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Original Research

Suicide Prevention Across the Community: Evaluation of Mental Health Training for Multiple Gatekeeper Groups

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ABSTRACT

Introduction. Suicide rates in the U.S. are higher than the global average, with rural areas experiencing even greater rates. This study investigated whether a single suicide prevention training could improve knowledge, awareness, and intention to act among various gatekeeper populations in Kansas, a rural state with elevated suicide rates.

Methods. Licensed clinical psychologists at a public university in Kansas developed an evidence-based suicide prevention training program, offered online to multiple subgroups: university faculty, staff, and students, health care workers, and community members (voluntarily), as well as high school staff and students (compulsorily). The study employed a reliable, validated instrument to assess participants' knowledge, awareness, and intention to act using a Likert-type scale. Participants also reported whether they had completed prior suicide prevention training. A total of 865 participants provided retrospective pre/post responses, and the data were analyzed using paired samples t-tests and one-way ANOVA/Kruskal-Wallis tests.

Results. Overall, participants in all subgroups, regardless of prior training, showed statistically significant pre/post increases across all measures. While no significant differences were found in learning between recruitment subgroups, variations were identified based on the number of previous trainings completed.

Conclusions. The findings support the effectiveness of a single suicide prevention training across diverse populations, suggesting important implications for targeting training efforts and optimizing resource allocation in high-need environments.

INTRODUCTION

While global suicide rates declined from 2000 to 2019, the suicide rate in the U.S. increased during the same period.[1,2] Starting in 2020, the COVID-19 pandemic exacerbated feelings of isolation and uncertainty, contributing to a rise in suicidal ideation worldwide.[3] In the U.S., the pandemic also led to an increase in mental health disorders[4] and substance-related "deaths of despair."[5]

Certain demographics are at higher risk for suicide due to factors at the individual, relationship, community, and societal levels.[6] In the U.S., individuals working in health care die by suicide at a higher rate than the general population.[7,8] Suicide rates also vary by population density, with less densely populated areas experiencing higher rates.[9] Additionally, a history of mental illness increases an individual's risk of suicide.[10] Young adults aged 18-25 have the highest prevalence of serious mental illness among all adult age groups.[11] In the U.S., suicide is the second leading cause of death for individuals aged 10-24, with rates increasing by more than 50% from 2000 to 2021.[7]

Suicide prevention interventions can be categorized as universal (targeting entire populations), selective (targeting high-risk groups), or indicated (targeting individuals exhibiting high-risk behaviors).[12] A gatekeeper is someone equipped with the knowledge and skills to recognize individuals in crisis or at risk of suicide, and to provide assistance. Gatekeeper training, a form of selective prevention, provides participants with the knowledge to identify and assist people at risk of suicide. These programs typically focus on building knowledge, skills, attitudes, and self-efficacy,[13] and they generally cover warning signs, risk factors, and available support resources.[14]

Despite shared core elements, many gatekeeper training programs are tailored to specific audiences and not widely applied across diverse populations.[14] Specific trainings have been developed for high risk groups such as health care workers, military personnel, school staff and students, helping professionals, college faculty/staff and students, and indigenous populations.[15,16] Although high school and college students face similar risk factors, interventions for these groups often have been treated separately.[17] This siloed approach can lead to duplicated efforts and unnecessary consumption of time and financial resources.

The state of Kansas presents a unique case for the need for broad suicide prevention training, while also facing significant resource limitations. Kansas, a largely rural state, has a suicide rate higher than the national average.[18] More than 90% of those who die by suicide in the state have no reported history of mental health issues.[18] Access to mental healthcare is severely limited, with 96 of the state's 105 counties designated as mental health professional shortage areas.[19] Kansas ranks last nationally on aggregated measures of mental illness prevalence and access to care for both adults and youth.[20] In the absence of adequate mental health professionals, primary care providers often bear the responsibility for both mental health care[21] and suicide response.[22] This demanding environment has led to high rates of burnout and depression among Kansas physicians,[23] particularly since the onset of the COVID-19 pandemic.[24,25]

In response to low engagement with nationally available suicide prevention training programs and the high cost of those programs, a Kansas university's counseling center developed an evidence-based suicide prevention training program in 2018 as part of a broader mental health outreach initiative. Beginning in May 2020, the training was offered online to university faculty, staff, and students, and was later expanded to other high-risk populations and their gatekeepers.

The present study had two primary objectives: first, to determine whether the suicide prevention training increased knowledge, awareness, and intention to act among multiple populations; and second, to

assess whether these populations benefited equally from the training. The results have important implications for expanding access to suicide prevention training and optimizing the allocation of limited training resources in Kansas during a time of heightened mental health needs.

METHODS

Training Content. A suicide prevention training program for gatekeepers was developed by licensed clinical psychologists and other mental health professionals at a public university in Kansas, incorporating evidence-based strategies for suicide prevention and mental health promotion.[26] Topics covered included suicide risk and protective factors, warning signs, statistics, stigma reduction, creating safer environments, psychological factors such as ambivalence and impulsivity, intervention techniques with direct questioning, strategies for engagement, and crisis resources (Table 1). The program combined didactic content with personal video narratives and reflection questions.

The training was self-paced and designed to take approximately 60 to 90 minutes, guided by prerecorded audio clips to ensure consistency between participants. Progress could be saved, allowing participants to complete the training in installments. This online, self-paced format was adopted to remove geographic barriers and provide participants the flexibility to complete the training on their own schedule.[27] Additionally, the online format ensured continued access during the COVID-19 pandemic.

Table 1. Structure of online suicide prevention course.

1. Mental health is health	Comparison of physical and mental health intervention
	Culture of silence and stigma
	Expectations for training and intervention
2. Understanding suicide	Rates by gender
	Rates by race, ethnicity, and LGBTQ+ status
	Rates by age
	Risk factors
	Protective factors
	Precipitating events
	Ideation and impulsivity
	Safer environments
	Ambivalence
	Deaths of despair
	Safer substance use
3. How to help	Share concern and listen
	Identify signs of distress
	Ask about ideation or intention
	Identify signs of crisis/immediate risk
	Support with resources and communication
	Resources
	How to respond in acute crisis
4. Losing someone to suicide	Stigma around suicide grief
	Support for grieving person

Participant Recruitment. The university counseling center led initial recruitment of faculty, staff, and students through campus internal communications (including signage), newsletters, emails, the counseling center website, meeting announcements, recommended on-boarding from departments, and social media. The participation incentive was a t-shirt with information about the mental health outreach initiative that encompassed this training. This was chosen as a visible sign of mental health destigmatization and support.

Through a community health coalition, the university counseling center then introduced the training to a private school system and a local hospital system. A private high school adopted the training as a universal requirement for students and staff, while hospital employees received training on a voluntary basis. The training also was made publicly available at no cost through the university counseling website. Recruitment from the wider community was conducted voluntarily through community health coalition partners, while local news media provided publicity.

Participants. A total of 865 participants completed the online training between May 2020 and March 2023 and provided assessment responses for the current study. Recruitment subgroups included 161 (19%) university students, 66 (8%) university faculty/staff, 229 (26%) health care workers, 296 (34%) high school students, 42 (5%) high school staff, and 71 (8%) participants from other sources in the community. The archival data available for analysis included participant recruitment group and previously trained status, but no individual demographic information. The university's Institutional Review Board (IRB) determined that the analysis of these aggregated anonymous responses was program evaluation, not human subjects research.

Instrument and Analysis. Participants completed a three-item retrospective pre/post evaluation measuring knowledge, awareness (skills/abilities), and intention to act (attitudes/self-efficacy). These items were adapted from the validated Gatekeeper Behavior Scale, which assesses preparedness, likelihood, and self-efficacy.[28] Licensed clinical psychologists and mental health professionals modified the items to better assess whether the training improved knowledge, awareness, and intention across multiple populations. The retrospective pre/post method, in which participants report their pre-training knowledge alongside their post-training level, was chosen to eliminate response-shift bias and is considered valid for repeated-measures research.[29,30]

Responses were provided on a Likert-type scale from 0 ("not at all") to 10 ("very"). Anonymous responses were aggregated by recruitment subgroup, and participants also were asked whether they had completed previous suicide prevention training (yes/no).

A posteriori reliability analysis of the three-item evaluation resulted in a Cronbach's alpha of $\alpha = 0.82$, indicating good internal consistency. Pearson's correlation between each item and the total score confirmed the validity of the instrument (Q1: $r(863) = 0.887$, $p < 0.01$; Q2: $r(863) = 0.902$, $p < 0.01$; Q3: $r(863) = 0.782$, $p < 0.01$), with all values exceeding the standard critical value (r_{crit} [df =100] = 0.254, $p < 0.01$).

For the pre/post evaluation responses, parametric test assumptions were met, as the dependent variable was continuous, distributions were

normal (confirmed by Q-Q plots, skewness, and kurtosis), and there were independent observations within each group. Homogeneity of variance was verified by Levene's test for equality of variance, which was not significant ($p > 0.05$). Paired samples t-tests were conducted on pre/post responses for the full sample, recruitment subgroups, and prior training status. Cohen's *d* was calculated to measure effect sizes and differences between group means. A one-way analysis of variance (ANOVA) was conducted to identify any differences in pre/post score increases across recruitment subgroups.

To compare the number of previous trainings completed by participants within each recruitment subgroup, an ANOVA was initially considered, but Levene's test for equality of variance was significant ($p < 0.05$), violating the test's assumptions. Consequently, the Kruskal-Wallis non-parametric test was used to compare independent samples from more than two groups. All statistical tests used an alpha level of 0.05, and data analysis was performed using IBM SPSS Statistics Version 29.0.1.0.

RESULTS

As a whole group, the 865 participants demonstrated statistically significant increases in knowledge, awareness, and intention on all three items ($p < 0.001$; Table 2). By recruitment subgroup (university students and faculty/staff, health care workers, high school students and staff, other community members), participants also demonstrated statistically significant increases on all three items (Table 2). Cohen's *d* effect size for knowledge and awareness items exceeded the large-effect benchmark of 0.8[31] for the group as a whole and for all recruitment subgroups. For the intention item, Cohen's *d* ranged from a low of 0.288 for high school staff to a high of 0.595 for community participants, a small to medium effect (Table 2). ANOVA identified no statistically significant differences between any recruitment subgroup scores and the overall group mean for Q1: $F(5, 859) = 0.772$; Q2: $F(5, 859) = 0.145$; Q3: $F(5, 859) = 0.608$. This indicates that the number of pre/post learning did not differ significantly by recruitment subgroup.

Of the 865 participants, 859 (99%) reported whether they had completed any suicide prevention training before this one. Of these 859, 22% (n = 190) had completed a previous training (PT) and 78% (n = 669) had not completed a previous training (NT). Regardless of previous training, the PT and NT subgroups reported significantly increased learning on all three items ($p < 0.001$; Table 3). For knowledge and awareness items, Cohen's *d* exceeded the large-effect benchmark of 0.8 for both PT and NT participants. For intention, Cohen's *d* was 0.311 for PT and 0.395 for NT, a small effect (Table 3).

The six recruitment subgroups also were compared on the number of suicide prevention trainings completed before the current training. Recruitment subgroups in order of fewest to most previously completed trainings were high school students, university students, community members/other, health care workers, university faculty/staff, and high school staff (Table 4). A Kruskal-Wallis test indicated a significant difference in the number of previous trainings across the six subgroups ($\chi^2(5) = 108.66$, $p < 0.001$). The median number of previous trainings was 0.0 for all six recruitment subgroups. Post-hoc comparisons using Dunn's method with a Bonferroni correction for multiple tests indicated that the median number of trainings of high school students was significantly lower than that of all other subgroups ($p < 0.001$). In addition, the median number of trainings of university students was significantly lower than that of university faculty/staff ($p < 0.001$) and health care workers ($p = 0.005$).

DISCUSSION

This study provides evidence that a single, evidence-based suicide prevention training program can significantly enhance knowledge, awareness, and intention to act across multiple populations in a state with high suicide rates and limited access to mental health care. It contributes to the literature by exploring how diverse groups respond to the same training program.

Across all recruitment subgroups and regardless of prior training experience, participants showed significant improvements in knowledge, awareness, and intention after completing the training. No consistent differences were found between the subgroups, and their responses did not significantly deviate from the overall mean, indicating a high level of consistency in pre/post training outcomes. This suggests that the training is generalizable and effective across a range of populations.

The analysis also revealed notable differences in the number of previous suicide prevention trainings completed by different subgroups. High school and university students had completed the fewest trainings, which is not surprising given their younger age and reduced opportunities for such experiences. However, students are a crucial target for suicide prevention efforts, as Kansas ranks 50 out of 51 (including Washington, D.C.) in youth mental illness prevalence and access to care.[20] This highlights the importance of continuing to engage student populations in these trainings.

Recognizing that some groups have had more opportunities for training can inform future recruitment efforts. Still, only 22% of participants had received prior suicide prevention training, underscoring the ongoing need for such programs. Importantly, the consistency of learning gains between participants with and without prior training demonstrates that suicide prevention education is not a *one-and-done* event. Instead, it is an ongoing process of reinforcing knowledge, awareness, and the intention to act, which continues to benefit gatekeepers.

