Younger patients, those newly diagnosed and those without known cardiovascular disease may warrant from a more stringent glucose target. However, patients with advanced complications, long-standing diabetes, multiple comorbidities or those with limited life expectancy are better treated to a less stringent goal to balance the risks and benefits of therapy.

Guidance for how to individualize therapy is provided in Figure 1 (page 14).
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FIGURE 1:
Guidance for how to individualize therapy. Depicted are patient and disease factors used to determine optimal A1C targets. Characteristics and predicaments toward the left justify more stringent efforts to lower A1C; those toward the right suggest less stringent efforts. Adapted with permission from Inzucchi et al.9 Reprinted with permission of the American Diabetes Association, Inc. Copyright 2015.

Pharmacologic treatment of type 2 diabetes
DSME/S and therapeutic lifestyle modification should be prescribed to patients at diagnosis. In addition to lifestyle changes, metformin should be started immediately for all people with type 2 diabetes, as long as it is tolerated and not contraindicated. This medication should be given at the time of diagnosis. Even a delay of 3-6 months after diagnosis can reduce the efficacy and durability of this medication (10). The patient should be evaluated at least every 3 months to see if agreed upon glucose treatment target has been achieved. If not, treatment should be intensified. Many medications are available for treatment, and guidance is available to help the clinician to decide which treatment is most appropriate for each patient.9 See Figure 2.

Insulin therapy should be considered in patients who present with catabolic symptoms (polyuria, polydipsia and weight loss) or an A1C ≥10%, and in patients who are unable to get control with dual or triple therapy at one year after treatment has started. Medication cost, potential side effects including hypoglycemia and weight gain, and efficacy are important factors when deciding what treatments are going to be used and avoidance of these side effects is preferred.

ASSESSMENT OF HOME GLUCOSE MONITORING

Self-monitoring of blood glucose (SMBG) is a key element to help people evaluate the effectiveness of their treatments (lifestyle and medications).11 The use of SMBG can be very helpful in medication titration, identification of hypoglycemia, and reinforcement of therapeutic lifestyle behaviors. Studies have supported a relationship between SMBG frequency and improved A1C in type 1 diabetes. SMBG is especially important in people who are taking insulin and in those who have experienced hypoglycemia. There is not enough evidence to support the optimal frequency of SMBG on those only on oral therapy or therapeutic lifestyle changes.

SMBG requires skills and all people with diabetes should receive education on the use of a glucometer and periodic reassessment of technique. Providers should review the results of SMBG at each assessment to determine the adequacy of treatment and to identify hypoglycemia.

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Cardiovascular risk reduction
Atherosclerotic cardiovascular disease (ASCVD) is the (9) prevent number 1 or major) cause of death in people with diabetes. People with diabetes should have their cardiovascular risk factors evaluated and managed. Numerous studies have shown the efficacy of controlling individual factors in preventing or slowing ASCVD in people with diabetes. Large benefits are seen when multiple risk factors are addressed simultaneously. There is evidence that measures of 10-year coronary heart disease risk among U.S. adults with diabetes have improved significantly over the past decade, with a decrease in morbidity and mortality.17, 18

Blood pressure
Blood pressure should be measured at every clinical appointment. Most people with diabetes should maintain a blood pressure below 140/90 mmHg.19 If the blood pressure is elevated or if there is evidence of nephropathy (albuminuria or proteinuria), then a an ACE inhibitor (ACEI) or angiotensin receptor blocker (ARB) should be started and titrated to the maximum tolerated dose. It is not recommended to start an ACEI or ARB in a person who is normoten- sive and without nephropathy, as the risks outweigh the benefits. Further, it is not recommended to use an ACEI and ARB concomitantly.

Treatment of dyslipidemia
In addition to intensive lifestyle therapy, statin use is recommend- ed for most people with diabetes age 40 years and older. People who have diabetes age 40 years and older with additional AS- CVD risk factors should consider using a moderate-intensity statin. Those people with diabetes age 40-75 years with ASCVD risk factors should consider using a high-intensity statin. Patients age 75 years and older with ASCVD risk factors should consider a mod- erate- or high-intensity statin. Table 2 provides guidance on statin use and intensity. The absolute evidence to moderate intensity statin therapy has been shown to provide additional cardiovascular benefit compared to moderate intensity statin therapy alone, and may be considered for a real-world tolerable dose of any syndrome with an LDL cholesterol ≥50mg/dL or in those patients who cannot tolerate high-intensity statin therapy.20

Table 2: Statin intensity in the treatment of ASCVD risk in diabetes

<table>
<thead>
<tr>
<th>Statin Intensity</th>
<th>Statin Therapy</th>
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</thead>
<tbody>
<tr>
<td>High - intensity statin therapy</td>
<td>Lower LDL by &gt;50%</td>
</tr>
<tr>
<td>Moderate - intensity statin therapy</td>
<td>Lower LDL by 30% to &lt;50%</td>
</tr>
<tr>
<td>Lovastatin 40–80 mg</td>
<td>Atorvastatin 10–20 mg</td>
</tr>
<tr>
<td>Rosuvastatin 20–40 mg</td>
<td>Rosuvastatin 5–10 mg</td>
</tr>
</tbody>
</table>

Severe hypoglycemia is defined as hypoglycemia that requires assis- tance from another person. All patients at risk of severe hypoglyce- mia should be prescribed glucagon injection and their family/close contacts should be instructed on how to administer glucagon during severe hypoglycemic episodes.

Hypoglycemia may be reversed with administration of rapid acting glucose (15-20 g). Blood glucose reversal should be confirmed with SMBG after fifteen minutes; if hypoglycemia persists, the process should be repeated. Pure glucose is the preferred treatment; how- ever, any form of carbohydrate that contains simple sugars not com- bined with fat or protein will raise blood glucose quickly (e.g., hard candies instead of a candy bar).

Physicians should assess at each visit if their patient is experienc- ing hypoglycemia. Patients should be educated on situations that may be relaxed but hypoglycemia and hyperglycemic complications co-existing conditions, such as ASCVD and chronic kidney disease, in their treatment plans without the physician’s knowledge. Hypoglyce- mia may be prevented by controlling the rate of absorption of carbohydrates (e.g., combining with fat or protein). The maximum tolerated dose of a lipid-lowering agent should be used. In those patients with diabetes and a history of ASCVD. In patients with ASCVD and documented aspirin allergy, clopidogrel (75 mg/day) should be used. Dual antiplatelet therapy is reasonable for up to a year after an acute coronary syndrome.

Hypoglycemia
Hypoglycemia (<70 mg/dL) is the rate-limiting step to normalizing glucose. It was previously thought that hypoglycemia and hypoglycemic complications should be avoided. Lipid-lowering and aspirin therapy should be con- sidered in the context of life expectancy. Hypertension treatment is indicated for nearly all older patients with diabetes. Older adults are a high-priority population for depression screening.19,20

Microvascular complications
Intensive blood glucose and blood pressure control can reduce the risk or slow the progression of microvascular complications.

Nephropathy: There should be annual assessment of urinary albu- min (e.g., spot urinary albumin-to-creatinine ratio [UACR]) and estimated glomerular filtration rate (eGFR) in patients with type 1 diabetes and a duration of >5 years, in patients with type 2 dia- betes, and in all patients with comorbid hypertension. For urinary albumin, two of three specimens collected within a 3 to 6 month period should be abnormal before considering a patient to have developed albuminuria.

For patients with diabetic kidney disease (DKD), dietary protein intake should be 0.8 g/kg body weight per day. ACEIs and ARBs have been shown to slow the decline in GFR in patients with el- evated urinary albumin excretion (>30 mg/day). An ACEI or ARB is not recommended for the primary prevention of DKD in patients with diabetes who have normal blood pressure, normal UACR (>30 mg/dL) and normal eGFR. Combined use of an ACEI and an ARB should be avoided as it provides no additional benefit for CVD or DKD and has a higher adverse event risk.

Retinopathy
Patients with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optom- istrict within 5 years after diagnosis of diabetes. Patients with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist shortly after the diagnosis of diabetes. The exams should be repeated annually. If there is evidence of retinopathy for one or more eye exams, then exams every 2 years may be considered. The presence of re- nitrophy is not a contraindication to aspirin therapy for cardiopre- vention, as aspirin does not increase the risk of retrorenal hemorrhage.

Neuropathy
All patients should be screened for diabetic peripheral neuropathy (DN) at diabetes diagnosis and 5 years after the diagnosis of type 1 diabetes and at least annually thereafter. Assess- ment should include a careful history and 10-grain (g) mono- polar pinprick, and at least one of the following tests: pinprick, temperature, and vibration sensation. Clinicians should screen for signs and symptoms of autonomic neuropathy in patients with more advanced disease. These signs and symptoms can include: resting tachycardia, exercise intolerance, orthostatic hypotension, gastroparesis, constipation, erectile dysfunction, impaired neuro- vascular function, and autonomic failure in response to hypoglyce- mia. Control of lipids, smoking, and other life-style factors can de- duce the progression and development of autonomic neuropathy.

The FDA has approved pregabalin, duloxetine, and tapentadol for the treatment of pain associated with DPN. Tricyclic anti- depressants, gabapentin, venlafaxine, carbamazepine, tramadol, and topical capsaicin, although not approved for the treatment of painful DPN, may be effective and considered for the treatment of painful DPN.

Foot Care
An annual comprehensive foot examination to identify risk factors predictive of ulcers and amputations is recommended. The foot examination should begin with inspection and assessment of foot pulses. The exam should seek to identify loss of peripheral sensa- tion (LOPS). The examination should include inspection of the skin, assessment of foot deformities, neurologic assessment including 10-g monofilament testing and pinprick or vibration testing or assessment of ankle reflexes, and vascular assessment including pulses in the legs and feet.

Patients who smoke or have histories of prior lower-extremity complications, a loss of protective sensation, structural abnor- malities, or peripheral arterial disease (PAD) should be referred to foot care specialists for ongoing preventive care and lifelong surveil- lance. Patients should be screened by careful history and physical exam of pulses for PAD. Ankle-brachial index (ABI) should be performed in patients in symptoms or signs of PAD. ABI may be considered starting at age 50 and in patients younger than 50 years of age with risk factors.

SUMMARY
The ADA 2016 Standards of Care is a source of high-quality evi- dence-based recommendations for the care of people with diabe- tes across the lifespan. Screening for prediabetes is an important priority to identify those at risk for diabetes, as lifestyle interven- tion is an established preventive strategy with a new emphasis on obesity management. Individualized glycemic targets with atten- tion to hypoglycemia can reduce the risk of diabetes complications. Studies also support evaluation and effective treatment of risk factors to reduce ASCVD in persons with diabetes. The 2016 Abridged Standards of Care can be an important resource for primary care physicians caring for those with diabetes.

