July 2025
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South Dakota medicine

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Office of Publication
2600 W. 49th Street, Suite 100
Sioux Falls, SD 57105
605.336.1965
Fax 605.274.3274
www.sdsma.org

Editor
Keith Hansen, MD

SDSMA President
Keith Hansen, MD

Chief Executive Officer
Barbara A. Smith

Staff Editor
Elizabeth Reiss, MS
–ereiss@sdsma.org, 605.336.1965

Advertising Representative
Elizabeth Reiss, MS
–ereiss@sdsma.org, 605.336.1965

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Mission Impossible: Fighting Burnout

Alan Sazama, MD

Recently I caught the new Tom Cruise *Mission Impossible* movie, highly recommend. The movie includes the 62-year-old Tom Cruise attempting several death defying stunts to successfully complete his mission. While I personally have never jumped from one moving plane to another, never climbed the world's building, or never saved the world, I have done some reflection about another impossible mission that I do come across as a physician: fighting burnout. As physicians, our mission, should we choose to accept it, is to exemplify health and wellness to patients and learners by balancing a demanding profession.

The COVID-19 pandemic accelerated the need to examine our habits as increasing numbers of practitioners reported burn out, depression, and cases of self-harm and suicide increased. In short, as a profession, we are not very good at this. The 2024 Medscape Physician Burnout and Depression Report saw modest decreases in reported depression and burn out, although burn out remained 49% in the reported survey. About half of physicians feel this! Certain specialties, including my own, emergency medicine, are reporting burn out at a much higher rate (63%) than others such as plastic surgery (37%). Does that mean our learners should avoid emergency medicine (please don't! I really love what I do) or that plastic surgeons are immune to the stressors of our healthcare system? I'm not convinced. Medical students observe our fatigue from working in American healthcare and it's clear they are factoring perceived burn out into future specialty selection. What can we do as attendings to help them, and ourselves find balance in a system set up to continue pushing us towards burn out? I came up with three things that have helped me in my career.

What's your why? Having served on a medical school admissions committee, I'm sure there was a time when you talked about how much you loved the idea of caring for others. That probably didn't include discussion of Press Ganey scores, quality metrics, peer review, hospital committees, EMR modules.... the list goes on! However, despite these factors, amongst others, I have found that centering myself on the reason I liked the idea of this profession as a pre-medical student, has helped immensely deal with the job's frustrations. At the medical school, I write monthly email updates about curricular activities and include anecdotes from my career that provide insights into various experiences and demonstrate (hopefully) the impact we can have in patient's lives. Maybe it's not an email for you, but perhaps it's conversation. Spend some time routinely reviewing what about being a physician inspires you.

Perspective is golden. I recently completed a seven-night stretch in the ER over the holiday weekend. I missed a weekend with my wife and son up at our lake cabin. As I slogged through 12-hour night shifts, I started to have thoughts of feeling sorry for myself. Why do I have to work so many night shifts? Is it really my turn to work another holiday? I took a piece of humble pie as I reminded myself of some advice I gave to some of our medical students at Pillar 2 orientation. I was asked about how to possibly balance life when nights, weekends, and studying were all on the table and how that wasn't supposed to make them all miserable. I responded by asking them if they ever went out to eat on a weekend? If they ever filled their car up at gas station on the way to a holiday gathering? I do think we sometimes sell ourselves that we have it the worst in medicine, as we work the hardest. It's true that the demands on us are often heavy. However, we do not have a monopoly on hard work, bad hours, or stress. We do have a remarkable profession in that our work has deep meaning and can meaningfully impact another person's life. I must remind myself, including this last week, that perspective is golden, and that it's pretty awesome to work at a job that gives me satisfaction.

Ask for help. I can't say working in the emergency department during COVID provided a lot of great things for me, but one thing it certainly did was pushing me to ask for help. As an extrovert the stress of work plus the social isolation that went along with the pandemic led me to burn out. I needed help. I got set up with a therapist who I met with weekly. I was initially horrified at the concept of meeting with someone. What if the board found out? What if my colleagues in the hospital knew? It turns out, the board doesn't care if I see a therapist, and many other practitioners see therapists. I have found it to help immensely with professional and personal growth to talk through stressors I experience as an emergency physician. If you are experiencing signs of distress or burn

out, please reach out for help, it'll make a difference! The South Dakota Physician Well-Being Program is a resource available to all physicians in the state. Learn more at sdpwbp.org or call 605-275-4711.

Spoiler-free article here, so I won't tell you how the eighth *Mission Impossible* movie ends, but I would point out that Tom Cruise has accomplished seven previous impossible missions successfully. We can beat burn out! The tips above may or may not help, but make sure you take care of yourself. You, your family, our medical students, and most importantly your patients are depending on a healthy you to provide the best care possible to them. Your health systems and the SDSMA have resources to help, we at SSOM can also assist and I can say that working with engaged learners also helps with burnout! This message will not self-destruct in 5 seconds...

About the Author:
Alan Sazama, MD, Pillar 2 Director and Asisstant Dean, Medical Student Education, University of South Dakota Sanford School of Medicine; Avera Medical Group Emergency Medicine, Sioux Falls, South Dakota.

President's Comments

On the Road Again

Keith Hansen, MD
President, South Dakota State Medical Association

The American Medical Association House of Delegates held its annual meeting in Chicago June 6 -11. Physicians, medical students, and residents/fellows from multiple different specialties and throughout the U.S. met in this democratic process to evaluate and develop a national physician consensus on current and emerging issues that face our patients and the practice of medicine. The SDSMA delegation comprised our two delegates; Robert Summerer, DO and Rob Allison, MD and our alternate delegates; Mary Carpenter, MD and myself. Our delegation is an integral part of the North Central Medical Conference which is composed of delegates from North Dakota, South Dakota, Nebraska, Iowa and Minnesota. Within the NCMC are multiple committees evaluating multiple different areas including medical education, constitution and bylaws, medical service, legislation and others. These committees and the NCMC reviewed and developed information on the various resolutions that were presented to the HOD meeting. During the HOD meeting each group was allowed to discuss the various issues prior to a vote and adoption or rejection of an issue. NCMC also met with the various candidates for national AMA office and determined which candidate(s) would receive our support. There were also multiple CME conferences during the meeting including advocacy, emergency inflight medicine and scope creep.

During the AMA HOD meeting, the U.S. Secretary of Health and Human Services fired the 17 members of the Advisory Committee on Immunization Practices. ACIP provides recommendations to the CDC on the critical topic of immunization practices in the U.S. Members of the ACIP are respected authorities on immunization research, immunization practice or public health. The ACIP members apply for membership and then are vetted by the ACIP committee with final selection by the U.S. health secretary. The ACIP has always been a trusted, informed committee to make evidence-based decisions and recommendations for the use of vaccines and vaccine schedules in the U.S. In response to the ACIP firing, the AMA HOD heard and adopted an emergency resolution (requires 2/3 majority) calling on the Secretary to reverse his decision on the firings of the 17 members of the ACIP, as well as ask the AMA leadership to draft a letter asking the Senate Health, Education, Labor and Pensions Committee to investigate these firings and the impact on public health. The SDSMA Board of Directors signed on to support this emergency response. Since the firing of the ACIP members, new members have been appointed without the usual vetting or transparency in the process.

At the meeting there were a number of important issues discussed that will impact our patients and medical practice. Augmented (aka artificial) intelligence is a rapidly developing tool in medicine. A recent survey found that 66% of physicians used AI in 2024, up from 38% in 2023. The AMA is devoted to making sure that AI works for patients and physicians. Research and implementation guidance are critical for the widespread adoption of AI in medicine. The AMA continues to strongly support Medicare reform. During the meeting physicians discussed having to close their private practices due to a "broke" Medicare model. There were multiple other discussions including fixing pre-authorization and removing redundant compliance training. As an alternate delegate I had an opportunity to review, evaluate and eventually vote on the Medical Education Committee's resolutions before the HOD. The AMA is working to give residents the educational resources and tools they need to advocate for the physician-led care team. The Medical Student Section advocated for reducing some of the stress associated with the national licensing board examinations by not requiring them to report the number of times they had to take the examination on their residency applications.

Additionally, the new AMA President, Bobby Mukkamala, MD was inaugurated. Dr Mukkamala is an otolaryngologist who in November was diagnosed with a large brain tumor and underwent craniotomy with sub-total resection and subsequent therapy. He has always been a strong advocate for improving patient access in his hometown of Flint, Michigan, and with his recent experience as a patient, plans to improve access and medical care throughout the U.S. The AMA and SDSMA are our voice nationally, locally and regionally to enhance the care of our patients and our practice of medicine. If you get the opportunity to attend an annual AMA HOD meeting, I would urge you to go to see our AMA in action.

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Aorto-Atrial Fistula Case Report with Discussion on Gerbode Defect

Owen Alvine, MD; Joshua Mohs, MD; and Samuel Jensen, MD

Abstract

This case report describes a 62-year-old female with a history of heart failure with preserved ejection fraction (HFpEF) who presented to the emergency department with heart failure exacerbation. She was initially diagnosed with bilateral pleural effusions and treated with thoracentesis and diuretics. When follow-up indicated a lack of improvement, an ischemic workup was ordered. A transesophageal echocardiogram (TEE) revealed an abnormal connection between the right atrium and proximal aorta (aorto-atrial fistula), which was promptly fixed with surgical patching. This report also discusses the Gerbode defect, an abnormal congenital or acquired connection between the left ventricle and right atrium. Both conditions can significantly impact patients undergoing anesthesia. Further research on these abnormalities is essential to prevent poor outcomes.

Introduction

The sinus of Valsalva is the proximal base of the aorta (Figure 1). An aneurysm originating from this region can erode or rupture into adjacent cavities, most commonly the right atrium, causing a fistula to form between the aorta and right atrium. This condition increases preload into the right atrium and right ventricle, causing dilation and potentially leading to right heart failure or right ventricular overload, pulmonary overcirculation, and pulmonary hypertension.

The exact incidence of aorto-atrial fistulas is unknown[1,2] because of their rarity. The etiologies of these fistulas are complex. The condition can be categorized as congenital or acquired, with acquired cases being more common. The acquired causes of aorto-atrial fistula development can be further subdivided into iatrogenic and acquired (non-iatrogenic). The iatrogenic causes include atrioventricular (AV) node ablations, cardiac valve replacements, and coronary artery bypass grafting. Any procedure involving the atrial septum or adjacent structures may lead to the formation of a fistula between that chamber and another hollow organ. Non-iatrogenic causes include ruptured sinus of Valsalva aneurysm and systemic vasculitis.[1] The most common non-iatrogenic cause is endocarditis, with the incidence of fistula formation at 1.6% in patients with native valves and 5.8% in those with prosthetic valves.[3]

Symptoms of aorto-atrial fistulas range from asymptomatic to overt heart failure. Therefore, this condition should be considered in any patient presenting with heart failure symptoms. Treatment involves addressing the underlying cause, such as administering antibiotics for endocarditis, as well as surgically closing the fistula.[4]

In this case, the fistula resulted from a ruptured sinus of Valsalva aneurysm (SOVA), which occurs in approximately 0.09% of the population.[5] SOVAs are dilations of the aortic root distal to the aortic valve[6] and are commonly congenital,[7] whereas aorto-atrial fistula are typically acquired.

Symptoms of SOVA usually become apparent only upon rupture, presenting as shortness of breath, lower extremity edema, venous congestion, and aortic regurgitation[8]—similar to acute heart failure. Prompt treatment is recommended to prevent complications such as endocarditis. Closure of the fistula with suture or patch is the definitive treatment.[9]

Case Presentation

This case describes a 62-year-old female with HFpEF and hypertension. Her past medical history included hypothyroidism, third-degree AV block requiring a pacemaker, breast cancer, and mitral valve prolapse. Two weeks prior to admission, she visited the emergency department because of acute HFpEF exacerbation, resulting in bilateral pleural effusions. Physical examination revealed bilateral decreased breath sounds, crackles in the right lower lobe, lower extremity edema, hoarseness, Jugular venous distention (JVD), and a 2/6 systolic ejection murmur. She also tested

Figure 1. Red arrow pointing to SOVA.

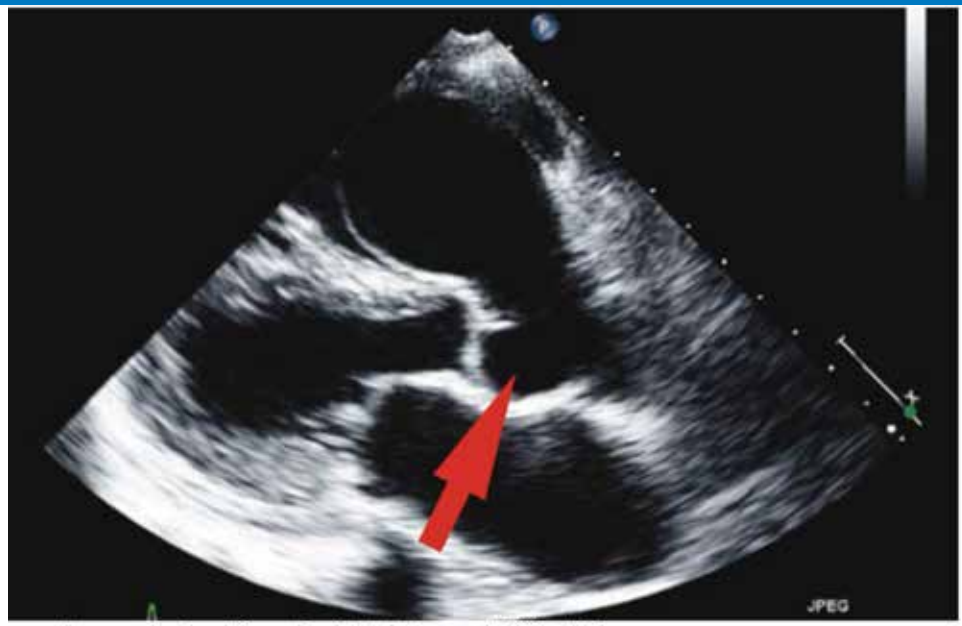


Image obtained from the British Journal of Cardiology

positive for COVID-19. After undergoing thoracentesis, she was admitted to the hospital. Further workup, including a lower extremity ultrasound for deep vein thrombosis and CT angiography for pulmonary embolism, was negative. She was started on 40 mg furosemide and discharged the same day when her condition improved.

Two weeks later, she followed up with the heart failure clinic for hypertension and her newly diagnosed diastolic congestive heart failure. Physical examination revealed bilateral edema, decreased breath sounds at the lung bases, JVD extending to the mandible, and abdominal distension. No murmur was noted. She reported fatigue, orthopnea, and shortness of breath. It was noted that she had gained 8 pounds since her last measurement at home. Despite being on a diuretic, she reported no increase in urination and no symptom improvement. Because she was hypervolemic and decompensating, she was admitted to the hospital. During her stay, she was diagnosed with acute kidney injury and a systolic murmur. An ischemic workup, including a transesophageal echocardiogram (TEE), was performed several days after admission.

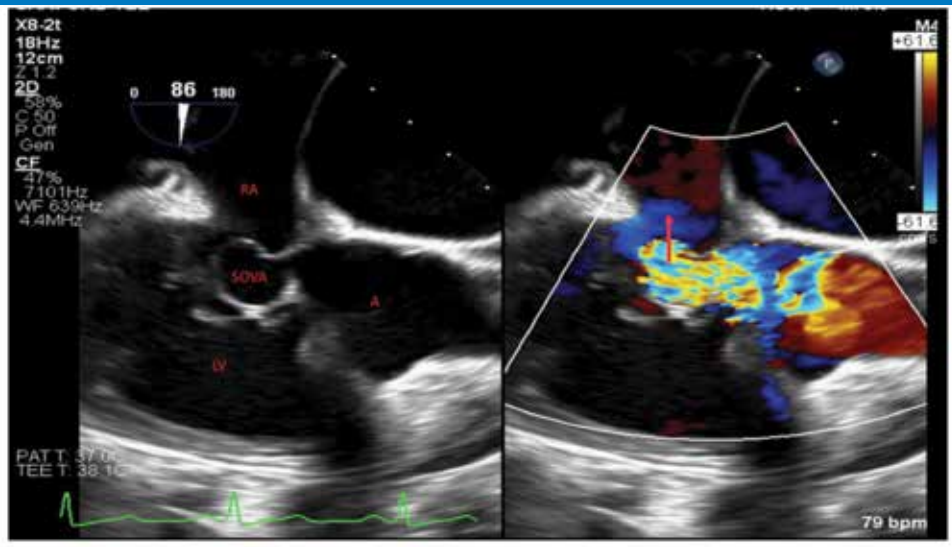
The TEE revealed a SOVA that ruptured and formed a fistula between the right atrium and the proximal ascending aorta (see figure 2). This fistula resulted in turbulent blood flow between the aorta and the right atrium. However, no stenosis or regurgitation was observed. That same day, she underwent an open surgical procedure to repair the fistula using a Dacron patch and a bovine pericardial patch to close the aortic and atrial ends, respectively.