While the training effectively serves multiple populations, its online format allows for easy adaptation to specific audiences.[27] The university-led mental health initiative is expanding efforts to reach high-risk groups, such as older adults, LGBTQ+ individuals, veterans, and indigenous populations.[7] These adaptations include unique statistics, data, risk and protective factors, and a review of literature specific to each group, while maintaining the general training framework. As of July 2024, the training is available in Spanish, with an LGBTQ+ version offered as well. A Vietnamese translation and a veteran-focused adaptation are planned for later in 2024, with future adaptations targeting older adults, indigenous communities, faith-based groups, and law enforcement/first responders.

Table 2. Participants' retrospective pre-post ratings as a whole group (N = 865) and by recruitment subgroup.

Paired Samples t-Test								
Assessment Items	Participant Group	Mean Before	Mean After	Mean Difference	*t*-value	*df* (n-1)	Sig. (1-tailed)	Cohen's *d*
1. KNOWLEDGE: How knowledgeable would you consider yourself about the facts surrounding suicide?	All participants	5.99	8.42	-2.43	-35.218	864	<0.001	1.197
	University students	5.87	8.56	-2.69	-17.374	160	<0.001	1.369
	University faculty/staff	6.46	8.58	-2.12	-8.372	65	<0.001	1.031
	Health care workers	6.41	8.71	-2.29	-17.965	228	<0.001	1.187
	High school students	5.63	8.05	-2.42	-19.653	295	<0.001	1.142
	High school staff	5.73	8.19	-2.46	-6.676	41	<0.001	1.030
	Community/other	6.06	8.70	-2.64	-11.938	70	<0.001	1.416
2. AWARENESS: How aware are you of resources for those struggling with suicidal thoughts or feelings?	All participants	5.90	8.59	-2.69	-34.492	864	<0.001	1.173
	University students	6.14	8.82	-2.68	-14.588	160	<0.001	1.150
	University faculty/staff	6.29	9.03	-2.74	-8.741	65	<0.001	1.076
	Health care workers	6.40	8.97	-2.57	-16.509	228	<0.001	1.091
	High school students	5.21	7.92	-2.72	-21.551	295	<0.001	1.253
	High school staff	5.88	8.68	-2.79	-7.031	41	<0.001	1.085
	Community/other	6.23	9.09	-2.86	-11.301	70	<0.001	1.341
3. INTENTION: How willing would you be to intervene if you came in contact with someone who you knew was considering suicide?	All participants	8.74	9.23	-.49	-11.104	864	<0.001	.378
	University students	8.72	9.27	-.55	-4.953	160	<0.001	.390
	University faculty/staff	8.92	9.35	-.44	-2.505	65	0.007	.308
	Health care workers	9.02	9.44	-.43	-5.605	228	<0.001	.370
	High school students	8.46	8.95	-.50	-6.191	295	<0.001	.360
	High school staff	8.91	9.22	-.31	-1.865	41	0.035	.288
	Community/other	8.80	9.51	-.71	-5.010	70	<0.001	.595

Table 3. Participants' retrospective pre-post ratings by previous training status (N = 859).

Paired Samples t-Test								
Assessment Items	Previous Training Status*	Mean Before	Mean After	Mean Difference	*t*-value	*df* (n-1)	Sig. (1-tailed)	Cohen's *d*
1. KNOWLEDGE: How knowledgeable would you consider yourself about the facts surrounding suicide?	PT	7.39	9.01	-1.62	-14.097	189	<0.001	1.025
	NT	5.59	8.25	-2.66	-32.822	668	<0.001	1.269
2. AWARENESS: How aware are you of resources for those struggling with suicidal thoughts or feelings?	PT	7.50	9.26	-1.76	-13.178	189	<0.001	.959
	NT	5.44	8.39	-2.95	-32.468	668	<0.001	1.255
3. INTENTION: How willing would you be to intervene if you came in contact with someone who you knew was considering suicide?	PT	9.32	9.64	-.32	-4.276	189	<0.001	.311
	NT	8.56	9.11	-.59	-10.204	668	<0.001	.395

*(PT, Previously Trained; NT, Not Previously Trained)

Table 4. Number of suicide prevention trainings previously completed by participants in each recruitment subgroup (N = 859).

Pairwise Comparisons							
Number of Previous Trainings Completed (PT)	High School Students	University Students	Community/ Other	Health Care Workers	University Faculty/ Staff	High School Staff	Total Participants by Number of Trainings
0 PT	284	126	54	146	36	23	669
1 PT	6	16	9	28	13	6	78
2 PT	3	9	3	19	4	3	41
3 PT	2	7	1	10	6	2	28
4 PT	1	0	2	4	1	0	8
5 PT	0	1	0	0	0	0	1
6 PT	0	2	2	18	5	7	34
Total Participants by Recruitment Subgroup	296	161	71	225	65	41	859
Median (Interquartile Range)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.0 (0.0-1.0)	0.0 (0.0-1.5)	0.0 (0.0-2.0)	0.0 (0.0-0.0)

Limitations. The demographic data collected for this training were limited to recruitment subgroup and previous training status, leaving it unclear whether characteristics such as sex, gender, race, or ethnicity were representative of the subgroups. This lack of demographic information could have influenced the results. Additionally, no follow-up data were gathered to assess whether the training's impact persisted over time.

Participation from university, health care, and community members was voluntary, which may have introduced self-selection bias, potentially affecting the generalizability of the findings. Those who chose to complete the training voluntarily might have been more motivated, which could lead to greater learning. However, the pre/post improvements observed among high school students, who were universally required to complete the training and therefore not subject to self-selection bias, did not significantly differ from those who completed the training voluntarily. These results mitigate concerns about self-selection bias and support the generalizability of the findings across various populations.

The goal of suicide prevention training is to reduce suicidal behaviors. Future research could examine a pre-training cohort from the high school where the training was universally required to assess whether there are differences in suicidal behaviors between students who received the training and those who did not. However, it is important to note that a causal relationship cannot be inferred from a single data point, given the complexity of suicide risk factors and prevention strategies. Suicide prevention efforts go beyond gatekeeper training alone; this program is just one component of a broader community mental health initiative.

CONCLUSIONS

Suicide prevention trainings may be more adaptable across various gatekeeper populations than previously recognized. This study demonstrates the potential for online training to be effectively delivered to diverse populations, particularly in environments with high need and limited access to care. By consolidating expertise and reducing resource demands on Kansas' already strained primary care and mental health systems, this approach offers a cost-effective solution. The ability to reach a broader audience without increased expense significantly expands the pool of trained gatekeepers, while the flexibility of the online format allows for easy customization to address the unique needs of populations facing disparities in suicide risk.

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Keywords: mental health, suicide, educational assessment, medically underserved areas, Kansas

KANSAS JOURNAL of MEDICINE

Brief Report

How Many Trauma Admissions Require Acute Trauma Team Interventions?

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ABSTRACT

Introduction. The aim of this study was to assess the percentage of trauma patients admitted and receiving intervention, and to identify which of these interventions were performed by non-trauma specialists.

Methods. The authors conducted a retrospective chart review of all adult patients who presented to the trauma service between January 2019 and June 2019. Collected data included demographics, trauma activation level, total interventions performed, interventions performed by the trauma team, interventions performed by subspecialty teams, and isolated injuries requiring orthopedic, neurosurgical, or other specialized care. Descriptive analyses were used to evaluate the data.

Results. The authors reviewed a total of 287 patient charts. Of these, 111 patients (38.7%) underwent operative intervention. Seventy-five patients (26.1%) received operative intervention from the orthopedic surgery team, 16 patients (5.6%) from the neurosurgery team, and 14 patients (4.9%) from other subspecialty teams. Only six patients (2.1%) underwent operative intervention by the trauma team.

Conclusions. The data suggest that many trauma admissions do not require trauma team interventions. This highlights the potential need to reassess the criteria for admitting trauma patients.

INTRODUCTION

The concept of trauma systems for the care of injured patients is well-established, with origins dating back to military history.[1] Over time, these systems have evolved into the modern North American trauma system, which encompasses prehospital care, acute surgical care, and recovery. This contemporary system has proven beneficial, significantly reducing trauma-associated morbidity and mortality.[1]

Despite these advancements, the North American trauma system faces challenges, particularly with the decreasing operative volume for trauma services as more patients are managed non-operatively.[2-7] This reduction in surgical experience for trauma surgeons is further exacerbated by the increasing compartmentalization of specialties and referrals to fields like orthopedics, neurosurgery, and interventional radiology.[2,3,8] Additionally, patients with isolated injuries requiring subspecialty care often receive post-operative care from trauma surgeons who did not participate in the initial surgery. As a result, the role of the trauma surgeon has shifted from being primarily interventional to increasingly supportive of other surgical subspecialists. This trend poses a concern for the trauma surgery subspecialty, as it reduces surgical opportunities and may deter surgical residents from pursuing this field.[3,4,9-12]

The aim of this study was to determine the percentage of trauma patients who were admitted and received interventions, and to identify which of these interventions were performed by non-trauma specialists.

METHODS

Patient Selection. The authors conducted a retrospective chart review on all patients aged 18 years or older who presented through the trauma service between January 2019 and June 2019. Patients meeting the criteria were identified using the trauma registry database at our American College of Surgeons Committee on Trauma-verified Level 1 trauma center. The study was reviewed and approved by the Institutional Review Board (IRB) of Ascension Via Christi Hospitals Wichita, Inc.

Data Collection. Medical records were reviewed to collect pertinent information, including age, gender, trauma activation level, Injury Severity Score (ISS), Glasgow Coma Scale (GCS) score, procedures and operations performed, interventions by the trauma surgery team, interventions by subspecialty surgery teams, isolated injuries (orthopedic, neurosurgery, and other), intensive care unit (ICU) admission and length of stay, hospital length of stay, discharge disposition, and mortality. For this study, a 'procedure' was defined as an ICU or bedside procedure performed by the trauma surgery team, which included central venous lines, chest tubes, arterial lines, bronchoscopy, resuscitative endovascular balloon occlusion of the aorta (REBOA), dialysis catheters, and intracranial pressure (ICP) monitors.

Statistical Analysis. Interval/ratio level data were summarized using means and standard deviations for normally distributed data or medians and quartiles for skewed data, as well as ordinal data. Nominal data were summarized by counts and proportions. All statistical analyses were conducted using complete case analyses in IBM SPSS Statistics for Windows, version 19.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Data from 287 patients were included in this study, with a majority being male (59.6%) and a median age of 66 years (Table 1). Of the patients evaluated, 9.1% were full trauma activations, 44.3% were partial trauma activations, 19.2% were trauma consults, and 27.5% had no trauma activation. The median ISS was 9, and the median GCS score was 15, with 93.4% of patients having a GCS score of 8 or higher. The massive transfusion protocol (MTP) was initiated in only one patient.

Less than half of the patients (39.4%, n = 113) underwent a surgical intervention by any surgical team, while the majority (60.6%, n = 174) did not undergo any surgical intervention (Table 2). Among those who did have surgery, most operative interventions were performed by teams other than the trauma surgery team. Specifically, 76 patients (26.5%) underwent surgery by the orthopedic team, 5.6% by the neurosurgery team, and 5.2% by other teams, including general surgery, interventional radiology, and plastic surgery. Only six patients (2.1%) underwent surgery by the trauma surgery team.

Table 1. Demographics, trauma activation level, and injury severity of patients admitted to the trauma service.

Parameter	Number (%)
Number of observations	287 (100%)
Age (years)[a]	66 (40 – 81)
Male gender	171 (59.6%)
Trauma activation level	
Full (Level I)	26 (9.1%)
Partial (Level II)	127 (44.3%)
Consult	55 (19.2%)
No trauma activation (direct admission)	79 (27.5%)
Injury Severity Score[a]	9 (4 – 10)
Glasgow Coma Scale score	
<8	13 (4.5%)
≥8	268 (93.4%)
Not documented	6 (2.1%)
Massive transfusion protocol initiated	1 (0.3%)

[a]Data presented as median (IQR)

Table 2. Operative interventions by specialty for patients admitted to the trauma service (entire sample).

Parameter	Number (%)
Number of observations	287 (100%)
No operation performed	174 (60.6%)
Operation performed	113 (39.4%)
Orthopedics	76 (26.5%)
Neurosurgery	16 (5.6%)
Other subspecialty (includes general surgery)	15 (5.2%)
Trauma	6 (2.1%)

When considering all types of interventions, both procedures and surgeries, 113 patients (39.3%) underwent some form of procedural or operative intervention (Table 3). About half of the patients (48.1%) were admitted to the ICU. Sixteen patients (5.6%) had ICU procedures performed by the trauma team, with a total of 26 procedures performed across all patients (9.1%), some undergoing more than one procedure. The individual procedures included nine central venous lines, seven chest tubes, six arterial lines, one bronchoscopy, one resuscitative endovascular balloon occlusion of the aorta (REBOA), one dialysis catheter placement, and one ICP monitor placement. The median ICU length of stay was two days, while the median hospital length of stay was three days.

DISCUSSION

To be verified as a Level 1 trauma center by the American College of Surgeons Committee on Trauma, several surgical subspecialists, including neurosurgery and orthopedics, must be available. The center also must maintain less than 10% non-surgical admissions, less than 5% undertriage, and less than 50% overtriage.[13] While the Advanced Trauma Life Support-certified providers can begin major trauma resuscitations without a qualified attending surgeon present, an attending surgeon must arrive within 15 minutes of the patient's arrival to direct the resuscitation. Once the patient is assessed and stabilized, a decision is made regarding admission.[13] These standards are particularly relevant when considering the findings of this study.