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DISCLOSURES
28 JS has received research support from Sanofi and has served as a consultant to Eli Lilly, Novo Nordisk, Inc., AstraZeneca and GlaxoSmithKline. EJ serves on the Nova Nordisk, Inc. speakers’ bureau and is a consultant for Sanofi. NS has served on the external advisory board for AstraZeneca, Lily, Sanofi, and Takeda IAP and FW have no conflicts of interest.

REFERENCES

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INTRODUCTION

Chest pain is one of the most common reasons for patients to seek medical care, accounting for about 1 to 3% of office visits to a primary care provider.1 Of these visits, the most common cause of pain is musculoskeletal, not cardiac, in origin.2,3 The complaint of chest pain must be considered seriously. It can represent life-threatening medical conditions potentially involving the cardiovascular, pulmonary and gastrointestinal systems. Other causes of chest pain are less critical and can be associated with musculoskeletal dysfunctions.2 In the hospital setting, about 20% of patients with undifferentiated chest pain are admitted for suspected acute coronary syndrome (ACS). There is an estimated cost of $8 billion for the initial care of these patients who are later discharged without a diagnosis of coronary artery disease.4

Since medical training teaches physicians to first rule out conditions associated with symptomatic ‘red flags’, we must be mindful to keep other causes in our differential. Osteopathic physicians are trained to approach patients as a unit, a whole person. When history, physical examination and pertinent diagnostic tests have ruled out life-threatening causes and provide no answer for the cause of pain, it is important to remember the osteopathic principles and treatments that can help provide the necessary care for patients.

EPIDEMIOLOGY

The number of patients with chest pain secondary to a musculoskeletal source is more common in patients presenting to their primary care clinician than an emergency department.5 It also occurs more frequently among women than men. In Dilsa et al.’s study that examined the incidence of musculoskeletal chest pain, 69% of patients diagnosed with costochondritis were women.6 In the primary care setting, frequencies of the different etiologies of chest pain are musculoskeletal 36-49%, cardiovascular 5-10%, gastrointestinal 8-19%, pulmonary 5-10% and psychiatric 8-11%.7

NON-MUSCULOSKELETAL CAUSES OF CHEST PAIN

The differential diagnosis of patients presenting with chest pain ranges from benign musculoskeletal etiologies to life-threatening diseases such as myocardial infarction, esophageal rupture, perforating peptic ulcer, pulmonary embolus and tension pneumothorax.8 It is important to rule out cardiovascular, pulmonary and gastrointestinal causes of chest pain before definitively diagnosing musculoskeletal chest pain.

Coronary artery disease can lead to ischemic chest pain, which may be present in a spectrum of cardiovascular diseases including stable angina, unstable angina, non-ST elevation myocardial infarction, and ST elevation myocardial infarction.9 Patients with myocardial infarction (MI) present with substernal chest pain, usually radiating to the shoulder, jaw or arm, which is exacerbated by exertional activity and relieved by rest or nitroglycerine. In one study (n=403 patients), Lassiter et al. found that 30% of patients presented with atypical symptoms of MI, including abdominal pain, paroxysmal dyspnea and symptoms of pulmonary edema, with the frequency of symptoms being 33%, 17% and 13%, respectively. These atypical symptoms were most prevalent in women over the age of sixty-five years.9 Thus, in elderly patients, risk factors for coronary artery disease should be assessed.10

The most common gastrointestinal cause of chest pain is gas-esophageal reflux disease (GERD), which is characterized by squeezing or burning substernal chest pain radiating to the back, neck, or jaw.11 Peptic ulcer disease (PUD) can also cause chest pain and may lead to a perforation of the gastrointestinal lining which is a life-threatening emergency. Patients with perforated PUD may present with a sudden onset of severe, sharp abdominal pain that betrays a serious life-threatening gastrointestinal cause of chest pain, is characterized by odynophagia, tachypnea, dyspnea, cyanosis, fever and shock.11

Tension pneumothorax and pulmonary embolus are life threatening pulmonary causes of chest pain. Although the initial presentation of pneumothorax can vary, development of severe dyspnea, tachycardia and hypotension can occur over time. Patients may also have distorted neck veins and tracheal deviation.4 Stein et al. found that the most common symptoms of pulmonary embolism were dyspnea (73%), pleuritic chest pain (66%), cough (37%) and hemoptysis (13%).12

OSTEOPATHIC PHYSICAL EXAMINATION

A general physical examination, including an osteopathic structural exam (OSE), should be conducted to rule out cardiovascular, pulmonary, gastrointestinal and other visceral causes of chest pain. There is no “one-size-fits-all” approach to these patients, as there are many different causes.12 Findings associated with

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- MUSCULOSKELETAL CAUSES OF CHEST PAIN

There are several key factors to consider in a patient’s history when evaluating musculoskeletal causes of chest pain. Musculoskeletal chest pain includes pain related to the thoracic spine and the anterior thoracic, truncal, and muscular structures.13 The pain has an insidious onset and a prolonged duration that lasts for hours to days. A recent history of repetitive activity may favor the diagnosis of musculoskeletal chest pain. Deep breathing, turning, or arm movement may exacerbate the pain which is frequently sharp and localized to a specific area near the costochondral junction.12

Costochondritis (also known as costosternal syndrome or anterior chest wall syndrome) is characterized by aching, sharp, pressure-like pain and tenderness of multiple joints in the costochondral junction. Pain is usually unilateral and aggravated by movements of the upper body, deep breathing or exertional activities. Signs of inflammation and swelling are usually absent. The mechanism of pain is believed to be mechanical derangement, muscular imbalance or neurogenic inflammation.14 Diagnosis is based mainly on the ability to reproduce the pain by palpation of tender areas. Bösner et al. demonstrated that tenderness was localized to the four features: local muscle tension, stinging pain, pain reproducible by palpation and absence of cough, are associated with the diagnosis of anterior chest wall syndrome.15

Lower rib pain syndrome (also known as rib-tip syndrome, slipping rib syndrome, twelfth rib syndrome and clicking rib syndrome) is characterized by pain in the lower chest or upper abdomen. A tender point on the costal margin and pain that is reproduced by pressure over or near the involved tenderness is the characteristic of this syndrome.14

Poster chest wall pain syndrome, also known as thoracic spinal pain syndrome, is relatively common in workplace settings and is associated with chest pain.13 Thoracic disc herniation is a cause of posterior chest wall pain that should be considered in patients with dermatomal pain. Costovertebral joint dysfunction is another cause in which the patient presents with pain that is made worse with coughing or deep breathing. Palpating the costovertebral junction often reproduces the pain. There may also be areas of local hyperalgesia.16

Strains of the intercostal, pectoralis, internal and external oblique and serratus anterior muscle are another common cause of musculoskeletal chest pain. Acute onset of muscle strain is usually caused by trauma or overuse while gradual onset of muscle pain results from tension or anxiety. Muscle tears may present with sudden pain in the region followed by swelling and bruising.13 Some less common causes of chest pain are sternals syndrome, Tietze’s syndrome, xiphoidalgia and spontaneous sternoclavicular subluxation. Sternalis syndrome is localized tenderness over the body of the sternum and palpation to the area causes pain to radiate bilaterally. Tietze’s syndrome is a diagnosis made if localized swelling in costosternal, sternoclavicular and costochondral joints.17 Xiphoidalgia is localized tenderness over the xiphoid process of sternum.13 Spontaneous sternoclavicular subluxation is an anterior or cranial displacement of the clavicle that usually occurs on the dominant-hand side in women 40-60 years old. This displacement may occur due to heavy repetitive activity. Radiography can also show sclerosis of the medial clavicle in spontaneous sternoclavicular subluxation.16

There are systemic diseases that can cause musculoskeletal chest wall pain such as rheumatoid arthritis (RA), ankylosing spondylitis and fibromyalgia. RA is an autoimmune disease that classically arises in late life and is characterized by destruction of cartilage and ankylosis or fusion of the joint. Clinical features include joint pain with morning stiffness that improves with activity. Joint-space narrowing, loss of cartilage and osteoporosis are typically seen on x-ray. In a recent study of 412 subjects, RA subjects (19%) had significantly more pain and swelling in the sternoclavicular joint than healthy controls (15%). Also in the RA group, ultrasound abnormalities such as osteophytes (29%), synovitis (15%) and erosions (11%), were recorded in 87 sternoclavicular joints (43%) compared with 36% in the healthy control.18

Ankylosing spondylitis is a chronic inflammatory disease of the spine and sacroiliac joints. It is commonly seen in younger patients with a history of chronic low back pain and morning stiffness. Any deficits while examining forward flexion of lumbar spine in a younger patient may suggest ankylosing spondylitis.19

Fibromyalgia is characterized by chronic widespread musculoskeletal pain with sleep disturbances and fatigue. Patients with fibromyalgia can have specific bilateral tenderpoints in the upper and mid-cervical, trapezius, lateral gluteal, lateral trochanteric, medial knees and anterior costochondral regions.20
The initial examination for non-visceral chest pain should start at the spine and shoulders using observation, palpation and range of motion testing.10 Physicians should note any tissue texture changes, asymmetry, restriction of motion and tenderness (TART) through direct palpation of the anterior and posterior chest wall. Acute changes will present with edema, tenderness, pain and tissue constriction. Chronic changes will present with tenderness, fibrosis and ropy changes.25 Physicians should then assess the mobility of the thoracic cage with respiration and the range of motion (passive and active) of the cervical, thoracic and lumbar spine. Any areas of restriction in the spine or rib cage should be noted. Tenderness or pain in the thoracic cage that is reproduced with movement is highly suggestive of a musculoskeletal cause of chest pain.26 Cervical spine somatic dysfunctions may contribute to postural strains and lead to pain in the chest and upper thoracic regions. Anterior structures, including the costochondral and chondrosternal joints, should also be examined.10 Other key areas to assess may include the diaphragm, thoracic outlet and upper extremities. It is important to do a complete structural examination so as not to miss dysfunctions in other areas that may be contributing to the presenting pain.

Osteopathic findings may assist in diagnosing or ruling out visceral causes of chest pain. A viscerosomatic reflex is caused by stimulus from an internal organ that produces a reflex response in the musculoskeletal system sharing the same spinal segment innervation.25 Chronic irritation and inflammation of the stomach lining that leads to tissue texture changes and thoracic cage somatic dysfunctions from T5-T9 is an example of a viscerosomatic reflex. Somatic dysfunction, tissue texture changes, or temperature variations may be due to viscerosomatic reflexes.25 Chapman points may also be associated with a visceral cause of chest pain. These points are “plaque-like changes” that represent visceral dysfunction or pathology and may play an important role in narrowing down the differential diagnosis of chest pain.25 Viscerosomatic findings are summarized in Table 1.