Postoperatively, the patient experienced cardiogenic shock requiring dobutamine support and prolonged intubation because of recurrent hypoxic episodes. She was successfully extubated 3 days later. Additionally, the patient developed complete AV block, necessitating the placement of a permanent pacemaker 5 days after the procedure. Two days after pacemaker placement, she was released from Sanford Hospital and transferred to an inpatient rehabilitation facility for 2 days before being discharged following significant improvement. At her follow-up 4 days after leaving the hospital, she reported resolution of all cardiac symptoms except for one brief episode of weakness.

Discussion

As shown in the figure, left to right shunts can have significant hemodynamic effects on patients. Pulmonary hypertension can occur due to increased right ventricular preload, which can subsequently lead to physiologically significant right heart failure. Aorto-atrial fistulas should be considered in patients presenting with pulmonary hypertension and right heart failure after cardiac surgery. Preventing these hemodynamic complications involves maintaining higher heart rates and stronger contractility to reduce right ventricles overload. Patients requiring treatment include those with low

Figure 2. Sinus of Valsalva aneurysm (SOVA) detected on TEE (left) with Doppler imaging (right) showing fistula formation. The arrow indicates blood flow through the fistula from the SOVA (extension of the aorta) to the right atrium.



ejection fraction, those who are preoperative, and those with pulmonary hypertension. Pulmonary vasodilators, such as nitric oxide, can help decrease right ventricular afterload and improve output in patients with pulmonary hypertension or right heart failure. Maintaining coronary artery perfusion is also important if cardiac output declines. Vasopressors should be used to support blood pressure and maintain perfusion, with vasopressin being preferred because of its minimal effect on pulmonary vascular resistance. Diagnosis requires a high index of suspicion and TEE imaging, ensuring visualization of both ends of the fistula for confirmation. The differential diagnosis includes atrial septal defect, ventricular septal defect, and isolated pulmonary hypertension.[10]

Another similar pathology is the Gerbode defect, which also involves a left to right shunt. It is relevant to this discussion because both conditions are rare, share similar etiologies, and involve abnormal fistulas. These defects arise from the pressure difference between the left ventricle the right atrium, which is normally inconsequential because of the thick intraventricular septum and atrioventricular valves preventing backflow. However, like aorto-atrial fistulas, iatrogenic and non-iatrogenic causes can reopen or weaken these barriers, allowing blood flow from the left ventricle to the right atrium. There are 3 types of Gerbode defects. The first is "direct," in which only the membranous septum above the tricuspid valve is involved, allowing direct blood flow into the right atrium. The second is "indirect," where the defect is located below the tricuspid valve, with an additional defect in the tricuspid leaflet allowing backflow. The third type is a combination of both and is known as "combined."[11]

Gerbode defects arise from congenital or iatrogenic causes, like SOVA. The two largest causes of Gerbode defects are previous cardiac surgery (AV valve replacement)[12] and percutaneous cardiac interventions (AV node ablation).[13]

Conclusion

In this report we discussed a case of a aorto-atrial fistula in a patient with symptoms of heart failure. The predominant concern in these patient is the blood from the high pressure left heart crossing over and overloading the lower pressure right heart, leading to right heart failure. Patients at risk of developing this condition are patient who have had a history of endocarditis or recent cardiac valve replacements. Medical management of these patients revolves around management of their heart failure. Pulmonary vasodilators can be used to decrease the pressure in the right heart, and vasopressors may be requires to support perfusion if ejection fraction is low.

REFERENCES

1. Goldberg N, Krasnow N. Sinus of Valsalva aneurysms. Clin Cardiol. 1990 Dec;13(12):831-6.
2. Nguyen Q, Vervoort D, Phan K, Luc JG. Surgical management for unruptured sinus of Valsalva aneurysms: a narrative review of the literature. J Thorac Dis. 2021 Mar;13(3):1833-50.
3. Anguera I, Miro JM, Vilacosta I, et al. Aorto-cavitary fistulous tract formation in infective endocarditis: clinical and echocardiographic features of 76 cases and risk factors for mortality. Eur Heart J. 2004 Nov 30;26(3):288-97.
4. Doost A, Craig JA, Soh SY. Acute rupture of a sinus of Valsalva aneurysm into the right atrium: a case report and a narrative review. BMC Cardiovasc Disord. 2020 Feb 18;20(1).

Please note: Due to limited space, we are unable to list all references. You may contact South Dakota Medicine at ereiss@sdsma.org for a complete listing.

About the Authors:

Owen Alvine, MD, University of South Dakota Sanford School of Medicine.

Joshua Mohs, MD, University of South Dakota Sanford School of Medicine.

Samuel Jensen, MD, University of South Dakota Sanford School of Medicine; Anesthesia Physicians LTD, Sioux Falls, South Dakota.

Medicaid in South Dakota Since Expansion

Narysse Nicolet, MD, MPH; Tiffany Bender, MD, MPH; Andrew L. Guymon, MD; Lindsey A. Kroboth, MD; Cole Tessendorf, MD; Sena Uzunlar, MD; J. Samuel Vassar, MD; and Suzanne Reuter, MD, MPH

Abstract

In 2023, South Dakota expanded the Medicaid program, providing health coverage to an additional 29,500 residents who were previously ineligible. Prior to expansion, Medicaid eligibility was limited leaving many South Dakotans without affordable health insurance. This gap in care contributed to significant disparities in healthcare access and outcomes across the state. Medicaid expansion was initially proposed under Senate Bill 186 and later passed during state elections under Amendment D in 2022. The rollout of the expansion program has faced challenges since its initiation with lower enrollment than expected, potentially due to less marketing and an outdated application system. Further the COVID "churning" effect, where thousands of individuals were disenrolled due the cessation of COVID-19 emergency protections, occurred in the spring before the Medicaid expansion start date of July 1, 2023, leading to confusion for many enrollees. Despite these challenges, Medicaid expansion has already provided crucial healthcare access to vulnerable populations, including Native American, Black, Hispanic, and Asian communities. However, the recent passing of work requirements under Amendment F, could impact the future of the program. As South Dakota continues to navigate the complexities of Medicaid expansion, ongoing evaluation will be crucial in ensuring the state maximizes the potential of the program.

Aequitas Honor Society

Aequitas Honor Society is a national medical honor society, founded in 2021, to bring awareness to health inequities that exist in our healthcare systems which were elucidated during the COVID-19 pandemic. The goal of the organization is to gather fellows dedicated to improving health inequities and disparities, especially those impacting minority ethnic groups. At the University of South Dakota Sanford School of Medicine, each year a new cohort is inducted into our chapter. This year we have worked to evaluate health policies in South Dakota, such as Medicaid, as well as improve access to healthcare in underserved populations. This year we were awarded a grant to help with healthcare outreach to the homeless population in Rapid City, South Dakota. It is our hope that these projects will be continued and built upon in the future by subsequent USD Aequitas Honor Society fellows.

Background

Prior to Medicaid expansion going into effect in 2023, South Dakotans' eligibility for Medicaid was limited. Only those who were pregnant, under the age of 18, elderly, or disabled were eligible for coverage. Thousands of South Dakotans who were unable to afford private insurance premiums and those whose employers did not provide insurance were left without coverage. This resulted in a significant portion of the population foregoing preventative screening and avoiding medical care until complications arose, further widening gaps in healthcare outcomes across the state.

Initial discussion surrounding South Dakota Medicaid expansion followed soon after the Affordable Care Act (ACA) was passed in 2010. The ACA provided federal funds for states to expand their Medicaid coverage; however, many politicians and constituents continued to oppose expansion, often citing concerns about patients relying on federal funds and significant long-term costs. Expansion was proposed in South Dakota through Senate Bill 186 and was first read to the Senate in February of 2022.[1] The bill was passed in the Health and Human Services Committee and then sent to the Senate floor, where it was approved again. Constituents were given the opportunity to vote on expansion in November of 2022 through Amendment D. The amendment passed in a close race with a 56 percent majority, making South Dakota the 39th state to adopt Medicaid expansion.[2]

Passage of Amendment D expanded eligibility to any South Dakotan over the age of 18 and under the age of 65, whose income is at or below 133 percent of the federal poverty level.

This allowed for more than 52,000 South Dakota residents to be eligible for coverage when the amendment went into effect on July 1, 2023. Over 90 percent of the cost to expand Medicaid coverage in South Dakota was funded by the federal government, with the state receiving over 500 million dollars. In return, South Dakota was tasked with funding the remaining 10 percent of the cost. In the state's 2023 budget, Governor Kristi Noem planned for approximately 12 million dollars to initiate and maintain the costs associated with expansion.[3]

The journey to enacting Medicaid expansion in South Dakota was a drawn out and politically contentious process, reflecting years of debate and policy making. The public vote on Amendment D in 2022 was a pivotal moment for healthcare policy in South Dakota. Medicaid expansion offered increased access and financial coverage for primary care, preventive services, rehabilitation services, and emergency care, as well as substance abuse treatment and prescription drug benefits.[4] Additional benefits included optometry and dental coverage for adults. This coverage expanded access for many tribal members in low-resource areas of the state. After passing in November of 2022, the state was able to successfully implement the program on July 1, 2023.

Impact of COVID-19

In March 2020, the Centers for Medicaid and Medicare Services instituted a public health emergency that allowed continuous coverage and Medicaid enrollment nationwide. As a result, in South Dakota there was a 32% increase in enrollment during the COVID-19 pandemic and immediately after (2020-2023).[5] The public health emergency was funded under the Families First Coronavirus Response Act and provided the continuous coverage as well as enhanced federal matching. This act reached across many areas of the government, but in regard to healthcare, it expanded coverage for uninsured people and allowed greater access to testing and treatment of COVID-19.[6] Despite Medicaid expansion set to be initiated in July 2023, a notable change to federal policy early 2023, which dissolved emergency COVID-19 expanded protections, led many South Dakotans to lose Medicaid coverage in April 2023.

In February of 2023 the Department of Social Services began notifying constituents that the public health emergency coverage from COVID-19 would cease the next month, April 2023.[5] It is estimated 16,000 South Dakotans were disenrolled on April 1, 2023. Along with four other states, South Dakota was one of the earliest states to start the "unwinding" process in April. Constituents of the program were disenrolled if they did not renew Medicaid or if they had become ineligible from the time the legislation was enacted in 2020-2023. Despite the Medicaid expansion amendment being passed the prior November and set to begin just months later in July, over 16,000 individuals were disenrolled with only 1,750 individuals (11%) eligible for renewal in July under the new expansion process.[7]

Regardless, the successful Medicaid expansion amendment in November 2022 passed by voters marked a critical step in South Dakota toward improving access to health care services addressing acute and chronic conditions and addressing long-standing healthcare disparities across the state.

Since Expansion

Since the expansion of Medicaid in July 2023, it is one of the largest healthcare insurers in South Dakota. Approximately 29,500 South Dakotans have been newly enrolled under Medicaid expansion since it became available, with a slow and steady enrollment.[8,9] There were 163,238 individuals participating with an average monthly enrollment of 145,350 in the 2023 State Fiscal Year (SFY). More than 63% of individuals covered by Medicaid or Children's Health Insurance Program (CHIP) are children, and around 40% of the children born in South Dakota will be on Medicaid or CHIP during their first year of life.[4] Since the expansion, healthcare has been granted to approximately 10,000 American Indian / Alaska Native, 1,400 Black, 1,000 Hispanic, and 600 Asian South Dakotans.[8]

Regarding cost, during SFY 2023 South Dakota's Medicaid expenditures were $1.27 billion, of which approximately $872 million was paid for by the federal government and $402 million by the state. The year's expenditures were down from $1.34 billion during the 2022 SFY. The federal medical assistance percentage was 56.74% for Federal Fiscal Year (FFY) 2023. This will decrease by 1.76%, down to 54.98%, in FFY 2024.[4] The elderly and disabled, 19% of the Medicaid population, account for around 58% of the program's spending in the state, which is similar to the rest of the U.S.[4]

With Medicaid expansion programs being relatively new, there have been limited studies to assess cost spent versus saving on overall healthcare services provided. By providing more cost-effective primary care resources and preventative care, it allows our community members to address medical conditions and access preventative care before such issues become life threatening or emergent.

Amendment F

During the 2024 South Dakota legislative session, just six months after Medicaid expansion was initiated, Senate Joint Resolution 501 was introduced calling for work requirements to be added as criteria for the Medicaid expansion program. Resolution 501 passed in both the South Dakota Senate and House of Representatives, and then was approved by the Secretary of State and Attorney General.[10] In November 2024 the constitutional amendment, Amendment F, was placed on the ballot, later passing with 56% of South Dakotans voting in favor of the amendment.[11]

The passing of Amendment F does not impose any immediate work requirements but rather opens the door for the consideration of future requirements and starts the conversation about what such regulations could look like in South Dakota. Combined with the approved Medicaid expansion program, this change has sparked debates about its potential impact, with supporters championing the amendment as a pathway to self-sufficiency and critics warning of barriers that could hinder healthcare access. Ultimately, its implementation hinges on federal policies, and a potential shift under the incoming administration which could provide South Dakota with the authority to enact work requirements.

Implementing work requirements could come with significant administrative and financial challenges. Developing systems to verify compliance and monitor exemptions would demand substantial state resources. Lawmakers must consider whether these costs are justified by the intended benefits of promoting employment and self-sufficiency among Medicaid recipients. Research from other states suggests that work requirements may lead to disenrollment among eligible beneficiaries due to administrative barriers, raising concerns about unintended negative consequences.[12] A clear and transparent communication strategy will be essential to prevent coverage loss among eligible individuals, ensuring that enrollees understand any new requirements and how to meet them.

It will be crucial to assess how Amendment F interacts with South Dakota's broader healthcare landscape. Ultimately, the debate surrounding Amendment F highlights the ideological divide about the role of social welfare programs. As lawmakers navigate next steps, South Dakota medical providers should stay engaged in these discussions. Involvement from medical professionals will be critical in shaping policies that balance economic sustainability and self-sufficiency with the program's original purpose: providing a safety net for those most in need. As the state considers its path forward, thoughtful and evidence-based policymaking will be key to achieving these goals.

Conclusions

Reflecting on the journey of Medicaid expansion in South Dakota, it is evident that the passage of Amendment D in 2022 marked a historic turning point in the state's healthcare landscape. Since Medicaid expansion was officially implemented on July 1, 2023, nearly 29,500 South Dakotans have applied to gain increased access to healthcare. With Medicaid expansion the state has witnessed significant improvements in access to preventive care and treatment for vulnerable populations including minority populations such as those identifying as Native American/American Indian, Black, Hispanic and Asian.

This process has not been without challenges. Although initial enrollment numbers have been lower than the expected 57,000 South Dakotans eligible, only 29,500 of these individuals have enrolled.[9] Because of the lower turnout seen thus far, changes to the total number of expected enrollees has also been adjusted from 57,000 to 40,000 individuals. However, the expansion has already demonstrated its potential to alleviate some of the most pressing healthcare gaps in the state. The ongoing rollout of a new online enrollment system aims to streamline the application process, while the focus on primary care and preventative services promises long-term cost savings for the state and better health outcomes for residents.

Despite these gains, the passage of Medicaid expansion has not resolved all the complexities of South Dakota's healthcare system. The "unwinding" of coverage that began in April 2023 following the end of the federal public health emergency left 16,000 individuals in South Dakota disenrolled from Medicaid, with only a small fraction qualifying for renewal under the new eligibility criteria. This phenomenon of "churn" represents a significant concern as people continue to lose and regain coverage, potentially leading to disruptions in care.

Looking ahead, the state faces difficult questions about the future of Medicaid. One key issue is the potential implementation of work requirements, a topic that remains a point of political contention. While the current expansion does not include work requirements, discussions are likely to continue, with supporters seeing these requirements as a means to encourage self-sufficiency, yet critics warning of the administrative hurdles offsetting potential monetary savings

and barriers they may create for vulnerable individuals. The state will need to carefully weigh the trade-offs between promoting employment and ensuring continued access to vital healthcare services. South Dakota's rural communities could see disproportionate impacts, with limited access to both jobs and healthcare infrastructure.

As the state moves forward, it will be crucial to continue evaluating the effectiveness of Medicaid expansion in improving public health and reducing uncompensated care costs. The active involvement of healthcare providers, advocacy organizations, and policymakers will be essential in shaping any future amendments or additions to the program. Thoughtful, evidence-based policymaking will be key to maintaining the program's momentum and ensuring that Medicaid expansion fulfills its promise of improving the health and well-being of all South Dakotans.

In conclusion, Medicaid expansion in South Dakota is a major step forward, but the state's healthcare journey is far from complete. The next phase will require ongoing evaluation, responsiveness to emerging challenges, and a commitment to closing healthcare gaps, especially in rural and underserved areas. With the right balance of policy and support, South Dakota has the opportunity to create a more equitable and accessible healthcare system.