Table 3. Interventions and outcomes of patients admitted to the trauma service.

Parameter	Number (%)
Number of observations	287 (100%)
Operative intervention	113 (39.4%)
Intensive care unit (ICU) admission	138 (48.1%)
ICU length of stay (days)[a]	2 (2 – 4)
Patients undergoing a trauma team ICU procedure	16 (5.6%)
Total procedures performed	26 (9.1%)
Central venous line placement	9 (3.1%)
Chest tube placement	7 (2.4%)
Arterial line placement	6 2.1%)
Bronchoscopy	1 (0.3%)
REBOA	1 (0.3%)
Dialysis catheter placement	1 (0.3%)
Intracranial pressure monitor placement	1 (0.3%)
Hospital length of stay (days)[a]	3 (2 – 6)
Disposition destination	
Home or self-care/home with services	137 (47.7%)
Long-term care/skilled nursing facility	71 (24.7%)
In-patient rehabilitation	22 (7.7%)
Hospice	8 (2.8%)
Inpatient mental health/psychiatric hospital	6 (2.1%)
Correctional Facility/court/law enforcement	4 (1.4%)
Against medical advice	3 (1.0%)
Other	21 (8.4%)
In-hospital mortality	15 (5.2%)

[a]Data presented as median (IQR)

In our study, less than half of trauma admissions involved any surgical intervention. Among those who underwent surgery, the majority were treated by orthopedic or neurosurgical subspecialists. Similar results were observed in a large study of a Level 1 trauma center by Ciesla et al.,[2] which reviewed 1,667 patients. They found that 92% of patients admitted to the trauma service did not meet trauma activation criteria, with 52% having injuries confined to a single abbreviated injury scale (AIS) region and 46% to the extremities. Only 11% of patients had surgeries performed by trauma surgeons, while orthopedic surgeons performed surgeries on 28%. The authors concluded that many trauma patients could be more appropriately admitted to teams other than the trauma surgery team, potentially preserving resources.

One potential strategy to reduce unnecessary admissions to the trauma service is to revise how Level 2 traumas are assessed. Ciesla et al.[2] suggested that these patients could first be evaluated by an emergency medicine physician, who would then determine whether to admit the patient to an appropriate team, such as medicine, non-trauma surgery, or trauma surgery. Another approach, possibly in conjunction with the first, involves a multidisciplinary team of physicians assessing the patient after initial evaluation and resuscitation.

This team could include specialists from surgical subspecialties, emergency medicine, internal medicine, and family medicine. This multidisciplinary discussion would occur in the trauma bay before the patient is admitted, with the team collaboratively determining the patient's admission status. If admitted to a non-trauma team, the trauma team would continue to follow the patient as consultants if needed. This approach aligns with our findings that our trauma admissions had a median ISS of 9, only 2.1% required trauma-specific operations, and only 5.6% of patients required a trauma team procedure during their inpatient stay.

In fact, some existing services within the contemporary trauma system already function similarly to this proposed plan.[14-16] For example, patients with isolated hip fractures are admitted to the medicine service, with the orthopedic team consulting as needed. It also may be beneficial to admit certain patients to a geriatric service, given evidence that gerontologists can improve outcomes for trauma patients.[14-16] A relevant case might be a geriatric patient with an isolated rib fracture and multiple medical comorbidities. Overall, it may be time to reconsider the current American College of Surgeons guidelines.

Limitations. This study had several limitations. As a retrospective review, there is a risk of selection bias and information bias, which may affect the accuracy of the analysis. Additionally, the study was conducted over a relatively short period of approximately five months. This limited time frame may not be fully representative of trauma admissions, and the findings could differ if a longer study period were used, accounting for seasonal variations. Furthermore, the study was performed at a single site, which may limit the generalizability of the results to other trauma centers. To better understand the outcomes investigated in this study, future research could include a larger sample size and/or a multicenter prospective study involving Level 1 trauma centers.

CONCLUSIONS

In the context of potential over-triage, these findings suggest the need to re-evaluate current American College of Surgeons guidelines and admission criteria for trauma patients. The data also may highlight the importance of considering admissions by non-trauma surgical subspecialties or medical teams, rather than defaulting to trauma surgery admissions. Such decisions could play a crucial role in enhancing resource efficiency, improving patient care, and ultimately, optimizing patient outcomes.

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Brief Report

Descriptive Evaluation in Outpatient Follow-Up of Direct LDL-C in Patients with Elevated Triglycerides and Diabetes

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ABSTRACT

Introduction. An annual fasting lipid panel (FLP) is recommended for patients with diabetes, with more frequent testing advised during the escalation of cholesterol-lowering therapy. However, the calculated low-density lipoprotein cholesterol (LDL-C) using the Friedewald equation becomes unreliable when triglycerides are ≥400 mg/dL. In such cases, providers must order a separate direct LDL-C assay to obtain accurate results. Failing to do so may lead to missed opportunities for therapy intensification. This study examined an institution's current practices for following up on invalid LDL-C results, especially considering the stringent LDL-C targets outlined in recent guidelines and consensus statements.

Methods. The authors conducted a retrospective chart review across 13 outpatient clinics within a single health system over five years. The study included patients aged 40-75 with diabetes who had at least one invalid LDL-C result. They assessed the frequency of ordering a direct LDL-C assay within seven days of an invalid LDL-C result.

Results. Out of 1,364 unique invalid FLPs, 97 (7.1%) met the criteria for the primary outcome. The rate of therapy escalation was not numerically affected by whether a direct LDL-C was ordered or the provider type. However, patients without a direct LDL-C ordered within seven days showed a trend towards more frequent therapy escalation (16.2%, n = 25/154) compared to those with a direct LDL-C (14.9%, n = 23/154).

Conclusions. The current practice at this institution of manually ordering a direct LDL-C assay to verify invalid LDL-C results poses a risk of missing necessary guideline-directed therapeutic intensification. This process may be improved by implementing a reflex direct LDL-C assay.

INTRODUCTION

Diabetes mellitus is a major risk factor for the development of atherosclerotic cardiovascular disease (ASCVD), the leading cause of mortality and morbidity in patients with diabetes.[1,2] ASCVD also significantly increases the costs and demands of diabetes care.[3,4] A fasting lipid panel (FLP) is essential for assessing clinical ASCVD risk, with low-density lipoprotein cholesterol (LDL-C) identified as the primary contributor to atherogenic risk.[5] However, FLPs do not directly measure LDL-C; instead, the Friedewald equation is used to calculate its value. When triglycerides (TG) exceed 400 mg/dL, the Friedewald equation yields an "invalid" LDL-C value, rendering it clinically useless.[6] In such cases, a direct LDL-C assay, which measures LDL-C independently, provides a more accurate estimation of ASCVD risk. While a direct LDL-C is generally more reliable than other formulas, most comparison studies in patients with diabetes have excluded those with elevated TG.[7-13]

In this health system, the standard outpatient practice relies on the Friedewald equation to calculate LDL-C from a patient's FLP. However, there is no automated reflex order for a direct LDL-C assay when an "invalid" LDL-C is reported. Providers must manually review FLP results and determine whether a direct LDL-C assay is necessary. Given that recent guidelines and consensus statements have set increasingly stringent LDL-C goals, appropriate monitoring and pharmacotherapy are crucial for effective care.[1,14,15] Adjusting medications to achieve LDL-C targets has been associated with a reduction in major vascular events.[16,17] However, limited information is available on the clinical consequences of relying on manual ordering of direct LDL-C assays rather than automating the process for elevated TG.[18-20]

The authors of this retrospective study examined the institution's current practices in following up on "invalid" LDL-C results to identify opportunities for improving patient care and reducing ASCVD risk.

METHODS

Study Design and Setting. The authors conducted a retrospective chart review across 13 outpatient clinics within a single health system, from January 1, 2016 to December 31, 2021. This study was reviewed and approved by the local Institutional Review Board (IRB). The clinics are part of Ascension Medical Group Via Christi, which provides both primary and specialty care to patients in south-central Kansas.

Study Population. The authors included patients diagnosed with Type 1 or Type 2 diabetes, aged 40-75 years, who had at least one "invalid" LDL-C result due to TG ≥400 mg/dL during the study period. The lipid panels were ordered by affiliated outpatient providers practicing in primary care, cardiology, or endocrinology. Patients with familial hypercholesterolemia or those who were pregnant at the time of the baseline lipid panel were excluded.

Data Collection. Clinical and demographic data were collected from the health system's electronic health record (EHR). Patient characteristics included age, biological sex, diabetes diagnosis (Type 1 or Type 2), race, ethnicity, and primary insurance payer. The active medication list for each patient was reviewed at the time of the baseline "invalid" LDL-C and again two weeks later. Data were collected on documented prescriptions and any escalation of cholesterol-lowering therapy, including the use of statins, fibric acid derivatives, ezetimibe, proprotein convertase subtilisin/kexin type 9 (PCSK-9) inhibitors, bile acid sequestrants, prescription omega-3 fatty acids, niacin, and bempedoic acid. The ordering provider type for the baseline FLP and

any follow-up labs also was noted, distinguishing between physicians (M.D. or D.O.), physician associates (P.A.), and advanced practice registered nurses (APRN). The first FLP with an invalid LDL-C during the study period was defined as the "baseline FLP," though this may not have been the first FLP recorded in the EHR. All subsequent FLPs and direct LDL-C results following the baseline event were collected until the end of the study period. Lab results from outside the health system or during inpatient admissions were excluded.

Primary Outcome. The primary outcome was the frequency of direct LDL-C assays ordered within seven days of an "invalid" LDL-C result. The health system retains blood samples for up to seven days, allowing for additional analysis without requiring a repeat blood draw. Each FLP with an invalid LDL-C result was treated as a new encounter, meaning that a single patient could have multiple FLPs included in this study.

Secondary Outcomes. Secondary outcomes were analyzed in encounters where a repeat FLP was available within 18 months of the baseline event or before the study period ended, whichever came first. These outcomes included the time from the baseline FLP to the direct LDL-C order and/or repeat FLP, as well as the frequency of direct LDL-C inclusion in subsequent lipid panels. The frequency of cholesterol-lowering therapy escalation within two weeks of the baseline lipid panel also was examined. Therapy escalation was defined as an increase in dose, the addition of a cholesterol-lowering medication, or a change in statin use from a lower to a higher intensity dose. Rates of therapy escalation were compared based on provider type and whether a direct LDL-C had been ordered within seven days. Additionally, the frequency of direct LDL-C orders within seven days of the baseline FLP, stratified by provider type, was compared.

Statistical Analysis. Descriptive statistics were used to analyze the data. The secondary outcome analysis was restricted to baseline FLPs. IBM SPSS (Statistical Package for the Social Sciences; Armonk, NY), version 26, was used for the analysis.

RESULTS

A total of 1,392 diabetic patients were identified as having at least one "invalid" LDL-C result during the study period. These patients collectively had 1,806 unique FLPs with an "invalid" LDL-C result. After applying the inclusion criteria, 442 baseline FLPs were excluded, leaving 1,364 FLPs for analysis. Of these, 97 (7.1%) had a direct LDL-C assay ordered within seven days of the "invalid" LDL-C result. The characteristics of the entire patient population are detailed in Table 1.

Table 1. Patients' characteristics.

Clinical Variables	Total FLP Assays (N = 1364)
Biological sex at birth, no. (%)	
Male	792 (58.1)
Female	572 (41.9)
Age, mean years (SD)	57 (8.8)
Diabetes diagnosis, no. (%)	
Type 2	1,340 (98.2)
Type 1	24 (1.8)
Race, no. (%)	
White or Caucasian	1,257 (92.1)
Black or African American	53 (3.9)
Asian	16 (1.2)
American Indian or Alaska Native	8 (0.6)
Decline to specify	30 (2.2)
Ethnicity, no. (%)	
Not Hispanic or Latino	1,249 (91.6)
Hispanic or Latino	92 (6.7)
Decline to specify	23 (1.7)
Primary insurance, no. (%)	
Commercial	806 (59.1)
Medicare	373 (27.3)
Medicaid	39 (2.9)
Tricare	11 (0.8)
Self-pay	52 (3.8)
Charity	3 (0.2)
Not reported	80 (5.9)

FLP, fasting lipid panel; SD, standard deviation.

For the secondary outcome analysis, 955 FLPs with an eligible follow-up FLP were included. Among these, 71 (7.4%) had a direct LDL-C obtained within seven days. The majority of baseline FLPs were ordered by physicians (839), followed by P.A.s (67) and APRNs (49). When a direct LDL-C was measured, it was typically obtained a mean of 115 days after the baseline "invalid" LDL-C result. The follow-up FLP was drawn a median of five months after the baseline FLP, with a direct LDL-C being measured during follow-up in 2.6% (n = 25) of cases.

Of the 955 FLPs included in the secondary outcome analysis, 154 (16.1%) were associated with an increase in cholesterol-lowering therapy within two weeks of the FLP. Although overall rates were low, patients without a direct LDL-C ordered within seven days showed a slight trend toward more frequent therapy escalation (16.2%, n = 25/154) compared to those who had a direct LDL-C ordered (14.9%, n = 23/154).