### TABLE 1

<table>
<thead>
<tr>
<th>Osteopathic Structural Findings Associated with Non-musculoskeletal Causes of Chest Pain25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viscerosomatic Reflexes</strong></td>
</tr>
</tbody>
</table>
| Cardiac | T1 - T5 | **Anterior:** 2nd ICS  
**Posterior:** T2 lamina of TP |
| | | **Anterior:** 3rd ICS: Upper Lung  
**4th ICS: Lower Lung** |
| Pulmonary | T2 - T7 | **Posterior:** Between T3-T4 TP: Upper Lung  
**Between T4-T5 TP: Lower Lung** |
| Gastrointestinal | Upper GI Tract (Stomach-Duodenum): T5-T9  
Middle GI Tract (Jejunum - Proximal transverse colon): T10-T11  
Lower GI Tract (Distal 1/3 of transverse colon - Rectum): T12-L2 | **Anterior Points:**  
5th ICS: Liver, Gallbladder (right), Stomach acid (left)  
6th ICS: Gallbladder (right), Stomach peristalsis (left)  
6th or 7th ICS: Spleen (left), Pancreas (right)  
7th - 10th ICS: Small Intestine  
TIP of 12th Rib: Appendix  
**Posterior Points:**  
Between T5 - T6 SP: Liver (right), Stomach acid (left)  
Between T6 - T7 SP: Liver, Gallbladder (right), Stomach peristalsis (left)  
Between T7 - T8 SP: Spleen (left), Pancreas (right)  
Between T8 - T11 SP: Small intestine  
T12 TP: Appendix |

Abbreviations: ICS - Intercostal space; SP - Spinous process; TP - Transverse process.

### TABLE 2

<table>
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<th>Management of Musculoskeletal Chest Pain 27</th>
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</thead>
<tbody>
<tr>
<td><strong>Considerations</strong></td>
</tr>
</tbody>
</table>
| Heat / Cold | Overload and overuse injuries may lead to muscle strains. Encourage patient to stop activity that may further exacerbate the injury.  
Heat: Muscle spasm  
Cold: Reduce swelling and discomfort, acute |
| Topical Agents | Counsel patients on safety of application.  
Capsaicin cream  
Salicylate-containing cream or gels  
Topical NSAIDs  
Lidocaine Patch |
| NSAIDs | Often used and important in patients with inflammation. Be sure that patients are aware of potential adverse effects (i.e. peptic ulcer disease, exacerbation of renal insufficiency) and that they are taking these medications appropriately.  
Ibuprofen  
Naproxen |
| Muscle Relaxants | May be used, especially with acute muscle spasm. Avoid long term therapy, use in elderly patients and patients with a history of drug abuse.  
Cyclobenzaprine  
Methocarbamol  
Benzodiazepines |
| Antidepressants | Can be used for chronic pain or pain that is neuropathic or osteoarthritic in origin.  
Tricyclic antidepressants  
SSRIs and SNRIs |
| Anticonvulsants | Chronic pain  
Gabapentin |
| Injections | Can use local glucocorticoid and/or anesthetic, often useful for arthritic pain  
Hydrocortisone  
Methylprednisolone  
Triamcinolone |
| Narcotics | Avoid in patients with musculoskeletal chest pain. Should only be considered in isolated cases of acute exacerbations.  
Short-acting, mild (i.e. codeine) |
| Psychiatric Evaluation | Evaluate patients for psychiatric factors that may contribute to presenting symptoms  
Anxiety, depression, panic attacks |
TABLE 3: Osteopathic Manipulative Treatment

<table>
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<tr>
<th>Technique</th>
<th>Basic Steps</th>
<th>Indications</th>
<th>Cautions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Myofascial Release</strong></td>
<td>Direct or Indirect technique; There are many variations of myofascial release. Once an area of altered fascia has been identified, it is important to remember the mechanics involved, the anatomic relationships of the area being treated, and neural influences. A parallel or perpendicular stretch can be applied to hypertonic muscles.</td>
<td>Presence of sensory dysfunction in the connective tissues, i.e. fascia, muscles, etc.</td>
<td>Helpful in patients with musculoskeletal chest pain.</td>
</tr>
<tr>
<td><strong>Facilitated Positional Release</strong></td>
<td>Indirect technique; Place the patient in a neutral position while monitoring the point. A force of compression, traction, or torsion is then applied to release tension and/or articular restriction.</td>
<td>Can be used to address superficial tissue change with additional use of muscle energy techniques.</td>
<td>Open wounds, fractures, connective tissue disease, internal injuries in patients with lymphatic drainage release.</td>
</tr>
<tr>
<td><strong>Counterstrain</strong></td>
<td>Indirect technique: Once most tender point is located, establish a pain scale. Passively position patient to position of greatest ease and reduced sensitivity of PP to a secondary point (SP). If PP is less, continue with SP’s until 2 cm from EP.</td>
<td>Presence of tender points: Useful in patients with fibromyalgia.</td>
<td>Fracture or ligamentous tear.</td>
</tr>
<tr>
<td><strong>Progressive Inhibition of Neuromuscular Structures</strong></td>
<td>Direct technique; Locate a “primary point” (PP), the most sensitive point in the region. Locate an “end point” (EP), a point proximal or distal to the first. Determine a path between the two points. Maintain pressure on EP throughout. Initiate pressure at PP for 20-30 seconds. Compare sensitivity of PP to a secondary point (SP). If EP is less, continue with SP’s until 2 cm from EP.</td>
<td>Hypercontractility of muscles. Hypersensitivity of the pectoralis minor muscle has been associated with chest pain.</td>
<td>Few contraindications. Avoid use with localized inflammation, abscesses, or infection.</td>
</tr>
<tr>
<td><strong>Muscle Energy</strong></td>
<td>Direct technique; Bring joint to the “feather’s edge” of the restrictive barrier and direct the movement through the full part towards the direction of freedom. Physician applies an isometric counterforce to resist movement for 3-5 seconds, followed by post-isometric relaxation for 3-5 seconds. Re-engage barrier and repeat 3-5 times.</td>
<td>Patient unable to follow verbal commands. Patient with low vitality (i.e. post-surgical, post-myocardial infarction).</td>
<td>Use caution in patients with acute injury.</td>
</tr>
<tr>
<td><strong>Articular</strong></td>
<td>Direct technique; Repetitive movement of a joint through its full range of motion until the restrictive barrier is engaged to increase range of motion.</td>
<td>Use when restrictive barrier is in the joint or periarticular tissues. Arthritic and frail patients tolerate this well. Helpful in patients with musculoskeletal chest pain.</td>
<td>Fracture/dislocation, neurologic entrapment, vascular compromise, local malignancy, local infection, bleeding disorder.</td>
</tr>
<tr>
<td><strong>High Velocity Low Amplitude (HVLA)</strong></td>
<td>Direct technique; Engage the barrier, while isolating the segment to be treated. A short and rapid thrust should be applied to the area during expiration.</td>
<td>Somatic dysfunction with a firm barrier.</td>
<td>Cervical HVLA: Advanced rheumatoid arthritis, Down syndrome, advanced carotid disease.</td>
</tr>
<tr>
<td><strong>Lymphatic Drainage</strong></td>
<td>Always free restrictions at transition areas/diaphragms first. Many different vibratory or oscillatory techniques can then be used to augment movement of lymph.</td>
<td>Acute somatic sprains/strains, inflammation, edema, tissue congestions.</td>
<td>Deep venous thrombosis, certain stages of cancer, certain bacterial infections.</td>
</tr>
</tbody>
</table>

**REFERENCES:**

3. Berkowitz MR. “Application of osteopathic manipulative treatment to a certain stage of cancer, myofascial release and soft tissue techniques can be used to reduce muscle pain and restore symmetry, especially in patients with acute musculoskeletal chest pain.” Progressive inhibition of neuromuscular structures (PINS) and facilitated positional release (FPR) are also useful for decreasing hypertonic muscles. Counterstrain is an effective technique for patients presenting with specific tender points, such as those seen in patients with fibromyalgia. Articular techniques, including high-velocity low amplitude (HVLA), can help to mobilize the thoracic cage in patients who present with decreased rib excursion, decreased range of motion, or facilitated segments with a firm endpoint. Muscle energy and FPR may also be helpful with improving range of motion and decreasing muscle hypertonicity. Lymphatic techniques should be considered in patients with congestion, inflammation, or edema that may be contributing to chest pain, such as in cases of costochondritis and thoracic cage strains or sprains. Gentle techniques may help balance autonomies in patients. Recent studies have shown that certain techniques have an effect on heart rate variability, increasing parasympathetic and decreasing sympathetic activity, in healthy subjects. There may be a role for these techniques in treating visceralosomatic reflexes post acute cardiac events. See Table 3 for a summary of possible techniques that can be used for patients with musculoskeletal chest pain, along with indications and cautions.

**SUMMARY & CONCLUSION**

Musculoskeletal problems are a common cause of chest pain in adults presenting to primary care physicians. The differential diagnosis of patients presenting with chest pain ranges from benign musculoskeletal etiologies to life-threatening disease. It is important to rule out cardiovascular, pulmonary and gastrointestinal causes of chest pain first. Reproducible chest wall tenderness is a major hallmark of chest pain of musculoskeletal origin. Integrating an osteopathic approach and manipulative treatment into patient care enables the physician to better diagnose and manage chest wall pain, especially when it is musculoskeletal in nature.


Osteopathic Considerations in Obstructive Pulmonary Disease: A Systematic Review of the Evidence

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2 Wilkes University – Nesbitt School of Pharmacy. Wilkes-Barre, PA.
3 Houston Healthcare – Family Medicine. Warner Robins, GA

INTRODUCTION
Since the earliest writings of Andrew Taylor Still, MD, DO, osteopathic literature has included case reports, study proposals, and research articles assessing efficacy in treating respiratory illnesses.1-3 Case reports have focused on somatic manifestations of respiratory disease, the role of anatomy and physiology in respiratory illness and the utilization of osteopathic manual medicine (OMM) to improve function as well as facilitate patient recovery. Investigations have evaluated the effect on recovery from infectious etiologies1-4 and improvement of pulmonary function in obstructive lung diseases.5-11 Chronic obstructive pulmonary disease (COPD) is characterized by a chronic limitation in airflow that is progressive and not fully reversible. It is caused by a chronic inflammatory response to noxious stimuli, including but not limited to tobacco use, and resulting in parenchymal destruction and airway disease. The pathologic changes lead to air trapping and airflow limitation causing breathlessness and other classic COPD symptoms.11 It represents the third leading cause of death in the United States11 and fourth leading cause worldwide.12 In addition to its role in mortality, the morbidity associated with the disease includes decreased exercise capacity and tolerance, as well as the direct and indirect costs of all medical interventions and decreased productivity in the workplace. The challenges that arise when treating the disease take a toll on the patient, the health care system, and the economy. When combined with interventions that impact the disease, such as tobacco cessation and evaluation of OMM not only has the potential to slow progression, but to also improve patient functionality and healthcare costs.

