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Original Research

Access to Health Care for Children and Youth with Special Health Care Needs in Kansas: A Retrospective Analysis

Trinity Bogle, MS-4, Dulcinea Rakestraw, Ph.D., MPH, Hayrettin Okut, Ph.D., Kari Nilsen, Ph.D.

ABSTRACT

Introduction. Despite the high prevalence of Children and Youth with Special Health Care Needs (CYSHCN) in the United States, health care services for this population remain insufficient. Prior studies have documented disparities in both access to and quality of care. We aimed to evaluate health care access and barriers among CYSHCN in Kansas.

Methods. Using data from the 2021 National Survey of Children's Health (NSCH), we conducted a retrospective, quasi-experimental analysis of health care access and barriers among 1,696 Kansas households. Children were classified as having special health care needs based on diagnoses across 24 specified conditions.

Results. Although most CYSHCN in Kansas reported adequate access to health care (97.2%), significant barriers persist, particularly among those with lifelong conditions. These children were more likely to report needing care but not receiving it ($\chi^2_{\text{Rao-Scott}}$ (1, n = 1696) = 11.64; p <0.001; OR 0.29; 95% CI, 0.14-0.61), primarily due to appointment or service unavailability and cost. They also were more likely to report difficulty paying medical bills ($\chi^2_{\text{Rao-Scott}}$ (1, n = 1291) = 10.21; p <0.001; OR 0.49; 95% CI, 0.31-0.77), and a greater proportion lived in poverty ($\chi^2_{\text{Rao-Scott}}$ (1, n = 1696) = 5.29; p = 0.021; OR 0.74; 95% CI, 0.57-0.96).

Conclusions. While CYSHCN in Kansas generally reports adequate health care access, important barriers remain. Efforts to improve access to specialty care, reduce costs, and enhance insurance coverage are essential to improving care for this vulnerable population.

INTRODUCTION

According to the National Survey of Children's Health (NSCH), nearly 14 million children in the United States were living with special health care needs as of 2019, representing 18.8% of the pediatric population.[1] Given this high prevalence, ensuring access to high-quality care for Children and Youth with Special Health Care Needs (CYSHCN) is important.

Despite their prevalence, research consistently demonstrates that health care for CYSHCN remains inadequate. In the 2019 NSCH, 30.9% of families of CYSHCN reported unmet health care needs, and 8.3% reported frustration in obtaining services, compared with 11.0% and 1.3% of families of children without special health care needs, respectively.[2] CYSHCN often require more complex and resource-intensive care, including interdisciplinary coordination, more frequent clinical visits, and higher out-of-pocket costs. As a result, access to care is critical for both affected children and their families.

Access to and quality of care for CYSHCN vary based on functional status and specific health care needs and are strongly influenced by factors such as insurance coverage, socioeconomic status, and geographic location.[3] Additional barriers include a nationwide shortage of pediatric subspecialists and insufficient training and support for primary care professionals managing these patients in the absence of specialty care.[2] Structural and societal factors, including racial and ethnic disparities and ableism, further contribute to inequities in care.[2,4]

Disparities particularly are pronounced in rural areas, where CYSHCN face greater challenges in accessing high-quality care compared with their urban counterparts. Contributing factors include higher rates of poverty and uninsurance, as well as limited availability of trained health care professionals, including pediatric specialists and general pediatricians.[5] However, the expanding use of telemedicine offers a potential solution by improving access to care and reducing barriers related to travel time and cost.[6]

Although numerous studies have documented disparities in access and quality of care for CYSHCN, meaningful improvements remain limited, as caregivers continue to report unmet needs at disproportionately higher rates compared with families of children without special health care needs. Addressing these disparities is critical to improving health outcomes and quality of life for this vulnerable population. Therefore, the purpose of this study was to evaluate access to patient-centered health care and identify barriers among CYSHCN in Kansas.

METHODS

Study Design and Data Source. This study was a retrospective, quasi-experimental analysis of data from the 2021 NSCH.[7] Approval to access the dataset was obtained from the Child & Adolescent Health Measurement Initiative (CAHMI) Data Resource Center for Child and Adolescent Health. The NSCH provides national- and state-level estimates on children's health and well-being, including the prevalence and impact of special health care needs. The survey is funded and directed by the Health Resources and Services Administration's Maternal and Child Health Bureau (HRSA MCHB) within the U.S. Department of Health and Human Services and is administered by the U.S. Census Bureau on behalf of HRSA MCHB. This analysis adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines[8] and PRICSSA (Preferred Reporting Items for Complex Sample Survey Analysis) guidelines.[9]

Participants. The 2021 NSCH was administered from June 25, 2021, to January 14, 2022, using a national sample of approximately 300,000 addresses.[10] The overall response rate was 40.3%.[10] A total of 106,000 screener questionnaires were completed, of which 62,010 households were eligible for the topical questionnaire.[10] Among these, 50,892 completed the topical survey.[10] Weighted estimates from the topical dataset are generalizable to state and na-

tional populations of children.[10] For this study, all 1,696 responses from Kansas households were included.

Procedure. The NSCH collects data on children's physical and mental health, special health care needs, health care access and utilization, insurance coverage, family and caregiver well-being, social determinants of health, and the child's home, school, and community environment.[10] The survey was administered online and by mail using a state-representative, address-based probability sample drawn from the U.S. Census Bureau's Master Address File. Addresses were stratified by the likelihood of containing children, with oversampling of households with young children. One child per eligible household was randomly selected for the topical survey, with additional oversampling of children aged 0-5 years and CYSHCN to ensure reliable estimates.[10]

Households received reminder letters and postcards to complete the survey, followed by a mailed paper screener questionnaire for nonrespondents.[10] The screener identified households with children and determined CYSHCN status. One child from each eligible household was then selected for a detailed topical questionnaire. Deidentified data were provided to the study team by the CAHMI Data Resource Center. The survey instrument is publicly available at: https://mchb.hrsa.gov/national-survey-childrens-health-questionnaires-datasets-supporting-documents.

Statistical Analysis. This was a primarily descriptive analysis of CYSHCN in Kansas. A two-stage, survey-weighted analytic approach was used to account for the complex sampling design, including clustering and unequal selection probabilities. First, survey-weighted univariate analyses were conducted to describe study variables, using frequencies and percentages for categorical variables. Standard errors were estimated using the Taylor series linearization method.

Second, survey-weighted bivariate analyses were performed using the Rao–Scott likelihood ratio chi-square test to assess associations. Missing data were assumed to be missing at random and were imputed as appropriate, an approach that yields valid estimates when missingness depends on observed characteristics rather than unobserved outcomes. All analyses incorporated survey weights and cluster adjustments and were conducted using SAS® version 9.4 (SAS Institute Inc., Cary, NC). This study was reviewed by the University of Kansas Medical Center Institutional Review Board and determined to be non-human subjects research.

RESULTS

Participants. Table 1 summarizes participant characteristics. Children evenly were distributed across age groups, and 51.7% were male. Most identified as White alone (82.3%), followed by two or more races (10.4%). About half (52.0%) lived in core-based statistical areas (CBSAs) with populations >10,000. Regarding income, 38.4% reported ≥400% and 10.9% reported <100% of the Federal Poverty Guidelines. Most children (95.6%) had health insurance.

Table 1. Identified child demographics and health care needs (N = 1696).

Measure	n	Weighted %
Age		
0 to 2	256	15.3
3 to 5	357	20.7
6 to 8	245	13.9
9 to 11	247	15.7
12 to 14	369	14.6
15 to 17	222	19.8
Gender		
Male	885	51.7
Female	811	48.3
Race		
White alone	1408	82.3
Black or African American alone	55	3.2
American Indian or Alaska Native alone	13	0.9
Asian alone	55	3.1
Native Hawaiian and Other Pacific Islander alone	5	0.2
Two or More Races	160	10.4
Location of Home Address		
Lives in area with >10,000 people	843	52.0
Lives in area with <10,000 people	118	6.7
Suppressed for confidentiality	735	41.3
Family Poverty Status		
<100% of Federal Poverty Guidelines	197	10.9
100 to 199% of Federal Poverty Guidelines	292	16.6
200 to 299% of Federal Poverty Guidelines	305	18.1
300 to 399% of Federal Poverty Guidelines	265	16
400% or more of Federal Poverty Guidelines	637	38.4
Health Insurance (Currently Covered)		
Yes	1615	95.6
No	77	4.4
Number of lifelong health conditions		
None	975	58.2
1 health condition	360	23.9
2 or more health conditions	361	23.9
Number of functional difficulties		
None	1304	74.8
1 functional difficulty	252	15.5
2 or more functional difficulties	140	9.7
Special Health Care Needs Status		
Yes	397	26.4
No	1299	73.6

Health Care Needs. Over half (58.2%) of children did not have a lifelong health condition.[11] Similarly, 74.8% had no functional difficulties, and 73.6% did not meet criteria for special health care needs.[11]

Health Care Access. Only 2.8% of respondents reported unmet health care needs in the past 12 months. Among these, 15.4% reported difficulty paying medical bills, 6.6% reduced work hours, and 8.9% avoided job changes due to insurance concerns (Table 2).

Children with lifelong conditions were more likely to report unmet care ($\chi^2_{Rao\text{-}Scott}$ (1, n = 1696) = 11.64; p <0.001; OR 0.29; 95% CI, 0.14-0.61), difficulty paying bills ($\chi^2_{Rao\text{-}Scott}$ (1, n = 1291) = 10.21; p <0.001; OR 0.49; 95% CI, 0.31-0.77), reduced work hours ($\chi^2_{Rao\text{-}Scott}$ (1, n = 1681) = 15.98; p <0.001; OR 0.29; 95% CI, 0.15-0.55), and avoiding job changes ($\chi^2_{Rao\text{-}Scott}$ (1, n = 1683) = 16.72; p <0.001; OR 0.36; 95% CI, 0.22-0.61). Effect sizes were small (≤0.15).

Table 2. Health care access.

During the past 12 months…	Yes (Weighted %)	No (Weighted %)
…was there any time when this child needed health care, but it was not received?	**48 (2.8%)**	**1648 (97.2%)**
No health condition	12 (30.0%)	
1 or more	36 (70.0%)	
…did your family have problems paying for any of this child's medical or health care bills?	**173 (15.4%)**	**1118 (84.6%)**
No health condition	74 (41.1%)	
1 or more	99 (56.9%)	
…did you cut down on the hours you work because of this child's health or health conditions?	**90 (6.6%)**	**1591 (93.4%)**
No health condition	24 (30.4%)	
1 or more	66 (69.6%)	
…did you avoid changing jobs due to concerns about maintaining health insurance for this child?	**124 (8.9%)**	**1559 (91.1%)**
No health condition	47 (35.7%)	
1 or more	77 (64.3%)	

Barriers to Care. Among those with unmet needs, the most common barriers were difficulty obtaining appointments (72.4%), cost (53.0%), and service unavailability (40.8%); transportation was least reported (15.8%; Table 3). Subgroup sample sizes limited further statistical testing.

Relationship with Providers. Most respondents reported positive health care professional interactions, including sufficient time (66.4%), careful listening (74.8%), cultural sensitivity (79.8%), ease of communication (70.0%), and shared decision-making (75.1%; Table 4). Fewer than 1.5% reported these behaviors never occurred.