DISCUSSION

Findings of this study highlighted that direct LDL-C values are infrequently obtained in patients with "invalid" LDL-C results due to elevated triglycerides. The clinics involved may not be achieving timely cholesterol monitoring, which could hinder optimal, evidence-based patient care. Identifying these potential gaps in current practice may support the development of new procedures to enhance patient outcomes.

The findings also indicated that the rate of follow-up using a direct

LDL-C assay within seven days of an "invalid" LDL-C result is low, with the direct assay most ordered on the same day as the baseline lab. Instead, providers often opted for a repeat FLP, which typically occurred five to six months after the initial event. This delay may suggest difficulties providers face in making guideline-directed medical therapy adjustments. The data across different provider types suggested that these monitoring trends are consistent throughout the institution.

Within this health system, it was estimated that a direct LDL-C assay costs approximately 50% less than an FLP. Despite this, the study showed that providers tend to favor repeating an FLP over ordering a direct LDL-C, resulting in a 100% increase in monitoring costs. Implementing a reflex direct LDL-C assay could potentially reduce lab monitoring costs by about 25%, not accounting for the additional time health care personnel spend collecting, analyzing, and interpreting labs. Previous literature has found that using direct LDL-C assays can lead to a 33% cost savings compared to FLP monitoring.[21]

Limitations. This study had several limitations, primarily due to its retrospective design. The rationale behind dose escalation decisions, or the lack thereof, could not be determined without insight into the treatment decision-making process. The accuracy of the medication lists relied on the practices of individual providers, and there was a possibility of incomplete lab records. Additionally, only the provider's degree was analyzed, leaving the influence of the provider's specialty on lab monitoring preferences unknown.

CONCLUSIONS

Through this study, the authors found that the lack of LDL information, due to the limitations of the standard FLP, can increase the risk of patients receiving insufficient therapeutic intensification. This, in turn, may impede the achievement of guideline-based goals for optimal cholesterol-lowering therapy and ASCVD risk reduction. Implementing a reflex direct LDL-C assay with FLP orders, coupled with provider education, could enhance adherence to guideline-recommended therapy while reducing healthcare costs.

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KANSAS JOURNAL of MEDICINE

Brief Report

Type 1 Diabetes Mellitus in Movies: The Hollywood Effect

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ABSTRACT

Introduction. Type 1 diabetes mellitus (T1D) is one of the most common chronic diseases with childhood onset. Cinematic films and movies can reach populations worldwide and affect their concept of this disease. Through this research, the authors examined the accuracy of movies depicting T1D from childhood into adulthood.

Methods. We conducted an internet search of several databases, which resulted in a list of 39 movies from 2000 to 2022 with characters who had diabetes. We ultimately assessed 13 fictional movies. We calculated the percentages of movies that addressed vital aspects of T1D such as disease management, access to care, character development, and complications. We also applied a qualitative approach to assess the depth and accuracy of the portrayal of T1D.

Results. Movies portrayed severe but rare diabetes manifestations such as coma. They emphasized access to essential diabetes supplies and the cost of care. It was not until 2020 that movies featured a continuous glucose monitor (CGM) and insulin pumps. They presented female characters as resilient and unaffected by the struggles of their T1D.

Conclusions. This sample of fictional movies portrays extreme T1D symptoms and mostly outdated monitoring and treatment technology. It would be beneficial if future movies reflected the advances in closed-loop CGM/insulin pumps. Clinicians should know how the movie industry presents the disease to their patients. Clinicians can use popular movies to start difficult discussions with patients about topics pertinent to the comprehensive care of T1D.

INTRODUCTION

Type 1 diabetes mellitus (T1D) is a prevalent chronic disease, particularly among children, but can manifest at any age.[1] Its global prevalence is 9.5 per 10,000 people, with an incidence rate of 15 per 100,000 people.[2] Given its widespread occurrence, it is crucial that the portrayal of T1D in popular media, such as movies, is accurate and informative.

Movies can reach populations worldwide and affect their concept of T1D. Prior reviews have concluded that representations of people with T1D in films are susceptible to metaphor and exaggeration and often are inaccurate.[3] A 2017 review of 20 Bollywood movies that included characters with diabetes found that they were peripheral characters with minimal screen time.[4] A small number of studies have examined the accuracy of T1D portrayals in Western movies. The authors in this study sought to evaluate the depiction of T1D in fictional English-language movies.

METHODS

This retrospective, observational study identified movies with several different approaches, including: "diabetes in movies" in Google and PubMed, the advanced search option for all movies with the keyword "diabetes" in the Internet Movie Database (IMDb),[5] and "list of films featuring diabetes" using the English language version of the website Wikipedia.[6] We excluded documentaries, non-fictional and non-English language movies, and those released before 2000 to avoid heterogeneity related to different time eras. We screened an initial list of 39 movies for substantial content related to the following variables: T1D disease management, access to care, character development, and complications, which resulted in 13 movies. We calculated percents to quantify the presence of these variables and employed a qualitative method to assess the depth and accuracy of the portrayal of T1D.

An individual with a 13-year history of T1D and a board-certified internist reviewed the movies independently to provide both patient and professional perspectives.

RESULTS

We assessed 13 fictional movies (Table 1). Disease management is the cornerstone in about half of the movies reviewed, mostly through scenes of hypoglycemia. Several tackled the importance of diabetic supplies. In *12 Feet Deep* (2017), the character is trapped underwater without supplies and becomes unconscious. *Greenland* (2020) also focused on the importance of packing supplies. In *Panic Room* (2002), the character carries the glucagon kit needed to reverse hypoglycemia. The accurate illustration of advances in treatment technologies took much time to come to cinema. An insulin pump first appears in *Greenland* (2020) but is an old model for that era. *Turning Red* (2022) shows an infusion pump. *Purple Hearts* (2022) presents a CGM and an insulin pump.

Table 1. List of assessed movies.

Movie	Date	Director	Genre
Purple Hearts	2022	Elizabeth Allen Rosenbaum	Romance
Turning Red	2022	Domee Shi	Animated-Comedy
Greenland	2020	Ric Roman Waugh	Thriller
12 Feet Deep	2017	Matt Eskandari	Horror
A Deadly Adoption	2015	Rachel Lee Goldenberg	Thriller
Broken	2012	Rufus Norris	Drama
State of Emergency	2011	Turner Clay	Horror
The Next Three Days	2010	Paul Haggis	Thriller
Wonderful World	2009	Joshua Goldin	Drama
Derailed	2005	Mikael Håfström	Thriller
Panic Room	2002	David Fincher	Thriller
No Good Deed	2002	Sam Miller	Thriller
Memento	2000	Christopher Nolan	Thriller

Three movies (23%) display the financial impact on T1D control. The lack of resource access in *The Next Three Days* (2010) leads to fluctuation and poor glucose control. *Purple Hearts* (2022) highlights the high cost of insulin when the character runs out due to low income. *Derailed* (2005) illustrates the cost of a kidney transplant and its associated medications.

Three movies (23%) send strong positive messages about resilience. Interestingly, all three characters are females. In *Broken* (2012), an adventurous 12-year-old manages T1D meticulously, not deterred by it. In *Purple Hearts* (2022), the character is hardworking and does not give up on her dreams. Similarly, T1D does not limit the character in *Turning Red* (2022).

Most of the movies reviewed (70%) highlighted the lifestyle effects of T1D outcomes. In *The Next Three Days* (2010), the character is a prisoner with fluctuating blood sugar. In *Panic Room* (2002), the character has poor dietary habits and uncontrolled sugar. Diabetic coma, a severe complication, is illustrated in *No Good Deed* (2002), *Wonderful World* (2009), *State of Emergency* (2011), and *A Deadly Adoption* (2015). *Memento* (2000) portrays insulin misuse (stacking) resulting in death. Renal failure, a significant long-term complication, is illustrated in *Derailed* (2005) with a character that has failed two kidney transplants and awaits a third one. Finally, in *Turning Red* (2022), the opposite is displayed with well-controlled T1D using an up-to-date insulin infusion pump.

DISCUSSION

The most common symptom of diabetes portrayed in movies is hypoglycemia, as it lends itself well to drama. Movies tend to overemphasize severe hypoglycemia with manifestations such as fainting or coma, but descriptions are mostly accurate. In real life, hypoglycemia is not as severe or as frequent, especially in patients monitoring blood sugars. Diabetic patients usually can recognize early symptoms, such as tremors, sweating, and hunger, and correct their blood sugar.[7] The more advanced symptoms like seizure and coma happen at much lower glucose levels if not treated.[8,9] It is not easy to show hyperglycemia's effects in a movie. Characters with high or fluctuating sugar appear but without much cinematic emphasis on associated symptoms.

The management of T1D is heavily dependent on supplies. Several movies highlight the importance of being prepared. That takes self-discipline, planning, and attention to detail, which can be problematic in adolescents. A different aspect, the lack of resources, is presented in adults. Poor socioeconomic status is associated with worse diabetes control and increased hospitalizations.[10] Total direct estimated costs of diabetes increased from $227 billion in 2012 to $307 billion in 2022. In January 2023, the Insulin Affordability and the Inflation Reduction Act capped the out-of-pocket insulin cost to Medicare Beneficiaries at $35.00.[11] In March 2023, Eli Lilly announced the Insulin Value Program, where all Lilly insulins are available for $35 a month regardless of insurance.[12]

The psychological aspect of T1D is not to be underestimated. Movies show adolescents with T1D as trying to fit in and be perceived as ordinary by their peers. In practice, adolescent diabetics are typically assessed for depression, anxiety, school absences, family conflict, and other mental health challenges, especially if non-compliant.[13,14] In recent movies, T1D characters are presented as successful and integrated into their environments. This positive message could significantly impact adolescents, an inspiration to overcome their psychological challenges.

Adolescents who perceive greater sharing of responsibility for their T1D care with their caregivers are more likely to engage in better management of their disease.[15] In movies, many T1D characters cannot manage their disease due to poor habits. Similarly, the trend for diabetes control in the U.S. has not been favorable. The National Health and Nutrition Examination Survey found a 7% decrease in control rate from 2015 to 2018 versus 2007 to 2010, with a 0.3% higher hemoglobin A1C.[16] In adolescents, the SEARCH for Diabetes in Youth study found that 30% had no documentation of A1C values at appropriate intervals.[17] Poor diabetes control can lead to severe and life-altering complications such as peripheral neuropathy, retinopathy, nephropathy, and vascular disease with potential loss of limbs and vital organ dysfunction.[18] The long-term effects of poor diabetes control are not typically addressed in movies but can be an easy target to raise awareness and highlight the importance of adherence to therapy.

The treatment and management of T1D have evolved significantly over the last 20 years. The use of insulin pumps drastically increased since 1993, when the Diabetes Control and Complication Trials showed a significant reduction in T1D complications with tighter control.[19] In the U.S., the number of insulin pump users grew from 7,000 in 1990 to 100,000 in 2000 and to greater than 350,000 in 2022.[20] New insulin pumps are user-friendly, small, and programmable by touch screen. Hybrid closed-loop systems include an algorithm-driven automated insulin delivery to correct high or low blood sugar. Coupled with a CGM, they offer better glucose control and reduced risk of hypoglycemia.[21] Movies have only recently been proactive in displaying insulin pumps or CGM. The lag technological innovations on the big screen is understandable, as with lengthy production, the insulin pump or CGM featured is likely an older model.

Due to its observational nature, this study had several limitations, such as selection bias, recall bias, and limited generalizability. The most critical limitation was the subjective nature of movie evaluation. This study used no objective method of interpretation for visual data, and personal bias could have affected analysis.

CONCLUSIONS

This sample of fictional movies described T1D symptoms mostly accurately but portrayed outdated technology for monitoring and treatment. Future movies could reflect the advances in closed-loop CGM/insulin pumps and their usefulness in preventing hypo/hyperglycemia. Positive messages about both male and female teenagers with controlled T1D could be helpful. To heighten awareness, consequences of poor T1D control, such as cardiovascular disease, amputation, or blindness, could be presented. Those might be harsh scenes, but they highlight the importance of lifestyle modifications and treatment compliance to avoid early morbidity and mortality.

Representations of T1D in movies immediately affect an audience of millions. Hence, they deserve greater attention from health care providers. A fictional movie character could influence the attitude of patients toward CGM devices and closed-loop insulin pumps. Teenagers are affected by what they see on the screen. Those characters could sway their compliance with treatment and their outlook on T1D outcomes. Clinicians must know how the movie industry presents T1D to their patients. They can correct misconceptions while emphasizing characters with accurate depictions of manifestations and management. Clinicians can use popular movies to start difficult discussions with their patients about new treatment options, compliance, potential complications, self-esteem, and many other topics pertinent to the comprehensive care of T1D.

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Brief Report

Fractures in the Transgender Population: A Descriptive Study

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ABSTRACT

Introduction. While there is some data on the bone health of transgender individuals, less is known about their fracture patterns. The authors of this study aimed to describe the anatomic locations of fractures and the prevalence of select comorbidities among transgender patients who presented with fractures at a single institution.

Methods. The authors conducted a retrospective chart review of patients with fractures at a single institution between January 2020 and January 2021. The study examined demographics, fracture locations, and comorbidities for all transgender individuals who sustained fractures.