When attempting to determine the efficacy of OMM in treating COPD, most investigators consider evaluation and treatment of body regions highly associated with somatic manifestations of pulmonary disease, mainly in the thoracic and cervical regions as well as the ribs and diaphragm. Case reports and investigational studies have shown a correlation in somatic regions associated with visceral somatic and somatosomatic reflex patterns related to both sympathetic and parasympathetic innervations (Figure 1).1,12,14-17 Specifically, visceral somatic changes related to parasympathetic innervation occur at the base of the occiput where the vagus nerve exits the cranial, somatic findings in the upper thoracic region represent changes related to the sympathetic innervation of the lungs, and the classic findings of somatic dysfunction in the region of C3-5 follows with the somatosomatic reflex pattern related to innervation of the diaphragm. Flattening of the respiratory diaphragm, rib restrictions, decreased thoracic compliance, and thoracic outlet obstruction all result from air trapping and decreasing motion of the thoracic cavity as COPD progresses.

The body of evidence related to OMM in COPD shows frequent discussion of regional somatic dysfunction without noting types of dysfunction present. Similarly, when case reports and studies mention OMM, some specific techniques are mentioned (thoracic pump, rib raising, doming the diaphragm), but the discussion mainly focuses on the body areas treated (Figure 2). One of the ongoing challenges associated with OMM research is determining the efficacy of an individual technique versus the impact of normalizing somatic function on the disease being evaluated.

When reviewing studies focused specifically on utilization of OMM in COPD, the predominant theory noted was utilizing OMM to decrease chest wall rigidity to improve pulmonary function tests (PFT) and in turn, symptoms. Despite lacking overwhelming evidence of improved PFT results, a disease-oriented measure, a consistency is noted in subjective patient improvement. When considering the importance of patient-oriented evidence, subjective improvement in exercise tolerance and work of breathing continues to inspire investigators to explore reasons why this improvement occurs. It is the purpose of this systematic review to summarize the available evidence regarding the manifestations of OMM on the soma, and the effect of OMM on COPD.

METHODS
The objective was to perform a systematic review of the published literature on the effects of OMM in COPD. Studies were included for review based on the following criteria: patients had a diagnosis of COPD, and use of OMM or a manipulative treatment whose description was found to be similar to OMM and would likely produce similar results. The intervention was compared to either standard care, sham manipulation, minimal touch control or patient’s pretreatment baseline. The outcome measures included the effects of OMM on one or more of the following: PFT exercise capacity, and subjective reporting of symptoms. Ideal study design would be randomized controlled trials (RCT), however a review of the literature showed a small number of studies available and therefore other study designs were included.

A literature search was conducted using PubMed, IndexCare, OSTMED.DR, Cochrane Central Register of Controlled Trials, Google Scholar, Google Advanced, clinicaltrial.gov and TRIP database in order to identify articles for the purposes of this review. The following search terms or MeSH headings were used: manipulation, osteopathic, manipulation, spinal, lung, pulmonary disease, chronic obstructive, respiratory function test, respiratory tract disease, OMT, OMM, and COPD. The dates searched were from database inception through July 2015. Initial search results were filtered for relevance, according to our inclusion criteria, by the hospital librarian and the reviewers and the subsequent remaining articles were reviewed by two investigators. The bibliographies from relevant articles were scanned and hand searched for additional articles that met inclusion criteria.

Data was extracted using a standard table that included author, year of publication, country, study design, population inclusion criteria, participants, interventions, controls, outcomes measured, main findings, adverse effects, dropouts, comments, and limitations. Risk of bias in individual studies
Risk of bias was assessed using the Cochrane Collaboration’s tool. Individual studies were rated as having a low, high, or unclear risk of bias in the following categories: random sequence generation, allocation concealment, blinding of participants and personnel, incomplete outcome data, selective reporting and other potential sources of bias.18

Keywords: Chronic Obstructive Pulmonary Disease COPD Osteopathic Manipulative Medicine OMM
RESULTS

Study selection

Initial search of databases was performed by the Wilkes-Barre General Hospital librarian as well as additional records identified by the researchers. Initial filter of results was performed by the hospital librarian. 282 records were reviewed by two researchers. After duplicates, records not studying COPD, records not utilizing OMM or a manipulation technique described similar to OMM, nine studies were included in the systematic review.

Characteristics of studies

The included studies originated from four different countries: four studies from the United States,16-17;19-20 two studies from Australia,21-22 two studies from India,23-24 and one study from Italy.25 Five of the studies were randomized controlled trials (RCTs), including one crossover RCT. There was one cross sectional study, two pre-test / post-test design, and one randomized cohort study. Three of the studies utilized a sham or minimal touch control.20-22 Two of the studies had no control group.17;19 Three studies included a control of a standard therapy whether it be a standard pulmonary rehabilitation program or standard medication.17;24 The remaining two studies did not provide a description of their randomization method.24 Both Howell et al 16 and Bhilpawar & Arora23 did not blind participants. Zanotti et al25 felt that their patients were adequately blinded and were not able to determine their treatment group.

Blinding of participants and personnel

Due to the nature of OMM treatments, it was not possible for the personnel providing the treatments to be blinded. Most studies did not provide a description of participant or personnel blinding for ethical reasons or confusion. Three studies17;19;24 did not blind participants. Zanotti et al25 felt that their patients were adequately blinded and were not able to determine their treatment group.

Blinding of outcome assessment

Five studies provided an adequate description of blinding of personnel involved in assessing the outcome measures.17;19;20 The remaining four studies did not provide this information.3;17;19;24

Incomplete outcome data

Three studies accounted for all outcome data and performed intention to treat analysis.17;20-22 Two studies did not account for all the participants’ data in their outcome analysis.4;17 Four studies either did not provide information insufficient to determine if there was an effect on the outcomes.19;20;22-24

Selective reporting

Study protocols were not available so there was insufficient information to judge bias.

Other bias

Five studies declared funding sources.3;17;20 Appropriate information regarding conflict of interest was provided for six studies.19-24 Ethical approval and informed consent was described in all studies except Miller17 and Howell et al.16

STUDY RESULTS

An overview of the main findings of each study as well as reporting of adverse effects, drop outs and other comments or limitations pertaining to each study is provided in Table 2 (page 32 - 39). All studies used some form of pulmonary function tests as an outcome measure. Some studies also collected participant subjective data and assessment of exercise tolerance. There were no overall results for PFT outcomes. Maseeh et al21 did not demonstrate a significant difference in testing between the intervention group who received one minute five session of thoracic lymphatic pump (TLP) without activation plus ten minutes of saltulatum neuibulation and the control group which only received the rehabilitation treatment. Both groups showed a significant improvement in vital capacity (VC), forced vital capacity (FVC), forced vital capacity in the first second (FEV1), and their FEV1/FVC ratio from pre to post testing. Miller17 performed a RCT of 44 patients with COPD and found no significant difference in PFTs between the treatment and control group however some trends showing increase in residual volume (RV), Mean VC, total lung capacity (TLC) and FEV1 and decrease in partial pressure of carbon dioxide (PCO2) for the OMM group were noted. There were no description of dropouts and not all participants were accounted for in the data analysis. Noll et al2008 studied 35 patients over age 65 with COPD and compared a single 20 minute session of seven standard OMM techniques to a sham protocol. They also received treatment of specific somatic dysfunction that was found on structural exam. The results revealed an increase in RV, TLC and the ratio of those values for the OMM group compared to the sham treatment group. The results suggested a worsening of air trapping in the OMM group when assessed 30 minutes after the treatment sessions compared to the sham group. Subsequently, Noll et al2009 studied the effect of single OMM treatments and minimal touch on PFTs of patients 50 years or older in a crossover randomized controlled trial. They hoped to demonstrate the effects seen from individual OMM techniques compared with a multi-technique protocol. The results showed that there were varying changes to PFTs for the different techniques. However in all four OMM groups there was a worsening of FEV1’s post-treatment (Table 2, pages 34 - 39).