REFERENCES

1. sdlegislature.gov. Pierre (SD): Senate Bill 186; 2022. Retrieved from https://sdlegislature.gov/Session/Bill/22813.
2. hhs.gov. Washington D.C.: South Dakota expands Medicaid bringing health coverage to more than 52,000 state residents; 2023. Retrieved from www.hhs.gov/about/news/2023/06/30/south-dakota-expands-medicaid-bringing-health-coverage-more-than-52000-state-residents.html.
3. South Dakota Department of Social Services. Governor Noem Budget Address one pagers; 2023. Retrieved from https://bfm.sd.gov/budget/FY2024/DSSMedicaidExpansion.pdf.
4. South Dakota Department of Social Services. South Dakota Medicaid report SFY23; 2023. Retrieved from https://dss.sd.gov/docs/medicaid/reports/2023_Medicaid_Report.pdf.
5. South Dakota Department of Social Services. South Dakota Medicaid unwinding: April 2023. Retrieved from https://mylrc.sdlegislature.gov/api/Documents/Attachment/251643.pdf?Year=2023.
6. kff.org. The Families First Coronavirus Response Act: summary of key provisions; 2020. Retrieved from www.kff.org/coronavirus-covid-19/issue-brief/the-families-first-coronavirus-response-act-summary-of-key-provisions/.
7. sdpb.org. Vermillion (SD): Thousands of South Dakotans could lose Medicaid soon; 2023. Retrieved from www.sdpb.org/healthcare/2023-04-11/thousands-of-south-dakotans-could-lose-medicaid-soon.
8. South Dakota Department of Social Services. Sioux Falls (SD): Power BI report Medicaid enrollment by coverage group; 2025. Retrieved from https://app.powerbigov.us/view?r=eyJrIjoiNmEy-OTU0OWQtMmZlMS00YWZjLWI4NDctOWE0MjZjZjNjOTcwIiwidCI6IjcwYWYtNDdjLTY5YWItN-DE2ZC1iNGE2LTU0M2I1Y2U1MmI5OSJ9.
9. Huber M. Medicaid expansion enrollment 'slow & steady' as state launches application portal. South Dakota Searchlight; 2024. Retrieved from https://southdakotasearchlight.com/2024/04/17/medicaid-expansion-enrollment-slow-steady-as-state-launches-application-portal/.
10. sdlegislature.gov. Pierre (SD): Senate Joint Resolution 501; 2024. Retrieved from https://sdlegislature.gov/Session/Bill/24592.
11. South Dakota Secretary of State. Pierre (SD): South Dakota unofficial election results 2024; 2024. Retrieved from https://electionresults.sd.gov/resultsSW.aspx?type=BQ&map=CTY.
12. Sommers B. The Commonwealth Fund. Did Medicaid work requirements achieve their goals in Arkansas?; c2020. Retrieved from www.commonwealthfund.org/blog/2020/did-medicaid-work-requirements-achieve-their-goals-arkansas.

About the Authors:

Narysse Nicolet, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Tiffany Bender, MD, MPH, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Andrew L. Guymon, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Lindsey A. Kroboth, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Cole Tessendorf, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Sena Uzunlar, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

J. Samuel Vassar, MD, Aequitas Honor Society, University of South Dakota Sanford School of Medicine.

Suzanne Reuter, MD, MPH, Interim Associate Dean of Student Affairs, University of South Dakota Sanford School of Medicine.

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A Potential Unrecognized Risk for Acute Hepatotoxicity: A Case Report of Fulminant Liver Failure Following Recent Initiation of Allopurinol and Colchicine

Nicholas Looby, MD; Cole D. Tessendorf, MD; Jack Hagen, BA; Michelle Looby, PharmD; and Jenny Guido, MD

Abstract

Drug-induced liver injury (DILI) is a leading cause of acute liver failure in the U.S., though allopurinol and colchicine have not been widely associated with fulminant hepatic failure. We present the case of a male in his 50s with chronic kidney disease (CKD) stage III who developed rapid hepatic decompensation shortly after starting allopurinol and colchicine for gout. Within days, he experienced worsening liver function, renal failure, and respiratory distress, ultimately progressing to multiorgan failure and death within 24 hours of hospital admission. A 6 cm esophageal mass was incidentally found on imaging, though its significance remains unclear. Given the temporal relationship between drug initiation and fulminant hepatic failure, this case raises concerns regarding the potential hepatotoxicity of allopurinol and colchicine, particularly in patients with preexisting renal impairment. Increased awareness and early liver function monitoring may be warranted in high-risk patients starting these medications.

Introduction

Drug-induced liver injury (DILI) is the most common cause of acute liver failure in the U.S.[1] While a wide range of medications, including acetaminophen, antibiotics, statins, and nonsteroidal anti-inflammatory drugs (NSAIDs), have been well-documented causes of DILI, allopurinol and colchicine are not commonly associated with fulminant hepatic failure.[1]

Allopurinol, a xanthine oxidase inhibitor widely prescribed for hyperuricemia and gout, has been associated with hypersensitivity reactions such as drug reaction with eosinophilia and systemic symptoms (DRESS), Stevens-Johnson syndrome (SJS), and toxic epidermal necrolysis (TEN), which can involve hepatic injury.[2] Similarly, colchicine, a microtubule inhibitor used for acute gout flares and pericarditis, has been linked to systemic toxicity in cases of overdose or impaired renal clearance.[3] However, neither allopurinol or colchicine has been extensively reported as a cause of acute-onset fulminant hepatic failure.

We present a case of fulminant hepatic failure occurring in a patient with preexisting chronic kidney disease (CKD) shortly after initiating both allopurinol and colchicine. Given the high prevalence of gout and CKD in South Dakota's patient population, this case highlights a potential but underrecognized risk of acute hepatotoxicity associated with these medications. Recognizing this association is crucial for clinicians managing gout in patients with even mild renal impairment, as early identification may prevent similar outcomes.

Case Report

A Caucasian male in his 50s presented to a rural outpatient clinic with a five-day history of progressively worsening right ankle and foot swelling and pain. His past medical history was significant for asthma, hypertension, type 2 diabetes mellitus, CKD stage III, and depression. His medication regimen included amlodipine, hydrochlorothiazide, metoprolol succinate, metformin, bupropion HCl, and as-needed albuterol. Suspecting an acute gout flare, he was prescribed prednisone 50 mg daily for five days.

Eight days later, the patient returned to the clinic, reporting a brief resolution of his ankle pain with prednisone, followed by an immediate recurrence upon completing the course. Laboratory tests showed a serum uric acid of 8.9 mg/dL (normal = 3.4-7.0 mg/dL) and a creatinine level of 1.4 mg/dL (normal = 0.7-1.3 mg/dL), which was consistent with his baseline CKD. His CBC and BMP were unremarkable. Radiographs of the right lower extremity demonstrated soft tissue swelling without evidence of acute fracture. Given the recurrence of symptoms, he was prescribed prednisone 40 mg daily for seven days. In light of his chronic hyperuricemia

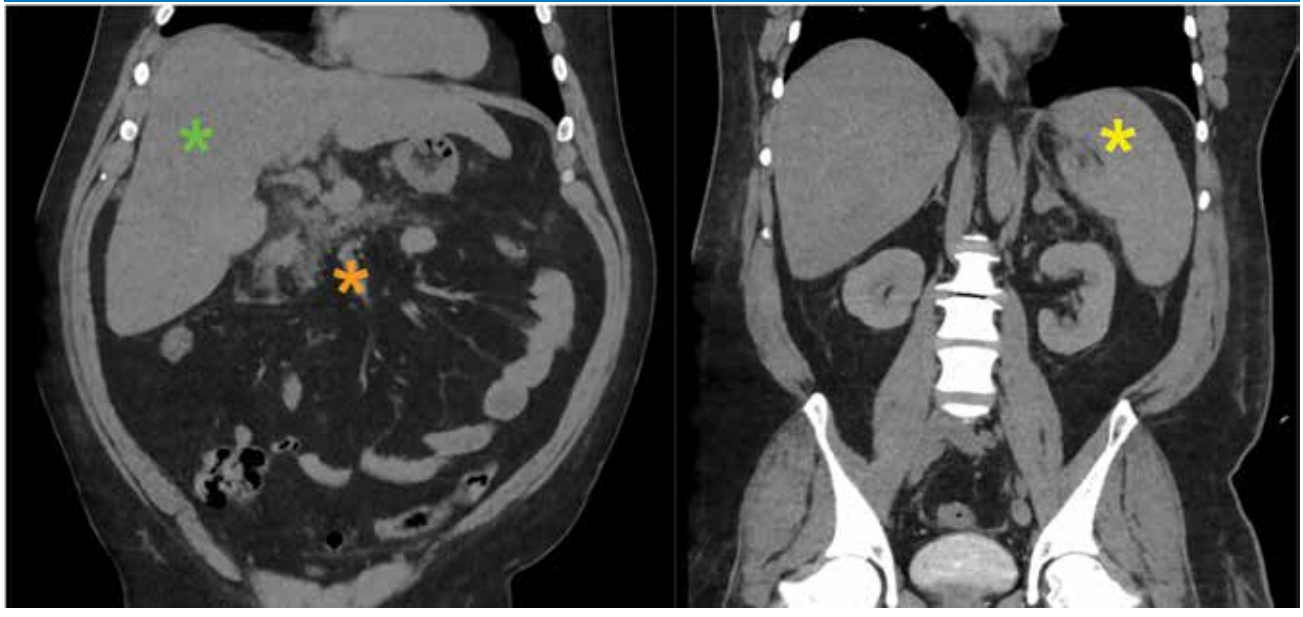
and CKD, a renally-adjusted dose of allopurinol 50 mg daily was initiated with counseling to start taking after the current pain episode resolved.

Ten days later, he returned to the clinic with recurrent right ankle pain and new-onset shortness of breath. He reported adhering to the prescribed prednisone course and switching to allopurinol 50 mg daily for the past three days as instructed. A workup including lower extremity venous duplex, COVID-19 and influenza testing, BNP, and troponin was unremarkable. His D-dimer was mildly elevated at 0.74 mg/L (normal < 0.50 mg/L). Given his respiratory symptoms, he was prescribed azithromycin and a cephalosporin. For his persistent ankle pain, colchicine 0.6 mg daily was added to his regimen alongside continued allopurinol therapy.

Six days later, he returned to the clinic with worsening shortness of breath, new-onset cough, and hemoptysis that had developed overnight. Laboratory tests revealed worsening renal function, with creatinine rising to 2.2 mg/dL and elevated liver function tests of ALT 150 IU/L (normal = 7-56 IU/L) and AST 484 IU/L (normal = 10-40 IU/L) compared to his previous values of ALT 33 IU/L and AST 21 IU/L from four weeks prior. Given his persistent respiratory symptoms, worsening bilateral lower extremity swelling, and recent medication changes, a CT angiogram was performed. Imaging revealed a 6 cm esophageal mass with associated lymphadenopathy, raising concerns for a possible malignancy or paraneoplastic process. However, in the setting of his rapidly worsening hepatic and renal function, drug-induced liver injury remained the leading concern. Due to his deteriorating condition, his recent medications (including colchicine, allopurinol, metformin, and antibiotics) were discontinued out of caution for potential hepatotoxicity or nephrotoxicity. The next day, he returned to the clinic with new-onset abdominal pain. However, due to technical issues with the clinic's CT scanner, the decision was made to transfer him to a higher level of care at a Level 1 trauma center for further evaluation and management.

Upon arrival at the trauma center later that evening, the patient was in respiratory distress and required BiPAP for respiratory support. Laboratory findings were significant for WBC 11.5 x10^9/L (normal = 4.0-11.0 x10^9/L), creatinine 3.07 mg/dL (normal = 0.6-1.2 mg/dL), direct bilirubin 12.9 mg/dL (normal = 0.0-0.3 mg/dL), total bilirubin 19.2 mg/dL (normal = 0.1-1.2 mg/dL), alkaline phosphatase 429 IU/L (normal = 44-147 IU/L), ALT 240 IU/L (normal = 7-56 IU/L), AST 793 IU/L (normal = 10-40 IU/L), and lactic acid 5.7 mmol/L (normal = 0.5-2.2 mmol/L). Abdominal and pelvic CT imaging demonstrated hepatosplenomegaly, porta hepatis enlargement, abdominal and pelvic ascites, and peripancreatic inflammation (Fig 1). Abdominal ultrasound

Figure 1. CT abdomen and pelvis taken on admission to level 1 trauma center. Two coronal images are shown. The green asterisk indicates hepatomegaly, with the hepatic right lobe measuring 23.5 cm. The orange asterisk indicates an area with peripancreatic fat stranding, which could be secondary to ascites or could represent an early pancreatitis. The yellow asterisk indicates mild splenomegaly, with the spleen measuring 15.4 cm in its greatest dimension.



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revealed a thickened gallbladder wall with biliary duct dilation, though no gallstones were identified. General surgery was consulted for possible cholecystitis, but given the marked hyperbilirubinemia (total bilirubin 19.2 mg/dL) and overall clinical picture, the differential diagnosis was broadened to include cholangitis, hepatitis, or fulminant liver failure. The patient was empirically started on piperacillin-tazobactam, and consultations with gastroenterology, pulmonology, infectious disease, and nephrology were initiated, with plans for evaluation the following morning.

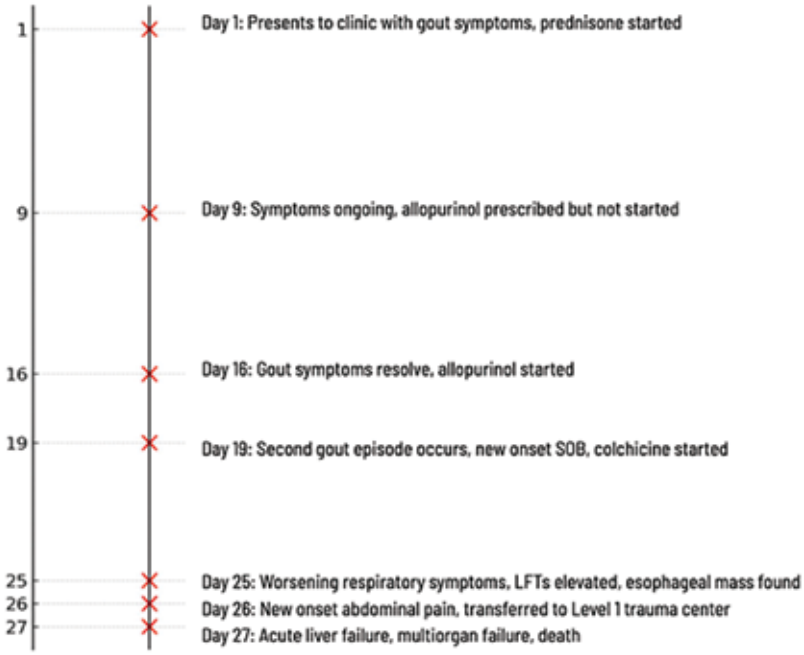
Over the next 24 hours, the patient's condition deteriorated rapidly. Laboratory markers reflected worsening transaminitis, escalating hyperbilirubinemia, severe metabolic acidosis, and progressive renal failure. Despite aggressive resuscitation efforts, he required multiple vasopressors for hemodynamic support. He died from fulminant hepatic failure later that evening, less than 24 hours after admission. His family declined an autopsy. A summary of the patient's clinical course, including key medication initiation points, symptom progression, and laboratory findings, is illustrated in Figure 2.

Discussion

DILI is the most common cause of acute liver failure in the U..S., accounting for a significant number of cases requiring liver transplantation.[1] Liver injury presents along a spectrum, from mild and transient enzyme elevations to acute liver failure, which can progress to fulminant hepatic failure—a rare but life-threatening condition marked by rapid hepatic dysfunction, encephalopathy, and multiorgan failure.[1] Among DILI-related cases of acute liver failure, acetaminophen toxicity is the most frequently implicated cause, followed by idiosyncratic reactions to medications such as statins, beta-lactam antibiotics, NSAIDs, and certain herbal supplements.[1] While many drugs have been documented to cause acute liver failure, allopurinol and colchicine have not been widely associated with fulminant hepatic failure in the acute setting.[2,3]

An additional consideration in this case is the presence of a 6 cm esophageal mass, which was identified on CT angiography shortly before the onset of fulminant liver failure. While no further workup was pursued due to the patient's rapid deterioration, paraneoplastic hepatic dysfunction or malignancy-associated liver failure remains

Figure 2. Timeline of events. Approximately nine days after initiating allopurinol and six days after starting colchicine, the patient experienced progression from acute liver injury to acute liver failure and ultimately fulminant hepatic failure and death. While uric acid was not measured on day 1, ongoing symptoms on day 9 leading to a confirmatory blood test showing elevated an uric acid of 8.9 mg/dL. On day 25 while taking both allopurinol and colchicine, ALT 150 IU/L and AST 484 IU/L were markedly elevated compared to ALT 33 IU/L and AST 21 IU/L four weeks prior. The following day at the level 1 trauma center (Day 26), labs continued to worsen and were significant for WBC 11.5 x10^9/L, creatinine 3.07 mg/dL, direct bilirubin 12.9 mg/dL, total bilirubin 19.2 mg/dL, alkaline phosphatase 429 IU/L, ALT 240 IU/L, AST 793 IU/L, and lactic acid 5.7 mmol/L.



a theoretical alternative explanation.[1] Some esophageal cancers and other malignancies have been associated with paraneoplastic hepatopathy, cholestatic liver injury, or metastatic disease affecting hepatic function.[4] However, in this case, the absence of overt metastatic liver involvement on imaging, the acute nature of hepatic decompensation, and the correlation with recent medication use make DILI the more probable etiology.[5] Nonetheless, without an autopsy or biopsy confirmation, a malignancy-related process cannot be definitively ruled out.