Health Insurance Coverage. As shown in Table 5, most reported that insurance "always" covered needed services (62.4%) and allowed access to health care professionals (76.4%). Coverage and access were lower among children with lifelong conditions; however, dichotomized analyses showed no significant associations (p = 0.060 and p = 0.665, respectively).

Demographic Differences. Lower household income (≤299% of the Federal Poverty Guidelines) was associated with having a lifelong condition ($\chi^2_{Rao\text{-}Scott}$ (1, n = 1696) = 5.29; p = 0.021; OR 0.74; 95% CI, 0.57-0.96), though the effect size was small. No significant associations were observed for race, gender, or urban versus rural residence.

Table 3. Barriers to receiving care.

Barriers	Yes (Weighted %)	No (Weighted %)
Not Eligible	**9 (27.9%)**	**40 (72.1%)**
No health condition	3 (32.3%)	
1 or more	6 (67.7%)	
Not Available	**20 (38.3%)**	**29 (61.7%)**
No health condition	2 (8.6%)	
1 or more	18 (91.4%)	
Getting an Appointment	**36 (72.4%)**	**13 (27.6%)**
No health condition	7 (23.3%)	
1 or more	29 (76.7%)	
Getting Transportation	**7 (15.8%)**	**42 (84.2%)**
No health condition	1 (25.5%)	
1 or more	6 (74.5%)	
Office not Open	**15 (31.8%)**	**34 (68.2%)**
No health condition	6 (46.0%)	
1 or more	9 (54.0%)	
Cost	**25 (53.0%)**	**24 (47.0%)**
No health condition	8 (39.0%)	
1 or more	17 (61.0%)	

DISCUSSION

This study provides important insights into health care access and barriers among CYSHCN in Kansas. Despite a diverse and generally representative sample, characterized by balanced age distribution, slight male predominance, and high insurance coverage, notable disparities persist. The predominance of White participants likely reflects the underlying demographics of Kansas, and the high rate of insurance coverage may partially explain the overall favorable access reported.[12,13] These contextual factors are critical when interpreting the findings.

Encouragingly, only a small proportion of children (2.8%) reported unmet health care needs, suggesting that pediatric health care access in Kansas broadly is adequate. However, this aggregate finding obscures meaningful disparities. CYSHCN were significantly more likely to experience unmet health care needs, despite their greater reliance on health services and increased vulnerability to adverse outcomes.[1-3,14] This discrepancy highlights a persistent gap between overall access and equitable access for high-need populations.

Barriers to care were consistent with prior literature, with appointment availability, cost, and service unavailability identified as the most significant challenges. These barriers disproportionately affected CYSHCN, who often require more frequent care, multidisciplinary coordination, and subspecialty services.[2,3] Structural limitations, particularly shortages of pediatric subspecialists and higher out-of-pocket costs for specialized services, likely contribute to these disparities.[15] Addressing these system-level constraints will be needed to improving care delivery for this population.

Patient-reported experiences with health care professionals were largely positive, with most respondents indicating effective communication, sufficient time spent, and shared decision-making. While these findings suggest generally high-quality care, even small proportions of dissatisfaction clinically are meaningful,

Table 4. Relationship with provider.

During the past 12-months, how often did this child's doctors or other health care providers...	Always (Weighted %)	Usually (Weighted %)	Sometimes (Weighted %)	Never (Weighted %)
... spend enough time with this child?	957 (66.4%)	372 (27.3%)	74 (4.8%)	20 (1.5%)
	563 (70.6%) None	*171 (23.7%) None*	*39 (4.3%) None*	*10 (1.3%) None*
	394 (61.2%) 1+	*201 (31.7%) 1+*	*35 (5.4%) 1+*	*10 (1.6%) 1+*
...listen carefully to you?	1062 (74.8%)	308 (21.2%)	44 (3.5%)	6 (0.6%)
	618 (80.0%) None	*145 (17.6%) None*	*17 (2.2%) None*	*1 (0.1%) None*
	444 (68.4%) 1+	*163 (25.5%) 1+*	*27 (5.0%) 1+*	*5 (1.1%) 1+*
...show sensitivity to your family's values and customs?	1117 (79.8%)	251 (16.9%)	39 (2.4%)	14 (0.9%)
	633 (81.4%) None	*127 (15.9%) None*	*17 (1.9%) None*	*4 (0.8%) None*
	484 (77.7%) 1+	*124 (18.0%) 1+*	*22 (3.0%) 1+*	*10 (1.2%) 1+*
...make it easy for you to raise concerns or disagree with recommendations for this child's health care?	307 (70.0%)	87 (21.1%)	28 (7.4%)	4 (1.5%)
	128 (75.7%) None	*25 (15.1%) None*	*9 (7.3%) None*	*3 (1.9%) None*
	179 (66.8%) 1+	*62 (24.6%) 1+*	*19 (7.4%) 1+*	*1 (1.2%) 1+*
...work with you to decide together which health care and treatment choices would be best for this child?	314 (75.1%)	83 (19.3%)	26 (8.3%)	3 (0.9%)
	131 (77.9%) None	*23 (12.1%) None*	*11 (8.7%) None*	*1 (1.3%) None*
	183 (67.7%) 1+	*60 (23.6%) 1+*	*15 (8.0%) 1+*	*2 (0.7%) 1+*

Note: "None" indicates the number/percent children without a reported lifelong health condition.
"1+" indicates the number/percent children with one or more lifelong health conditions.

Table 5. Health insurance coverage.

How often does this child's health insurance…	Always (Weighted %)	Usually (Weighted %)	Sometimes (Weighted %)	Never (Weighted %)
...offer benefits or cover services that meet this child's needs?	*1019 (62.4%)*	*473 (29.9%)*	*108 (7.0%)*	*10 (0.7%)*
	621 (70.2%) None	*237 (23.7%) None*	*44 (5.0%) None*	*8 (1.1%)*
	398 (52.0%) 1+	*236 (38.2%) 1+*	*64 (9.7%) 1+*	*2 (0.2%) 1+*
... allow them to see the health care providers they need?	*1239 (76.4%)*	*295 (18.9%)*	*70 (4.5%)*	*2 (0.2%)*
	723 (80.1%) None	*158 (15.5%) None*	*26 (4.0%) None*	*2 (0.4%) None*
	516 (71.4%) 1+	*110 (23.5%) 1+*	*44 (5.0%) 1+*	*0 (0.0%) 1+*

Note: "None" indicates the number/percent children without a reported lifelong health condition.
"1+" indicates the number/percent children with one or more lifelong health conditions.

as negative experiences may erode trust, reduce adherence, and exacerbate disparities in outcomes.[16-18]

Contrary to expectations, no significant differences were observed between rural and urban populations. This finding should be interpreted with caution due to suppressed geographic data and limited subgroup power. Additionally, the increasing adoption of telemedicine may be mitigating traditional geographic barriers to care, though this was not directly measured.[6]

The modest effect sizes observed likely reflect high baseline levels of access and insurance coverage, which reduce variability across groups.[13] Methodological factors, including reliance on caregiver self-report, broad survey measures, and the heterogeneity of CYSHCN, may further attenuate observed associations.[19-21] These limitations underscore the need for more granular, longitudinal data to better capture disparities in access and outcomes.

Several study limitations warrant consideration. The voluntary, mail-based survey design may introduce selection bias, potentially underrepresenting families with lower socioeconomic status or greater caregiving burden. Additionally, self-reported data are subject to recall bias and variable interpretation. Despite these limitations, the findings provide valuable population-level insights into pediatric health care access in Kansas.

CONCLUSIONS

While pediatric health care access in Kansas appears generally adequate, important disparities persist for CYSHCN, particularly in access to timely and affordable care. These findings underscore the need for targeted interventions to improve specialty access, reduce financial barriers, and strengthen care coordination. Advancing equitable, patient-centered care for CYSHCN will require coordinated efforts across clinical, policy, and health system levels to ensure that access translates into meaningful, high-quality care for all children.

ARTICLE INFORMATION

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Corresponding Author: Dulcinea Rakestraw, The University of Kansas School of Medicine-Wichita, Wichita, Kansas, 1010 N. Kansas St., Wichita, KS, 67214, drakestraw@kumc.edu.

Author Affiliations: The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Bogle, Rakestraw, Nilsen); Department of Family and Community Medicine, The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Rakestraw, Nilsen).

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Brief Report

KANSAS JOURNAL of MEDICINE

Is Embolization a Safe Treatment Option for Certain Traumatic Subdural Hematomas?

Cody Neuburger, M.D., Siman Antar, M.D., Mohamad Halloum, M.D., Jared Reyes, Ph.D., James M. Haan, M.D.

ABSTRACT

Introduction. Middle meningeal artery (MMA) embolization is effective in chronic subdural hematoma (SDH), but its safety in acute SDH remains unclear. Authors of this study evaluated the safety of MMA embolization in acute SDH management.

Methods. We conducted a retrospective review of adult acute SDH patients treated between July 2021 and July 2023 at a community-based Level I Trauma Center. Demographics, injury characteristics, treatments, and outcomes were compared between patients who did and did not undergo MMA embolization.

Results. Records from 33 patients with acute SDH were reviewed: 17 underwent MMA embolization and 16 did not. Patients in the embolization group were older (median age 71.0 vs. 37.5 years). Minimal differences were observed between groups with respect to sex, race, or injury severity score. Non-embolized patients presented with a lower median Glasgow Coma Scale (GCS) score (11.5 vs. 14.0). Among the 17 embolized patients, 11 presented with acute bleeding and 6 with acute-on-chronic bleeding. Two patients in each subgroup required craniotomy prior to embolization. Of the remaining non-operatively managed patients, one underwent burr hole evacuation one day after embolization and was subsequently discharged to hospice. No patients required craniotomy after MMA embolization.

Conclusions. MMA embolization appears to be a safe and potentially effective adjunct in the management of acute SDH, particularly in less severe cases. Larger, controlled studies are needed to better define its role and to determine whether it should be incorporated into standard treatment paradigms.

INTRODUCTION

Subdural hematoma (SDH) is an intracranial hemorrhage defined as bleeding into the space between the dura and arachnoid membranes surrounding the brain. Traumatic injury is a common cause of SDH, with acute traumatic SDH most often resulting from tearing of bridging veins between the arachnoid and dura, and less commonly from arterial rupture. The risk of traumatic acute SDH increases with age.[1]

Management of traumatic SDH typically begins with nonoperative strategies, including serial neuroimaging and neurologic examinations; however, certain clinical and radiographic features may warrant surgical intervention.[1] Subdural hematomas are classified as acute, characterized by a subdural clot without a protective membrane, or chronic, defined by an encapsulated, liquefied hematoma within the subdural space.[2] Surgical treatment options include craniotomy, craniectomy, or a combination of both, but operative management has been associated with higher mortality, complication, and recurrence rates.[3-5]

Middle meningeal artery (MMA) embolization has emerged as an alternative treatment for chronic SDH. This approach is thought to reduce immature capillary proliferation and membrane formation, thereby decreasing recurrent bleeding. Radiographic findings of irregular MMA branches in chronic SDH support this mechanism.[2] Sioutas et al.[6] have demonstrated MMA embolization to be a safe and effective treatment for chronic SDH and non-inferior to surgical evacuation alone.

To date, MMA embolization primarily has been used in chronic and subacute SDH, and there is limited literature evaluating its role in acute SDH.[7] The objective of this study was to assess the safety of MMA embolization in the management of acute SDH at a community-based Level I Trauma Center.