Two studies utilized a pre-post test design. Bilhpawar & Arora26 utilized a pre-post test design with no control group to study 30 COPD patients using non-randomized convenience sampling and used a single 20 minute OMM session with 7 different techniques.
<table>
<thead>
<tr>
<th>Author / Year / Country</th>
<th>Design</th>
<th>Inclusion Criteria</th>
<th>Participants</th>
<th>Intervention / Techniques used</th>
<th>Control</th>
<th>Outcomes / Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhilpawar &amp; Arora, 2013 India</td>
<td>pre-posttest non-random convenience sampling</td>
<td>COPD with FEV1 / FVC &lt;70%</td>
<td>30 patients (28 males) with COPD selected from outpt PT utilizing convenience sampling No specific baseline characteristics Ages 37-81</td>
<td>Single 20 minute session utilizing 7 techniques: Soft tissue kneading (paraspinal muscles in lower cervical and thoracic region) Rib raising Redomining the abdominal diaphragm Suboccipital decompression Thoracic inlet myofascial release Pectoral traction Thoracic lymphatic pump with activation</td>
<td>No control group</td>
<td>Chest expansion at axillary and xiphisternal level Peak expiratory flow rate Respiratory rate</td>
</tr>
<tr>
<td>Mascarenhas et al. 2013 India</td>
<td>Cross-sectional Patients with stable COPD grade I-III by GOLD guidelines</td>
<td>50 COPD patients in pulmonary medicine dept. Recruitment not clear</td>
<td>One 5 minute session Thoracic lymphatic pump without activation plus ten minutes of Salbutamol nebulization</td>
<td>Control group received only ten minutes of Salbutamol nebulization</td>
<td></td>
<td>Pulmonary function tests: VC, FEV1, FVC, FEV1/FVC ratio, PEF, FEF</td>
</tr>
<tr>
<td>Howell et al. 1975 US</td>
<td>pre-posttest case series</td>
<td>COPD according to ATS criteria</td>
<td>17 patients with COPD over a one year period Recruitment not clear</td>
<td>Single 20 minute session of 7 standard OMM techniques: Soft tissue to paraspinal muscles Rib raising Redomining of the abdominal diaphragm Suboccipital decompression Thoracic inlet myofascial release Pectoral traction Thoracic lymphatic pump with activation If applicable additional OMM for specific somatic dysfunctions discovered</td>
<td></td>
<td>Disease severity score derived from 11 parameters from spirometry and ARBs: pre-post testing at periodic intervals (pretreatment, 1 month and 3 months after initiation of OMM and then at 3 month intervals)</td>
</tr>
<tr>
<td>Noll et al. 2008 US</td>
<td>Double-blinded RCT 65 years and older with FEV1/FVC ratio &lt;70%</td>
<td>35 patients OMM group: 18 pts (mean age 69.6) Sham group: 17 pts (mean age 72.2)</td>
<td></td>
<td></td>
<td></td>
<td>Baseline and post-treatment PFTs Subjective feedback on effects and blinding protocols via phone survey</td>
</tr>
<tr>
<td>Noll et al. 2009 US</td>
<td>Cross over RCT 50 years and older with COPD, recruited from the clinical practice, newspaper ad, local talk radio, and COPD support groups</td>
<td>25 subjects: mean age 68</td>
<td>5 single technique treatment sessions: 4 OMM, 1 minimal touch control 4 week wash out period Random order: Minimal touch control Thoracic lymphatic pump with activation Thoracic lymphatic pump without activation Rib raising Myofascial release</td>
<td>Minimal Touch Control</td>
<td>PFTs at baseline, 30 minutes post treatment Subjective report on a telephone survey</td>
<td></td>
</tr>
<tr>
<td>Miller 1975 US</td>
<td>RCT Ages 36-65 with COPD Height: 145-185 cm for females 157-190 cm for males Weight: 41-85 kg for females 50-115 kg for males</td>
<td>Treatment group: n=23 Control group: n=21 Matched pairing for sex, age, gender and disease severity</td>
<td>Standard Treatment plus OMM 2x per week Methods to hyperextend the dorsal spine Techniques to increase any restrictive motion Techniques to increase lymphatic flow by applying anterior chest compression</td>
<td>Standard Treatment</td>
<td>PFTs: VC, FEV1, FEV2, FEFR, FRC, RV, TLC, pH, PO2, PCO2 Diffusion studies Minute ventilation Questionnaire on Respiratory Symptoms Musculoskeletal exam</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 1 (CONT.):
Characteristics of included studies

<table>
<thead>
<tr>
<th>Author / Year / Country</th>
<th>Design</th>
<th>Population Inclusion Criteria</th>
<th>Participants</th>
<th>Intervention / Techniques used</th>
<th>Control</th>
<th>Outcomes / Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zanotti et al. 2012 Italy</td>
<td>RCT: pilot study</td>
<td>COPD patients consecutively admitted to the pulmonary rehabilitation unit Stage III by GOLD criteria</td>
<td>20 stable patients with severe COPD in pulmonary rehabilitation (PR) Mean age 63, FEV1 26.9%</td>
<td>Pulmonary rehabilitation and 4 sessions of OMT tailored to suit the needs of the individual Treatment sessions once per week lasting 45 minutes each</td>
<td>Pulmonary rehabilitation plus soft manipulation sham treatments</td>
<td>6 minute walk test PFTs: VC, FEV1, RV, FVC</td>
</tr>
<tr>
<td>Engel et al. 2013 Australia</td>
<td>Randomized cohort pilot study</td>
<td>Age 40-65 Volunteers with moderate COPD Recruited from the general public by newspaper and radio ads</td>
<td>15 subjects: 9 male/6 female mean age 56.1 (range 49-63) moderate COPD, All white</td>
<td>Subjects randomly assigned to 1 of 3 groups: Soft Tissue (ST) ST and spinal manipulation (SM) ST, SM and exercise</td>
<td>No control group</td>
<td>FEV1, FVC Chronic respiratory questionnaire 6 minute walk test Monitoring of adverse effects</td>
</tr>
<tr>
<td>Engel et al. 2014 Australia</td>
<td>RCT</td>
<td>COPD referred by a respiratory specialist to a PR unit, ages 55-70 Non-smoker for preceding 12 months, ability to complete a 6-minute walk test</td>
<td>33 participants mean age 65.5 with COPD in PR</td>
<td>Subjects randomly assigned to 1 of 3 groups: Pulmonary rehabilitation ST + PR ST + SM + PR Each manual therapy session 20 minutes, before the exercise component of PR Two times per week for 8 weeks between weeks 4 to 12 of PR</td>
<td>PR only</td>
<td>BP, FEV1, FVC 6-minute walk test, St. George’s respiratory questionnaire hospital anxiety and depression scale</td>
</tr>
</tbody>
</table>

FEV1: forced expiratory volume in 1st second; FVC: forced vital capacity; GOLD: Global Initiative for Chronic Obstructive Lung Disease; VC: vital capacity.

### TABLE 2:
Summary of study results

<table>
<thead>
<tr>
<th>Author / Year / Country</th>
<th>Main Findings</th>
<th>Adverse Effects / Dropout</th>
<th>Comments / Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bhilpawar &amp; Arora, 2013 India</td>
<td>Mean increase in chest expansion at axillary level of 0.30 post treatment (p&lt;0.05) Mean increase in chest expansion at xiphisternal level of 0.29 post treatment (p&lt;0.05) Decrease in RR of 2.14/min (p&lt;0.05) Improvement in PEF of 11.73 (p&lt;0.05)</td>
<td>Stated patients had no signs of discomfort</td>
<td>Small sample size Baseline characteristics not fully described Methods not fully described No blinding described</td>
</tr>
<tr>
<td>Mascarenhas et al. 2013 India</td>
<td>No significant difference in PFTs between groups Both groups showed a significant improvement in VC, FVC, FEV1, FEV1/FVC The experimental group showed an improvement in FEF 75/25</td>
<td>Stated technique is free from side effects</td>
<td>PFTs at baseline similar in both groups No description of randomization Subjects not divided based on disease severity No patient subjective data No blinding described</td>
</tr>
<tr>
<td>Howell et al. 1975 US</td>
<td>Improvement in disease severity scores of 10.7% Significant improvement in PC02, O2, TLC and RV (p&lt;0.05)</td>
<td>No description of drop outs or adverse effects</td>
<td>Only 11 of 17 subjects data analyzed Patients admitted at different times No description of statistical tests Missing data/patients unaccounted for Small sample size Non-validated severity score</td>
</tr>
</tbody>
</table>

PEF: peak expiratory flow; FEF: forced expiratory function; ATS: American Thoracic Society; ABG: arterial blood gas; PFT: pulmonary function test; RCT: randomized controlled trial; FEFR: forced expiratory flow; FRC: functional residual capacity; RV: residual volume; TLC: total lung capacity
TABLE 2 (CONT.):
Summary of study results

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<thead>
<tr>
<th>Author / Year / Country</th>
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<th>Comments / Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noll et al. 2008 US</td>
<td>Significant improvement between OMT and control groups for 8 out of 21 pulmonary function parameters. FEV1 25% (p=0.04), FEF 50% (p=0.008), FEF 25-75% (p=0.02), and ERV (p=0.02) were significantly lower in the OMT group. RV (p=0.03) and TLC (p=0.02) were significantly increased in the OMT group. Airway resistance decreased in the OMT group (p=0.04). Phone survey showed that both groups reported an improvement in their breathing. 53% in the OMT group and 43% in the sham group correctly guessed their group assignment.</td>
<td>No severe side effects</td>
<td>Stratifed randomization by disease severity not fully described</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Small sample size</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phone survey is not a validated tool</td>
</tr>
<tr>
<td>Noll et al. 2009 US</td>
<td>Minimal touch control: Inspiratory capacity showed a decrease from baseline post-treatment (p=0.008) Thoracic lymphatic pump with activation: Post-treatment decrease in FEV1max (p=0.001), MVV (p=0.005), ERV (p=0.0001), and SVC (p=0.04). There was a significant increase in RV (p=0.03) and RV/TLC (p=0.04) Thoracic lymphatic pump without activation: Post-treatment decrease in FVC (p=0.02), FEV25-75% (p=0.006), and MVV (p=0.02). Increase in airway resistance relative to baseline (p=0.04). Rib raising: Post-treatment decrease from baseline in FEV1max (p=0.01) and MVV (p=0.0004) Myofascial release: Post-treatment decrease in FEV1 (p=0.03), FEV25-75% (p=0.007), FEVmax (p=0.007), MVV (p=0.03), and SVC (p=0.008). No significant difference between groups from baseline to 30 minutes post-treatment. Subjects reporting perceived health benefits from the treatment: minimal touch control 41%, TLP with activation 76%, TLP without activation 67%, rib raising 68%, myofascial release 53%. Subjects reporting improved breathing after treatment: minimal touch control 44%, TLP with activation 74%, TLP without activation 57%, rib raising 79%, myofascial release 50% Subjects in all group reported enjoying the treatment (71-88%) and would recommend it to others (71-95%).</td>
<td>Side effects were noted in 1/18 patients (6%) in the minimal touch session, 4/23 (17%) after TLP with activation, 4/21 (19%) after TLP without activation, 3/20 (15%) after rib raising, and 2/16 (13%) after myofascial release. Side effects reported were: common muscle soreness or pain and none were severe. Missed sessions for each group described</td>
<td>Subjects and physicians performing OMT were not blinded Individuals collecting the data, performing the PFTs, and performing the phone survey were blinded Allocation concealment, description of randomization provided Unable to contact all patients for follow up telephone survey</td>
</tr>
<tr>
<td>Miller 1975 US</td>
<td>92% of treatment group reported greater walking distances, few cold/URIs, and less dyspnea than prior to treatment. Trends noted: RV: OMT group increased by 0.5L (29%), no change in control (p=0.05) Mean VC: OMT group increased 0.5L, control group increased 0.1L (p=0.05) TLC: OMT group increased 1.0L (17%), control group increased 0.1L (2%) FEV1: OMT group increased 2.1L, control decreased 2.4L PCO2: OMT group decreased 5 mm Hg, control decreased 3.3 mm Hg</td>
<td>No description of drop outs or adverse effects</td>
<td>Recruitment not clear Random allocation with matched pairing No description of allocation concealment Neuro muscular exam performed by 2 physicians who were blinded to treatment group Follow up time not given / Duration of treatment not stated Not all participants/data accounted for No description of statistical analysis Small sample size</td>
</tr>
<tr>
<td>Zanotti et al. 2012 Italy</td>
<td>Both groups showed an increase in 6MWT PR group increased 23.7 m and PR + OMT group increased 72.5 m (p = 0.01) Between group analysis showed a significant increase in 6MWT in the OMT group compared to the PR only group (48.4 m; 95% CI 17-80.6m; p = 0.04) Significant decrease in RV in OMT + PR group compared to PR only group (-0.44L; 95% CI -0.26 to -0.62; p = 0.001) FEV1: Between group analysis showed no difference but within group analysis showed a change of FEV1 from 0.99L to 1.13L (14%) for the OMT+PR group which is noteworthy despite not reaching statistical significance.</td>
<td>Reported no adverse eects or side-effects No-drop-outs</td>
<td>Allocation concealment described Data collectors and patients blinded Statistical analysis described No patient subjective data on symptoms or quality of life</td>
</tr>
<tr>
<td>Engel et al. 2013 Australia</td>
<td>FVC: Increase in ST + SM + Ex group compared to ST + SM (100%) and ST only (100.1%) groups (p=0.0001) Increase in walking distance for groups that received ST + SM (120m) and ST + SM + Ex (168m), when compared to ST only (p=0.0001) Decreased dyspnea levels reported in ST + SM (0.64) and ST + SM + Ex (0.44) groups compared to ST only group (p=0.0001)</td>
<td>One participant dropped out for personal reasons No major or moderate adverse effects reported Mild adverse effects of muscle soreness after 15% of MT sessions</td>
<td>Random allocation described Assessor blinding to intervention ST and SM interventions administered by single clinician who was blinded to all results during the intervention phase of the study Duration 4 weeks (8 sessions at 2 sessions per week) / Small sample size Standardized duration of treatment session for each intervention group Intention to treat analysis performed</td>
</tr>
</tbody>
</table>
Five of the studies reported some form of subjective patient data; three utilized non-validated surveys or questionnaire.11,12,20 and two studies using a validated questionnaire.19,21 Miller19 utilized a questionnaire on respiratory symptoms and found that 92% of the OMM treatment group reported greater walking distance, fewer colds or upper respiratory infections, and less dyspnea than prior to OMM treatment. No difference in blood pressure. Two studies utilized validated questionnaires to collect patient health benefits from the treatments and improved breathing after treatment (see Table 2).