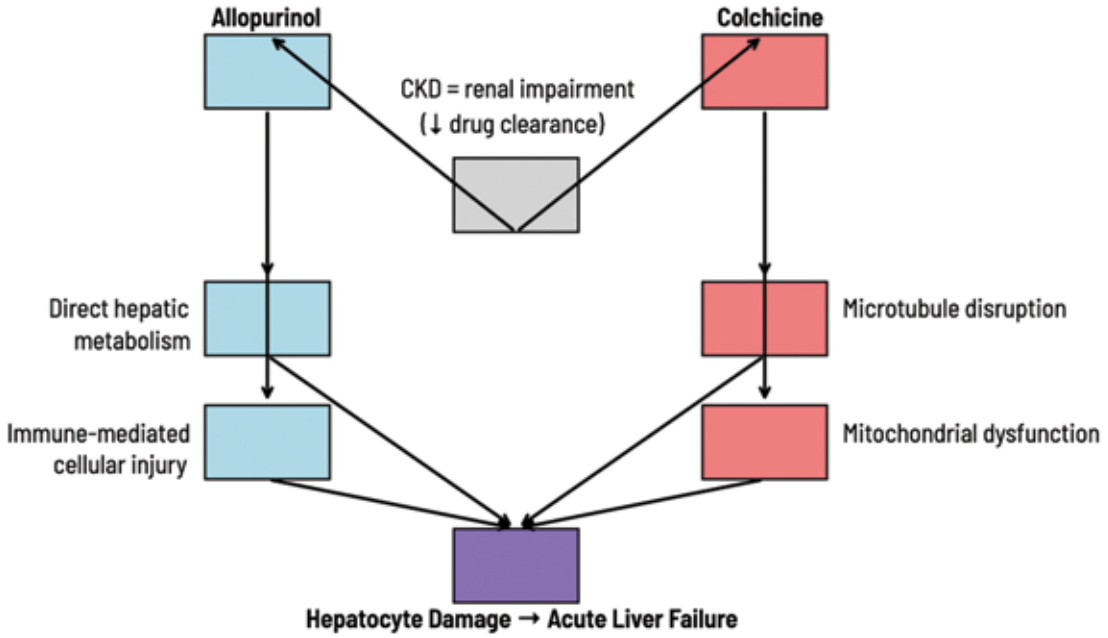
We present a case of a patient who developed rapid-onset liver failure and multiorgan dysfunction approximately nine days after initiating allopurinol and six days after starting colchicine. The progression from acute liver injury to acute liver failure occurred within a matter of days, ultimately resulting in fulminant hepatic failure and death. Given the temporal relationship between drug initiation and hepatic decompensation, this case raises concerns regarding the potential for acute DILI from allopurinol and colchicine, particularly in patients with preexisting renal disease.

Allopurinol and Hepatic Toxicity

Allopurinol is widely prescribed for hyperuricemia, a condition that can lead to chronic gout, tumor lysis syndrome, and uric acid nephrolithiasis. It functions as a xanthine oxidase inhibitor, blocking the enzymatic conversion of hypoxanthine to xanthine and subsequently to uric acid.[5] While allopurinol is generally well tolerated, chronic therapy has been associated with DRESS syndrome, a severe hypersensitivity reaction characterized by fever, rash, eosinophilia, lymphadenopathy, atypical lymphocytosis, and thrombocytopenia.[2,6] More severe manifestations of allopurinol hypersensitivity include SJS and TEN, both of which can involve hepatic injury.[2] Although most cases of allopurinol-induced liver enzyme elevations are mild and transient, rare instances of acute liver failure have been reported.[2]

Our patient's fulminant liver failure may have resulted from an immunoallergic response to allopurinol, despite the absence of eosinophilia. Studies have documented allopurinol-induced hepatotoxicity in a small subset of patients, often linked to immune-mediated liver injury.[5] The exact mechanism is not fully understood but is thought to involve direct hepatic metabolism of allopurinol or its oxypurinol metabolite, leading to immune-mediated hepatocyte damage.[5] Certain risk factors, including human herpesvirus-6 (HHV-6), Epstein-Barr virus (EBV), cytomegalovirus (CMV), and

Figure 3. Proposed mechanism of acute liver failure from allopurinol and colchicine with CKD. Though not well documented, allopurinol has been linked to both direct hepatic injury and immune-mediated liver injury via its oxypurinol metabolite. With colchicine disrupting microtubule function, hepatic toxicity could potentially occur through mitochondrial dysfunction and direct hepatocyte injury in cases of colchicine overdose or renal impairment.



the HLA-B*58:01 allele, particularly in Asian populations, have been associated with a higher risk of severe allopurinol reactions.[2] While most cases of hepatotoxicity improve upon drug discontinuation, this case underscores the potential for rapid progression to fulminant liver failure in susceptible individuals. A proposed mechanism of our patient's DILI is illustrated in Figure 3.

Colchicine and Hepatic Toxicity

Colchicine is widely used for acute gout flares and pericarditis. Unlike allopurinol, colchicine does not reduce uric acid levels but instead modulates inflammation by disrupting microtubule formation, preventing neutrophil activation and migration to inflamed joints.[3,4] While generally well tolerated, colchicine toxicity has been implicated in multiorgan failure, including hepatic failure, in cases of overdose or impaired drug clearance due to renal dysfunction.[5]

Despite its widespread use, colchicine has not been well-documented as a cause of acute liver failure outside of overdose scenarios or predisposing conditions. However, given its cytotoxic potential and known systemic toxicity, colchicine should be used cautiously in patients with preexisting liver or kidney disease.[3] This case highlights the need for further research into potential hepatic effects of colchicine, particularly in combination with other hepatotoxic medications.

Conclusion

This case highlights a rare but potentially fatal adverse event following recent initiation of allopurinol and colchicine therapy. Our patient developed fulminant liver failure approximately nine days after starting a renally adjusted dose of allopurinol (50 mg daily) and six days after adding colchicine (0.6 mg daily). Given the temporal association, it remains unclear whether allopurinol, colchicine, or a combination of the two contributed to the acute hepatic injury. Additionally, an interaction with the patient's chronic medications, including amlodipine, hydrochlorothiazide, metoprolol succinate, metformin, and bupropion HCl, cannot be ruled out.

Allopurinol-induced hepatotoxicity has been previously reported, but cases of acute fulminant liver failure remain exceedingly rare.[2] While hypersensitivity reactions such as DRESS, SJS, and TEN have been associated with liver injury, most cases involve mild and transient aminotransferase elevations rather than fulminant hepatic failure.[4] Similarly, colchicine has not been well-documented as a cause of acute liver failure outside of overdose scenarios.[3] Given the widespread use of both allopurinol (>2 million prescriptions/year in the U.S.) and colchicine (>1 million prescriptions/year in the U.S.), clinicians should be aware of potential hepatotoxicity, particularly in patients with preexisting renal dysfunction, polypharmacy, or recent medication changes. Early liver function monitoring following the initiation of allopurinol and colchicine may be warranted, particularly in high-risk patients.

REFERENCES

1. Lee WM. Drug-induced acute liver failure. Clin Liver Dis. 2013;17(4):575-86.
2. LiverTox: Clinical and research information on drug-induced liver injury. National Institute of Diabetes and Digestive and Kidney Diseases; 2012. Allopurinol. Updated December 26, 2020.
3. LiverTox: Clinical and research information on drug-induced liver injury. National Institute of Diabetes and Digestive and Kidney Diseases; 2012. Colchicine. Updated October 26, 2017.
4. David S, Hamilton JP. Drug-induced liver injury. US Gastroenterol Hepatol Rev. 2010;6:73-80.
5. Brooks CG, Calderon LF, Qayed E. A DILI-terious response to allopurinol: acute immunoallergic hepatitis in a chronic gout patient. Am J Gastroenterol. 2023;118(10S):S2271-2.

About the Authors:

Nicholas Looby, MD, University of South Dakota Sanford School of Medicine.
Cole D. Tessendorf, MD, University of South Dakota Sanford School of Medicine.
Jack Hagen, BA, Augustana University.
Michelle Looby, PharmD, Monument Health, Rapid City, South Dakota.
Jenny Guido, MD, Sanford USD Medical Center, Sioux Falls, South Dakota; University of South Dakota Sanford School of Medicine.

Graves' Disease Complicated by Cardiac Tamponade in Pregnancy: A Case Report and Review of the Literature

Haley S. Jerman, MS III, PA-C; and Rachel L. Rodel, MD

Abstract

Thyrotoxicosis and its associated complications pose a diagnostic and therapeutic challenge with heightened complexities in pregnant patients. Although Graves' disease is an established but infrequent cause of pericarditis, cardiac tamponade has been documented in association with hyperthyroidism only in case reports. We present the case of a 23-year-old patient with Graves' disease, leading to recurrent thyrotoxicosis and pericarditis. She presented in her second trimester of pregnancy with cardiac tamponade requiring emergent pericardiocentesis and interval thyroidectomy. This case highlights the rarity of cardiac tamponade and Graves' disease during pregnancy. Although medication management is first line in the treatment of hyperthyroidism in pregnancy, surgical management should not be delayed if the benefits to maternal and fetal health are deemed to outweigh the risks.

Introduction

Hyperthyroidism in pregnancy requires careful treatment and surveillance due to the risk of maternal, fetal, and neonatal complications. While hyperthyroidism has a diverse set of clinical signs and symptoms, the specific complication of cardiac tamponade has only been described in case reports.[1-5] Unique characteristics of thyrotoxicosis include enhanced vascular permeability, expanded blood volume, and an elevated metabolic rate, which collectively lead to an increase in both cardiac output and heart rate.[6] These factors could contribute to the clinical presentation and may be exacerbated by the physiologic changes of pregnancy.

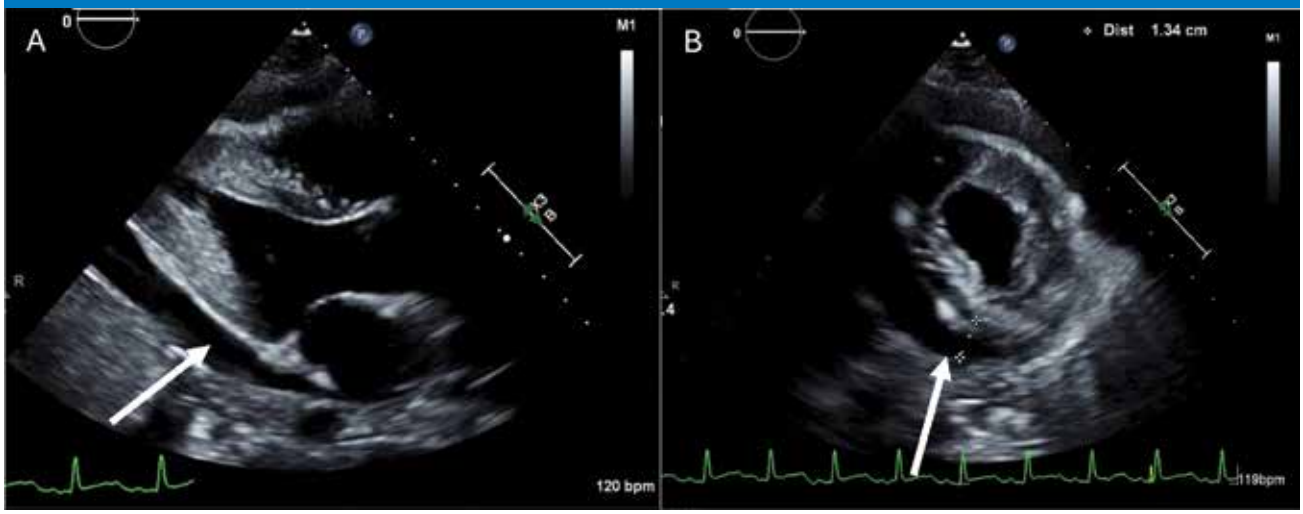
Clinical Course

The patient, a 23-year-old gravida 2 para 1, was diagnosed with Graves' disease two years prior when presenting for prenatal care in her first pregnancy and being found to have a goiter on physical exam. Laboratory studies confirmed the diagnosis of Graves' disease with a suppressed TSH <0.01 (0.35-4.94) uIU/mL, elevated free T4 2.0 (0.7-1.5) ng/dL, T3 18.9 (1.6-3.9) pg/mL, thyroid peroxidase antibody 813.4 (=< 5.6) IU/L, and thyrotropin receptor antibody of 12 (0.00 - 1.75) IU/L. Thyroid ultrasound at that time showed a diffuse symmetric goiter without dominant or discrete nodules and hyperintense vascular flow. Her hyperthyroidism was successfully treated with propylthiouracil after suffering from a reaction of hives with methimazole, and her pregnancy resulted in a full-term delivery without apparent neonatal complication. Although postpartum treatment with radioactive iodine was discussed with the patient, she was unfortunately lost to follow up until presenting for care in her second pregnancy.

At 17 weeks gestation in her second pregnancy, she presented to the emergency department reporting chest pain and shortness of breath. Her physical exam was notable for a visible and palpable goiter, although no myxedema or exophthalmos was present. Her laboratory evaluation on admission was significant for thyrotoxicosis with TSH <0.01 (0.35-4.94) uIU/mL, free T4 1.4 (0.7-1.5) ng/dL, T3 9.2 (1.6-3.9) pg/mL, and thyrotropin receptor antibody of 14 (0.00 - 1.75) IU/L. She reported reliably taking previously prescribed propylthiouracil 50 mg three times daily and propranolol 10 mg three times daily. However, she had no recent labs performed. Her vital signs were notable for blood pressure 87/50 mmHg, respiratory rate 26, pulse 100 bpm, SpO2 100%, and temperature 97.8 °F. Cardiac troponin was normal, a chest X-ray showed a normal cardiomediastinal silhouette, and EKG showed sinus tachycardia. She was admitted and treated with intravenous hydration and an increased dose of propylthiouracil. The following day, she developed worsening hypotension, tachycardia, and lethargy, prompting her transfer to the intensive care unit.

An echocardiogram (shown in Figure 1) revealed a large pericardial effusion and partial right atrial diastolic collapse, consistent with early cardiac tamponade. Left ventricular ejection fraction was normal at 50-55%. Repeat troponin

Figure 1. Maternal echocardiogram showing a parasternal long-axis view (A) and a short-axis view (B), both depicting a large pericardial effusion (white arrows).



returned elevated, and EKG showed sinus tachycardia, prolonged QT interval, and ST elevation concerning for pericarditis. She was started on dexamethasone to inhibit peripheral conversion of T4 to T3. A pericardiocentesis was performed with nearly 300 cc of serous fluid drained, and a pigtail catheter was placed. Cytology was unremarkable with negative cultures. Her troponin also normalized. The pigtail catheter was removed 48 hours following pericardiocentesis. Her thyroid hormone levels, vital signs, and overall clinical status stabilized. Given the patient's challenging social determinants of health, including housing and transportation insecurity, and history of unsuccessful medication management, the decision was made to proceed with total thyroidectomy four days following pericardiocentesis. She had an uncomplicated perioperative course. Thyroid pathology showed only diffuse hyperplasia. She was started on levothyroxine 112 mcg daily (1.9 mcg/kg) and was discharged on postoperative day four. Fetal status was evaluated by Doppler during her hospitalization, and an ultrasound was reassuring prior to discharge.

Thyroid function tests were reevaluated 3 weeks postoperatively, and levothyroxine dose was increased to 150 mcg daily after TSH returned at 8.35 (0.35-4.94) uIU/mL and free T4 was 0.7 (0.7-1.5) ng/dL. At 36 weeks gestation, the patient was diagnosed with fetal growth restriction at 4% with normal umbilical artery Doppler evaluation. There was no evidence of fetal goiter noted on ultrasound. Twice weekly fetal testing was ordered, and the patient underwent a repeat cesarean section at 38 weeks gestation, delivering a 2670-gram female infant without evidence of neonatal Graves' disease or malformations.