METHODS

This study was reviewed and approved by the Human Subjects Protection Program at the University of Kansas Medical Center and the Institutional Review Board (IRB) at Ascension Health. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines[8] were followed to ensure appropriate reporting of methods, results, and discussion.

A retrospective chart review was conducted of all adult patients (≥18 years) presenting through the trauma service with a SDH between July 1, 2021, and July 1, 2023. Patients were identified using the trauma registry database at our American College of Surgeons Committee on Trauma (ACS-COT)-verified Level I trauma center.

Patients' medical records were reviewed to collect data on demographics (age, sex, race), Injury Severity Score (ISS), Glasgow Coma Scale[9] (GCS) score, initial vital signs (systolic and diastolic blood pressure, heart rate, respiratory rate), laboratory values (hemoglobin, hematocrit, lactate), comorbidities, anticoagulant use, procedures performed, middle meningeal artery embolization status, blood product utilization, intensive care unit (ICU) admission and length of stay, hospital length of stay, complications, discharge disposition, and mortality. Post-discharge complications were identified through chart review of events occurring within 30 days of discharge. To evaluate safety, we decided to look at the rates of complications, hospital outcomes, and the number of failed embolizations. Failed embolizations were defined as embolizations that required a craniotomy after embolization.

Statistical analyses were performed using SPSS version 29.0 (IBM Corp., Armonk, NY). Patients were grouped based on whether middle meningeal artery embolization was performed. Continuous variables are reported as medians with interquartile ranges, and categorical variables as frequencies and percentages.

Group comparisons are presented as the standardized mean difference between study groups. All analyses were performed as complete case analyses.

RESULTS

The initial trauma registry query identified 37 patients treated for SDH. Patients were excluded for chronic SDH (n = 1), acute-on-subacute SDH (n = 2), and ward-of-the-state status (n = 1). The final analysis included 33 patients with acute SDH, of whom 17 underwent MMA embolization and 16 received standard management without embolization.

Table 1. Patient demographics.

Parameter	Embolized (n = 17)	Not Embolized (n = 16)	*Standardized Mean Difference*
Age (yr)	71.0 (61.5-84.0)	37.5 (25.0-78.5)	-1.12
Gender (male)	64.7% (11)	75.0% (12)	0.23
Race			0.51
White	88.2% (15)	87.5% (14)	
Black or African American	0.0% (0)	6.3% (1)	
Asian	5.9% (1)	0.0% (0)	
Unknown	5.9% (1)	6.3% (1)	

Patients who underwent embolization were older than those who did not (median age 71.0 vs. 37.5 years). Minimal differences were observed between groups in sex or race (Table 1). Non-embolized patients presented with a lower median Glasgow Coma Scale (GCS) score (11.5 vs. 14.0), lower median systolic blood pressure (132.5 vs. 150 mmHg), and lower median respiratory rate (14 vs. 18 breaths/min) compared with embolized patients. Injury severity, initial laboratory values (hematocrit and lactate), and comorbidity burden did not differ greatly between groups (Table 2).

Among the 17 embolized patients, 11 presented with acute SDH and six with acute-on-chronic SDH. Four patients (two in each subgroup) underwent craniotomy as part of initial management prior to embolization. Of the four embolized patients initially managed non-operatively, one subsequently required burr hole decompression due to worsening mental status and radiographic progression; this patient was later discharged to hospice. No patients underwent craniotomy after MMA embolization.

Post-treatment complication rates did not differ meaningfully between groups. However, embolized patients were less likely to require mechanical ventilation (23.5% vs. 62.5%) and had a longer median hospital length of stay (9 vs. 4 days). Discharge disposition was similar between groups based. Mortality was lower in the embolization group (5.9% vs. 37.5%; Table 3). The single death in the embolization group was attributed to ischemic stroke with subsequent SDH expansion on hospital day 3; anticoagulation initiated for stroke management confounded assessment of embolization effectiveness. In the non-embolized group, deaths were due to spinal cord injury (n = 1), anoxic brain injury (n = 3), and non-traumatic brain injury (n = 2).

Table 2. Injury severity, initial vital signs, and comorbidities.

Parameter	Embolized (n = 17)[a]	Not Embolized (n = 16)[a]	*Standardized Mean Difference*
ISS	10 (10-18)	21 (6.5-32)	0.71
GCS	14 (13-15)	11.5 (3-14)	-1.00
SBP	150 (137.8-165.8)	132.5 (120-141.5)	-0.07
DBP	83 (75.3-102.8)	83 (68.5-97.3)	-0.43
Heart Rate	83 (69-101)	93 (72.8-126)	0.35
Respiratory Rate	18 (16-20)	14 (2.3-19)	-1.13
Hematocrit	36.9 (31.8-39.4)	41.3 (35.5-44.7)	0.51
Lactate	1.8 (0.8-2.8)	3.1 (1.4-4.5)	0.77
Comorbidities			
Smoker	17.6% (3)	12.5% (2)	-0.12
Functionally Dependent	35.3% (6)	12.5% (2)	-0.75
Mental/Personality Disorder	5.9% (1)	18.8% (3)	0.43
COPD	29.4% (5)	6.3% (1)	-0.62
HTN	70.6% (12)	43.8% (7)	-0.65
DM	41.2% (7)	25.0% (4)	-0.47
Anticoagulant Use	35.3% (6)	25.0% (4)	-0.19
Other Comorbidities	47.1% (8)	43.8% (7)	-0.14

[a]The n (n_1 = Embolized, n_2 = Not Embolized) for the following variables is different than those listed at the top of each table: ISS (n_1 = 13, n_2 = 15), GCS (n_1 = 16, n_2 = 15), SBP (n_1 = 14, n_2 = 16), DBP (n_1 = 14, n_2 = 16), Heart Rate (n_1 = 14, n_2 = 16), Respiratory Rate (n_1 = 14, n_2 = 15), Hematocrit (n_2 = 15), Lactate (n_1 = 15, n_2 = 7)
Abbreviations: Injury Severity Score (ISS); Glasgow Coma Scale Score (GCS); Systolic Blood Pressure (SBP); Diastolic Blood Pressure (DBP); Chronic Obstructive Pulmonary Disease (COPD); Hypertension (HTN); Diabetes Mellitus (DM)

DISCUSSION

The purpose of this study was to evaluate the safety of MMA embolization in the management of acute SDH. Patients who underwent embolization presented with a higher median GCS score, suggesting less severe initial neurologic impairment. This may have contributed to their reduced need for mechanical ventilation and more favorable clinical course. Importantly, use of MMA embolization in these patients did not result in unanticipated adverse events or require subsequent craniotomy.

MMA embolization is a relatively novel intervention for SDH, with existing evidence largely limited to chronic cases. Prior studies have demonstrated lower treatment failure rates and comparable complication rates for MMA embolization compared with conventional management of chronic SDH.[10,11] Although these findings cannot be directly extrapolated to acute SDH, they support consideration of MMA embolization as a potential therapeutic option in carefully selected acute cases.

This study has several limitations. Its retrospective design and small sample size limit statistical power and introduce potential selection bias and unmeasured confounding. The 30-day follow-up period may not capture delayed complications, recurrence, or long-term outcomes such as functional recovery

Table 3. Patient procedures and hospital outcomes.

Parameter	Embolized (n = 17)[a]	Not Embolized (n = 16)[a]	*Standardized Mean Difference*
Burr Holes	5.9% (1)	6.3% (1)	0.02
Craniotomy	23.5% (4)	18.8% (3)	10.15
Fluoroscopy	64.7% (11)	81.3% (13)	0.38
Transfusion	11.8% (2)	18.8% (3)	0.20
PRBC (cc)	620 (620-620)	1240 (930-n/a)	1.47
Time to Initiation of VTE prophylaxis (days)	2 (1-5)	3 (1.5-5)	0.06
Duration of VTE (days)	2.5 (1.8-6)	4 (2-5)	0.10
ICU Admission	100% (17)	100% (16)	0.00
ICU Days	8 (3-14)	4 (3-8.8)	-0.71
Vent Use	23.5% (4)	62.5% (10)	0.86
Vent Days b	2 (2-2)	2 (2-3)	0.97
HLOS (days)	9 (4-15.5)	4 (2-8.8)	-0.76
Complications			
Readmission	10.0% (2)	6.3% (1)	-0.19
Stroke/CVA	5.0% (1)	0.0% (0)	-0.35
Sepsis	5.0% (1)	0.0% (0)	-0.35
AKI	5.0% (1)	6.3% (1)	0.02
ETOH Withdrawal	5.0% (1)	6.3% (1)	0.02
Unplanned Operation	10.0% (2)	6.3% (1)	-0.19
Delirium	25.0% (5)	6.3% (1)	-0.63
Other complication	55.0% (9)	81.3% (13)	0.63
Mortality	5.9% (1)	37.5% (6)	0.83

[a]The n (n_1 = Embolized; n_2 = Not Embolized) for the following variables is different than those listed at the top of each table: PRBC ($n_1 = 3$; $n_2 = 1$), time to initiation of VTE prophylaxis ($n_1 = 9$; $n_2 = 10$), duration of VTE ($n_1 = 9$; $n_2 = 10$).
[b]Cases with zero days were excluded from this analysis.
Abbreviations: Packed Red Blood Cells (PRBC); Intensive Care Unit (ICU); Venous Thromboembolism (VTE); Hospital Length of Stay (HLOS); Cerebrovascular Accident (CVA); Acute Kidney Injury (AKI); Alcohol (ETOH).

and quality of life. Consequently, these findings should be interpreted cautiously. Larger retrospective analyses and prospective trials are needed to more definitively evaluate the safety, effectiveness, and optimal role of MMA embolization in the acute SDH setting.

In conclusion, MMA embolization demonstrated promise as a management strategy for traumatic acute SDH, with no major procedure-related complications observed. These preliminary findings suggest that MMA embolization may be a safe option for select patients and could reduce the need for more invasive surgical interventions; however, further investigation is required to establish its efficacy and define appropriate patient selection.

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Corresponding Author: James M. Haan, M.D., Department of Trauma Services, Ascension Via Christi Hospital, Saint Francis, 929 N. Saint Francis Street, Room 2514, Wichita, KS, 67214, USA., James.Haan.Research@ascension.org.

Author Affiliations: Department of Surgery, The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Neuburger, Antar, Reyes, Haan); Department of Trauma Services, Ascension Via Christi Hospitals, Wichita (Haan).

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Keywords: *acute subdural hematoma; embolization, therapeutic; brain hemorrhage, traumatic*

KANSAS JOURNAL of MEDICINE

Brief Report

A Cross-Sectional Analysis of Expanding Maternity Care Deserts in Rural Kansas Counties, 2016-2023

Anna Carlson, MS-4, Brenda Aguirre, MS-4, Joshua Young, MS-2, Ryan Hoefferle, M.S., Michael Kennedy, M.D., Laurel B. Witt, M.D., M.Phil

ABSTRACT

Introduction. Rural Kansas accounts for one-quarter of the state's population and births. Living in rural areas is associated with delayed prenatal care, adverse birth outcomes, and higher infant mortality. Limited access to obstetric services, particularly in maternity care deserts (MCDs), defined as counties without hospitals or clinicians offering obstetric care, contributes to these disparities. Authors of this study assessed obstetric care availability in rural Kansas and compared findings with 2016 data.