Two studies utilized validated questionnaires to collect subjective patient data. Engel et al (2014)11 utilized the Chronic Respiratory Questionnaire (CRQ-SAS) score and found that patients in the ST + SM + PR group had a significant increase in FVC compared to PR only (0.40L, 95% CI: 0.02, 0.79; p=0.03). No difference between group for HAD or SGRQ scores. Noll et al (2009)19 found that both the OMM and sham treatment groups reported an improvement in their breathing and 53% in the OMM group and 41% in the sham group correctly guessed their group assignment. Noll et al (2009)19 found that 71% of subjects within the minimal touch treatment group reported enjoying the treatments compared to 80-88% in the four OMM treatment groups. Most subjects would also recommend the treatment to others, ranging from 71% in the minimal touch group to ranging from 91-95% in the four OMM treatment groups. More subjects in the OMM groups reported health benefits from the treatment and improved breathing after treatment (see Table 2).

FEV1: forced expiratory volume in 1st second; FVC: forced vital capacity; VC: vital capacity; PEF: peak expiratory flow; FEF: forced expiratory flow; ATS: American Thoracic Society; ABG: arterial blood gas; PFT: pulmonary function test; RCT: randomized controlled trial; FEFR: forced expiratory flow; TLP: thoracic lymphatic pump; SVC: slow vital capacity; URI: upper respiratory infection; AE: adverse effects; 6MWT: 6 minute walk test; PR: pulmonary rehabilitation; ST: soft tissue; SM: spinal manipulation; MT: manual therapy; HAD: hospital anxiety and depression scores; SGRQ: St. George’s Respiratory Questionnaire

**TABLE 2 (CONT.)**

<table>
<thead>
<tr>
<th>Author / Year / Country</th>
<th>Main Findings</th>
<th>Adverse Effects / Dropouts</th>
<th>Comments / Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engel et al. 2014 Australia</td>
<td>Difference between all three groups significant for FVC at 24 weeks (p&lt;0.04)</td>
<td>Two participants in the ST + PR group reported mild AE of muscle soreness, withdrawn reports</td>
<td>Randomization and allocation concealment described</td>
</tr>
<tr>
<td></td>
<td>ST + SM + PR group had a significant increase in FVC at 24 weeks compared to PR only (0.40L, 95% CI: 0.02, 0.79; p&lt;0.03)</td>
<td></td>
<td>Statistical analysis described</td>
</tr>
<tr>
<td></td>
<td>No difference between group for HAD or SGRQ scores.</td>
<td></td>
<td>Intention to treat analysis</td>
</tr>
<tr>
<td></td>
<td>There was a difference between all three groups for the 6MWT at 16 and 24 weeks (p=0.01 and p&lt;0.003, respectively). No difference when comparing the ST + SM + PR group or the ST + PR group to the PR only group.</td>
<td></td>
<td>Baseline characteristics not all similar (gender and HAD scores)</td>
</tr>
<tr>
<td></td>
<td>Significant improvement noted in the 6MWT between the ST + SM + PR group compared to the ST + PR group at 16 and 24 weeks (p=0.01) and p&lt;0.02 respectively.</td>
<td></td>
<td>Groups not evenly distributed</td>
</tr>
<tr>
<td></td>
<td>No difference in blood pressure.</td>
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</table>

One study did not mention any adverse effects.17 There were no severe adverse effects reported in any studies and the common minor adverse effects reported were mild muscle soreness or pain which mainly resolved on their own without any treatment.14,15

**DISCUSSION**

The clinical case reports reviewed in preparation for this systematic review all discussed the positive impact noted when adding OMM to treatment of acute exacerbations of COPD and reinforced that clinical experience physicians have expressed as the basis for the studies conducted in this area. The research articles included in this review focused less on acute exacerbations and more on management of the chronic disease process. Most utilized a variety of disease-oriented markers such as FEV1, FEF, ABGs, and chest wall expansion but some also included patient-oriented outcomes such as impact on exercise capacity and frequency of symptom questionnaires. This review found that incorporating OMM into chronic disease management had the highest impact on patient-oriented outcomes, such as symptom improvement, while limited effect was demonstrated on disease-oriented outcomes. We also found that most of the studies had limitations associated with small study size, study design, and the potential for bias. Previous discussions looking to explain the impact of OMM on COPD have focused on the mechanical aspect of breathing but the results of this systematic review would indicate that other means of impacting the disease should be considered as well. Techniques such as the thoracic pump and doming the diaphragm decrease congestion areas, improve lymphatic flow within minutes of the treatment and the evidence supports that when applied, patients report feeling better regardless of the results of lung function measurements. This may also explain the improvement noted in the case studies reviewed for this article. Improving lymphatic flow and minimizing pulmonary congestion allows the body to maximize its ability to resolve the acute disease process.

This review ran into challenges associated with limited studies that were not consistently of high quality and built from information garnered from reviewing case studies that is outside the usual spectrum of a literature review. Considering the relative infancy of osteopathic medicine and the challenges associated with performing research in OMM, case studies still serve a role in defining the impact OMM may have in treating a disease process. As knowledge and understanding of OMM study limitations increase, future investigation of OMM and COPD should minimize the challenges noted here and incorporate well-designed studies that provide evidence regarding the effects on patient-oriented outcomes. It is our hope that this review will stimulate thought regarding study design that will demonstrate the impact OMM has on treating patients with this disease process.

Considering the impact that this disease has on patients and society, continuing to explore how to best utilize OMM within the context of treating it has the potential to impact the health care system on multiple levels. Further studies might wish to focus on treatment in acute exacerbations and longer, larger studies utilizing techniques that address lymphatic flow in addition to maximizing thoracic cage function and using patient-oriented outcomes to demonstrate the value OMM can add to managing COPD.

**ACKNOWLEDGMENTS**

The authors would like to thank Rosemarie Taylor, MALS, MBA, AHP, manager of Library Services at Wilkes-Barre General Hospital for her assistance in the literature search and retrieval of full text versions of articles requested.

**REFERENCES**


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**Erythrodermic Psoriasis**

Erythrodermic psoriasis can result from chronic plaque psoriasis and is defined as generalized erythema that covers nearly the entire body surface area with varying degrees of scaling. As illustrated in Figure 2a, it can often appear as if the skin is severely burned. Fever, chills, and even dehydration due to fluid loss can accompany this variant of psoriasis.

**Guttate Psoriasis**

Guttate psoriasis is characterized by salmon-pink drop lesions that are approximately 1-10mm in size. This form of psoriasis typically has a sudden onset following a Streptococcal infection. It is seen more often in individuals younger than 30 years old (Figure 2e).

**Inverse**

Inverse or flexural psoriasis is described as lesions that develop within skin folds like axillae, groin, gluteal cleft, nails, and sites of recurrent trauma. The location and appearance of these lesions can significantly help distinguish psoriasis from other papulosquamous skin disorders.

**Comorbidities**

Psoriasis is a complex disease of deregulated inflammation that is thought to have an immunologic pathogenesis. Due to chronic inflammation and suspected immunologic pathology there are several associated comorbidities that must be addressed when treating psoriasis. Patients with psoriasis have an increased risk of cardiovascular disease. These patients are typically overweight or obese (BMI >25), have a higher incidence of diabetes and hypertension, and decreased high-density lipoproteins. Even after correction for risk factors in individuals unaffected by psoriasis, the probability of a psoriasis patient experiencing a myocardial infarction was significantly higher.

**Materials & Methods**

In order to research the current information pertaining to the treatment of psoriasis, a literature review was conducted utilizing the keywords of psoriasis, psoriasis treatment, and psoriasis management. Several different search engines were used to find the current and most appropriate treatment options to treat psoriasis including PubMed, Medscape, Up to Date, and Google Scholar. To supplement these search engines The Journal of the American Academy of Dermatology, American Journal of Clinical Dermatology, and several journals published by the American Academy of Dermatology were also used.

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**Psoriasis**

Psoriasis is a chronic, hyperproliferative skin disorder that affects approximately 2% of the U.S. population. It is a hyperproliferative state most commonly resulting in erythematous skin papules and plaques with a silver scale. Psoriasis is a chronic condition that is present throughout a patient’s lifetime with periods of waxing and waning often precipitated by the initiation or cessation of treatment.