Results. The average age of patients was 35.7 ± 13.2 years. The shoulder and upper arm were the most common fracture sites, accounting for 38% of injuries. Twenty-seven percent of transgender patients presented with multiple fractures. Notably, no lumbar spine fractures were observed in this group. The prevalence of depression was 54%, and hypertension was 19% among transgender patients. Although 85% of fractures were not due to high-energy trauma, none of the patients had a documented history of bone health disorders.

Conclusions. This study provides insights into the fracture patterns among transgender individuals at a single institution, highlighting a tendency toward low-energy fractures in a relatively young population. Further research, including age-matched comparative studies, is needed to better understand bone health and fracture risk in transgender patients.

INTRODUCTION

In 2016, an estimated 390 per 100,000 U.S. adults identified as transgender.[1] Transgender and gender-nonconforming individuals may choose to manage gender dysphoria through gender-affirming hormone therapy (GAHT),[2-4] which could affect bone health, highlighting the need for further research on associated risks.[5]

Prior studies have shown changes in bone mineral density in the transgender population, particularly among transgender women.[6,7] However, the impact of transgender status and GAHT use on fracture risk remains unclear. Previous research found that transgender women over 50 using GAHT long-term had a significantly higher fracture risk after both low and high-impact injuries compared to age-matched cisgender men, though their fracture incidence was similar to age-matched cisgender women.[8] Additionally, transgender women experienced relatively more fractures in the hip, spine, forearm, and humerus compared to cisgender men.

Various health conditions can influence bone health and fracture risk. However, the limited existing data on fractures among transgender individuals primarily focus on prevalence without considering comorbidities, despite their known impact on bone health.[8] Certain comorbidities, such as hypertension[9] and depression,[10] are more common in the transgender population. The purpose of this study was to retrospectively assess fractures and related comorbidities in the transgender population treated at a single academic institution.

METHODS

A local Institutional Review Board (IRB) approved this study. Data were obtained using Healthcare Enterprise Repository for Ontological Narration (HERON) queries and chart reviews.[11,12] International Classification of Diseases (ICD) 10 codes were employed to identify patients treated at the authors' institution, a tertiary academic center, who experienced a fracture between January 1, 2020, and January 1, 2021, as well as to collect data on fracture locations, gender dysphoria, and comorbidities. Two authors conducted chart reviews on all individuals with a gender dysphoria diagnosis to gather additional data.

Individuals were included in the analysis if their medical records contained a diagnosis of gender dysphoria (ICD10 code F64.x) and documented transgender status. GAHT and gender-affirming surgeries (GAS) also were recorded. Patients identifying as transgender but not receiving GAHT were included in the study, as previous research has identified variations in bone density among trans women prior to initiating GAHT.[13] Relevant fracture information and comorbidities were described for the transgender population.

RESULTS

Patient demographics are listed in Table 1. Among the 26 transgender individuals, 14 were trans women and 12 were trans men, with an average age of 35.7 ± 13.2 years. All but one of the transgender patients were White. The history of GAS and GAHT is detailed in Table 2. Of the group, 11 individuals (42.3%) had undergone GAS, and 24 (92.3%) were using GAHT.

Table 1. Participant demographic characteristics.

Measure	Transgender Group (N = 26)
Age, y	
Mean (SD)	35.7 (13.2)
Median	33
Minimum	19
Maximum	64
Range	45
Biological sex at birth, no (%)	
Male	15 (58)
Female	11 (42)
Self-reported race, no (%)	
White/Caucasian	25 (96)
Black/African American	0
Other	1 (4)

Table 2. Transgender indentity, related gender affirming surgery, and fracture details (N = 26).

Measure	Number (Percentage)
Gender identity	
Transgender female	14 (54)
Transgender male	12 (46)
Undergoing GAHT in the study period?	
Yes	24 (92)
No	2 (8)
Gender affirming surgery	
Top surgery	1 (4)
Bottom surgery	3 (12)
Top and bottom surgery	1 (4)
Gonadectomy	6 (23)
None	15 (58)
Underwent surgery for fracture	
Yes	5 (19)
No	21 (81)
History of prior fractures	
Yes	7 (27)
No	19 (73)
Single high energy fracture event	
Yes	4 (15)
No	22 (85)
Gender affirming hormone therapy	
Transgender women	
Estradiol	4 (15)
Estradiol and progesterone	3 (12)
Estradiol and spironolactone	4 (15)
Estradiol, spironolactone, progesterone	1 (4)
None	2 (8)
Transgender men	
Testosterone cypionate	9 (35)
Testosterone enanthate	3 (12)
None	0 (0)

Fracture prevalence is summarized in Table 3. The most common fracture location was the shoulder and upper arm, accounting for 38% of all fractures. Notably, no lumbar spine fractures were observed in this group, and 27% of the patients presented with multiple fractures. Only 14% of the fractures were attributed to high-energy mechanisms of injury.

Regarding comorbidities, depression was the most prevalent, affecting 54% of the patients, followed by obesity at 31%. Less common comorbidities included hypothyroidism (12%), chronic kidney disease (15%), and essential hypertension (19%).

Table 3. Anatomic locations of fractures and patient co-morbidities.

Fracture Location or Comorbidity, no. (%)	Transgender Population (N = 26)
Foot and toe	3 (12)
Skull and facial bones	4 (15)
Ribs, sternum, and thoracic Spine	6 (23)
Lower leg and ankle	2 (8)
Shoulder and upper arm	10 (38)
Wrist and hand	6 (23)
Lumbar spine	0 (0)
Forearm	2 (8)
Femur	3 (12)
Multiple	7 (27)
Comorbidities, no. (%)	
Chronic kidney disease	4 (15)
Osteoporosis	0 (0)
Other bone density disorders	0 (0)
Essential hypertension	5 (19)
Hypothyroidism	3 (12)
Vitamin D deficiency	6 (23)
Obesity	8 (31)
Depression	14 (54)

Note: Data represents positive results from a single ICD10 code indicating presence or no presence of associated condition (i.e., foot and toe fracture vs none).

DISCUSSION

The impact of transgender status and gender-affirming treatment on fracture risk, location, and characteristics remains poorly understood.[8] In this study, fractures were most common in the shoulder and upper arm, with no lumbar spine fractures reported. This distribution differed from the general fracture population, where fractures are more frequently observed in the distal radius, proximal femur, ankle, and proximal humerus.[14] The proportion of shoulder and upper arm fractures in this study was notably higher than the previously reported rates of 4% and 13%, respectively.[14,15]

The study also differed from general fracture data in terms of patient age. The mean age of 35.7 ± 13.2 years in this transgender cohort was younger than the average age of 58 years typically reported in fracture populations.[14] This younger average age aligned with existing data showing that transgender individuals tended to be younger.[16] However, it raises concerns because only 15% of fractures in this group were caused by high-energy events, and a quarter of the patients had a history of prior fractures. These findings suggest potential compromised bone health, despite no diagnoses of osteoporosis or other bone conditions at the time of fracture. The younger age of these patients might have contributed to them not being evaluated for low bone mass or fracture risk.

Another indicator of compromised bone health was the presence of vertebral fractures.[17] The absence of lumbar spine fractures in this study is surprising, given that 85% of the fractures were low-energy, and approximately 25% of lumbar spine fractures in younger individuals were related to falls.[18] This absence might suggest that GAHT does not increase the risk of lumbar fractures. One study found that GAHT had no impact on lumbar spine bone mass after 12 months.[19] However, lumbar spine fractures can be underdiagnosed, particularly in younger patients, where suspicion may be lower.[20] Increased awareness

of GAHT's potential impact on bone health and further research into its effects on fracture risk are necessary. Until more data are available, bone health assessments in the transgender population should follow guidelines from the International Society for Clinical Densitometry.[21]

The transgender group in this study also exhibited conditions that affect bone health, notably depression and obesity. Over half of the participants had a history of depression, a rate significantly higher than the 9% reported among U.S. adults and the 33% noted in other studies of transgender individuals.[22,23] A 2018 meta-analysis found a significant association between depression and increased risk of fracture and bone loss.[24] Numerous studies have linked depression or antidepressant use with fracture risk, making it important to consider these factors in the transgender population.[24-28] Additionally, one-third of the study participants were obese, which may contribute to the higher incidence of upper arm fractures, as obesity has been associated with an increased risk of humerus fractures.[29] Given the prevalence of obesity in the transgender population,[30] further research is needed to explore the relationship between obesity, GAHT, and fracture risk.

Limitations. This study had limitations. First, the small sample size limited the generalizability of the findings. Additionally, the racial homogeneity of the transgender population in this study did not accurately reflect the broader diversity within the transgender community.[31] Another limitation was the potential for improper documentation of gender dysphoria and transgender status. Challenges in using gender-related terms to identify transgender patients in electronic medical records have been reported, which may have resulted in some transgender individuals not being included in our study.[32]

CONCLUSIONS

The impact of transgender status and GAHT on fracture risk remains unclear. While none of the transgender patients in this study had a documented diagnosis of osteoporosis or low bone mass, several factors raised concerns about compromised bone health, including fractures resulting from low-impact injuries and histories of prior fractures. These issues are particularly concerning given the relatively young age of the transgender group. To better understand the impact of transgender status on fracture risk, larger studies are needed that compare fracture incidence and location with age-matched cisgender patients, differentiate outcomes between trans women and trans men, evaluate changes over time and with the duration of GAHT, and account for mechanisms of injury and the influence of comorbidities.

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Keywords: transgender persons, bone fracture, hormone replacement therapy

KANSAS JOURNAL of MEDICINE

Brief Report

Clinical Efficacy of Ultrasound-guided Iliopsoas Corticosteriod Injection for Hip Pain

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ABSTRACT

Introduction. Iliopsoas bursitis and tendinopathy are common causes of hip pain and major contributors to snapping hip syndrome, which affects 5-10% of the general population. These conditions often are treated with conservative measures, including corticosteroid injections into the iliopsoas bursa. However, the clinical effectiveness of such injections has not been well studied. Through this study, the authors evaluated the efficacy of ultrasound-guided corticosteroid injections into the iliopsoas bursa.

Methods. The study included 68 patients diagnosed with iliopsoas tendinopathy, iliopsoas bursitis, or snapping hip syndrome (coxa saltans), all of whom received corticosteroid injections into the iliopsoas bursa as a standard treatment. A single-sample, non-experimental design was employed, with participants completing assessments of pain, mechanical symptoms, physical function, activity level, and total hip score at baseline, and again at three- and six-month post-injection. Data were collected from January 1, 2023, to April 1, 2024, and changes in the outcome measures were analyzed using repeated measures ANOVA.

Results. Participants showed significant improvements in pain, mechanical symptoms, physical function, and activity level at both three-month and six-month follow-ups. Additionally, overall hip scores improved statistically by the end of the study.

Conclusions. Our data suggest that ultrasound-guided corticosteroid injections into the iliopsoas bursa can effectively improve physical function, enhance the ability to perform daily activities and physical tasks, and reduce disability associated with iliopsoas tendinopathy. Further research with a longer follow-up period and more rigorous controls is warranted to confirm these findings and assess the long-term benefits and potential risks of the procedure.

INTRODUCTION

Coxa saltans, also known as snapping hip syndrome, affects 5-10% of the general population.[1,2] The iliopsoas tendon, a primary hip flexor, often is implicated in this condition, and iliopsoas tendinopathy is increasingly recognized as a cause of anterior hip pain and snapping hip.[2,3] Corticosteroid injections into the bursa surrounding inflamed tendons have been shown to be beneficial both pathologically and clinically for patients.[1,3]

Typical conservative treatments for tendonitis include oral and topical NSAIDs, physical therapy focusing on the hip flexion kinetic chain, instrument-assisted soft tissue massage, and activity modification.[3] Second-line therapy may include ultrasound-guided corticosteroid injections for cases that do not respond to conservative treatments.[4] Previous research has mainly focused on iliopsoas tendon injection after total hip arthroplasty as a post-operative pain adjunct, with longitudinal data showing improvement in about 75% of patients.[4,5] However, there are limited data on the longitudinal effect of interventions in non-operative patients. Ultrasound-guided corticosteroid injections have been shown to be more effective than the previous standard of fluoroscopic-guided injections, with the added benefit of no radiation exposure.[4-6]

We evaluated the efficacy of ultrasound-guided corticosteroid injections into the iliopsoas bursa in patients with iliopsoas tendinopathy. We assessed immediate and long-term efficacy using the Nonarthritic Hip Score[7] and the patients' ability to return to previous activity levels at spaced intervals after the injection.

METHODS

Study Design and Participants. The authors employed a single-sample, nonexperimental design to compare baseline (before injection but after diagnosis), three-month post-ultrasound-guided iliopsoas corticosteroid injections, and six-month follow-up using validated outcome measures for pain, mechanical symptoms, physical function, activity level, and total hip score.[7] The Nonarthritic Hip Score inventory assesses hip function and evaluates hip pain across four dimensions: pain, mechanical symptoms, physical function, and activity level. Participants rated their hip function and pain on a five-point scale (0 = extreme difficulty, 4 = no difficulty). Scores for the four questions in each dimension were summed, with lower scores indicating greater difficulty in hip function and higher levels of pain. The overall hip score was calculated by summing the scores from all four dimensions and multiplying the raw total by 1.25, resulting in a possible score range from 0 to 100. Higher scores reflect minimal difficulty experienced due to hip pain within the past 48 hours.