Methods. In this cross-sectional study, rural hospitals were defined as those located in counties with <39.9 people per square mile using Kansas Department of Health and Environment (KDHE) data. Ninety-three hospitals were contacted by phone between August and October 2023. A survey, replicated from a 2016 study, assessed obstetric clinicians' availability, attrition, and anticipated retirements. Data were analyzed using descriptive statistics and Wilcoxon signed-rank tests.

Results. Of 93 hospitals, 66 (71.0%) responded. Among these, 38 (57.6%) reported no obstetric services and 28 (42.4%) offered services. Nine hospitals (32.1%) anticipated losing clinicians within five years, including one (3.5%) expecting complete loss. Among 28 hospitals with data from both years, 50.0% lost ≥1 provider and 21.4% lost all. Median provider counts declined from 5 (IQR 3-6.5) to 4 (IQR 2-5; p = 0.038). MCDs have continued to expand.

Conclusions. Obstetric care access in rural Kansas has declined, with expanding MCDs. These trends threaten maternal and neonatal outcomes and underscore the need for targeted strategies to sustain rural obstetric services.

INTRODUCTION

Approximately 25% of Kansans live in rural counties, and in 2020, 27% of births occurred in these areas.[1] Living in rural settings is associated with higher rates of delayed prenatal care, hospitalization, low birth weight, preterm birth, and infant mortality.[2] Limited access to obstetric services, particularly in maternity care deserts (MCDs), is a key contributor to these disparities. An MCD is defined as a county with no hospitals or birth centers offering obstetric care and no obstetric providers.[3]

As MCDs expand, access to essential childbirth services declines, increasing the risk of perinatal morbidity and mortality for both the pregnant individual and the infant.[4-6] Prior work by Kozhimannil et al.[1] demonstrated a decline in Kansas hospitals providing obstetric care. Since then, access may have further changed, potentially influenced by factors such as the COVID-19 pandemic. Authors of this study evaluated current obstetric care access in rural Kansas and compared it with pre-pandemic conditions.

METHODS

In this cross-sectional study, counties were classified using Kansas Department of Health and Environment (KDHE) definitions as frontier (<6 people per square mile [PPSM]), rural (6.1-19.9 PPSM), densely settled rural (20.0-39.9 PPSM), semi-urban (40.0-149.9 PPSM), or urban (>150 PPSM). Using Kansas Hospital Association data, we identified all hospitals in Kansas in 2023. Hospitals located in frontier, rural, or densely settled rural counties (collectively defined as "rural") were included, while those in semi-urban and urban counties (n = 30) were excluded. A total of 93 hospitals met inclusion criteria. The Institutional Review Board (IRB) at The University of Kansas Medical Center approved this study, which followed STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.[7]

Survey instrument. A multi-question survey from a similar 2016 study was replicated (see appendix). It assessed: (1) the number of physicians providing obstetric services at each hospital; (2) the number of certified nurse midwives and lay midwives in the county; and (3) the number of physicians who had discontinued obstetric services since 2016 and the reasons for doing so.

Survey procedures. All 93 hospitals were contacted by phone between August and October 2023. Of these, 21 did not respond. To improve response rates, physicians affiliated with The University of Kansas Summer Training Option in Rural Medicine (STORM) program and practicing in those counties were contacted by email. Both phone and email responses were accepted, with no observed differences in interpretation.

Survey data were stored in Research Electronic Data Capture (REDCap®) hosted on a secure server at The University of Kansas Medical Center.[8,9] The 2016 dataset, provided by the original study's principal investigator (M. Kennedy), was used for comparison.

Statistical analysis. Clinician rates were calculated per 1,000 population using KDHE county population estimates. Counts and rates were summarized using medians and interquartile ranges (IQR), with distributions assessed visually. Analyses were limited to counties represented in both 2016 and 2023 (n = 28), yielding paired observations. The Wilcoxon signed-rank test was used to compare clinician counts due to non-normal distributions. Statistical significance was set at $\alpha = 0.05$. Analyses were conducted using R version 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Sixty-six of 93 hospitals participated (71% response rate). Of these, 38 (57.6%) reported no obstetrical services, while 28 (42.4%)

reported providing such services. Nine facilities (32.1%) anticipate losing at least one obstetrical clinician within the next five years, and one hospital (3.5%) expects to lose all obstetrical clinicians.

Among the 28 hospitals that responded in both 2016 and 2023, 14 (50.0%) lost at least one obstetric clinician, and 6 (21.4%) lost all obstetric clinicians during that period.

The median number of obstetric clinicians per county declined from 5 (IQR 3-6.5) in 2016 to 4 (IQR 2-5) in 2023. The median clinician rate per county decreased from 0.37 (IQR 0.29-0.74) to 0.31 (IQR 0.13-0.63). Visual inspection of boxplots and histograms suggested similar distribution shapes (Figures 1 and 2). The Wilcoxon signed-rank test showed a significant decline in clinician counts ($V = 152$, $p = 0.004$), but not in clinician rates ($V = 287$, $p = 0.056$). However, clinician rates do not account for changes in the population of reproductive-age individuals and may therefore underestimate shifts in access to obstetrical care.

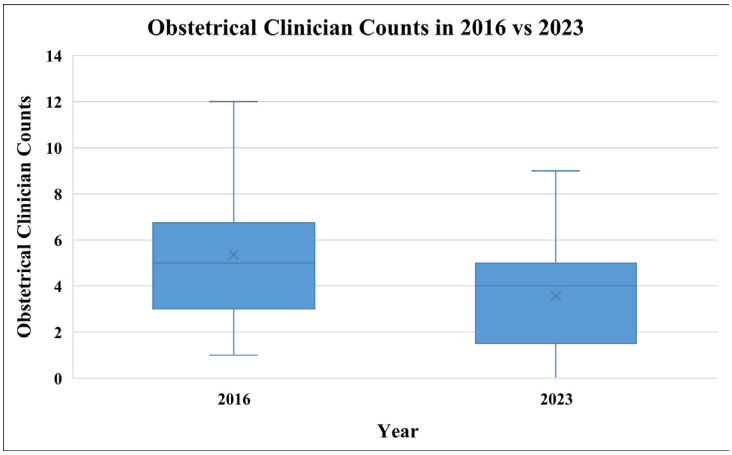

Figure 1. Boxplot comparing obstetrical clinicians in 2016 and 2023.

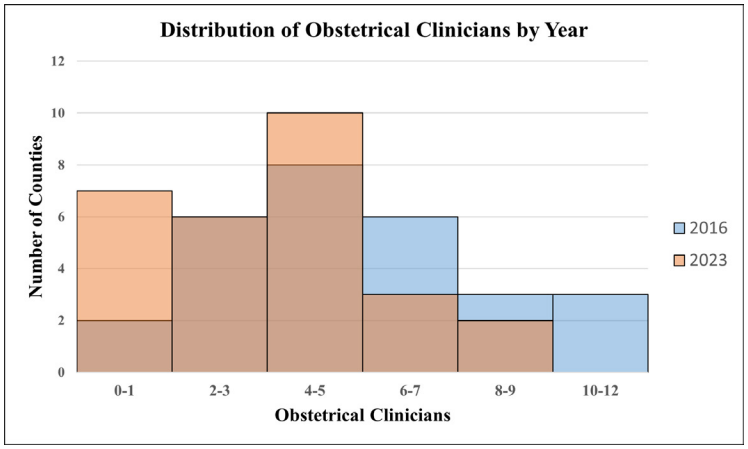

Figure 2. Histogram of obstetrical clinicians in each county for 2016 and 2023.

Overall, access to obstetric care in rural Kansas declined between 2016 and 2023, with a corresponding expansion of maternity MCDs. As shown in Figure 3, MCDs now encompass much of western Kansas and parts of the southeast. Counties without obstetrical clinicians are shown in white, those with declining clinician numbers in orange, and those where services have been discontinued since 2016 in red.

DISCUSSION

Authors of this study examined the availability and trends of obstetric clinicians in rural Kansas counties and compared these findings with data from a similar 2016 study. The results indicate declining access to rural obstetric clinicians, contributing to the expansion of both previously identified and newly emerging MCDs. Multiple factors likely contribute to this trend, including the high cost of maintaining obstetric units with in-house anesthesia, rising liability insurance costs, and increasing the number of physician call burden.

The expansion of MCDs and the reduction in obstetric care availability likely are to adversely affect maternal and neonatal outcomes.[10] Additionally, hospitals that lose obstetric clinicians may place increased strain on remaining clinicians and resources, potentially leading to burnout and further workforce attrition.

Targeted strategies to increase the number of obstetric clinicians in rural Kansas are urgently needed. Potential approaches include loan repayment programs, scholarships for trainees from rural backgrounds, and tax incentives for clinicians practicing in rural areas.[10] Expanding shadowing and mentorship opportunities for medical students and residents interested in obstetric care may help foster early interest, build confidence, and support long-term commitment to rural practice. The Kansas Medical Student Loan Program, a state-funded initiative that supports tuition and living expenses at the University of Kansas School of Medicine in exchange for service in underserved communities,[11] represents a successful model. This program could be expanded to allow family physicians to complete obstetric fellowships, thereby increasing the number of clinicians eligible for obstetric privileges in rural settings. Additionally, partnerships between academic centers and rural hospitals could support knowledge sharing, training, and teleconsultation for high-risk pregnancies, helping to mitigate the impact of MCDs.

Limitations. This study has several limitations. Survey responses were accepted from a range of health care team members (e.g., physicians, receptionists, charge nurses, etc.) to maximize response rates. However, reliance on a single respondent per facility may have introduced variability and potential bias based on individual perspectives. Additionally, the findings may not be generalizable beyond Kansas.