Discussion

Although hypothyroidism is complicated by pericardial effusion in 3-37% of cases, hyperthyroidism has only been associated with cardiac tamponade in a handful of case reports.[7] Our literature search revealed five previous cases of suspected hyperthyroidism-induced cardiac tamponade, and only one of these cases was noted in pregnancy.[1-5] Due to the limited literature available, best treatment strategy involves assembling information from various guidelines pertaining to the acute management of Graves' disease, pericarditis, and pericardial effusion leading to cardiac tamponade. Here, we summarize treatment for hyperthyroidism, pericarditis, and pericardial effusion progressing to tamponade, as well as special considerations for pregnancy.

Overt hyperthyroidism affects 0.6% of pregnancies, with Graves' disease being the most common cause.[8,9] Maternal thyrotoxicosis increases the risk for preeclampsia with severe features, maternal heart failure, thyroid storm, medically indicated preterm delivery, low birth weight, miscarriage, and stillbirth.[10] Further, hyperthyroidism causes far-reaching complications due to the systemic effects of increased metabolic rate. Pericarditis has been associated with Graves' disease in numerous case reports; however, the concurrent occurrence is unknown, and the pathophysiology is not well understood.[11] Pericardial effusion progressing to cardiac tamponade is associated with pericarditis and portends a worse prognosis.[12]

Although TSH may be physiologically depressed by human

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chorionic gonadotropin (hCG) in the first trimester, elevated level TSH beyond the first trimester and presence of elevated thyrotropin receptor antibody indicates Graves' disease.[10] Treatment of hyperthyroidism in pregnancy is accomplished with thioamide therapy, with propylthiouracil being the preferred agent in the first trimester due to methimazole's association with esophageal or choanal atresia and aplasia cutis.[10] Beta blockers are used as adjunctive therapy for symptomatic palpitations and to control tachycardia.[10] In patients with a T4 thyrotoxicosis, the goal should be at the upper end of the normal pregnancy range, while patients with a T3 thyrotoxicosis should have this lab preferentially monitored with the goal also at the upper end of the normal range.[10] If symptoms progress to thyroid storm, dexamethasone should be added to block peripheral conversion of T4 to T3 by inhibiting type 1 deiodinase.[10,13]

There is, however, limited research or available guidelines for patients who have failed thioamide therapy. Most thyroidectomies that occur in pregnancy are for the indication of thyroid cancer. Research suggests that pregnant patients have a higher risk of both endocrine and general complications postoperatively, with a fetal and maternal complication rate of 5.5% and 4.5%, respectively.[14] However, these risks must be weighed against the risk of future thyrotoxicosis. Due to surgery data in pregnancy being limited to retrospective cohort studies, it is challenging to delineate if the surgery itself poses a risk outside of the maternal condition requiring surgery and underlying maternal health. However, the attributable risk of undergoing non-obstetric surgery in pregnancy appears low and surgery should not be withheld if necessary for optimal treatment.[15]

Treatment strategies for pericarditis aim to reduce inflammation, relieve pain, and address the underlying cause. Although nonsteroidal anti-inflammatory drugs (NSAIDs) are a mainstay of therapy, NSAIDs should be avoided after 32 weeks gestation due to the increased risk of fetal ductus arteriosus constriction.[16] Additionally, NSAIDs are associated with fetal renal injury and can precipitate or potentiate oligohydramnios.[17] Colchicine is also a common treatment strategy to reduce inflammation by blocking tubulin polymerization, thereby inhibiting inflammasome formation and cytokine release in white blood cells.[12] Although colchicine is not commonly utilized in pregnancy, colchicine use in pregnancy has been described in rheumatologic diseases in which no acceptable alternatives exist and no substantial teratogenic risk has been associated.[17] Finally, corticosteroids are a mainstay of treatment, especially for more prolonged disease courses. Interestingly, lower dose prednisone at doses of 0.2 to 0.5 mg/kg is associated with lower recurrence rates and treatment failure as opposed to higher dose corticosteroids.[12] Corticosteroids are frequently used in pregnancy, and although adverse effects exist, the benefit of treatment in pericarditis typically outweighs the potential risk.

Pericardial effusion is present in 50-65% of patients with pericarditis and can progress to cardiac tamponade.[12] Although there are typically several signs and symptoms of cardiac tamponade, including jugular venous distension, hypotension, muffled heart sounds, tachycardia, pulsus paradox, and decreased amplitude of QRS complexes, the mainstay for diagnosis of cardiac tamponade is an echocardiogram which can also allow for estimation of severity.[12] Treatment of cardiac tamponade requires surgical drainage with imaging guidance.[12] Typically, pericardial window is preferred to pericardiocentesis in situations involving hemopericardium or where the pericardial effusion is likely to recur.[12]

Conclusion

This case demonstrates an unusual presentation of uncontrolled hyperthyroidism in pregnancy. The patient was initially treated with medical management using propylthiouracil and propranolol. However, the subsequent development of cardiac tamponade and the history of failed treatment necessitated a more definitive approach. Although the best course of action was difficult to determine given the complexity of balancing maternal and fetal health, the decision to proceed with thyroidectomy offered definitive treatment and eliminated the risk of future thyrotoxicosis. This decision was made, in part, because she was clinically stable to undergo surgery, the second trimester is the optimal timing for surgical intervention if required, and she had previously failed medication management of her hyperthyroidism.

REFERENCES

1. Bui PV, Zaveri SN, Pierce JR Jr. Sanguineous pericardial effusion and cardiac tamponade in the setting of Graves' disease: report of a case and review of previously reported cases. Case Rep Med. 2016;9653412.
2. Clarke NRA, Banning AP, Gwilt DJ, et al. Pericardial disease associated with Grave's thyrotoxicosis. QJM. 2002;95:188-9.
3. Fonseca EM, Schonhofen I, Toralles MP, de Carvalho JF. Graves' disease inducing a massive cardiac tamponade. BMJ Case Rep. 2021;14:e239772.

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About the Authors:

Haley S. Jerman, MS III; PA-C; Sanford Maternal-Fetal Medicine, Sanford USD Medical Center, Sioux Falls, South Dakota; Lake Erie College of Osteopathic Medicine at Seton Hill.

Rachel L. Rodel, MD, Sanford Maternal-Fetal Medicine, Sanford USD Medical Center, Sioux Falls, South Dakota; Department of Obstetrics and Gynecology, University of South Dakota Sanford School of Medicine.

Prenatal to Postpartum:

What South Dakota's Data Tells Us About Missed Care

Every clinical encounter with a patient of reproductive age is a chance to make a lasting impact—not just on immediate health, but on future pregnancies, births, and maternal outcomes. In South Dakota, where many women begin prenatal care late or receive inadequate care, these missed opportunities can have serious consequences. Physicians play a vital role as early responders, and their actions—screening for complications, asking the right questions, and referring to support services—can save lives and improve the well-being of families across our state.

THE PRENATAL WINDOW: A Missed Opportunity

Despite progress, gaps in prenatal care remain in South Dakota:

- In 2022, **14% of mothers did not begin prenatal care in the first trimester**.
- Striking racial differences remain:
  - **1 in 4 American Indian mothers** delayed care beyond the first trimester, compared to just **1 in 10 White mothers**.
- Prenatal care isn't just about when it starts – it is also about **staying engaged throughout pregnancy.**
- Overall, **22.5% of mothers received care that fell short of "adequate"** based on the Kotelchuck Index, which considers both timing and number of visits.

(Source: South Dakota PRAMS, 2022)

Early prenatal care improves outcomes, yet many women delay or miss it due to barriers like lack of awareness, transportation, or missed provider prompts.

POSTPARTUM CARE: An Overlooked Lifeline

Recent data from South Dakota highlight persistent gaps in postpartum care:

- **96.1% of White mothers** reported attending a **postpartum visit**, compared to just **65% of American Indian mothers**.
- **Teen mothers (<20 years) were also less likely to receive care,** with only 66.7% attending a postpartum visit.
- Postpartum depression affected **1 in 5 American Indian mothers (20%)**, compared to **8.3% of White mothers**.

(Source: South Dakota PRAMS, 2022)

The postpartum period isn't just about recovery – it's a matter of life and death. Between 2014 and 2023, **57% of pregnancy-associated deaths in South Dakota occurred in the late postpartum period** – that is, between 43 days and 1 year after the end of pregnancy.

WHAT WE CAN DO

- **Ask every patient of reproductive age:** "Have you had a pregnancy in the last year?"
- **Normalize routine postpartum visits** and schedule the appointment before discharge.
- **Screen for depression, anxiety, and physical complications** at any healthcare visit during postpartum months, Every opportunity counts!
- **Ensure clear communication and support referrals** for patients who may be unaware of recommended follow-up care.
- **Coordinate with OB and pediatric teams** – especially for higher risk patients
- **Advocate for flexible care models**, including telehealth and integrated pediatric–maternal follow-ups

Perinatal and postpartum visit attendance gaps are not the result of individual failure – they reflect systemic barriers and multifactorial challenges. But we can act – earlier and more consistently.

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Disclaimer: This project is supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under Grant Number B0452953 for Maternal Child Health (MCH) services. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Maternal Child Health Bureau /HRSA.

To Take or Not to Take: A Case of Cholestyramine Induced Vitamin K Deficiency

Tinotenda ME Sekeramayi, MD; and Christopher Sumey, MD

Abstract

Cholestyramine resin combines with bile acids preventing their reabsorption from the small bowel, leading to a reduction in the absorption of fat-soluble vitamins A, D, E, and K. While rarely clinically significant, in some cases this can lead to vitamin K related coagulopathy. We present a case of a 57-year-old female with a profound vitamin K deficiency refractory to concomitant oral vitamin K supplementation in the setting of ongoing cholestyramine administration.

Introduction

Bile acids synthesized in hepatocytes combine with phospholipids to form mixed micelles which are required for proper absorption of dietary lipids and nutrients in the small intestine.[1] Cholestyramine, an anion exchange resin that binds bile acids, can be used in patients suffering from bile acid diarrhea or bile acid malabsorption due to colitis or small bowel resection. Common side effects of cholestyramine therapy include constipation, abdominal discomfort, abnormal liver function, or skin rash. Rare side effects of cholestyramine therapy include hemorrhage and resultant anemia presumably due to vitamin K deficiency. Vitamin K is essential for the synthesis of clotting factors II, VII, IX, and X through its action as a cofactor in their gamma-carboxylation.[2] This modification is essential for the clotting factors to bind effectively to phospholipids in the platelet membrane.[2] Under-carboxylated clotting factors can result in reduced protein activity and excessive bleeding.[2,3]

Bleeding has been described within a few weeks but also as late as 25 years after initiation of cholestyramine.[4] The authors describing the late-onset coagulopathy recommend warning patients that bleeding may occur at any time during their treatment.[4] Herein we present recurrent immediate severe vitamin K depletion whilst taking both cholestyramine and oral vitamin K.

Case Presentation

A 50-year-old female with a history of obesity status post gastric bypass and partial small bowel resection and chronic macrocytosis without anemia was admitted with melena, mucosal bleeding, epistaxis, and nailbed bleeding. She also reported a 20-to-30-pound unintentional weight loss over the past six months, progressive solid food dysphagia, fatigue, and reflux. Her home medications at time of this admission included a daily multivitamin, vitamin B12, and folate supplements that she had been taking since her gastric bypass 21 years ago. Hematologic work-up revealed a chronic macrocytic anemia with a hemoglobin of 11.1 g/dL (reference 11.5-15.8 g/dL) and a macrocytosis to 108.5 fL (80-98 fL), and markedly elevated internal normalized ratio (INR) to 14 (0.9-1.1). Mixing studies with normal plasma corrected the INR, consistent with factor deficiencies. She was given phytonadione 10 mg intravenously, followed by an additional five milligrams orally once the patient's INR normalized. The etiology of the patient's coagulopathy was attributed to cholestyramine, which had been started a month prior to admission by her urogynecologist for insensate fecal incontinence. She was discharged with instructions to continue cholestyramine but to supplement with phytonadione 5 mg orally daily.

Five days later the patient presented to the emergency department with melena, oropharyngeal mucosal bleeding, and epistaxis. The coagulation profile on admission again revealed a prothrombin time (PT) of 104.3 and INR of 14.1 (Table 1). Further laboratory testing revealed normal levels of vitamin D, vitamin B12, folate, and iron levels. The disseminated coagulopathy panel that includes schistocytes, D-dimer, fibrinogen, platelet count, PT/INR, and PTT levels was negative. However, the PT and PTT mixing studies were consistent with a factor deficiency. A review of her factor levels revealed deficiency of the vitamin K dependent factors, namely II, VII, IX and X (Table 2). A

Table 1. Coagulation profile.

Date	Day of admission	Day 1	Day 2	Day 3	Day 4	Day 9 (post-discharge)
PT (12-14.5 s)	104.3	42.5	25.8	24.4	16.5	14.1
INR (0.9-1.1s)	14.1	4.4	2.3	2.2	1.3	1.1
APTT (24-35s)			46			29

Table 2. Coagulation factor levels.

Factor activity	Result	Reference range (%)
Factor 2	19	86-150
Factor 7	52	80-181
Factor 9	27	78-184
Factor 10	14	81-157

diagnosis of cholestyramine-induced coagulopathy refractory to vitamin K supplementation was made. Cholestyramine therapy was discontinued and phytonadione 10 mg daily was administered intravenously, her bleeding ceased completely and her coagulopathy resolved. Following shared decision making, cholestyramine was discontinued permanently along with a transition from intravenous to oral five milligram vitamin K supplementation. She was discharged with plans for follow-up with hematology and oncology and a repeat PT and INR check as an outpatient.

Discussion

Vitamin K deficiency is rare in otherwise healthy adults in the absence of vitamin K antagonists such as warfarin. When present, the typical mechanism is malabsorption rather than dietary, or drug-induced deficiency. For adults, a diagnostic criterion for vitamin K deficiency bleeding may comprise a PT that is greater than four times the normal range and the presence of one of the following conditions and decreased coagulation factor levels in the setting of high clinical suspicion and exclusion of anticoagulation use (i.e., heparin, dabigatran, rivoraxaban, or apixaban) or liver disease-induced coagulopathy.[2]

Fat soluble vitamin supplementation has been proposed in the past following a case report on a patient taking cholestyramine who developed hypoprothrombinemic hemorrhage.[5] However, there remains no current consensus regarding addition and monitoring of fat-soluble vitamins with initiation of cholestyramine therapy. Vitamin K has a short half-life, approximately 1.7 hours but a study examining the effect of warfarin on serum levels of vitamin K demonstrated that the duration of action following intravenous vitamin K (10 mg) has yet to be defined.[6] Hence, due to patient specific comorbidities clinicians may opt to monitor for deficiency related coagulopathy with a PT and INR anywhere from weekly to monthly or assess for any symptoms or signs of bleeding during routine clinic visits. Patients with a history of gastrointestinal disorders, such as short bowel syndrome or inflammatory bowel disease, may be at increased risk for this complication and should be screened more aggressively, such as weekly PT and INR monitoring. For example, the patient's susceptibility to cholestyramine may have been exacerbated by her prior laparoscopic Roux-en-Y gastric bypass followed within the week by a small bowel resection for small bowel obstruction, resulting in chronic malabsorption. If a patient is found to have a coagulopathy, the physician should provide education regarding bleeding risk associated with continuing cholestyramine and discuss discontinuing the cholestyramine therapy. If a patient prefers to continue the therapy then a physician can discuss intravenous vitamin K supplementation and frequent monitoring of PT and INR. In summary, this case highlights a rare complication of cholestyramine therapy that can be life threatening, but prompt recognition of this complication and rapid management can lead to rapid improvement.

REFERENCES

1. Saeed A, Hoekstra M, Hoeke MO, Heegsma J, Faber KN. The interrelationship between bile acid and vitamin A homeostasis. Biochimica et Biophysica Acta (BBA) – Molecular and Cell Biology of Lipids. 2017;1862(5):496-512.
2. Mihatsch WA, Braegger C, Bronsky J, Campoy C, Domellöf M, Fewtrell M, Mis NF, Hojsak I, Hulst J, Indrio F, Lapillonne A, Mlgaard C, Embleton N, van Goudoever J, ESPGHAN Committee on Nutrition. Prevention of vitamin K deficiency bleeding in newborn infants: a position paper by the ESPGHAN Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2016 Jul;63(1):123-9
3. Fusaro M, Gallieni M, Rizzo MA, et al. Vitamin K plasma levels determination in human health. Clin Chem Lab Med. 2017;55(6):789-99.