This study was conducted at the University of Kansas School of Medicine-Wichita Sports Medicine Program at Ascension Via Christi, using a convenience sample of 68 adult English-speaking patients diagnosed with iliopsoas tendinopathy. All participants underwent corticosteroid injections into the iliopsoas bursa as a standard treatment. Each participant received an iliopsoas bursa corticosteroid injection using 3 mL lidocaine 1% without epinephrine and 1 mL 40 mg/mL triamcinolone. Participants completed a seven-minute surveys (baseline, three-month, and six-month follow-up). The study protocol for human subject research was approved by the University of Kansas Medical Center and Ascension Via Christi Institutional Review (IRB) Boards.

Procedure. Participants completed the survey at three different time points: before the procedure, at three-month post-ultrasound-guided iliopsoas corticosteroid injection, and at the six-month follow-up.

Surveys were conducted using SurveyMonkey®, a secure web-based survey system, accessible via a quick response (QR) code printed on flyers distributed to participants. Participants also had the option to complete the survey on paper or over the phone after the initial online survey via QR code. Each survey included validated measures of pain, mechanical symptoms, physical function, and activity level to assess participants' pain levels, mechanical symptoms related to the hip, physical function, and ability to engage in other various activities as detailed by Christensen et al.[7] The baseline survey also included demographic questions (Table 1). Data collection took place from January 1, 2023 to April 1, 2024.

Table 1. Participants' characteristics at baseline.

Characteristics	Measure (N = 68)
Age	
Mean (SD), y	40.3 (16.1)
Median	38.5
Biological sex at birth, no. (%)	
Male	22 (32.4)
Female	46 (67.6)
Marital status, no. (%)	
Never married	25 (36.8)
Married	38 (55.9)
Divorced	3 (4.4)
Widowed	2 (2.9)
Body Mass Index	
Mean (SD)	27.4 (5.9)
Median	26.6
Minimum	17.0
Maximum	42.9
Employment status, no (%)	
Employed Full-time	37 (54.4)
Employed Part-time	11 (16.2)
Not employed, seeking employment	2 (2.9)
Not employed, not seeking employment	18 (26.5)
Race, no. (%)	
White or Caucasian	59 (86.8)
Black or African American	1 (1.5)
Hispanic or Latino	3 (4.4)
American Indian or Alaska Native	1 (1.5)
Two or more race	2 (2.9)
Decline to not answer	1 (1.5)
Other (please specify)	1 (1.5)

Statistical Analysis. We used standard descriptive statistics to create the demographic information, and repeated measures ANOVA to estimate the effect of the ultrasound-guided iliopsoas corticosteroid injections for hip pains on the outcome variables. All analyses were two-sided with α of 0.05. All survey questions were analyzed using IBM SPSS® Statistics Version 29 (Armonk, NY). A sample size of 30 was calculated as necessary for adequate power (>0.80) to detect significant group differences among the variables with 0.25 effect size and $p < 0.05$.[8]

RESULTS

Participant Characteristics. All 68 participants completed the baseline survey, with 30 (44.1%) providing data in the post-intervention (three months) survey and 32 (47.1%) in the follow-up survey (six months). The average age was 40.3 (SD = 16.1); 67.6% were female and 86.8% identified as Caucasian (Table 1).

Outcome Measures. Table 2 displays the participants' scores on each subscale item at the three-month and six-month surveys, showing increases from baseline. Specifically, participants experienced statistically significant improvements in pain ($F[2, 50] = 17.05$; $p = 0.002$; $\eta^2_p = 0.41$), mechanical symptoms ($F[2, 50] = 7.61$; $p = 0.001$; $\eta^2_p = 0.23$), physical function ($F[2, 46] = 10.37$; $p < 0.001$; $\eta^2_p = 0.31$), and activity level scores ($F[2, 46] = 3.43$; $p = 0.043$; $\eta^2_p = 0.13$) over the past 48 hours by the end of the study. Additionally, the participants' overall hip score showed a statistically significant improvement ($F[2, 50] = 7.23$; $p = 0.002$; $\eta^2_p = 0.22$). Post hoc pairwise comparisons revealed significant improvements across all measures between baseline and the six-month follow-up (Table 2).

DISCUSSION

Corticosteroid injections are known to provide relief for other musculoskeletal pathologies for up to 24 weeks following injections.[9] However, the duration of effect in iliopsoas tendinopathy has been less clear. Our study revealed positive effects on pain from the injection lasting up to 24 weeks. Additionally, we found that patients were more active following the injection. This was an important finding because increased exercise and general activity have been shown to be beneficial for pain in various musculoskeletal conditions,[10] which favors a positive prognosis for patients who become more active following the injection.

The technique used by the authors also has been shown to be safe, with no reported adverse events during the study. Corticosteroid injections have been effective in treating numerous musculoskeletal conditions,[11] including iliopsoas tendinopathy.[4,5] While these previous studies focused on post-operative pain management following hip surgery, our study focused on the effectiveness of corticosteroids for iliopsoas tendinopathy, irrespective of prior hip procedures.

Iliopsoas tendinopathy is an underrecognized cause of anterior hip pain affecting both active and sedentary individuals. Our findings suggest that ultrasound-guided iliopsoas bursa corticosteroid injection can be an effective treatment modality for iliopsoas tendinopathy. This study demonstrated improvements in pain, mechanical symptoms, physical function, and activity levels. Firstly, the significant reduction in pain highlights the effectiveness of the ultrasound-guided iliopsoas bursa corticosteroid injection in alleviating discomfort associated with iliopsoas tendinopathy. The large effect size ($\eta^2_p = 0.41$) indicates that this intervention had a substantial impact on reducing pain, which is a critical factor in enhancing patients' quality of life.[12]

The improvement in mechanical symptoms suggested that the injection not only alleviated pain but also addressed the underlying mechanical dysfunctions that contributed to the symptomatology of

Table 2. Outcomes scores at each survey with comparison to baseline.

Scale (Possible Range)	Time Point[a]			Change,[b] Mean Difference (95% CI)	*F*	η^2_p
	Baseline (N = 68)	Three Months (N = 30)	Six months (N = 32)			
Pain[c] (0-20)	10.8 (9.9-11.6) -	13.9 (12.7-15.1) [<.001]	13.3 (12.1-14.6) [<.001]	2.5 (0.8-4.3) [0.002]	17.05	0.41
Mechanical symptoms[d] (0-16)	9.7 (8.9-10.4) -	12.1 (11.1-13.0) [<.001]	11.1 (9.9-12.3) [0.008]	1.4 (-0.1-2.9) [0.001]	7.61	0.23
Physical function[e] (0-20)	12.1 (11.1-13.2) -	14.2 (12.8-15.7) [<.001]	14.0 (12.6-15.4) [<.001]	1.9 (-0.2-3.9) [<.001]	10.37	0.31
Activity level[f] (0-24)	11.4 (10.2-12.7) -	14.1 (12.1-16.0) [0.007]	12.7 (10.5-14.9) [0.109]	1.3 (-1.4-4.0) [0.043]	3.43	0.13
Hip score[g] (0-100)	54.9 (51.1-58.9) -	66.7 (59.9-73.5) [<.001]	62.9 (56.0-69.7) [0.005]	8.0 (-0.9-16.7) [0.002]	7.23	0.22

[a]Values shown are mean score (95% CI) [P value]. P values were calculated with the repeated measures ANOVA and denote the significance of *F* value.
[b]Change from baseline to six months (95% CI) [P value].
[c]Higher scores indicate less pain experienced in the past 48 hours.
[d]Higher scores indicate fewer symptoms experienced in the past 48 hours.
[e]Higher scores reflect minimal difficulty caused by hip pain in the past 48 hours.
[f]Higher scores indicate reduced non-arthritic hip pain in the past 48 hours.
[g]Higher scores reflect minimal difficulty due to hip pain in the past 48 hours.

iliopsoas tendinopathy. The moderate effect size (η^2_p = 0.23) supported the clinical relevance of this finding.[13,14]

The increase in physical function (η^2_p = 0.31) demonstrated that participants were better able to perform daily activities and engage in physical tasks following the intervention. This significant enhancement in physical function is essential for improving overall well-being and reducing the disability associated with iliopsoas tendinopathy.[10] Similarly, the improvement in activity level scores indicated that participants were more active following the injection. Although the effect size is smaller (η^2_p = 0.13), this finding is still meaningful, as increased activity levels are associated with better overall health outcomes.[15-17]

Lastly, the overall hip score (η^2_p = 0.22) showed a statistically significant improvement, reflecting comprehensive benefits of the intervention on hip-related symptoms and function. This broad improvement underscores the potential of corticosteroid injections as an effective treatment option for iliopsoas tendinopathy.[17]

Limitations. There are several limitations to this study. First, there was no control or comparison group, so we cannot infer causality. Secondly, the authors' institution is a referral center for various injections, including the iliopsoas bursa, for outside health care professionals. Consequently, many patients were referred for an iliopsoas injection by orthopedic surgeons and other providers not involved in the study, leading to a lack of standardization in pre- and post-injection therapies. Additionally, some patients underwent various surgical procedures, such as hip arthroplasty, which could have influenced the number of participants in the post-interventions and associated results.

During the study, a national shortage of triamcinolone required the use of methylprednisolone in some patients, and a comparison of the steroids used was not included in the analysis. Data collection was managed by Sports Medicine Fellows, leading to missed data collection between the graduation of one class and the start of the next, resulting in some patients missing the three-month follow-up.

Moreover, there was over a 50% attrition rate between baseline and six-month follow-up, limiting result reliability. The study's short duration prevented conclusions about the long-term effectiveness of the procedure and its impact on avoiding surgery or further interventions. Additionally, the non-arthritic hip score used is validated for a younger population, potentially limiting the generalizability of the results to older populations with more degenerative hip pathology as in our study.

Lastly, the study did not set population-based inclusion or exclusion criteria, limiting the ability to report specific findings on subsets of the population based on varying activity levels, ages, BMI levels, gender, or race.

CONCLUSIONS

In summary, these data provide evidence supporting the effectiveness of ultrasound-guided iliopsoas bursa corticosteroid injections in improving pain, mechanical symptoms, physical function, and activity levels in patients with iliopsoas tendinopathy. These results suggest that this intervention can significantly enhance patients' quality of life and functional abilities. However, further research with a longer follow-up period and more rigorous controls is warranted to confirm these findings and assess the long-term benefits and potential risks of the procedure.

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Keywords: iliopsoas, tendinopathy, bursitis, hip pain

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Case Report

A Case Report of a Mediastinal Granuloma Related to Histoplasmosis with *Streptococcus dysgalactiae* Subspecies *equisimilis* Superinfection Resulting in Abscess and Subsequent Pericarditis in a Pediatric Patient

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INTRODUCTION

Streptococcus dysgalactiae belongs to the pyogenic group of streptococci and presents with a disease spectrum similar to that of *Streptococcus pyogenes*.[1] *S. dysgalactiae* subspecies *equisimilis* (SDSE) is a beta-hemolytic, Lancefield group C and G streptococci that often colonizes skin lesions as well as the upper respiratory, gastrointestinal, and female genital tracts of humans.[2] While initially thought to be non-pathologic, *S. dysgalactiae* is now a known cause of invasive disease, especially among immunocompromised patients.[2]

A mediastinal granuloma is a rare cause of mediastinal mass, but histoplasmosis is the most common etiology in the United States, especially in endemic areas like the Ohio and Mississippi river valleys.[3] It remains a rare diagnosis in the pediatric literature.[4] We describe a case of a mediastinal mass and abscess due to *S. dysgalactiae* as a superinfection of a mediastinal granuloma related to histoplasmosis.

CASE REPORT

A previously healthy 16-year-old female was admitted to our children's hospital from a rural Emergency Department (ED) in Kansas for concern of a possible malignant or infectious mediastinal mass. She initially presented one month prior to admission for cough where she was diagnosed with respiratory syncytial virus (RSV). She continued to have worsening cough, fatigue, and developed fevers. She then had shoulder and chest pain with shortness of breath, leading her to present to the ED where a chest computed tomography angiography (CTA) ruled out a pulmonary embolism; a calcified mediastinal mass was discovered instead. The patient had been living in a group home with 13 other adolescents for the six months leading to admission.

On admission, she was alert and in no distress. Vital signs were as follows: temperature, 36.8 °C; blood pressure, 96/58; heart rate, 125; respiratory rate, 20; and oxygen saturation 96% on ambient air. Physical examination showed clear breath sounds with a mild intermittent cough and was only significant for tenderness to palpation over the right scapula. Laboratory findings showed a normal white blood cell count (WBC) of 8.2×10^3/mcL and low platelets at 125×10^3/mcL. A chemistry panel was grossly unremarkable. A C-reactive protein (CRP) level was 189 mg/L. Her troponin level was within normal limits. A nasopharyngeal multiplex polymerase chain reaction assay was positive for RSV. A histoplasma yeast antibody titer was positive at 1:16. Histoplasma mycelial antibody and serum and urine antigen were negative. Human immunodeficiency virus (HIV) and Quantiferon-TB tests were negative, and rapid plasma reagin (RPR) testing was nonreactive. The chest CTA from the ED showed a middle mediastinal mass with dystrophic calcifications in the superior margin and a central fluid attenuation that measured approximately 3.3x3.7x4.3 cm that began in the subcarinal region and extended into the hilum and inferior posterior to the right atrium.