CONCLUSIONS

Access to obstetric care in rural Kansas continues to decline, with a corresponding expansion of MCDs. These trends pose significant risks to maternal and neonatal outcomes and place additional strain on an already limited workforce. Addressing this issue will require targeted, multifaceted strategies, including

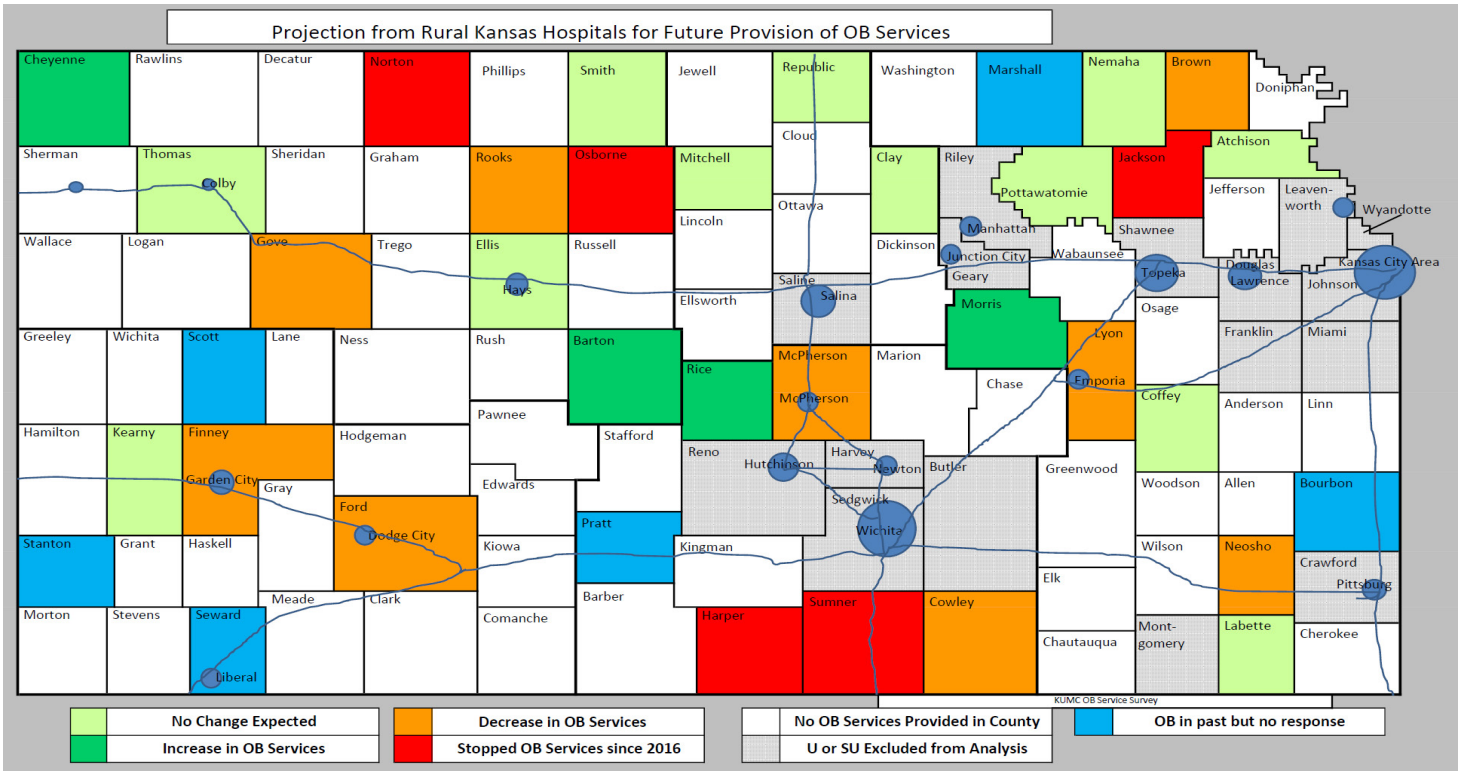

Figure 3. Rural Kansas obstetric clinician change from 2016 to 2023.

workforce incentives, expanded training pathways, and strengthened partnerships between academic and rural health systems. Timely intervention is important to stabilize and rebuild the rural obstetric care infrastructure.

ARTICLE INFORMATION

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Corresponding Author: Anna Carlson, The University of Kansas School of Medicine-Wichita, Wichita, Kansas, 1010 N. Kansas St., Wichita, KS, 67214, acarlson11@kumc.edu.

Author Affiliations: The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Carlson, Aguirre); The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas (Young, Hoefferle, Kennedy, Witt); Department of Family Medicine and Community Health, The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas (Hoefferle, Kennedy, Witt).

Conflict of Interest Disclosure: None.

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Keywords: *pregnancy; rural; rural health services; family medicine; obstetrics*

Appendix: Obstetrical Services Offered in Nonurban Kansas Counties Survey.

1. How many physicians (FM or OBGYN) deliver babies at this hospital? (*Numerical*)
2. To the best of your knowledge, how many midwives deliver babies in the surrounding community? (*Numerical*)
3. Do you anticipate any of the providers who deliver babies to retire/stop delivering babies in the next 5 years? (*Yes/No*)

   How many?
4. Have any providers that delivered babies in your hospital retired/stopped delivering babies since 2015? (*Yes/No*)

   How many?

   Comments?
5. Do you anticipate continuing to offer obstetrical care and services for the next 10 years? (*Yes/No*)

   Comments?

KANSAS JOURNAL of MEDICINE

Case Report

Multifocal Cardiac Fibroma Discovered During Pregnancy: A Case Report

Reuben L. Odai, M.D., Emmanuel Oundo, M.D., Abdul-Rahman Akkawi, M.D., Laiba Sajjad, M.D., Anthony Alchaer, M.D., Hope Smelser, MS-3, Wassim H. Shaheen, M.D.

INTRODUCTION

Cardiac fibromas are rare, benign primary cardiac tumors composed of fibroblasts and connective tissue. They represent the second most common cardiac neoplasm in the pediatric population, after rhabdomyomas.[1,2] However, cardiac fibromas in adults are exceptionally rare. A recent large institutional series demonstrated that although these tumors predominantly affect children, more than half (54%) of diagnosed cases at tertiary care centers occurred in adults.[3] This finding likely reflects referral-center ascertainment bias rather than true population-level epidemiology. Clinical presentation varies considerably depending on tumor size, location, and involvement of the cardiac conduction system.

Approximately two-thirds of pediatric patients remain asymptomatic.[1] When symptoms occur, they may include palpitations (31%), syncope (15%), chest pain (15%), and heart failure (12%).[3] Unlike cardiac rhabdomyomas, fibromas do not undergo spontaneous regression and are associated with a significant risk of life-threatening ventricular arrhythmias, with ventricular tachycardia reported in 31-64% of symptomatic patients.[3,4] The associated risk of sudden cardiac death underscores the importance of early diagnosis and appropriate management.[2,5]

These tumors most commonly arise in the left ventricular free wall (57%) and have a mean diameter of approximately 5 cm, although they may exceed 10 cm.[3,6] Cardiac magnetic resonance imaging (MRI) typically demonstrates characteristic T2 hypointensity and delayed gadolinium enhancement, reflecting the tumor's high fibrous tissue content.[7] The substantial hemodynamic changes of pregnancy, including 40-50% increases in blood volume and cardiac output, may unmask previously asymptomatic cardiac masses.[8] While fetal cardiac tumors are well described,[9] maternal cardiac tumor presentation during pregnancy remains poorly characterized.

We present an exceptional case of a large, multifocal left ventricular fibroma in a young adult woman, discovered following syncope during the third trimester of pregnancy. This case is notable for the rarity of cardiac fibroma in adulthood, its presentation during pregnancy-related hemodynamic stress, and a substantial tumor burden exceeding 6 cm with two distinct nodules. Additionally, the patient's reported history of "myocardial infarction" at age 17 may represent an earlier manifestation of the disease. This report highlights the diagnostic challenges of cardiac masses in pregnancy, the critical role of multimodality imaging, and successful management through delayed surgical resection with favorable maternal and fetal outcomes.

CASE REPORT

A 25-year-old woman at 32 weeks' gestation presented to the cardiology clinic following an episode of syncope that began during her second trimester. Initial evaluation at an outside hospital revealed a large right-sided cardiac mass on echocardiography. She reported intermittent left-sided chest pain lasting a few seconds and occasional dyspnea but denied palpitations, orthopnea, or recurrent syncope. Her past medical history was notable for a reported "myocardial infarction" at age 17; however, no cardiac testing or documentation from that event was available.

Physical examination revealed a well-appearing woman with a blood pressure of 94/50 mmHg, heart rate of 66 bpm, and oxygen saturation of 97%. Cardiovascular examination demonstrated a regular rhythm with a soft systolic murmur, without heaves, thrills, or jugular venous distension. The lungs were clear bilaterally, and there was no peripheral edema. Electrocardiography showed normal sinus rhythm with nonspecific ST-T wave abnormalities.

Initial transthoracic echocardiography demonstrated a preserved left ventricular ejection fraction (LVEF) of 60% and a 4.2 × 2.8 cm mass attached to the posteromedial papillary muscle, concerning for tumor versus myxoma. At approximately 35 weeks' gestation, repeat echocardiography performed at another facility approximately three weeks later demonstrated interval increase in the size of the left ventricular mass to 5.3 × 2.6 cm; however, this apparent change may reflect differences in imaging planes rather than true tumor growth. Cardiac MRI with contrast was recommended but deferred until after delivery due to concerns regarding gadolinium exposure during pregnancy.

The patient subsequently underwent a scheduled cesarean delivery of a healthy infant at 39 weeks' gestation. Postpartum, she reported worsening and more persistent atypical chest pain. Cardiac MRI was then performed for further characterization, revealing a large multilobulated mass involving the inferior wall of the left ventricle, extending approximately 6.1 cm from near the apex to the base (3.3 cm craniocaudal × 4.1 cm anteroposterior). The lesion was hypointense on T2-weighted imaging (Figures 1a–b) and isointense to myocardium on T1-weighted imaging. First-pass perfusion demonstrated minimal enhancement, whereas delayed post-contrast imaging showed prominent, heterogeneous delayed gadolinium enhancement, findings most consistent with cardiac fibroma.

No atrial mass was identified on MRI, suggesting that the previously reported right-sided mass on echocardiography likely represented mislocalization of the left ventricular tumor. The LVEF was 53% (low-normal), with no regional wall motion abnormalities despite the large tumor burden. Right ventricular ejection fraction was borderline low-normal at 42%, without right ventricular dilation or evidence of right-sided heart failure.

The patient underwent surgical resection of the cardiac mass via median sternotomy with cardiopulmonary bypass. Intraoperatively, two rubbery, tan-pink-white masses were identified and completely excised, measuring 6.5 × 5.5 × 3.1 cm in aggregate and weighing 50 grams. The smaller component demonstrated moderate calcification on ex vivo radiographic examination of the resected specimen. Histopathologic analysis confirmed cardiac fibroma, revealing two well-circumscribed nodules composed of paucicellular fibrous tissue with areas of calcification. Tumor involvement at the myocardial interface was noted, consistent with the infiltrative nature of cardiac fibromas.

Postoperative recovery was uncomplicated. At three-month follow-up, the patient remained asymptomatic with improved exercise tolerance. Follow-up echocardiography demonstrated no evidence of tumor recurrence and stable ventricular function. She continues to undergo serial imaging surveillance.

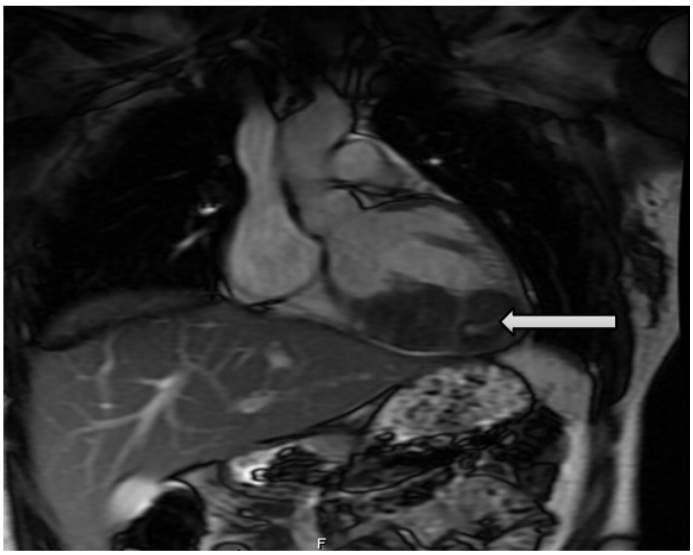

Figure 1. Cardiac MRI showing T2 hypointensity (white arrow), suggestive of fibrosis (cardiac fibroma).