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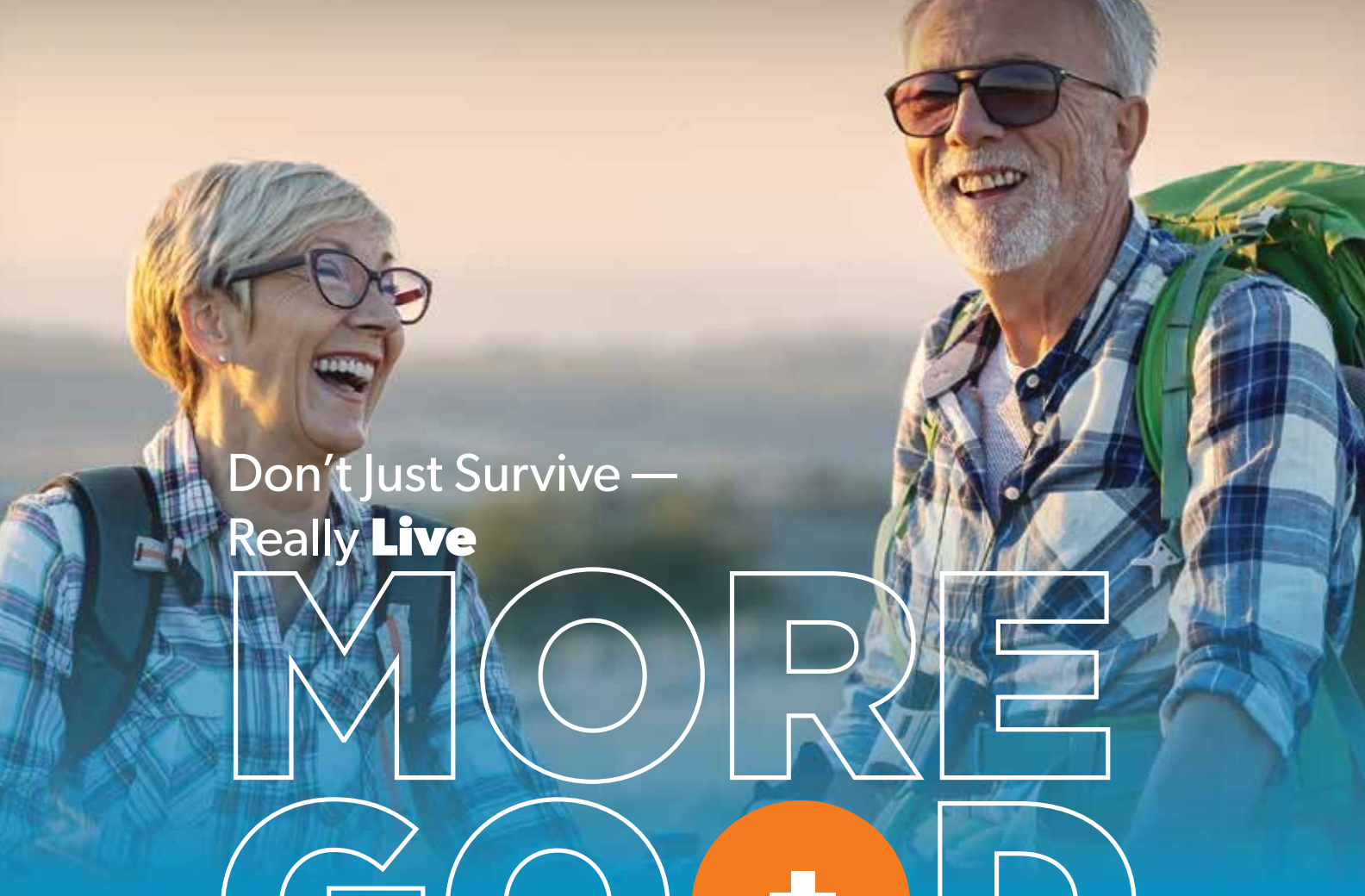
About the Authors:

Tinotenda ME Sekeramayi, MD, Internal Medicine Residency Program, University of South Dakota Sanford School of Medicine; Sanford USD Medical Center, Sioux Falls, South Dakota.

Christopher Sumey, MD, Department of Internal Medicine, University of South Dakota Sanford School of Medicine; Department of Hematology and Oncology, Sanford Cancer Center, Sioux Falls, South Dakota.



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Pronounced Disparities in Amyloidosis Cardiovascular Mortality among elderly adults in the United States from 1999-2020

Mustafa Shehzad, MD; Dawood Shehzad, MD; Logan Johnke, MD; Dawlat Khan, MD; and Hammad Shabir Chaudhry, MD

Abstract

Amyloidosis is a group of protein-folding disorders marked by the accumulation of amyloid fibrils, leading to significant organ dysfunction. This study investigates trends in cardiovascular mortality linked to amyloidosis in the U.S. from 1999 to 2020, using data from the CDC WONDER database. We analyzed age-adjusted mortality rates (AAMR) among older adults (older than 65 years) across various demographic, racial, and geographic categories. Findings show a concerning increase in AAMR from 1.71 in 1999 to 4.23 in 2020, with a notable acceleration after 2018 (annual percentage change of +16.30). Males consistently demonstrated higher mortality rates than females, while non-Hispanic Black individuals had nearly double the AAMR compared to other racial groups. Regional analysis revealed the highest mortality rates in the Northeast and West, contrasting with lower rates in the South despite a larger Black population in that region. These disparities highlight potential influences from socioeconomic factors, healthcare access, and diagnostic practices. The increase in amyloidosis-related mortality may reflect enhanced recognition rather than an actual rise in disease prevalence. Our results underscore the urgent need for targeted public health interventions to address these disparities and improve diagnostic and treatment strategies. Continued investigation into the underlying causes of these trends is essential for enhancing patient outcomes and managing the growing burden of amyloidosis among the aging population.

Introduction

Amyloidosis is a group of protein-folding diseases characterized by the extracellular deposition of amyloid fibrils. At least 30 human proteins can serve as precursors for these fibrils, which typically have a rigid, unbranched structure around 10 nm in diameter.[1] Their molecular configuration, mainly composed of antiparallel beta-pleated sheets, leads to their insolubility and resistance to proteolysis and their affinity for the Congo Red dye, showing green birefringence under polarized light. Extracellular deposition of amyloid fibrils causes tissue infiltration and swelling, leading to progressive organ dysfunction. The type of precursor protein, the tissue distribution, and the amount of amyloid deposited largely determine clinical manifestations.

This study investigates the trends and cardiovascular mortality due to amyloidosis in the U.S. from 1999 to 2020, focusing on temporal changes and disparities across gender, racial and ethnic groups, and geographic regions. Little prior work has been done in this area, especially on the Centers for Disease Control and Prevention's Wide-Ranging Online Data for Epidemiological Research (CDC WONDER) dataset. A review of the current literature shows an article by Alexander, K. M et al.[2] looking at geographic disparities in cardiac amyloidosis-related mortalities from 1979-2015. Their study also found similar trends and disparities in amyloidosis-related mortality.

By analyzing the mortality data from the CDC Wonder database, we aim to elucidate patterns among amyloidosis-related deaths. Understanding these trends is crucial for identifying disease burden, healthcare disparities, clinical trends, and gaps in disease management, as well as for developing target interventions and improving management strategies for this increasingly recognized condition.

Methodology

This study utilized data from the CDC WONDER data set, which is publicly available. Our analysis can be replicated through the methods described. This data set includes the mortality data from the death certificates of all 50 states and the District of Columbia.

We conducted a retrospective analysis using the death certificate data from the CDC WONDER database. (http://wonder.cdc.gov/) We focused on the Multiple Cause of Death Public Use data set, which includes mortality and population counts for all U.S counties and various socio-demographic parameters, including race/ethnicity and place of death. We examined the trends in mortalities in older adults (>65 years old) from 1999 to 2020, in which Amyloidosis was recorded as the underlying cause of death using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision Codes (ICD-10) E85.0, E85.1, E85.2, E85.3, E85.4, E85.8, E85.9.[3] Ethical approval was not applicable as our analysis utilized de-identified publicly available data and adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for rigorous reporting standards.[4]

Data was extracted by querying the CDC Wonder database, and files were downloaded in Excel. We extracted data regarding year, population, demographics, states, urban-rural classification, and regions to analyze the temporal trends in Amyloidosis mortality across various socio-demographic parameters. Sex, race/ethnicity, place of death, and age were included in the demographics. Racial/ethnic groups included Hispanic or Latino, Non-Hispanic (NH) White, NH American Indian or Alaska Native, NH Black or African American, and NH Asian or Pacific Islander. These classifications rely on information recorded in death certificates as reported by the funeral director, either through information provided by the next of kin or self-reported based on observation. The place of death includes home, hospice, nursing home/long-term care facility, and medical facilities, which are further subdivided into inpatient, outpatient, or emergency room, dead on arrival, and status unknown. The urban-rural classification was based on the National Center for Health Statistics, which categorizes areas into metropolitan and non-metropolitan. [5] Metropolitan regions are further divided into large (>1 million people), medium (250,000-999,000 people), and small (<250,000 people) metropolitan counties. Non-metropolitan areas include micropolitan (<50,000 people) and noncore counties, which are rural. Regions included Northeast, Midwest, South, and West according to the US Census Bureau's classification. [5]

Statistical Analysis

Our analysis examined the trends in amyloidosis mortality from 1999 to 2020 stratified across various demographic, regional, and geographic regions. Crude mortality rates per 100,000 individuals were determined by dividing the number of deaths in a year by the population in that specific year, and age-adjusted mortality rates (AAMR) per 100,000 individuals were also determined, with the 2000 US population serving as a baseline for AAMR standardization. Data points with fewer than 20 mortality events were considered unreliable and treated as missing data. Temporal changes in mortality rates were assessed using the Joinpoint Regression Program, calculating the annual percent change (APC) in AAMR and its 95% confidence interval (CI), which involves fitting log-linear regression modes to identify significant changes in AAMR over time.[6] APCs were termed as increasing or decreasing based on their statistical deviation from the null hypothesis of zero change, with significance determined using a 2-tailed t-test ($P < 0.05$). The program iteratively evaluates models with varying joinpoints (0 to k, where k is determined by the data and model fit). Each joinpoint represents a statistically significant inflection point where the slope (APC) changes. A Monte Carlo Permutation Test follows this identifies the optimal number of joinpoints that best describe the data while balancing model complexity and statistical fit.

Results

Annual and Sex Stratified Trends in AAMR

A total of 928,476,665 deaths were recorded amongst older adults (>65 years) from 1999 to 2020. Amyloidosis was implicated as the underlying or contributory cause of death in 21,010 of these patients.

The AAMR for amyloidosis mortality increased overall during the study period from 1.71 in 1999 to 4.23 in 2020 (AAPC: +4.07%, 95% CI: 3.72 to 4.44). Temporal trends demonstrated a steady, continuous rise in AAMR from 1999 to 2012, followed by an abrupt incline during the latter part of the study period from 2012 to 2018 (APC: 7.46, 95% CI: 4.84 to 9.36). From 2018 to 2020, the AAMR rose from 3.00 to 4.04 (APC: 16.30, 95% CI: 11.82 to 19.45). The average annual percentage change for the entire study period was (AAPC: 4.07, 95% CI: 3.72 to 4.44). Males (overall AAMR: 3.36, 95% CI: 3.30 to 3.41) had a higher AAMR throughout the study duration than females (overall AAMR: 1.59, 95% CI: 1.55 to 1.62). These trends are depicted in Figure 1.

Race-based Analysis

We also analyzed racial trends in AAMR across the study period. Our analysis revealed a striking contrast among the different racial/ethnic groups. NH Blacks had profoundly higher AAMR as compared to other racial groups. The overall AAMR (4.36, 95% CI: 4.22 to 4.51) of NH Blacks

Figure 1. Trends in overall and sex-stratified age-adjusted amyloidosis-associated CVD-related mortality in the U.S. from 1999 to 2020.

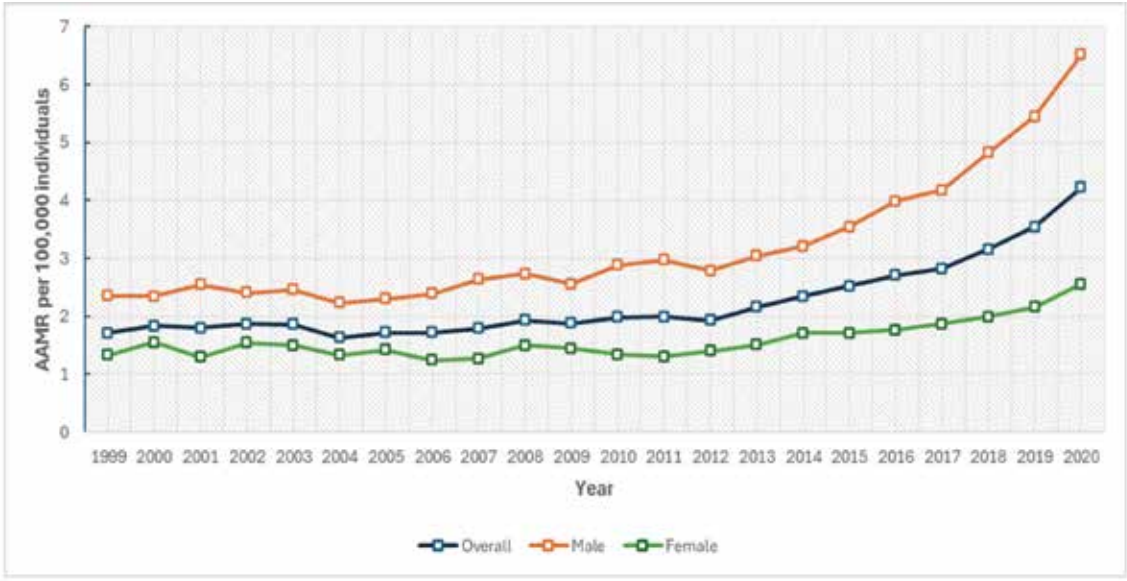
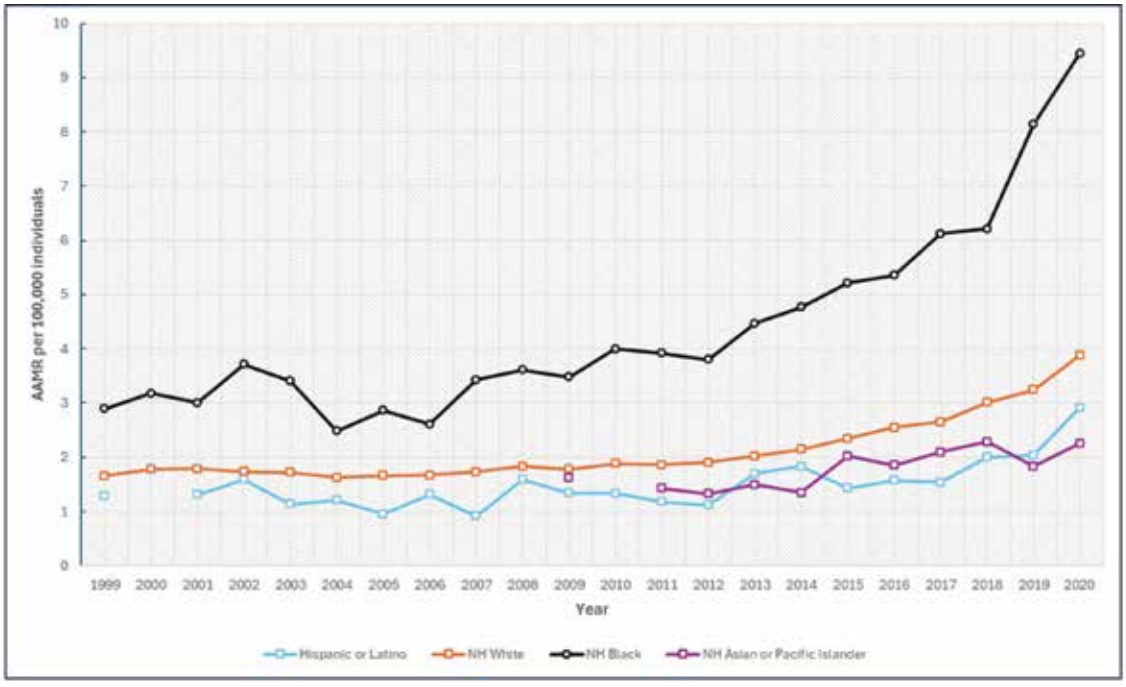


Figure 2. Racial trends in amyloidosis-associated CVD-related mortality in the U.S. from 1999 to 2020.



was almost two times higher than the AAMRs for the rest of the races. NH Asian or Pacific Islanders (1.61, 95% CI: 1.47 to 1.74), Hispanic or Latino (overall AAMR: 1.54, 95% CI: 1.44 to 1.64), and NH White (overall AAMR: 2.16, 95% CI: 2.12 to 2.19). NH American Indian/Alaskan Native reported the lowest AAMR (overall AAMR: 1.17, 95% CI: 0.86 to 1.55).

The AAMRs followed an increasing trend across most groups from 1999 to 2020 throughout the study period. For NH Blacks, there has been a steady incline in the AAMR from 2007-2018. From 2018 to 2020, the APC was 23.87 (95% CI: 11.82 to 31.04) in this population. For NH Whites, the APC from 2017 to 2020 was 12.68 (95% CI: 9.98 to 16.67). These trends are represented in Figure 2.