The mediastinal mass was thought to be oncologic, but given the high CRP level, the oncologist consulted thought it was more likely to be infectious. A computed tomography (CT) of the chest was repeated to assess potential lymph nodes to biopsy and showed the stable mediastinal mass that was cystic and necrotic in appearance with calcifications suspicious for histoplasmosis or mycobacterial infection (Figures 1 and 2) along with a new right pericardial region fluid collection containing a small amount of gas measuring 4.7x2.3 cm (Figures 3 and 4). There also were enlarged calcified mediastinal lymph nodes and a small pericardial effusion. An echocardiogram showed a potential space next to the right atrium and a trivial pericardial effusion.

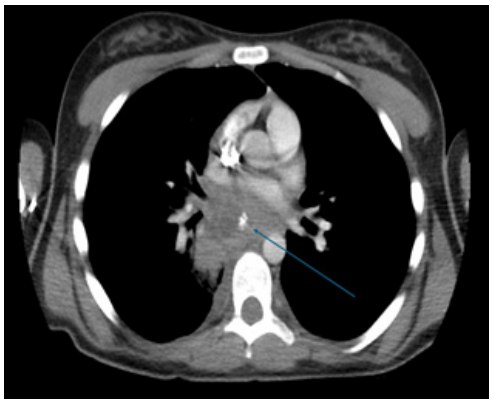

Figure 1. CT chest axial view of the complex cystic/necrotic and calcified mediastinal mass.

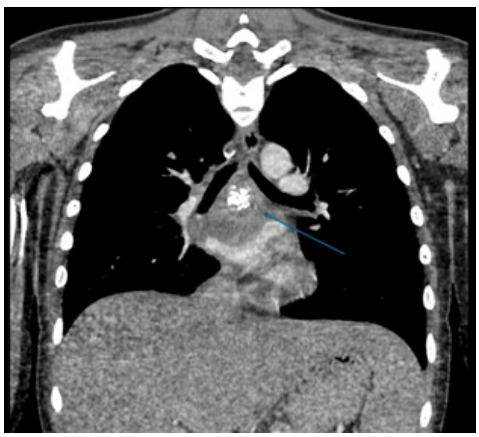

Figure 2. CT chest coronal view of the complex cystic/necrotic and calcified mediastinal mass.

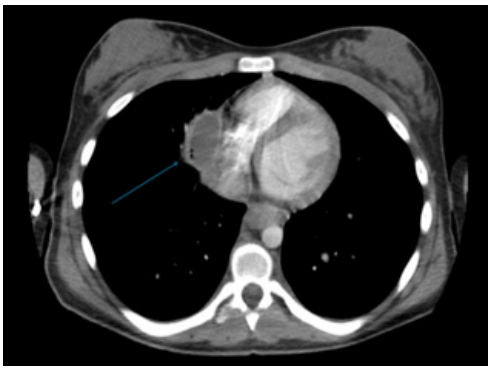

Figure 3. CT chest axial view of the abscess in the right pericardial region.

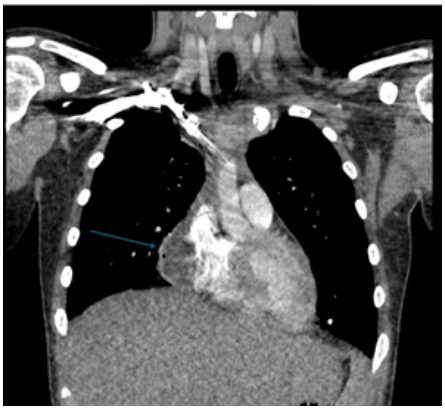

Figure 4. CT chest coronal view of the abscess in the right pericardial region.

Azithromycin was started but antibiotic coverage was expanded with the guidance of infectious disease specialist on day three of hospitalization to vancomycin and ampicillin/sulbactam as the CRP rose to >190 mg/L and her cough worsened. Pulmonology performed endobronchial ultrasound bronchoscopy with transbronchial needle aspiration; the mediastinal mass was biopsied in the medial segment of the right lower lung along with a necrotic lymph node. Cultures from both the lymph node needle aspirate and bronchoalveolar lavage (BAL) of the right lower lobe grew *Streptococcus dysgalactiae* resistant to vancomycin but susceptible to ceftriaxone and clindamycin and intermediate to penicillin. Fungal and mycobacterial cultures from the needle aspirate and BAL fluid showed no growth. Blood culture from admission also showed no growth. Cytology from the needle aspirate showed fibrinoid debris, neutrophils of acute inflammation, alveolar macrophages, and some markedly reactive bronchial epithelial cells; flow cytometry was negative for malignancy. Vancomycin was discontinued. The ampicillin/sulbactam was continued as the patient was clinically improving, and due to concern of polymicrobial infection with mixed aerobic and anaerobic infection since the CT noted some gas in the pericardial fluid collection. Antifungal treatment was not started at that time since her symptoms had improved on antibacterial treatment with the presumption that her symptoms were due to infection from *Streptococcus dysgalactiae*. Additionally, the calcification and histoplasma yeast antibody titer of 1:16 would be consistent with a non-acute or active infection. A pediatric general surgery consultant evaluated the need to drain the abscess, but no intervention was recommended given the location of the abscess and the patient's improved clinical status on antibiotics. She was discharged on day eight of hospitalization on amoxicillin/clavulanic acid to complete a four-week course of antibiotics. A CRP at two weeks post-discharge was <2.9 mg/L.

The patient then presented to a local ED four weeks post-discharge for syncope, vomiting, abdominal pain, chest pain and shortness of breath. A chest CT showed no mediastinal mass, but there was a large circumferential pericardial effusion measuring 1.7x1.2x1.4 cm, calcified subcarinal lymph nodes, and a new lung nodule. She was then transferred to another children's hospital where echocardiogram showed a large pericardial effusion and right atrial and ventricular collapse. The patient underwent pericardiocentesis and started a course of non-steroidal anti-inflammatories (NSAIDs) and colchicine for pericarditis. Ampicillin-sulbactam was started as well as oral itraconazole and she was subsequently changed to clindamycin. Pericardial fluid cultures showed no growth on bacterial and fungal cultures. The patient improved and was able to be discharged on day five of her second hospitalization on two weeks of clindamycin and six weeks of itraconazole for pulmonary histoplasmosis.

On post-discharge day three, the patient developed a fever and neck and shoulder pain. She was re-admitted at the referral children's hospital where laboratory studies showed: WBC 18.39 (x10^3/mcL), CRP 24.5 mg/dL, and ESR 68 mm/h. A chest ultrasound (US) showed a small right pleural effusion and a moderate left pleural effusion. A small pericardial effusion with no right atrial or ventricular collapse was found on echocardiogram. The patient was started on high dose steroids and rheumatology was consulted. Anti-nuclear antibodies were elevated with negative reflex; the studies were inconsistent with any systemic rheumatologic process. Clindamycin and itraconazole were continued. Repeat chest US on day four of hospitalization showed resolution of the right and improvement of the left pleural effusion. Laboratory studies on day five of hospitalization showed: WBC 11.56x10^3/mcL and CRP 2.1 mg/dL. The patient had clinical improvement and was discharged home on a steroid taper, clindamycin to complete a two-week course for the previously noted SDSE infection, and itraconazole to complete a six-week course for histoplasmosis.

DISCUSSION

SDSE is a pyogenic streptococcus strain that is a human pathogen, whereas *Streptococcus dysgalactiae* subsp. *dysgalactiae* is alpha-hemolytic or non-hemolytic and is typically an animal pathogen.[5] SDSE is commensal in the oropharyngeal flora and has been commonly associated with pharyngitis in children. Severe infections tend to affect those with risk factors like a history of injection drug use, elderly patients with comorbidities, or immunocompromised patients.[2] Our case is unique in that it describes a previously healthy pediatric patient who presented with a mediastinal mass and pericardial abscess that both grew SDSE. This patient's mediastinal mass was likely a mediastinal granuloma (MG) given the appearance on CT imaging. MG is typically found subcarinal or paratracheal and occurs as a group of necrotic lymph nodes coalesce into a mass. Patients are often asymptomatic with MG found incidentally years after histoplasma infection or with no known history exposure. Our patient likely had histoplasmosis prior to presentation;

prior to presentation; calcifications are unlikely to be seen if the MG formed within a few months of infection. While the patient did not have positive serum or urine histoplasma antigens, she did have a positive histoplasma yeast antibody titer of 1:16 which is consistent with past infection. A single histoplasma titer of ≥1:32 is presumptive evidence of active or recent infection.[6] In a case series of pediatric mediastinal granuloma related to histoplasmosis[4], histoplasma antibody was positive in 100% and histoplasma antigen was negative in 90% of patients. Fine needle aspirations (FNA) were positive in 31% whereas BAL was negative for histoplasma where performed. Like with our case, histoplasma cultures tend to be negative in MG and small samples taken by excisional biopsy or FNA are not fruitful; large samples are required as the organisms are usually scattered and scarce.

Per the 2007 Infectious Diseases Society of America guidelines on histoplasmosis[7], treatment of MG with an anti-fungal is not necessary unless the patient is symptomatic. Our patient's symptoms during her first hospitalization were thought to be from the SDSE infection given her improvement on antibacterial therapy without antifungal therapy. Pericarditis occurs as a complication of inflammation in adjacent mediastinal lymph nodes rather than infection of the pericardium. Pericardial infection is a rare complication of disseminated infection. Pericarditis with histoplasmosis generally responds to NSAIDs. Large pericardial effusions may require drainage which was performed for this patient and cultures showed no growth adding evidence that this was an inflammatory process, not infectious. Corticosteroids are recommended if there is hemodynamic compromise or unremitting symptoms with NSAIDs. Itraconazole is recommended if corticosteroids are given.[7]

A retrospective cohort study[8] of children with mediastinal lymph nodes with suspected or confirmed histoplasmosis showed that lymph node biopsies were rarely of diagnostic value. They also described three cases of large mediastinal burden with mass where two of the three cases underwent extensive surgical debulking and found that there was not always benefit and added the risk of surgical complications. This study also showed that antifungals and steroids were of unclear benefit and may not change disease course.

Bacterial superinfection is a known complication of MG, and it tends to occur following diagnostic biopsy or from esophageal fistulization with infection of enteric flora.[3] Our patient likely developed superinfection with SDSE secondary to esophageal fistulization, but there was no preceding biopsy. Fistulization was not confirmed by endoscopy or seen on CTA chest. It is also possible that the SDSE was a contaminant, but both the BAL and needle aspirate had moderate growth of SDSE and there was clinical improvement along with subsequent improvement of the CT with antibacterial treatment.

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Keywords: histoplasmosis, mediastinal disease, Streptococcus dysgalactiae, granuloma, abscess

KANSAS JOURNAL of MEDICINE

Case Report

A Diagnosis of Trichoblastic Carcinoma Using Immunohistochemistry

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INTRODUCTION

Trichoblastic carcinoma is a rare cutaneous adnexal neoplasm that primarily develops de novo (87.1%), though it also can arise from a preexisting tumor, such as a trichoblastoma (12.9%).[1] Trichoblastic carcinoma often is misidentified as basal cell carcinoma and is challenging to distinguish based solely on histopathology. From June 2000 to October 2020, only 93 cases have been documented in the literature.[1,2] Notably, nearly one in four cases were initially misdiagnosed as basal cell carcinoma.[1] This frequent misclassification suggests that many cases of trichoblastic carcinoma may go undetected. Given the differences in prognosis and metastatic potential between trichoblastic carcinoma and basal cell carcinoma, a more systematic approach to trichoblastic carcinoma identification is critical. In this report, we detail the diagnostic method used to identify trichoblastic carcinoma in an unusually young patient who presented with a tumor measuring 12×13 cm.

CASE REPORT

A 38-year-old man presented to the clinic with a large, ulcerative lesion on the right parietal scalp (Figure 1). The patient first noticed the mass at age 35, and it grew periodically over the next three years. The lesion was painful, with frequent bleeding and serosanguinous discharge. He had no notable medical history, was not on any medications, and had not received prior treatment for the lesion. A shave biopsy initially identified the lesion as a moderately well-differentiated squamous cell carcinoma. Consequently, the patient was referred for wide excision and staging of the malignancy. Pre-operative computed tomography (CT) imaging suggested metastasis to a right occipital lymph node. A wide excision, including a partial thickness craniectomy, was performed, with the tumor measuring 12×13 cm. Surgical margins of the excised tumor were negative for carcinoma. Although an attempt was made to excise the suspicious occipital lymph node during the procedure, the specimen submitted to pathology contained no lymph tissue.

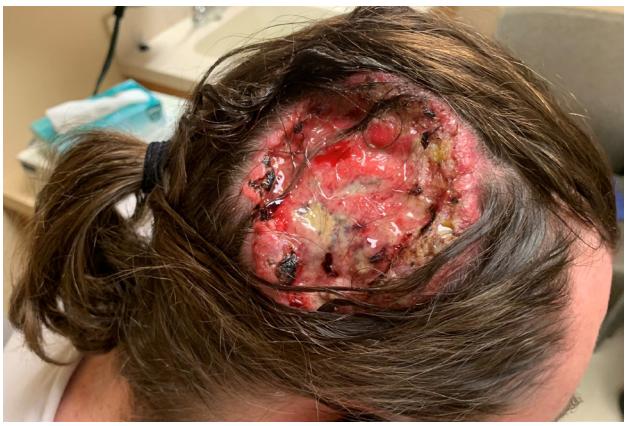

Figure 1. Trichoblastic carcinoma. Preoperative gross image. Large ulcerative mass measuring 12×13 cm.