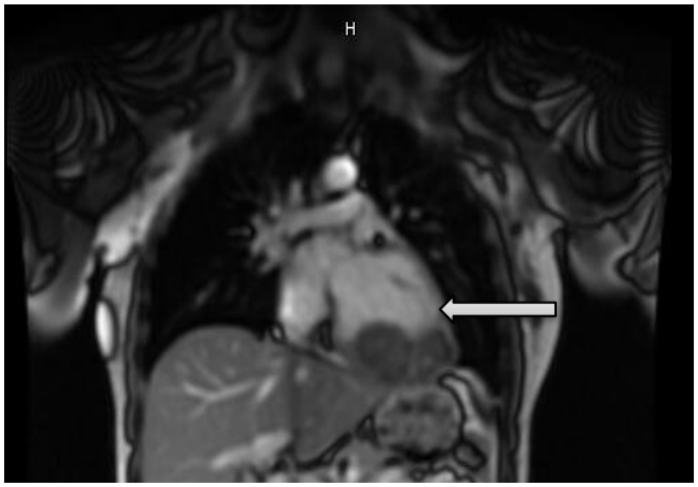

Figure 2. Cardiac MRI showing T2 hypointensity (white arrow), suggestive of fibrosis (cardiac fibroma).

DISCUSSION

This case represents a rare presentation of multifocal cardiac fibroma in a young adult woman. Although typically considered a pediatric tumor, recent data indicate that more than half of cases reported at tertiary centers occur in adults, challenging this traditional view.[3] Its discovery during pregnancy underscores how physiologic cardiovascular adaptations can unmask previously occult pathology.

This case highlights the central role of multimodality imaging. Transthoracic echocardiography enabled initial detection, albeit with inaccurate localization, and longitudinal assessment, while cardiac MRI provided definitive tissue characterization. The lesion demonstrated classic fibroma features, including T2 hypointensity, isointense T1 signal, and prominent delayed gadolinium enhancement.[7] These findings distinguished fibroma from myxoma and thrombus[3] and informed surgical planning.

The patient's reported "myocardial infarction" at age 17, in the absence of risk factors or documentation, may represent an earlier manifestation of the tumor, possibly due to coronary compression, arrhythmia, or misdiagnosed chest pain. Given the arrhythmogenic potential of cardiac fibromas, initial evaluation appropriately included electrocardiography, which showed nonspecific ST-T abnormalities. Although ambulatory monitoring was not performed at presentation, it may be warranted after diagnosis, particularly in patients with syncope. This case emphasizes the importance of considering cardiac tumors in young patients with unexplained cardiac symptoms.

Deferral of surgery until after delivery was appropriate given stable hemodynamics and absence of malignant arrhythmias. Although cardiac surgery during pregnancy is feasible, it carries significant maternal and fetal risk.[9] Close surveillance allowed safe cesarean delivery at 39 weeks' gestation, followed by definitive postpartum resection, an approach that minimized maternal risk and avoided fetal exposure to cardiopulmonary bypass.

CONCLUSIONS

Cardiac fibromas should be considered in young adults with unexplained cardiac symptoms, particularly when pregnancy unmasks disease. Multimodal imaging is necessary for diagnosis and management, and surgical resection offers an excellent prognosis. Long-term surveillance remains important given rare recurrence. This case further underscores the value of a multidisciplinary cardio-obstetric approach to optimize maternal and fetal outcome.

ARTICLE INFORMATION

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Corresponding Author: Reuben L. Odai, The University of Kansas School of Medicine-Wichita, Wichita, Kansas, 1010 N. Kansas St., Wichita, KS, 67214, rodai@kumc.edu.

Author Affiliations: The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Odai, Oundo, Akkawi, Sajjad, Alchaer, Smelser, Shaheen); Department of Internal Medicine, The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Odai, Oundo, Akkawi, Sajjad, Alchaer, Shaheen); Heartland Cardiology, Wichita, KS (Shaheen)

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Keywords: *fibroma; heart neoplasms; pregnancy complications, cardiovascular; cardiac surgical procedures; magnetic resonance imaging*

KANSAS JOURNAL of MEDICINE

Case Report

Lower Abdominal Juvenile Xanthogranuloma in an Infant: A Rare Site of Presentation

Jack R. Thomas, MS-3, Brandon R. Litzner, M.D.

INTRODUCTION

Juvenile xanthogranuloma (JXG) is a non-Langerhans cell histiocytosis most commonly seen in infancy or early childhood.[1] The first documented case, described by Adamson in 1905, was termed "congenital xanthoma multiplex."[2] JXG is characterized by solitary or multiple yellow to red papules or nodules that are benign and typically self-limiting.[3] These lesions most often appear on the head, neck, or upper trunk, but they may occur anywhere on the body and, in rare cases, involve the eyes, deep soft tissues, or internal organs.[4-6] Atypical presentations, particularly in uncommon locations such as the abdomen, rarely are reported and can pose diagnostic and therapeutic challenges. Here, we present the case of a 10-month-old girl with a large JXG localized to the lower abdominal skin.

CASE REPORT

A 10-month-old female presented with an abdominal skin lesion. Her mother reported that the lesion had been present for two months, was progressively enlarging, and was accompanied by a new, smaller adjacent growth. She also noted that the lesion bled after being accidentally scratched and did not improve with application of Neosporin.

Physical examination revealed a 1.2 cm pink-yellow nodule with central induration on the lower abdomen (Figure 1), along with a smaller yellow umbilicated papule just lateral to the primary lesion. A shave biopsy of the primary lesion was performed to the level of the dermis using a Dermablade, removing the bulk of the lesion.

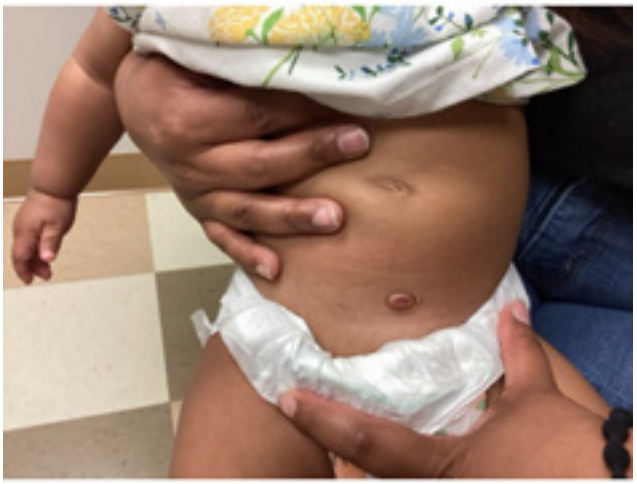

Figure 1. 1.2-centimeter yellowish pink plaque with induration present centrally.

Histopathologic evaluation demonstrated a diffuse dermal infiltrate composed predominantly of histiocytes, including Touton-type giant cells, with scattered lymphocytes and eosinophils (Figures 2 and 3). Immunohistochemical staining showed that the histiocytes were positive for CD68 (Figure 4) and negative for S100, supporting the diagnosis of juvenile xanthogranuloma and helping to exclude other histiocytic disorders. At one-month follow-up, there was no evidence of lesion recurrence.

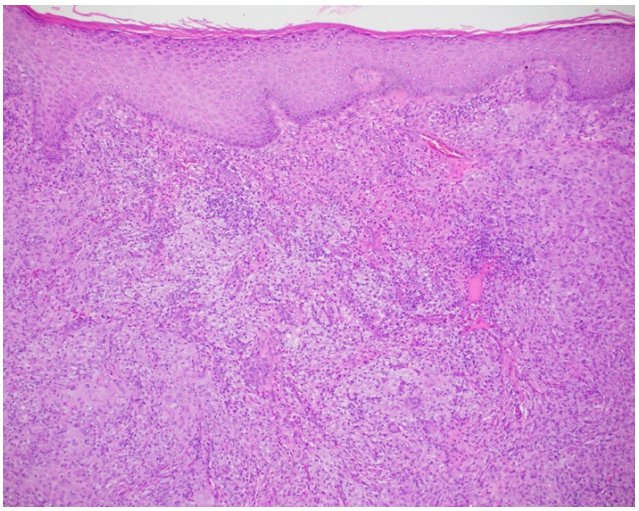

Figure 2. Histological sections revealed foamy histiocytes with scattered Touton giant cells and eosinophils (100x).

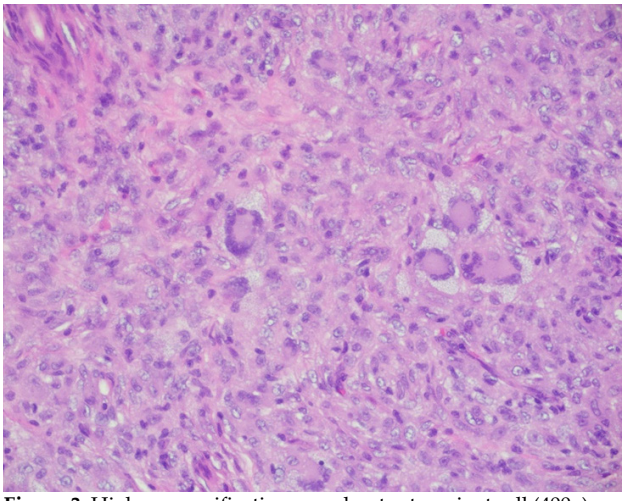

Figure 3. Higher magnification reveals a touton giant cell (400x).

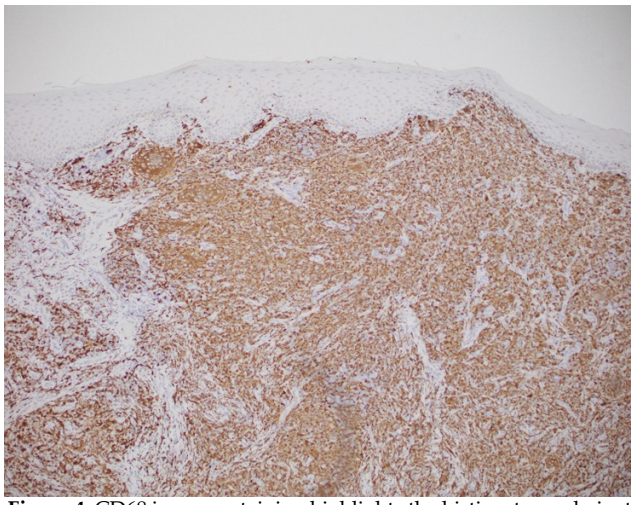

Figure 4. CD68 immunostaining highlights the histiocytes and giant cells (100X).

DISCUSSION

This case is typical in terms of patient age and histopathologic findings but is notable for the size and location of the lesion. The lower abdominal location, rather than the more common head and neck distribution, represents an uncommon presentation of JXG. JXG typically presents as a solitary cutaneous lesion in infancy or early childhood, with a strong predilection for the first two years of life.

Cutaneous lesions usually regress spontaneously within 3-6 years and rarely require treatment. However, atypical presentations may raise concern for extracutaneous involvement and warrant careful evaluation.[1] Characteristically, JXG lesions appear as red or yellow papules or nodules measuring 0.5-2 cm.[4] Although most found on the head, neck, or upper trunk, lesions can occur anywhere on the body. Abdominal involvement has been reported but remains rare; to our knowledge, lower abdominal cutaneous JXG has not been previously described, highlighting the uniqueness of this case.