State and Census-wise Analysis

Our analysis across the four U.S. Census regions according to the U.S. Census Bureau's Classification revealed the Northeast (overall AAMR: 2.85, 95% CI: 2.77 to 2.93) and Western (overall AAMR: 2.53, 95% CI: 2.46 to 2.60) as regions with the highest AAMRs. The Midwest was not far behind, with an overall AAMR of 2.45, 95% CI: 2.38 to 2.52. The lowest overall AAMR was recorded in the Southern region 1.70, 95% CI: 1.65 to 1.75). These trends are depicted in Figure 3.

Considering the entire duration of the study, the AAPC increased across all census regions. The AAPC across all census regions is shown in Figure 4. Figure 5 presents a state-wise map illustrating the regional differences in amyloidosis-associated CV mortality.

Discussion

This analysis provides a comprehensive examination of the trends in amyloidosis-associated cardiovascular mortality among elderly adults in the U.S. from 1999 to 2020, highlighting significant disparities based on gender, race/ethnicity, and regional factors.

While previous studies have shown an increase in rates of amyloidosis among adults in the U.S., recent studies on the mortality rates of this population remain limited.[7] This analysis of the temporal trends in amyloidosis mortality from 1999 to 2020 reveals an apparent and concerning increase in age-adjusted mortality rates (AAMR) for elderly adults. Furthermore, the acceleration of amyloidosis-related cardiovascular mortality with an APC of 7.46% from 2012 to 2018 and 16.30% from 2018 to 2020 is concerning; however, given the concern for underdiagnosis demonstrated in prior studies, this increase may represent better diagnosis through recognition rather than an actual rise in mortality.[2]

The gender-based analysis reinforces the finding of higher AAMR in males compared to females, with males consistently experiencing nearly double the mortality rate

Figure 3. Trends in amyloidosis-associated CVD-related mortality stratified by Census Region in the U.S. from 1999 to 2020.

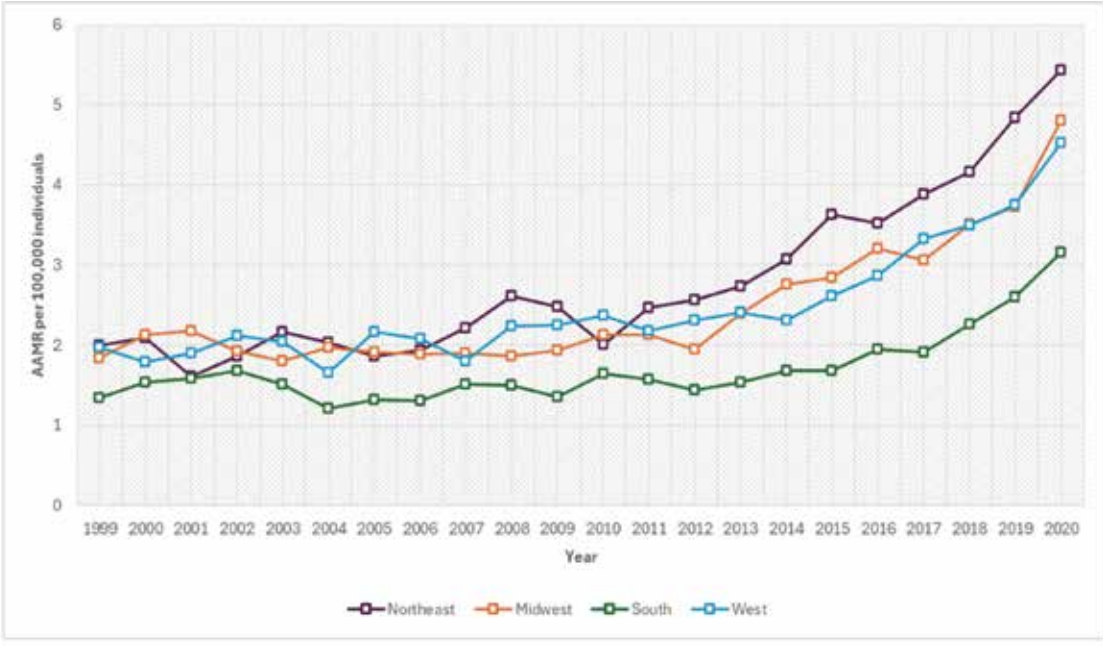
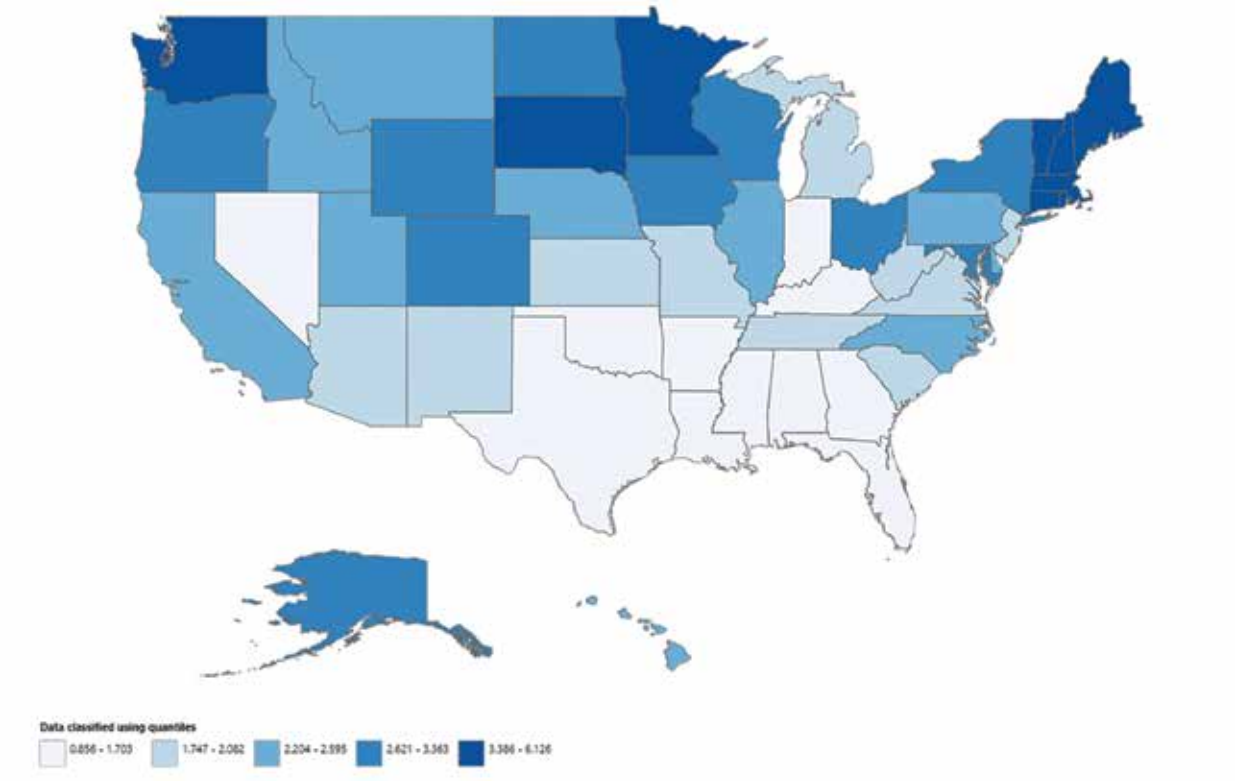


Figure 4. Age adjusted annual percentage change from 1999-2020 for all Census Regions of the U.S.

Cohort	Lower End	Upper End	AAPC	Lower CI	Upper CI
Census Region 1: Northeast - 1 Joinpoint	1999	2020	5.0394*	4.1398	6.1046
Census Region 2: Midwest - 1 Joinpoint	1999	2020	3.9168*	3.1729	4.7665
Census Region 3: South - 1 Joinpoint	1999	2020	3.6829*	2.7491	4.6732
Census Region 4: West - 1 Joinpoint	1999	2020	4.1437*	3.6435	4.7633

*Indicates the statistically significant difference of average annual percentage change (AAPC) from 0 at $\alpha = 0.05$

Figure 5. A map of the U.S. demonstrating state-wise variations in amyloidosis associated CVD-related AAMRs per 100,000 in the U.S., 1999 to 2020.



of females throughout the study period. Prior studies have shown a male predominance in cardiac involvement in various amyloidosis subtypes, including ATTR amyloidosis, AL amyloidosis, and AA amyloidosis.[8-9] This disparity might be attributed to gender differences in the prevalence of underlying conditions, such as cardiovascular diseases, that are associated with amyloidosis or to differences in disease biology and progression. Understanding these gender differences is crucial for developing targeted interventions and treatment strategies to address the needs of both male and female patients and guiding future studies.

The study also highlights the stark racial/ethnic disparities in amyloidosis mortality. Non-Hispanic Black individuals exhibit nearly twice the AAMR compared to other racial groups, suggesting that socioeconomic factors, healthcare access, or biological differences might contribute to this elevated risk.[2]

Prior studies have also highlighted this disparity, with NH black populations being noted to be at particular risk of transthyretin amyloid cardiomyopathy or ATTR-CM subtypes of amyloidosis.[11] Asian or Pacific Islanders and Hispanic or Latino groups show relatively lower mortality rates, which could be indicative of differences in disease prevalence, access to early diagnosis, or differences in comorbid conditions that influence amyloidosis outcomes.

Regional trends in amyloidosis-related cardiovascular death show significantly higher rates in patients in the Northeast region of the U.S., closely followed by Midwest and West regions. The AAMR in the Southern region is 40% lower across the study period compared to the Northeast region despite the African American population being approximately 66% greater per capita than the Northeast region, according to a 2022 estimate from the US Census Bureau.[11] Despite southern states having the highest proportion of black individuals, the mortality rate in this region remains low when compared to the other regions. This difference in mortality among regions, despite the above-noted racial and ethnic trends, highlights that regional variation might be further influenced by differences in healthcare infrastructure and diagnostic practices and that there may be systemic underdiagnosis of black individuals in southern states.

As diagnostic methods and disease recognition of cardiac amyloidosis improve, we postulate that the apparent mortality rate will continue to rise in conjunction with this. Further

advances in treatment and life-prolonging strategies will help stabilize and improve the survival of this population over the coming decade.

Limitations

This is a retrospective review of data available within the CDC WONDER database. As such, this study utilized data from death certificates, which may have limitations in accuracy and completeness as diagnosis of amyloidosis on death certificates may be influenced by reporting practices or misclassification, which may include differences in reporting across states and regions.[12] While this data provides mortality data, there is a lack of detailed clinical information on the patients included in the study that may not capture factors impacting individual patients, such as complicating comorbid conditions. In addition, changes in diagnostic criteria and practice strategies may have evolved throughout the period studied, which may have influenced the trends observed.[13]

Conclusion

This study highlights a significant increase in the measured amyloidosis-related cardiovascular mortality among elderly adults in the U.S. from 1999 to 2020. The rising age-adjusted mortality rates, particularly the accelerated increase observed in recent years, likely represent increased recognition. Regardless, gender disparities and marked differences in mortality rates across racial/ethnic groups and geographic regions do exist. This further emphasizes the need for targeted public health interventions and further research. Addressing these disparities through improved diagnostic practices, enhanced healthcare access, and tailored treatment strategies is crucial for mitigating the rising burden of amyloidosis. Continued surveillance and investigation into the underlying causes of these trends are essential to improving outcomes for affected individuals.

REFERENCES

1. Hazenberg BP. Amyloidosis: a clinical overview. Rheum Dis Clin North Am. 2013;39(2):323-45.
2. Alexander KM, Orav J, Singh A, Jacob SA, Menon A, Padera RF, et al. Geographic disparities in reported US amyloidosis mortality from 1979 to 2015: potential underdetection of cardiac amyloidosis. JAMA Cardiol. 2018;3(9):865-70.
3. World Health Organization. The ICD-10 classification of mental and behavioural disorders. Geneva: World Health Organization; 1993.
4. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol. 2008;61(4):344-9.
5. Ingram DD, Franco SJ. 2013 NCHS urban-rural classification scheme for counties. Vital Health Stat 2. 2014;(166):1-73.
6. Joinpoint Regression Program, Version 5.0.2 - May 2023. Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute. Joinpoint Regression Program (cancer.gov).
7. Gilstrap LG, Dominici F, Wang Y, El-Sady MS, Singh A, Di Carli MF, et al. Epidemiology of cardiac amyloidosis-associated heart failure hospitalizations among fee-for-service medicare beneficiaries in the United States. Circ Heart Fail. 2019;12(6):e005407.
8. Caponetti A, Rapezzi C, Gagliardi C, et al. Sex-related risk of cardiac involvement in hereditary transthyretin amyloidosis: insights from THAOS. J Am Coll Cardiol HF. 2021 Oct;9(10):736–46.
9. Muchtar E, Dispenzieri A, Magen H, Grogan M, Mauermann M, McPhail ED, et al. Systemic amyloidosis from A (AA) to T (ATTR): a review. J Intern Med. 2021;289:268–92.
10. Spencer-Bonilla G, Njoroge JN, Pearson K, Witteles RM, Aras MA, Alexander KM. Racial and Ethnic Disparities in Transthyretin Cardiac Amyloidosis. Curr Cardiovasc Risk Rep. 2021 Jun;15(6):8. Epub 2021 Apr 4. PMID: 35280930; PMCID: PMC8916707.
11. U.S. Census Bureau. Race American Community Survey 1-year estimates. Washington, DC: U.S. Census Bureau; 2022. Retrieved from: https://censusreporter.org. Accessed 2024 Sep 4.
12. Schuppener LM, Olson K, Brooks EG. Death Certification: Errors and Interventions. Clin Med Res. 2020;18(1):21-6.
13. Adams D, Ando Y, Beirão JM, Coelho T, Gertz MA, Gillmore JD, et al. Expert consensus recommendations to improve diagnosis of ATTR amyloidosis with polyneuropathy. J Neurol. 2021;268(6):2109–22.

About the Authors:

Mustafa Shehzad, MD, Internal Medicine Residency Program, Hackensack University Medical Center.

Dawood Shehzad, MD, Internal Medicine Residency Program, University of South Dakota Sanford School of Medicine.

Logan Johnke, MD, Internal Medicine Residency Program, University of South Dakota Sanford School of Medicine.

Dawlat Khan, MD, Sanford USD Medical Center, Sioux Falls, South Dakota; Department of Internal Medicine, University of South Dakota Sanford School of Medicine.

Hammad Shabir Chaudhry, MD, Sanford USDMedical Center, Sioux Falls, South Dakota; Department of Internal Medicine, University of South Dakota Sanford School of Medicine.

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Member News

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2025 SDSMA Annual Leadership Conference Highlights

The 2025 SDSMA Annual Leadership Conference and Awards Banquet on Friday, May 30 at the Hilton Garden Inn Downtown Sioux Falls was a success! The day was incredible with excellent presenters on the transformative role of AI in medicine. Thank you to those who attended and presented!

Tim Ridgway, MD - USD SSOM

Rebecca Vande Kop, MD - Avera Health

Kim Olson - Office of Senator Mike Rounds

Jeremy Cauwels, MD - Sanford Health

Jason Lambert - Monument Health

David Aizuss, MD - American Medical Association

Member News

2025 Awards - Congratulations to the Recipients!

Awards were presented to recipients at the SDSMA Annual Awards & Scholarship Banquet.

SDSMA Awards

2025 Award recipients pictured left to right: Jacob Quail, MD - SDSMA Community Service Award; Matthew Schaffer, DO - SDSMA Outstanding Young Physician Award; Maggie Becker, MD - Copic Humanitarian Award; Barb Smith - SDSMA Special Presidential Award; Mary Carpenter, MD - AMA Distinguished Service Award; William Fuller, MD - SDSMA Distinguished Service Award; and Roy Mortinsen, MD - SDSMA Young at Heart Award. Not pictured: Denise Hanisch, MD - SDSMA Past Presidents Award and Sheila Agee - Richard P. Holm MD Media Award

- The SDSMA's **Distinguished Service Award** recognizes a physician or lay person who has been of outstanding service to the medical profession in South Dakota. This year the Distinguished Service Award recipient is **William Fuller, MD**.
- The **Outstanding Young Physician Award** was presented to **Matthew Schaffer, DO**. This award is given to a young physician under 40 or within the first eight years of professional practice after residency and fellowship training. This physician is recognized for outstanding achievements, dedication and service to the community and the SDSMA at the local, state, or national levels.
- The SDSMA's **Community Service Award** is presented each year to a physician who separates himself or herself through outstanding work in the area of community affairs. This year the award was given to **Jacob Quail, MD**.
- **Sheila Agee** is the recipient of the SDSMA's **Richard P. Holm, MD Media Award**. The award is in recognition of her contributions to the Humanities supplement of the SDSMA's medical journal, South Dakota Medicine.
- The **Young at Heart Award** is presented to a physician who has inspired young physicians as a mentor, role model and leader. This year's recipient is **Roy Mortinsen, MD**.
- **Denise Hanisch, MD** is the recipient of the SDSMA's **Past President's Award**. This award is presented each year to the immediate past president of the SDSMA in recognition of their many years of work and dedication to the SDSMA.
- **Barbara Smith, SDSMA CEO** who will be retiring this fall, is the recipient of the **Special Presidential Award**. This award is chosen by the SDSMA president to recognize the recipient's contributions to the medical profession.