This article will briefly describe the varying types of psoriasis, pathogenesis of the disease, how to diagnose psoriasis, and an in-depth discussion of the numerous options available to treat psoriasis. We will outline the various treatments using a stepwise approach ranging from over the counter remedies for mild psoriasis to prescription medications used for severe psoriasis. A comparison of each treatment’s indication, advantages, and disadvantages will also be presented along with illustrations on how to treat patients suffering from psoriasis utilizing an osteopathic approach by focusing on the body as a unit. The goal of this review is to provide a systematic technique that one can use in order to effectively treat psoriasis patients.

**Background**

Various types of psoriasis are traditionally diagnosed using morphologic descriptions. It is common for clinical findings to overlap in more than one category resulting in the implementation of numerous treatment regimens to control the patient’s varying disease states.

**Plaque**

Plaque psoriasis is the most common form of psoriasis affecting 80 to 90 percent of psoriasis patients. It is defined as scaly, erythematous, patches, papules, and plaques. The severity of plaque psoriasis can range from only a few plaque lesions to numerous lesions covering most of the skin surface.
DISCUSSION

General Approach

It is important when diagnosing a patient with psoriasis to provide education on treatment options and communicate that psoriasis is a chronic condition with no cure.4,5 It may also be beneficial to refer patients to an organization such as the National Psoriasis Foundation for more information and support groups.3,6

Realistic expectations should be explained when determining an appropriate treatment regimen with the goal of treatment being to control the disease and lessen the appearance of skin lesions.1,7

Topical Treatment

Topical therapy is typically first line when treating psoriasis. This option is practical for patients suffering from localized lesions or mild to moderate psoriasis affecting less than 5% of BSA.2,3,5

Over the Counter

There are several over the counter treatment options for plaque psoriasis. The active ingredients in treatments approved by the FDA is tar and salicyclic acid.2,3 Salicylic acid is considered a keratolytic agent that causes the outer layer of skin to shed that helps to soften psoriatic lesions and reduce the appearance of scaling.4,5 Although rare, the concern of using salicylic acid is the potential for systemic absorption if it is applied to >20% BSA. It can decrease the efficacy of UVB phototherapy and should be avoided prior to treatment.2

Topical corticosteroids are the first line agent for localized psoriasis; however, these studies show a wide range of efficacy and only average several weeks which inhibits the assessment of long-term therapy (See Table 1).4

Due to the variation in study design and populations make it difficult to compare each of these studies. However, a systematic review by Mason et al. has demonstrated that potent and very potent formulations are more effective at improving psoriasis plaques than mild or moderate corticosteroids.1,6

Non-Steroids

In addition to topical corticosteroid treatment there is a variety of non-steroidal topical treatment options.

Vitamin D Derivatives

These formulations include calcipotriene and calcitriol, which act by binding to vitamin D receptors inhibiting keratinocyte proliferation and enhancing keratinocyte differentiation.2 Calcipotriene has been proven effective through a systemic review of randomized controlled trials where only potent topical corticosteroids appeared to have a comparable outcome at 8 weeks.70% of patients with plaque psoriasis improved with calcipotriene compared to 20% - 75% improvement in their condition compared to 15% of vehicle-treated patients.3 Calcitriol has additional mechanism to treat psoriasis by inhibiting T-cell proliferation and other inflammatory mediators.4 In a systemic review, calcipotriene and calcitriol showed equal efficacy, but calcitriol appeared to be less irritating on sensitive areas of the skin compared to calcipotriene.

The greatest benefit of topical vitamin D derivatives are when used in conjunction with topical steroids.2 Combining the use of these agents show clearance of lesions or excellent improvement of the plaque.4 However, a separate study of 80 patients with interiginous psoriasis showed that the use of betamethasone valerate 0.1% was more effective than pimecrolimus.5 It is recommended that these agents be used when topical treatment of the face or intertriginous areas are required for a prolonged period.6 The use of these agents has reduced side effects compared to the long-term risk of skin atrophy seen in chronic topical corticosteroid use.7

Advantages

Vitamin D derivatives have been proven to provide improvement to plaque psoriasis, especially when used in combination with topical corticosteroids.6-8 It has also been shown that with continuous use local side effects are often diminished.

Retinoid

The class of drugs, specifically tazarotene, is commonly used for acne and psoriasis.9 It works by normalizing keratinocyte differentiation, diminishing hyperproliferation, and by decreasing expression of inflammatory makers.10 This drug has been proven safe and effective in two randomized, vehicle-controlled trials.11,12 Daily administration of tazarotene gel (0.1% or 0.5%) compared favorably with the twice-daily administration of topical fluocinolone 0.05%. Furthermore, it was proven that the 0.1% cream was more effective than 0.05% cream, but had a higher incidence of local side effects.13,14 Similarly to vitamin D derivatives, tazarotene is best beneficial when used in combination with topical corticosteroids.6,8,15

Indications

The use of tazarotene is an alternative first-line agent that should be used with topical corticosteroids for optimal therapy.15-16

Advantages

The major side effects of tazarotene are local irritation, dryness, potential for sensitizing effect, and its teratogenic properties. For this reason, tazarotene is considered Pregnancy category X.16

Combining this product with topical steroids or moisturizers should reduce the prevalence of local irritation.15,16

Calcineurin Inhibitors

Tacrolimus and pimecrolimus, two calcineurin inhibitors used to treat psoriasis, act by blocking the synthesis of numerous inflammatory cytokines that play a role in psoriasis.17

Indications

The use of calcineurin inhibitors is most effective when used on thinner skin such as the face and intertriginous regions. Two separate eight week randomized trials found that the use of these agents show clearance of lesions or excellent improvement versus the placebo.18 However, a separate study of 80 patients with interiginous psoriasis showed that the use of betamethasone valerate 0.1% was more effective than pimecrolimus.19 It is recommended that these agents be used when topical treatment of the face or intertriginous areas are required for a prolonged period. The use of these agents has reduced side effects compared to the long-term risk of skin atrophy seen in chronic topical corticosteroid use.20

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<td>41% - 83%</td>
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Advantages

Side effects for vitamin D derivatives are minimal. However up to 35% of patients may experience local skin irritation including burning, pruritus, edema, peeling, dryness, and erythema.15-16 Systemic side effects with this treatment are possible but extremely rare unless the patient is applying more than the recommended dosage of 100g/week. These side effects can include hypercalcemia and parathyroid suppression.15 The biggest disadvantage of vitamin D derivatives is their cost compared to many generic potent corticosteroids. This product is a pregnancy category C.17

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Corticosteroid & Vitamin D Derivatives
This combination is more efficacious than the benefit of using either as monotherapy. In a four-week trial study with 1603 participants 48% of patients treated with combination calcipotriene 0.005% and betamethasone 0.064% achieved clear or almost clear response (EASI 75) compared to 16.5% and 26.3% in patients treated with calcipotriene or betamethasone alone respectively. The use of this drug in treating plaque psoriasis in all areas of the body excluding the face is a grade A recommendation and should be considered as a first line agent when choosing an initial topical therapy option.

Corticosteroid & Tazarotene
It has been demonstrated that adding topical corticosteroids to tazarotene reduces the irritating side effects of tazarotene. Combination therapy has several potential benefits including increasing the duration of treatment benefit, increasing length of remission, and decreasing steroid induced atrophy. This combination is a category A recommendation and could be considered first line when determining an option for optimal topical therapy.

Systemic Therapy
Conventionally systemic treatment options are reserved for patients with severe psoriasis (>10%BSA); however some patients with limited psoriasis have been treated successfully systemically if their condition is causing debilitating symptoms such as lesions localized to palms, soles of the feet, or scalp. Patients being treated systemically for there psoriasis should be seen regularly by a dermatologist with appropriate training in order to achieve maximal therapy.

Phototherapy
UVA and UVB wavelengths have been used to treat psoriasis. It is thought that a direct immunosuppressive effect on Langerhans cells and an indirect immunosuppressive effect on cytokines by blocking the activation of T-helper cells have been demonstrated. The most commonly reported adverse effects of this therapy is erythema, itching, burning, and stinging; these typically can be managed by altering the duration of therapy. UVA and UVB therapy should be monitored by a dermatologist with appropriate skill and expertise in this area in order to minimize adverse effects.

Apostil
Sulfuric acid has been shown to improve the efficacy of corticosteroids by increasing penetration. To ensure the risk of toxicity is not increased when adding sulfuric acid to steroid treatment it is recommended that the corticosteroid should not exceed medium potency. The use of this combination is a category B recommendation and should be used when treating especially thick or scaly plaques.

Acitretin
Oral retinoids are vitamin A derivatives that act to treat psoriasis by modulating epidermal proliferation and differentiation by exerting an anti-inflammatory and immunomodulatory effect. There are several adverse effects that have been associated with acitretin therapy that may be severe in its teratogenicity. It is pregnancy category X due to its potential to cause cardiovascular, ocular, auditory, central nervous system, craniofacial, and skeletal abnormalities. The half-life of acitretin is significantly increased with the ingestion of alcohol; potentially taking up to three years for the drug to be eliminated from the body and therefore should be avoided in women of childbearing age. It is common for patients with active psoriasis to experience mucocutaneous side effects including dry eyes, nasal and oral mucosa, hair loss, and epistaxis in varying degrees. Patients who are being maintained on acitretin should obtain a lipid profile every 2 weeks for the first 8 weeks and then every 6-12 weeks after that due to the reported effect on triglyceride levels. Adverse effects of acitretin may be exacerbated when taken concomitantly with drugs that are metabolized by cytochrome p450. Studies have shown that acitretin in combination with phototherapy is more effective than either as monotherapy and decreases the risk for squamous cell carcinomas. Prior to initiating therapy it is important to conduct a thorough history and physical, obtain a pregnancy test, lipid profile, and liver function tests. "

Apremilast
This newly approved treatment acts by inhibiting phosphodiesterase-4 leading to a reduced production of cytokines that are thought to be involved in the pathogenesis of psoriasis. In two randomized, placebo-controlled studies, patients taking apremilast achieved a 75% improvement in their psoriasis compared to 5% and 6% of the placebo groups. The reported success rate of this treatment option is lower than those achieved by calcipotriene, TNF-α inhibitors, and ustekinumab. Apremilast has been reported to cause short-term diarrhea typically occurring during the onset of treatment and improving with continued use. Research has demonstrated that titrating patients up to the recommended dose improves the tolerability of treatment. Other commonly reported side effects of apremilast include nausea, upper respiratory infection, headache, weight loss, and an increased risk for depression. Apremilast is metabolized by cytochrome p450 and has been shown to have a reduced efficacy if given with an inducer. It is also recommended to reduce the dose of Apremilast in patients with severe renal impairment (CrCl ≤ 30 mL/min). Safety and efficacy of this treatment option has not been established in patients younger than 18 years old. It is classified as pregnancy category C and has not been adequately studied in pregnant women.