Extracutaneous involvement, while uncommon, has been reported in the central nervous system, lungs, liver, spleen, kidneys, bone marrow, and gastrointestinal tract.[5] Ocular involvement may occur, particularly in children younger than two years or in those with multiple lesions, and can lead to serious complications, including vision loss.[1]

JXG is thought to originate from macrophages derived from dermal dendrocytes.[7] The clinical differential diagnosis includes Spitz nevus, mastocytoma, dermatofibroma, molluscum contagiosum, and malignancy.[8] Biopsy often is necessary to confirm the diagnosis and exclude alternative conditions. Immunohistochemical staining provides additional support: lesional histiocytes are typically positive for CD68, CD163, and CD4, and negative for CD1a, CD207 (langerin), and S100, which helps distinguish JXG from Langerhans cell histiocytosis.[4,9]

In rare cases (<1%), JXG is associated with juvenile myelomonocytic leukemia (JMML) and neurofibromatosis type 1 (NF1).[10] In patients with NF1, the presence of JXG is considered a warning sign for JMML, with a 20- to 30-fold increased risk compared to those with NF1 alone.[10] Although systemic involvement is uncommon, it can result in significant morbidity and, rarely, mortality. Treatment generally is not required, and systemic therapy is reserved for rare cases with visceral involvement affecting vital organ function.[10]

CONCLUSIONS

This case illustrates a rare histiocytic skin disorder with an unusual lower abdominal presentation and possible early multifocality, which prompted diagnostic biopsy. In infants presenting with an enlarging papule or nodule, JXG should be included in the differential diagnosis, and histologic confirmation should be pursued when the presentation is atypical, or the diagnosis is uncertain. Although most JXG lesions regress spontaneously, shave biopsy can serve both diagnostic and therapeutic purposes. In this case, there was no evidence of ocular or systemic involvement consistent with the typically benign course of the disease. Caregivers should be counseled regarding the potential for ocular and systemic involvement, particularly in patients with multiple lesions, and the importance of close follow-up should be emphasized.

ARTICLE INFORMATION

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Corresponding Author: Brandon R Litzner, The University of Kansas School of Medicine-Wichita, Wichita, Kansas, 1010 N. Kansas St., Wichita, KS, 67214, drlitzner@heartland-derm.com.

Author Affiliations: The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Thomas, Litzner); Department of Family and Community Medicine, The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Litzner); Department of Dermatology, St. Louis University School of Medicine (Litzner); Heartland Dermatology and Skin Cancer Center (Litzner)

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Keywords: *juvenile xanthogranuloma; lower abdominal lesion; cutaneous nodule; pediatric dermatology; case report*

KANSAS JOURNAL of MEDICINE

Critical Appraisal of a Systematic Review Comparing Surgical and Conservative Therapies in Treating Meniscus Root Tears

Alexandria Watkins, MS-3, Shang-You Yang, M.D., Ph.D.

Manuscript Citation: Hayashi M, Isaji Y, Kurasawa Y, Kitagawa T. Effectiveness of Meniscus Root Tear Repair Versus Conservative Therapy and Adjunct Therapies: A Systematic Review. Cureus. 2024 Dec 13;16(12):e75645. PMID: 39803041.[1]

Type of Investigation: Systematic review.

Question: Meniscus root tears (MRT) can result in knee cartilage damage and osteoarthritis; there are currently several treatment options available in clinical practice. The published study aimed to address the question of which type of management of MRTs results in better quality of life (QOL) and activities of daily living (ADL) scores:

1. Surgical management of MRT (consisting of surgical repair or partial meniscectomy) versus conservative therapy (medications)
2. Conventional physical therapy (PT) versus multimodal therapy (traditional PT plus manual therapy) or adjunct therapies (conventional PT plus electrostimulation/electromyographic feedback)

METHODS

Design. Systematic review of randomized controlled trials (RCT's) and cohort studies on MRT management (surgical or conservative) from various electronic bibliographic databases including PubMed, Ovid, EBSCO and the Physiotherapy Evidence Database in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[2]

Population. The population consisted of both males and females of all ages who had experienced a MRT, from any country, in studies published up to April 22, 2023. Exclusion criteria included osteoarthritis of the knee only, knee cartilage degeneration only, surgery other than MRT repair, and meniscus injury with ligament rupture. A total of 546 patients were included across eight (8) cohort studies and three (3) RCT's, screened from a total of 3,837 articles.

Intervention/Exposure. MRT surgical repair.

Comparator. Conservative therapies (medication, rehabilitation, physical therapy, exercise, manual therapy, orthotic intervention, aerobic exercise program, injection therapy. Multimodal therapy included manual rehabilitation in addition to exercise therapy.

Outcome. The primary outcome was comparison of ADL and QOL scores between surgical and conservative management of MRT's. The secondary outcomes included pain, body mass index (BMI), physical functionality, Kellgren and Lawrence (KL) classifications, and Ahlback classifications. Various scoring systems and analysis tools were used to assess ADL and QOL among studies before and after treatment. The Knee Injury and Osteoarthritis Outcome Score (KOOS)[3] subscales were calculated for ADL's and QOL comparing surgical intervention versus conservative/conventional therapy, and multimodal versus adjunct therapy from zero up to twenty-four months post-intervention. Both the Lysholm knee scoring scale and Tegner activity score were utilized to assess time-bound differences (zero up to twenty-four months) in QOL and ADLs between surgical versus traditional PT or multimodal therapy. The Newcastle-Ottawa Scale,[4] a star-based rewarding system out of 9, was used to compare the quality of the eight cohort studies.

Statistical analysis. The GRADEpro system developed by Cochrane[5] was used to assess the quality of evidence for each study, categorizing it from high to very low certainty. Outcomes compared surgical versus conservative management, as well as conventional versus multinomial therapy, using KOOS subscales for ADLs and QOL. Statistical significance was set at $p < 0.05$, with intervention effects reported using 95% confidence intervals. Risk of bias was evaluated using the Cochrane Collaboration's Risk of Bias 2 tool for randomized controlled trials and the Newcastle-Ottawa Scale for cohort studies.

When feasible, meta-analysis was conducted for continuous outcomes (ADL and QOL) using mean differences (MD) or standardized MD, along with 95% confidence intervals, when at least two RCTs were available. Dichotomous outcomes were analyzed using risk ratios with 95% confidence intervals. A random-effects model was applied. Heterogeneity was assessed using the Q statistic and I^2, with $I^2 > 50\%$ and a Q statistic p-value of 0.05 indicating significant heterogeneity. Data analysis was performed using Review Manager software (RevMan 5.4).[6]

Follow-Up. There was a vast range of follow-up timing in the studies included in this review. RCT's ranged from one week to two months, whereas cohort studies ranged from three months to four years.

RESULTS

Both ADL and QOL scores improved with surgical and conservative management. Conservative management demonstrated greater short-term improvements, followed by a plateau over time, whereas surgical management was associated with better long-term outcomes in both KOOS domains (see Figures 3 and 4).

GRADE evaluation of ADL (KOOS subscale) showed a mean score of 84.5 points, with conservative therapy MD of 9.1 points lower than surgical management (95% CI: -22.09 to 3.89). For QOL, the mean KOOS score was 54 points, with conservative therapy showing a MD of 0.5 points lower than surgical management (95% CI: -18.74 to 17.74).

Compared with conventional therapy, multimodal therapy

demonstrated a MD ranging from 1.70 to 2.78 points higher on the KOOS ADL subscale (95% CI: -5.74 to 6.69) and from -1.00 to 1.78 points on the KOOS QOL subscale (95% CI: -13.51 to 6.66).

However, the certainty of evidence across comparisons was very low due to study limitations, including risk of bias, small sample sizes, and short follow-up durations. Therefore, the relative effectiveness of MRT repair surgery, conservative therapy, and multimodal therapy remains inconclusive based on this systematic review.

Study Conclusion. The authors conclude that surgical management of MRT is associated with higher ADL and QOL scores compared with conservative management, potentially due to restoration of normal joint mechanics. However, the true effectiveness of these interventions requires evaluation in studies with longer follow-up periods. Short follow-up duration was a key limitation across the three RCTs, which otherwise suggested that both multimodal and adjunct therapies improve ADL and QOL outcomes.

The overall certainty of evidence was low based on GRADE assessments, and the risk of bias, particularly due to lack of blinding of participants and outcome assessors, limits confidence in the findings. As a result, the comparative effectiveness of surgical versus conservative management and conventional physical therapy versus multimodal therapy for MRT remains unclear.

Although the included cohort studies were generally of high quality and may be applicable to broader populations, well-designed RCTs remain the preferred standard. Future studies with larger sample sizes, longer follow-up periods, and lower risk of bias are needed to better inform clinical decision-making.

Commentary. The purpose of the systematic review by Hayashi et al.[1] was to evaluate the outcomes of different interventions for MRTs, surgical versus conservative management and conventional versus multimodal physical therapy, on short- and long-term scores. Data were sparse, which limited the ability to conduct robust statistical comparisons. Hayashi et al.[1] presented four forest plots based on two RCTs and one cohort study, all of which yielded inconclusive results, as indicated by confidence intervals overlapping zero (Figures 10-13). Similar findings were reported in the GRADE summaries. Secondary outcomes, such as pain, physical functionality, and body mass index (BMI), were not evaluated.

Although some studies attempted to demonstrate improved outcomes over time (Figures 3-9), many lacked consistent follow-up periods. Research indicates that surgical repair of an MRT requires long-term follow-up to adequately assess outcomes such as osteoarthritis.[7] It is possible that the studies included in the review were not optimally selected or did not adhere strictly to a pre-determined PICOS framework. This could have led to significant heterogeneity in patient populations, interventions, comparators, and study designs (RCT vs. cohort).

Both the interventions (medial or lateral MRTs) and comparator groups (various conservative therapies) encompassed multiple scenarios, further complicating comparisons. Moreover, cohort studies are often susceptible to selection and other biases, whereas randomized trials better control for bias, making direct comparisons between these study types inappropriate.

Overall, the results from the eleven studies included in the systematic review were inconclusive, and most were rated as high risk of bias and/or low quality of evidence. It appears that the research questions and literature search were too broad to be effectively summarized through a systematic review, and additional methodological weaknesses may be revealed with a more rigorous assessment.

Assessment Instruments. We used two instruments for critiquing systematic reviews: the PRISMA 2020 checklist[2] and the Critical Appraisal Skills Programme (CASP) checklist[8] to evaluate the study by Hayashi et al.[1] The PRISMA checklist was chosen because the authors reported adherence to this guideline, and it allows verification of whether all checklist items were addressed. Based on this evaluation, we summarize the strengths and weaknesses of the Hayashi et al.[1] study. The completed PRISMA checklist is provided in Appendix A (available online at journals.ku.edu/kjm), along with results from an abbreviated CASP assessment.

Weaknesses. Completion of the PRISMA checklist revealed that, while many items were reported, several notable exceptions were identified. The Abstract did not disclose the inclusion/exclusion criteria. PRISMA Item 4 (Objectives) requires an explicit statement, and when evaluating the effects of interventions, it recommends using the Population, Intervention, Comparator, Outcome (PICO) framework or a variant. Hayashi et al.[1] did not apply PICO in the Abstract, nor was it followed in the Introduction section:

> Abstract: *This study aimed to compare the effectiveness of MRT repair versus conservative therapy and conservative therapy versus multimodal or adjunct therapy in patients with MRTs.*
>
> Introduction: *This study had two aims: first, to determine the effectiveness of MRT repair versus conservative therapy for patients with MRTs, and second, to assess the effectiveness of conventional versus multimodal or adjunctive therapies in these patients.*

Thus, the outcome was missing from the objectives, and it is unclear what is meant by the term effectiveness.