American Medical Association Distinguished Service Award

The **American Medical Association Distinguished Service Award** was presented to **Mary Carpenter, MD**. The award recognizes a physician member of the AMA for meritorious service in the science and art of medicine. AMA Board of Trustees President-Elect David Aizuss, MD, presented the award to Dr. Carpenter. As SDSMA's long-time AMA delegate, whose final term will conclude at the end of the year, Dr. Carpenter has demonstrated extraordinary dedication, making a significant impact on the art and science of medicine and the betterment of public health. This nationally-recognized award celebrates her profound influence on patients, communities, future physicians and healthcare delivery throughout her remarkable career, recognizing her outstanding contributions to medicine and public health.

Mary Carpenter, MD, received the AMA Distinguished Service Award.

Copic Humanitarian Award

The Copic **Humanitarian Award** honors a physician for volunteer medical services and contributions to their community. **Margaret Becker, MD**, is the recipient of this year's award for her unwavering dedication and selfless service. Dr. Becker is a family medicine physician at Monument Health Spearfish Clinic. She has served as medical director of Good Shepherd Clinic in Spearfish for eight years, serving uninsured patients with fully volunteer services. The recipient of the Copic Humanitarian Award designates a $10,000 donation from Copic to be provided to a health care-related 501(c)(3) organization in South Dakota. Dr. Becker has designated Good Shepherd Clinic as the donation recipient.

Margaret Becker, MD (right) received the Copic Humanitarian Award. She is pictured with Bev Razon of Copic.

50-Year Awards

Eight physicians were recognized with the SDSMA's 50-Year Award for medical practice in South Dakota: **William Fuller, MD; William Howard, MD; Rif'at Hussain, MD; Dennis Knutson, MD; Norman Neu, MD; Ken Vogele, MD; H. Bruce Vogt, MD; and Larry Wehrkamp, MD**. These physicians have been practicing medicine for a half-century and have contributed greatly to the medical profession. Pictured below are those who attended the banquet.

Outgoing SDSMA President Jen Tinguely, MD, MPH presented 50-Year Awards May 30 to (L to R) William Howard, MD; Rif'at Hussain, MD; and William Fuller, MD

2025-26 SDSMA Board of Directors

Below are the members of the 2025-26 SDSMA Board of Directors as of May 30 following the annual conference:

- President – Keith Hansen, MD
- President-Elect – Benjamin Meyerink, MD
- Vice President – Mandi Greenway Bietz, MD
- Secretary-Treasurer –Deepak Goyal, MD, MBA
- At-large Director – Sarah Flynn, MD
- At-large Director – Laura Hoefert, MD
- At-large Director – Ty Hanson, DO
- Policy Council Chair – Megan Smith, MD
- Immediate Past President – Jen Tinguely, MD, MPH
- AMA Delegate – Robert Allison, MD
- AMA Alternate Delegate – Robert Summerer, DO
- AMA Alternate Delegate – Mary Carpenter, MD

Thank you to outgoing board members Denise Hanisch, MD and Lisa Brown, MD!

These dedicated leaders are guiding the SDSMA forward, advocating for physicians, patients, and the health of all South Dakotans.

Pictured back row L to R - Drs. Carpenter, Greenway Bietz, Meyerink, Hoefert, Hansen, Allison, Summerer. Front row: Drs. Hanisch, Tinguely, Smith, Brown, Flynn, Goyal. Not pictured: Ty Hanson, DO

Member News

SDSMA Foundation Announces Scholarships

At the South Dakota State Medical Association banquet during the annual conference, the SDSMA Foundation recognized scholarship recipients for medical students attending the University of South Dakota Sanford School of Medicine during the 2025-26 school year.

- Alexander Bergeson – Mitchell – Avera Health Plans Scholarship
- Morgan Carr – Pierre – Pierre District Medical Society Scholarship
- Linzie Christensen – Yankton – Yankton District Medical Society Scholarship
- Gabriel Dally – Sioux Falls – J. Michael McMillin Scholarship
- Hannah DeHoogh-Kliewer – Sioux Falls – Richard P. Holm Prairie Doc Memorial Scholarship
- Aaron Fest – Harrisburg – Howard and Mary Ann Saylor Scholarship
- Tanner Flickema – Sioux Falls – SDSMA Freshman Tuition Scholarship
- Holly Gerberding – Sturgis – Richard P. Holm Prairie Doc Memorial Scholarship
- Velvet Jessen – Harrold – Pierre District Medical Society Scholarship
- Joseph Kelly – Yankton – J. Michael McMillin Scholarship
- Sarah Lane – Hot Springs – Black Hills District Medical Society Scholarship
- Molly Lien – Wentworth – Howard and Mary Ann Saylor Scholarship
- Kiley Medler – Rapid City – Black Hills District Medical Society Scholarship
- Jackson Meyer – Sioux Falls – Avera Health Plans Scholarship
- Leah Naasz – Aberdeen – Herbert A. Saloum Memorial Scholarship
- Jordyn Post – Harrisburg – J. Michael McMillin Scholarship
- Alyssa Roby – Watertown – J. Michael McMillin Scholarship
- Amanda Rook – Aberdeen – Wulbers Scholarship
- Rachel Schild – Tyndall – T.H. Sattler Memorial Scholarship
- Joshua Schumacher – Rapid City – J. Michael McMillin Scholarship
- Bailey Smith – Presho – SDSMA Senior Scholarship
- Jada Tschetter – Brandon – SDSMA Junior Scholarship

Recipients who attended the banquet are pictured with SDSMA Foundation Chair Dr. Jen Tinguely.

Back row, L to R: Leah Naasz, Bailey Smith, Hannah DeHoogh-Kliewer, Holly Gerberding, Jada Tschetter, Aaron Fest. Front row, L to R: Alyssa Roby, Rachel Schild, Amanda Rook, Linze Christensen, SDSMA Foundation Chair Jen Tinguely, MD, MPH, Tanner Flickema, Morgan Carr

Poster Session

During the Annual Leadership Conference, USD SSOM students participated in a poster session highlighting their work. With the poster session, the SDSMA aims to help students and recent graduates improve their CVs and applications for residency programs, an increasingly competitive process. Congratulations to Olivia Heinecke, MS II, who presented her winning project, "Enhancing Surgical Skill Acquisition: Assessment of a Novel 3D Printed Laparoscopic Trainer (Non-Inferiority Trial)," to the SDSMA Policy Council.

Pre-dinner Reception Held in Celebration of Barb Smith's Upcoming Retirement

During the pre-dinner reception, a celebration was held for outgoing SDSMA CEO Barb Smith, who will retire on October 31. We wish Barb the very best in her upcoming retirement! This image was used on table tents during the celebration. In addition, Dr. Jen Tinguely awarded Barb with the 2025 SDSMA Special Presidential Award to recognize her contributions to medicine in South Dakota.

Medical students: Call for Humanities Submissions

South Dakota Medicine is now accepting and reviewing SSOM submissions for the Humanities Supplement of *South Dakota Medicine* that will be published this fall. Following the success of the inaugural issue in November 2024, the publication will once again primarily feature students' creative work. This is a fantastic opportunity for medical students to have a publication in a professional journal.

We welcome a wide array of creative endeavors within the humanities. The editorial staff will consider submissions such as:

- Visual art
- Photography
- Poetry
- Memoir
- Short fiction

For written submissions, please ensure your submission does not exceed 1,500 words. Student submissions may be made at any point through September 30, 2025. Please submit your work to Elizabeth Reiss, *South Dakota Medicine* staff editor, at ereiss@sdsma.org.

South Dakota medicine

SDSMA Health Leadership Institute: Now Enrolling for Fall 2025 Cohort

The SDSMA Center for Physician Resources Health Leadership Institute helps physicians balance life and work, sharpen their skills in practice management, and train for future leadership positions.

Watch a video at sdsma.org to hear participants describe their experiences from the HLI. The next cohort begins October 17, 2025!

Sign up today! **Full and partial tuition scholarships** may be available for those eligible. **Contact:** Justin Ohleen — johleen@sdsma.org

SDSMA CENTER FOR PHYSICIAN RESOURCES
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Member News

Tammy Hatting Leads SDSMA as Next CEO

The South Dakota State Medical Association is pleased to announce Tammy Hatting as its next CEO. Hatting began her role on July 7. The position is being vacated by Barb Smith, who is retiring after serving the organization since 2000. Her retirement was announced earlier this year.

Hatting has served as the chief operating officer for the South Dakota Association of Healthcare Organizations (SDAHO) for seven years where she was responsible for advocating on behalf of members and overseeing multiple divisions including human resources, benefits, compliance, and program development. In this role, she was involved in state and federal government relations, lobbying, emergency preparedness, grants management, and policy development. Prior to joining SDAHO, Hatting was the director of innovation for Avera (now Avel) eCARE. In this role, she worked with key business and clinical stakeholders to bring telemedicine services to residents of South Dakota and was an advocate at both the state and federal levels for reimbursement of virtual services. Her experience also includes working at critical access hospitals and clinics in northwest Iowa as a patient relations manager and admissions manager, working across the continuum of care in patient access, EMR initiatives, quality improvement, corporate compliance, risk management, process improvement, and emergency preparedness. Hatting also spent more than 12 years in sales and management for Gateway Computers before entering the healthcare industry.

"We are thrilled to welcome Tammy," said Keith Hansen, MD, president of the SDSMA. "Her extensive background in healthcare makes her an exceptional choice to lead our organization. We are confident that her leadership will be invaluable as we continue to advocate for physicians and patients, and promote the health of our communities."

Hatting holds a master's degree in public administration and a bachelor's degree in healthcare administration from Bellevue University, as well as an associate degree in financial management from the American College of Business in Des Moines. She also holds several certifications.

"I am honored to step into this role for the SDSMA," said Hatting. "I look forward to working closely with members, staff, and partners to serve the needs of physicians and the patients they care for to ensure the highest quality of care for South Dakotans."

Tammy has been married to her husband Dan for 33 years. They have two adult children: a son who lives in Milford, Iowa, and a daughter who lives in Des Moines. Tammy and Dan have lived in Sioux Falls for eight years, where Dan is employed at Sanford Health in IT services. In their spare time, they enjoy their lake home in Okoboji, traveling as much as possible, and attending sporting events and concerts.

SDSMA Joins 100+ Medical Societies to Urge Reinstatement of Vaccine Advisors

The SDSMA joined more than 100 medical societies in submitting a joint letter calling on Health & Human Services Secretary Kennedy to immediately reinstate the members of the CDC's Advisory Committee on Immunization Practices following the abrupt dismissal of all committee members. The letter urges the Secretary to adhere to longstanding, transparent processes that prioritize experience and expertise for any future appointments. The letter also raises concern regarding the impact of the decision on vaccine hesitancy and prevention of vaccine-preventable disease, as well as potential access issues should ACIP recommendations impact health plan coverage.

SDSMA statement on ACIP dismissals:

Immediately following the HHS Secretary's ACIP dismissals, the SDSMA released the following statement voicing strong opposition in response: "The SDSMA is alarmed by the recent removal of all 17 ACIP members. The ACIP has been a reliable national authority, offering science-backed guidance on immunizations to prevent disease. Their guidance is crucial for healthcare professionals, parents, and public health officials to protect some of our most vulnerable patients from serious, often life-threatening, illness. It is essential that the scientific process guiding vaccine policy remains firmly rooted in evidence-based medicine. The dismissal of ACIP members jeopardizes this trusted process, threatening to worsen existing outbreaks and decrease immunization rates."

SDSMA delegates attend AMA Annual Meeting

The AMA Annual Meeting, held each June in Chicago, brings together physicians across the nation to engage in discussions and formulate policies to enhance public health and uphold sound medical policy at the federal and local levels. From the SDSMA, the delegation included Robert Summerer, DO; Keith Hansen, MD; Mary Carpenter, MD and Rob Allison, MD (pictured). SDSMA CEO Barb Smith and incoming CEO Tammy Hatting also attended. USD SSOM students who attended were Will Brown, Brant Hannahs, Alivia Ankrum and Kiley Medler. Watch for more information about the meeting and actions taken in upcoming communications from the SDSMA.

Annual conference photos by Rob Allison, MD – Allison Media.

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Help Shape the Future of Medicine in South Dakota

The South Dakota State Medical Association Foundation, the philanthropic arm of the South Dakota State Medical Association, is a tax-exempt 501(C)(3) non-profit corporation, was established to assist and support medical research, medical teaching and medical education at the Sanford School of Medicine.

On average, medical students graduate with $130,000 in debt. Contributions to the South Dakota State Medical Association Foundation provide financial assistance to students at the Sanford School of Medicine and are all designated for scholarships, grants and low-interest loans for students.

Any amount can be donated at any time throughout the year. If you have questions or want more information, please call 605.336.1965.

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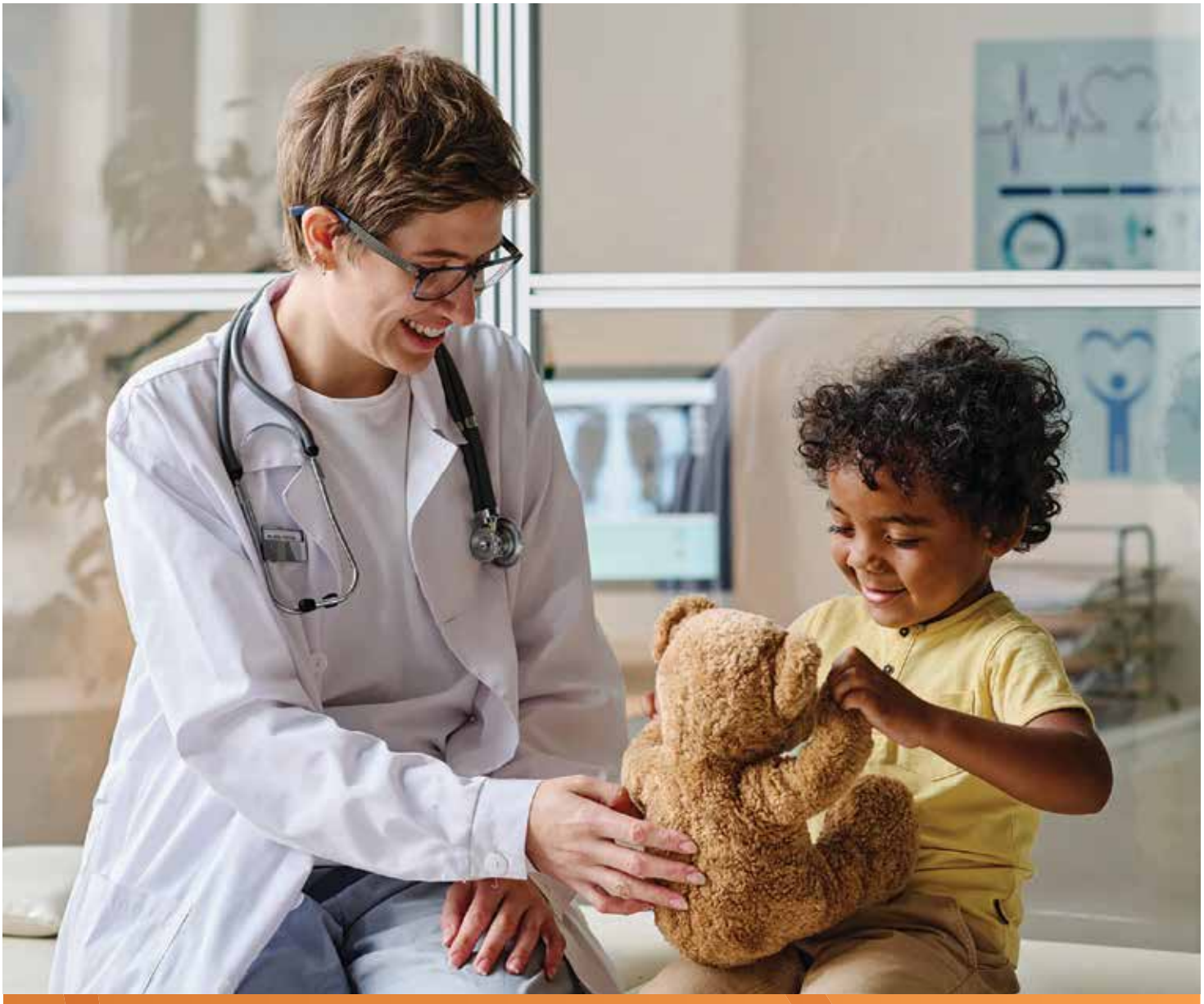

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