Biologic Agents
Biologic agents are a relatively new approach to treating psoriasis and are most commonly administered subcutaneously or intravenously. The biologic therapies that are currently available in the United States include etanercept, infliximab, adalimumab, all which act to inhibit TNF-α and, ustekinumab, which is a human monoclonal antibody that targets IL-12 and IL-23. Biologic agents are routinely used when traditional systemic agents fail or are unsuitable due to comorbidities.
TNF-α Inhibitors
Eternoncept, infliximab, adalimumab all act by inhibiting the pro-inflammatory cytokine TNF-α.8,9 Each of these drugs increases the risk of infection particularly in the upper respiratory tract.2 Due to the subtle presentation of this adverse effect, it is important to conduct regular monitoring in these patients. In the event the patient requires treatment with antibiotics, the TNF-inhibitor should be withheld and should be avoided in any patients with chronic or recurring infections.1 It has also been noted that TNF-α has an important role in the host response to tuberculosis (TB), putting patients taking TNF-α inhibitors at an increased risk for developing TB or experiencing a reactivation of TB. Prior to initiating therapy all patients should obtain test- ing for TB.2,3 Additional adverse effect of this medication is the association with peripheral and central demyelinizing disorders, heart disease, drug-induced lupus-like syndrome, hepatic disease, lymphoma, and skin cancer.1 These effects warrant ongoing physi- cal exam, TB testing, CBC, and LFT.10 In general TNF-α inhibitors should be avoided in patients who have Multiple Sclerosis (MS), a first-degree relative with MS, or any active infection. Extreme caution should also be taken when prescribing TNF-α inhibitors to patients with heart failure. Due to its immunosuppressive effect, it is also important patients to avoid any live vaccinations. These drugs are considered pregnancy category B.8

IL-12/23 Blockers
The FDA approved use of Ustekinumab in 2009 to treat patients with moderate to severe psoriasis.11 There has been occasional injection site reaction and rare reports of serious infection and cardiovascular events with usage of this drug. It requires similar monitoring as the other biologic agents including PPD, LFT, and CBC with ongoing physical examination. Ustekinumab is also a pregnancy category B.8,9

Additional Treatment
The evidence linking psoriasis to metabolic disease is rapidly ex- panding and although this association does not infer causality it is vital that patient’s with psoriasis be evaluated for the concomitant presence of these diseases.5,6 By using a targeted intervention approach for patients with psoriasis, early detection of diseases that are in the spectrum of metabolic syndrome can help reduce mortality.

In addition to screening, patients should be encouraged to cor- rect any modifiable cardiovascular risk factors including smoking cessation and lowering their BMI.11,12 Although the predominant visual manifestation of psoriasis is cutaneous, it also affects the patients mind, body, and spirit. It can be a very aggravating dis- ease for patients and it is vital that as a provider you spend adequate time with these individuals to address every aspect of the disease.6 Patients suffering from psoriasis have an increased risk for psychological disorders and psychosocial disability due to the affected perception of the themselves.6,7 These can be al- leviated with counseling, support groups, or psychoactive medi- cations.6 Due to the immunologic pathogenesis of psoriasis, it is also important to maintain the osteopathic principle that the body is capable of self-regulation, self-healing, and health maintenance. Treating the whole patient by addressing mind, body, and spirit can help improve overall quality of life.

CONCLUSION
Psoriasis is a chronic inflammatory condition affecting approxi- mately 2% of the Population.1 There are several approaches to treating this disease ranging from the over the counter treatments to biologic injectable agents. An algorithm for approaching the treatment can be found in Figure 3. Treatment is based off of the type of psoriasis and where on the body the patient is affected. When managing patients suffering from psoriasis it is important to consider the effect it has on the mind, body, and spirit paying close attention to any psychological changes and monitoring for co-morbid conditions such as metabolic syndrome. The treatment of psoriasis can be complex and very frustrating for patients. With appropriate monitoring and collaboration with a dermatologist as needed, can help patients set realistic treatment goals and have an increased quality of life.

REFERENCES:
The patient is a 47-year-old white female who presents to the clinic with right eye pain and redness of two days duration. She describes the pain as burning and constant with an intensity of 8/10. The eye problem was preceded by congestion in the ipsilateral maxillary sinus as well as pain in the ipsilateral ear and throat. She also reports a headache localized to the right periorbital region with intermittent, stabbing pains radiating to the right ear. She has tried OTC decongestants and analgesics with only temporary relief. She also tried hot/cold compresses with no relief. She has no fever and no pain or rash anywhere else on the body. Medical and family histories are noncontributory. She works as a second grade school teacher. She reports no known sick contacts but does admit to increased stress lately due to family issues.

QUESTIONS:

1. What is the diagnosis?
   a. Viral conjunctivitis
   b. Ramsay-Hunt syndrome
   c. Impetigo
   d. Rhus dermatitis
   e. Shingles with ocular involvement

2. How is this condition diagnosed?
   a. HSV titers
   b. Slit lamp exam
   c. Thorough history and physical
   d. Tzanck smear
   e. All of the above aid in diagnosis

3. How is this condition treated?
   a. Aggressive pain control
   b. Antiviral/anti-inflammatory ophthalmic formulations
   c. Supportive measures
   d. Systemic antiviral therapy
   e. All of the above
The given clinical history is most suspicious for ocular shingles.

**What is this condition treated?**

The correct Answer is: E. 

**How is this condition diagnosed?**

The correct Answer is: E. All of the above

**What is this condition treated?**

The correct Answer is: E. All of the above

**REFERENCES**


### CALENDAR OF EVENTS

#### 2016

**June 3 - 5, 2016**  
Maine Osteopathic Association  
2016 Annual Oceanside Convention  
Samoset Resort  
Rockport, Maine  
www.mainedo.org

**July 27 - 31, 2016**  
Florida ACOFP Annual Convention  
Omni Orlando Resort  
Champions Gate, Florida  
www.fsacofp.org

**August 4 - 7, 2016**  
California ACOFP 40th Annual Scientific Medical Seminar  
Disneyland Hotel  
Anaheim, California  
www.acofp4ca.org

**August 4 - 7, 2016**  
MAOFP Summer Family Medicine Update  
Grand Traverse Resort & Spa  
Acme, Michigan  
www.marofp.org

**August 4 - 7, 2016**  
TOMA & Texas ACOFP Joint Annual Convention  
LaCantera Hill Country Resort  
San Antonio, Texas  
www.txacofp.org

**August 5 - 7, 2016**  
POFPS 41st Annual CME Symposium  
Hershey Lodge  
Hershey, Pennsylvania  
www.pomas.org

**August 11 - 14, 2016**  
North Carolina ACOFP Annual Meeting  
Courtyard Marriott  
Carolina Beach, North Carolina  
www.nc-acofp.org

**August 12 - 14, 2016**  
ACOFP Intensive Update & Board Review  
Loews Chicago O‘Hare Hotel  
Rosemont, Illinois  
www.acofp.org

**September 17 - 20, 2016**  
OMED 2016: ACOFP / AOA's 122nd Annual Osteopathic Medical Conference & Exhibition  
Anaheim, California  
www.acofp.org

**September 20 - 24, 2016**  
AAFP Family Medicine Experience  
Orange County Convention Center  
Orlando, Florida  
www.aafp.org

**November 3 - 6, 2016**  
Inaugural Joint IOMS Annual Meeting & Scientific Seminar  
Hilton Chicago  
Oak Brook, Illinois  
www.ioms.org

**December 2 - 4, 2016**  
IOA Annual Winter Update  
Sheraton Hotel at Keystone Crossing  
Indianapolis, Indiana  
www.inosteo.org

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**August 12 - 14, 2016**  
ACOFP Intensive Update & Board Review  
Loews Chicago O'Hare Hotel  |  Rosemont, Illinois  
32 AOA Category 1-A CME credits anticipated!

**September 17 - 20, 2016**  
OMED 2016  
Anaheim, California  
Over 30 AOA Category 1-A CME credits anticipated!

**March 16 - 19, 2017**  
ACOFP 54th Annual Convention & Scientific Seminars  
Gaylord Palms Resort & Convention Center  |  Kissimmee, Florida  
Over 30 AOA Category 1-A CME credits anticipated!
Updated ADA Standards for Diabetes Management Include:

- Adults without symptoms of any age, who are overweight or obese (Body Mass Index: BMI ≥ 25 or ≥ 23 in Asian Americans) and have one or more additional risk factors for type 2 diabetes should be checked for diabetes. For all patients, testing for diabetes should begin at age 45 years.
- All people with diabetes should participate in a Diabetes Self-Management Education and Support program. This program should have information that patients need to prevent the onset of diabetes and complications.
- Your doctor should encourage you to eat a healthy diet with whole grains, beans, fresh vegetables, and fruit (instead of simple sugars and carbs). If your doctor has no concerns about you doing exercise, you should perform at least 150 min/week of physical activity (such as brisk walking) over at least 3 days/week to achieve the appropriate weight loss.
- Weight loss medications may be helpful in addition to diet, physical activity, and behavioral counseling for selected patients with type 2 diabetes and a BMI ≥ 27. Bariatric surgery may be considered for adults with a BMI > 35 and type 2 diabetes, particularly if the diabetes or associated comorbidities are difficult to control with lifestyle and medication therapy.
- Do not smoke cigarettes, use other tobacco products, or e-cigarettes.
- Your physician should treat your blood pressure to a goal of < 140/90 mmHg.
- Aspirin therapy should be considered as a primary prevention strategy in most men and women with diabetes who are ≥ 50 years of age and have at least one additional major risk factor (family history of premature heart disease, high blood pressure, high cholesterol, protein in the urine, smokers) and not at risk for bleeding.
- An eye doctor should do a dilated & complete eye exam yearly for all diabetics. If you have type 1 diabetes, the first exam should be within 5 years of the onset of diabetes. Patients with type 2 diabetes should have the same eye exam performed at the time of diabetes diagnosis. Your doctor may consider exams every 2 years if you have no symptoms and previous exams were normal.
- Your physician should assess you for diabetic nerve damage at each visit. This exam should start at the time of type 2 diabetes diagnosis and at least annually thereafter. This includes a complete foot exam.
- If you are a woman with diabetes who is of childbearing age, your physician should counsel you about the importance of near normal blood sugar control before planning pregnancy.
AUGUST 12 - 14, 2016
Loews Chicago O’Hare Hotel | Rosemont, IL

2016 INTENSIVE UPDATE & BOARD REVIEW IN
OSTEOPATHIC FAMILY MEDICINE

32 Category 1-A CME credits anticipated!
Register online at acofp.org.
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