The Methods section had several deficiencies, including inadequate handling of missing data (Items 10b and 13b) and insufficient detail on methods used to explore possible causes of heterogeneity (Item 13e). Additionally, no information was provided regarding sensitivity analyses (Item 13f). In the Results section, there were omissions related to heterogeneity (item 20c) and risk of bias due to missing data (Item 21). For the Discussion section, limitations of the review process were not reported (Item 23c).

Strengths. Although the Objectives lacked explicit PICO elements (Item 4), Hayashi et al.[1] provided detailed eligibility crite-

ria (Item 5). However, the interventions (surgical procedures) and comparators (conservative therapies) spanned a wide range, and the principal outcomes, ADL and QOL, encompassed multiple types of measures. The inclusion of multiple study designs further complicated the analysis. Individually, these elements suggest that a systematic review may not have been ideal due to their breadth; collectively, they cast doubt on whether the research objectives could be adequately addressed with only 11 studies.

Other notable strengths per PRISMA guidelines include items 6-9, where the authors provided sufficient detail to replicate the literature search, included Grey literature and ClinicalTrials.gov, and explained how studies were selected. Risk of bias was appropriately assessed using RoB 2 for RCTs and the Newcastle-Ottawa Scale for cohort studies (Item 11), and certainty of evidence was evaluated using GRADEpro software (Item 12). The GRADE system, a subjective tool by Cochrane, allows stepwise upgrading or downgrading of study quality, with RCTs starting at high quality and non-RCTs at low quality. The PRISMA flow diagram (Item 16a) also was provided, clearly showing study selection for the analysis.

CASP Assessment. To further evaluate the evidence presented, we conducted a CASP appraisal of the systematic review. Table 1 presents an abbreviated version of this appraisal (the full version is available in Appendix B at journals.ku.edu/kjm). The CASP assessment highlighted significant weaknesses in the Hayashi et al.[1] article. Of the 10 items evaluated, only two (items 4 and 5) received a "Yes" rating, largely because the included studies were well-summarized in a table that detailed PICO elements, risk of bias, and GRADEpro assessments. All other areas were rated as "No" (5 of 10) or "Can't tell" (3 of 10), underscoring the limitations in the review.

Limitations. The studies included in the review were not comparable due to differing PICO elements and inconsistent long-term follow-up, which limited the reliability of the evidence and rendered the results inconclusive. The authors did not directly compare surgical management versus adjunct therapies, despite this being implied by the review's title. Additionally, no definition of effectiveness was provided for the outcomes, such as cut-off values on the KOOS subscales for QOL and ADLs. Although missing data were evident (see Table 2: Characteristics of inclued studies), Hayashi et al.[1] did not address this issue.

CONCLUSIONS

This systematic review included studies with varying sample sizes, follow-up periods, and interventions. While KOOS subscales for ADLs and QOL, along with the GRADE evaluation, suggest potential improvements with surgical management over conservative management and with multimodal therapy over conventional therapy, the results remain inconclusive. Well-designed future studies with explicit objectives, larger sample sizes, standardized and extended follow-up, strict control of confounding variables, and robust statistical analyses are needed to determine the most effective treatment for meniscus root tears.

COMPLIANCE WITH ETHICAL STANDARDS

All authors declared no financial support or relationships within the last 3 years of completing this work. All authors declared no other relationships or activities that could appear to have influenced this work.

Table 1. CASP General SR Checklist: Collation of critical appraisal responses.

Checklist Question	Yes	No	Can't Tell
Is the basic study design valid for a systematic review?			
Did the systematic review address a clearly formulated research question?		x	
Did the researchers search for appropriate study designs to answer the research question?		x	
Is the systematic review methodologically sound?			
Were all relevant primary research studies likely to have been included in the systematic review?			x
Did the researchers assess the validity or methodological rigour of the primary research studies included in the systematic review?	x		
Did the researchers extract, and present information on the individual primary research studies appropriately and transparently?	x		
Are the results of the systematic review trustworthy?			
Did the researchers analyze the pooled results of the individual primary research studies appropriately?		x	
Did the researchers report any limitations of the systematic review and, if so, do the limitations discussed cover all the issues in your critical appraisal?		x	
Would the benefits of intervention outweigh any potential disadvantages, harms and/or additional demand for resources associated with acting on the results?			x
Are the results of the systematic review relevant locally?			
Can the results of the systematic review be applied to your local population/in your local setting or context?			x
If actioned, would the findings from the systematic review represent greater or additional value for the individuals or populations for whom you are responsible?		x	

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Corresponding Author: Alexandria Watkins, The University of Kansas School of Medicine-Wichita, Wichita, Kansas, 1010 N. Kansas St., Wichita, KS, 67214, awatkins6@kumc.edu.

Author Affiliations: The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Watkins, Yang); Department of Orthopedic Surgery, The University of Kansas School of Medicine-Wichita, Wichita, Kansas (Yang)

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Commentary

Emerging Concern: Lidocaine Adulterated "Purple Fentanyl" in the Midwest

Satneet Singh, M.D., Melissa Perchellet, M.D., Sophie Troupe, M.D., Roopa Sethi, M.D.

The opioid crisis continues to evolve in dangerous and unpredictable ways. This article highlights the emerging concern of "purple fentanyl," which has been reported in the Midwest, including Kansas, Missouri, and neighboring states.[1,2] Fentanyl and other synthetic opioids already have been linked to a high number of overdose deaths. For example, in 2024, more than 82,000 people in the United States died from opioid overdoses, with fentanyl being the primary contributor.[3]

According to the Midwest High Intensity Drug Trafficking Area (HIDTA) Threat Assessment, the Kansas City metropolitan area and the broader Midwest region remain vulnerable to fentanyl trafficking, with law enforcement seizing approximately 1,376 pounds of fentanyl in Kansas in 2024 alone.[4] News reports have described law enforcement seizures of purple fentanyl powder and tablets in the Midwest between 2023 and 2025, in some cases linked to fatal overdoses.[1,2] These fentanyl products often are adulterated with other dangerous substances, such as xylazine and benzodiazepines.[5,6] More recently, lidocaine has emerged as an additional adulterant of concern. For example, an addiction treatment facility in Texas issued a public warning about purple fentanyl reportedly containing lidocaine.[7]

In cases of illicitly manufactured fentanyl identified in the Kansas City metropolitan area, the purple coloration may indicate the presence of lidocaine as an adulterant, based on reports that Drug Enforcement Administration laboratories have detected lidocaine in seized purple fentanyl samples.[8] However, it is important to note that there is not always a direct correlation between drug color and specific adulterants. A Report suggests that lidocaine may be added to increase profitability and potentially intensify the perceived effects of fentanyl.[9] In the past, the purple coloration in unregulated opioids was sometimes believed to be a marketing strategy or the result of harmless fillers. However, recent laboratory analyses have detected local anesthetics, particularly lidocaine, in fentanyl samples.[9,10] Illicit drug suppliers have previously used lidocaine as a substitute for cocaine because it produces a similar numbing sensation while increasing the quantity of product available for sale. The growing presence of lidocaine in fentanyl is therefore concerning.

A report from Philadelphia indicates that lidocaine is increasingly being detected in opioids obtained outside medical settings.[10] Researchers found that the prevalence of lidocaine and tetracaine in drug samples rose from approximately 3% in March 2024 to nearly 63% by March 2025, demonstrating how rapidly the illicit drug supply can change.[10] Similarly, Palamar et al.[9] reported in JAMA Psychiatry in 2025 that fentanyl across the United States frequently is adulterated with lidocaine and procaine, suggesting a growing national trend. The same study also identified other "–caine" type local anesthetics, including bupivacaine and tetracaine, as fentanyl adulterants.[9] Bupivacaine may be more cardiotoxic than lidocaine, while tetracaine has a longer duration of action. All these agents carry the risk of local anesthetic systemic toxicity.[8] Additionally, a separate report from Los Angeles identified lidocaine as a bulking agent in 172 of 353 analyzed samples of illicitly manufactured fentanyl.[11]

Pharmacologically, lidocaine functions as both a local anesthetic and an antiarrhythmic agent. It works by inhibiting voltage-gated sodium channels in neurons and cardiac cells.[10] Toxic effects of lidocaine exposure may include numbness, bradycardia, hypotension, lightheadedness, confusion, anxiety, methemoglobinemia, respiratory depression, seizures, and allergic reactions.[10] Several of these symptoms overlap with manifestations of fentanyl toxicity, including respiratory depression, which may complicate clinical recognition.

Clinicians should therefore consider several important points when evaluating suspected opioid overdoses. Lidocaine is not detectable on standard rapid urine drug screens commonly used in emergency departments. Although naloxone effectively reverses opioid toxicity, it does not treat lidocaine poisoning.[12] Patients exposed to fentanyl adulterated with lidocaine may develop seizures, hypotension, or ventricular arrhythmias, cardiovascular symptoms that are not typical of opioid overdose, which may obscure recognition of fentanyl as the underlying cause.[9] Such cases may require additional emergency management.

The opioid crisis continues to evolve as new drug combinations emerge within the illicit drug supply. The potential rise of lidocaine-adulterated fentanyl, particularly in purple-colored formulations, is therefore noteworthy. We urge clinicians, toxicologists, and public health officials in Kansas and surrounding regions to remain vigilant, monitor suspected cases, and report relevant findings to the Drug Enforcement Administration. Clinicians also should educate patients about potential adulterants in illicitly manufactured fentanyl (Figure 1), which may help individuals seek care promptly if exposed.

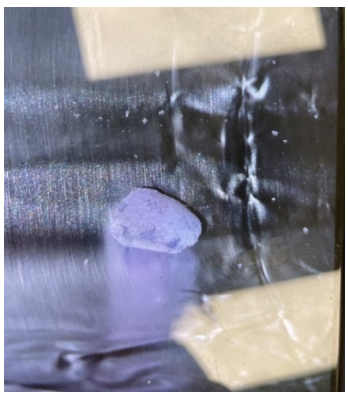

Figure 1. Purple fentanyl. We have included an illustrative image of purple fentanyl from work in the addiction treatment center. Permission taken from patient.

Current American College of Emergency Physicians opioid overdose guidelines suggest considering the possibility that a patient may be "not overdosing on an opioid, but rather some other substance."[13] However, these guidelines do not specifically address the growing concern of adulterants in illicit opioids. As a future direction, we recommend updating opioid overdose management guidelines to include awareness of potential adulterants such as lidocaine. Increased awareness of this hidden risk is essential for improving harm reduction and clinical response as the illicit drug landscape continues to evolve.

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Corresponding Author: Roopa Sethi, The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas, Mailstop 4015. 3901 Rainbow Boulevard, Kansas City, KS 66160, rsethi@kumc.edu.

Author Affiliations: The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas (Singh, Perchellet, Troupe, Sethi); Department of Psychiatry and Behavioral Sciences, The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas (Singh, Perchellet, Sethi); Department of Neurology, The University of Kansas School of Medicine-Kansas City, Kansas City, Kansas (Troupe).

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1010 N. Kansas, Wichita, KS 67214
316-293-3811 • Email: kjm@kumc.edu