Histopathologic examination of the excised tumor revealed a deeply infiltrative Clark Level V neoplasm arising as a predominantly dermal/subcutaneous nodule from non-sun-damaged scalp skin (Figure 2). No evidence of a precursor lesion was found, and extensive sectioning was negative for basal cell carcinoma. The neoplasm extended into the subcutaneous panniculus down to the fascia and was composed of irregular aggregates of basaloid cells with areas of central necrosis and peripheral spindle cell stroma. It was continuous with a surface proliferation of cells forming sinus tracts and keratin. Primitive hair follicle-like structures also were observed at the periphery of the surface proliferation. Immunohistochemical staining showed neprilysin (CD10) positivity in the stroma and CD10 negativity in the carcinomatous epithelium. Full immunohistochemistry (IHC) results are detailed in Table 1.

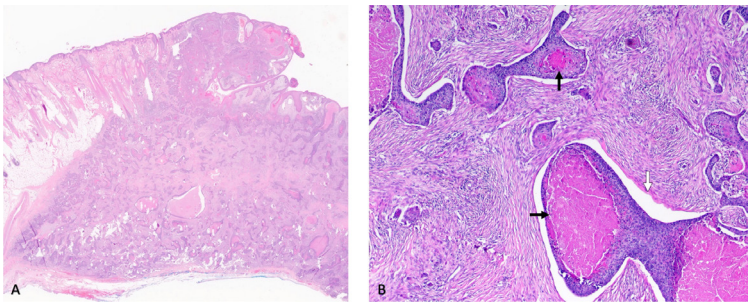

Figure 2. Low-power image showing infiltrative trichoblastic carcinoma invading the subcutaneous panniculus to the level of the fascia (A) High-power image demonstrates infiltrative tumor islands (black arrows) composed of basaloid cells demonstrating comedonecrosis and clefting (white arrow) with the morphologically bland hair follicle-specific stroma (B) (A and B, hematoxylin and eosin stain; original magnifications: A, ×6; B, ×40).

Based on post-operative histopathologic and IHC findings, the initial diagnosis of squamous cell carcinoma was ruled out, and a diagnosis of de novo trichoblastic carcinoma was confirmed. The tumor was successfully excised without complications, and the patient underwent a six-week course of radiation therapy. At follow-up, treatment was well-tolerated, and a five-month post-operative CT scan with contrast of the head and neck showed no evidence of malignancy.

Table 1. Immunohistochemical staining of excised trichoblastic carcinoma.

Antibody	(+/-)
Cluster designation 10	(+) in peritumoral stroma; (-) in tumor epithelial cells
Antihuman epithelial antigen	(+), 4+
Cytokeratin 19	(+), 3+
Carcinoembryonic antigen	(-)
Epithelial membrane antigen	(-)
Androgen receptor	Mostly (-), 1+
p16 tumor suppressor protein	(+), 4+
Cytokeratin 7	(+), 3+
Adipophilin	(-)
GATA-binding protein 3	(+), 4+
Beta-Catenin	Membrane (+), Nuclear (-)
Calretinin	(-)

DISCUSSION

Trichoblastic carcinoma is a rare adnexal tumor that is often misdiagnosed as basal cell carcinoma. Distinguishing between these two conditions is crucial, as trichoblastic carcinoma can be significantly more aggressive, with a metastasis rate of up to 11%, compared to basal cell carcinoma, which has a metastasis rate of only 0.55%.[3,4] Despite their differences, trichoblastic carcinoma and basal cell carcinoma share similarities, including an average age of diagnosis of 65 years and a male predominance (66.7% vs. 54.8%).[2,5] While basal cell carcinoma predominantly occurs in White individuals (92.1%), racial and ethnic trends in trichoblastic carcinoma remain unclear due to limited data.[5] Trichoblastic carcinoma most commonly appears on the face, though it also can develop on the trunk, scalp, and extremities,[1] while basal cell carcinoma primarily is associated with sun exposure and typically manifests on the face, head, and neck.

Currently, there are no definitive clinical criteria for diagnosing trichoblastic carcinoma. It is described as an aggressive, sometimes painful tumor originating in the dermal or subcutaneous layer, growing as a solitary, poorly circumscribed, asymmetric mass.[2,6] A retrospective case review of 21 reports found that 95% of trichoblastic carcinoma cases were clinically misdiagnosed as basal cell carcinoma, highlighting the challenge of identifying trichoblastic carcinoma based on clinical presentation alone.[3] Therefore, biopsy is the gold standard for trichoblastic carcinoma diagnosis. Trichoblastic carcinoma and basal cell carcinoma can share several histopathologic features, such as basaloid cells with uniform, ovoid nuclei, lobular tumor nests, and peripheral palisading.[6-8] However, trichoblastic carcinoma is distinguished by a biphasic presentation with high mitotic activity, a deeply infiltrative growth pattern, central necrosis, hypercellular stroma, and the presence of primitive hair follicle-like structures.[9] These histopathologic differences can be subtle, contributing to the initial biopsy misclassification rate of 24.7%.[1] When histopathologic findings are inconclusive, cluster designation 10 (CD10) staining has proven highly effective in differentiating trichoblastic carcinoma from basal cell carcinoma.[10] Specifically, trichoblastic carcinoma shows CD10 positivity in the stroma and CD10 negativity in the carcinomatous epithelium, whereas basal cell carcinoma shows the opposite pattern.

In our patient's case, the differential diagnosis included basal cell carcinoma, squamous cell carcinoma, sebaceous carcinoma, and porocarcinoma. Squamous cell carcinoma is the second most common skin cancer in the United States, presenting with scaling, crusting, erythema, and ulceration, often progressing from precursor lesions like actinic keratoses.[11] It stains p63+, epithelial membrane antigen (EMA)+, and antihuman epithelial antigen (BerEP4)-.[12] Sebaceous carcinoma, another aggressive cutaneous adnexal neoplasm, differs from trichoblastic carcinoma in that it shows sebaceous gland rather than hair follicle differentiation and typically occurs in the orbital region, with extra-orbital cases presenting as yellowish nodules with ulceration.[13] Histopathologic features include small basaloid cells, nuclear palisading, central comedonecrosis with pagetoid spread, and spindle cell proliferation areas.[14] It stains EMA+, BerEP4-, and adipophilin+.[15] Porocarcinoma, an eccrine gland malignancy, often develops from a pre-existing eccrine poroma and presents as a nodular, sometimes ulcerated, fungating lesion.[16,17] Histopathology reveals basaloid cells with hyperchromatic nuclei and duct-like structures containing eosinophilic cuticular borders, with EMA+ and carcinoembryonic antigen (CEA)+ staining in the duct-like structures.[17]

Given the clinical ambiguity of trichoblastic carcinoma and its frequent misclassification as basal cell carcinoma, IHC is essential for accurately narrowing the differential diagnosis. Unfortunately, IHC staining is rarely used in trichoblastic carcinoma diagnosis, having been performed in only 31.2% of published cases.[2]

In our patient's case, we were able to lower our suspicion of basal cell carcinoma by staining for CD10, which revealed CD10+ hair follicle stroma and CD10- carcinomatous epithelium (Table 1). Staining for EMA was negative, effectively ruling out squamous cell carcinoma, sebaceous carcinoma, and porocarcinoma. Additionally, BerEP4+ staining further supported the exclusion of squamous cell carcinoma and sebaceous carcinoma, while negative adipophilin and CEA stains excluded sebaceous carcinoma and porocarcinoma, respectively. Although other biphasic neoplasms with follicular differentiation, such as trichoblastoma and trichoepithelioma, were considered in the differential diagnosis, their slow-growing, benign nature made trichoblastic carcinoma the most likely diagnosis.

CONCLUSIONS

In this case report, we discuss a 38-year-old man who presented with a large ulcerative lesion on the right parietal scalp, ultimately diagnosed as trichoblastic carcinoma. Immunohistochemistry proved to be a valuable tool in identifying this rare neoplasm, which was challenging to diagnose based on clinical presentation and initial biopsy alone. Although there are no established staining criteria for trichoblastic carcinoma, we hope the immunohistochemistry findings presented here contribute to the existing literature on trichoblastic carcinoma staining characteristics, encouraging more widespread use of immunohistochemistry in suspected cases, and aiding in the development of definitive diagnostic criteria.

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Keywords: immunohistochemistry, neprilysin, carcinoma, basal cell/pathology, skin neoplasms/pathology

KANSAS JOURNAL of MEDICINE

Case Report

Acute Border Zone Infarcts in Hypereosinophilic Syndrome

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INTRODUCTION

Hypereosinophilic syndrome (HES) is a rare condition characterized by peripheral eosinophilia that leads to multi-organ damage.[1] The underlying cause of eosinophilia may be identifiable, such as parasitic infections or autoimmune diseases, or it may be idiopathic.[2] HES can present with various neurological manifestations, including acute ischemic stroke, cerebral venous sinus thrombosis, encephalopathy, and peripheral neuropathy.[3] Ischemic strokes associated with hypereosinophilia typically occur in a watershed border zone distribution but can occasionally present as major arterial territorial infarcts.[3,4] Recognizing the ischemic stroke pattern on neuroimaging in the context of hypereosinophilia is crucial for guiding diagnostic and treatment strategies.[5]

CASE REPORT

A 30-year-old male with no prior medical history presented to the emergency department with acute chest pain and bilateral upper and lower extremity weakness. Neurological examination revealed decreased strength in both upper and lower extremities, with more pronounced weakness in the proximal muscle groups. Specifically, shoulder abductors and elbow extensors had a strength of 2/5, finger muscles were 4/5, and hip flexors were 3/5, while distal lower extremity muscles remained intact at 5/5. An electrocardiogram showed nonspecific ST changes without ST elevation. Initial laboratory tests revealed elevated troponin and D-dimer levels, along with peripheral eosinophilia, with an absolute eosinophil count of approximately 4,000/µl.

A computed tomography (CT) angiogram of the chest ruled out acute aortic pathology and pulmonary embolism but revealed a small, indeterminate hypodense mass in the right hepatic lobe. Noncontrast CT of the head showed small hypodensities in the bilateral internal and external border zone territories (Figure 1). A follow-up CT angiogram of the head ruled out large vessel occlusion (Figure 2). Brain magnetic resonance imaging (MRI) revealed multiple small, acute to early subacute infarcts in the bilateral internal and external border zones, as well as scattered throughout the bilateral cerebral cortices (Figure 3). Echocardiography and cardiac MRI were normal, with no evidence of cardiac abnormalities or intracardiac thrombus. Extensive infectious, autoimmune, and neoplastic workups were negative, leaving idiopathic HES as the diagnosis.

A contrast-enhanced MRI of the abdomen was performed to further evaluate the hepatic mass, revealing several heterogeneously enhancing hepatic lesions (Figure 4). Histopathologic examination of one lesion showed a focal lymphohistiocytic infiltrate with scattered eosinophils.

The patient was treated with a single 100 mg dose of intravenous methylprednisolone, which resulted in the resolution of peripheral eosinophilia and significant improvement in extremity weakness. He was discharged home on a short-term maintenance regimen of prednisone and hydroxyurea.

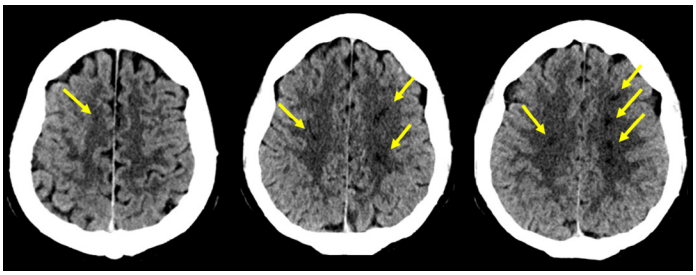

Figure 1. Axial noncontrast CT of the head demonstrates scattered small hypodensities in the bilateral border zones (Yellow arrows).

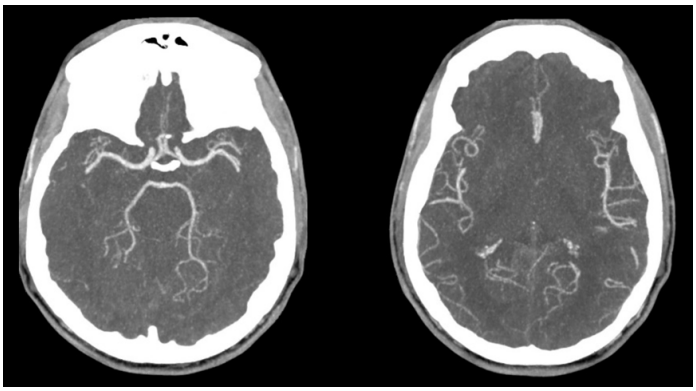

Figure 2. Axial CT maximum intensity projection (MIP) reformats of the head demonstrating patency of the major intracranial arteries.

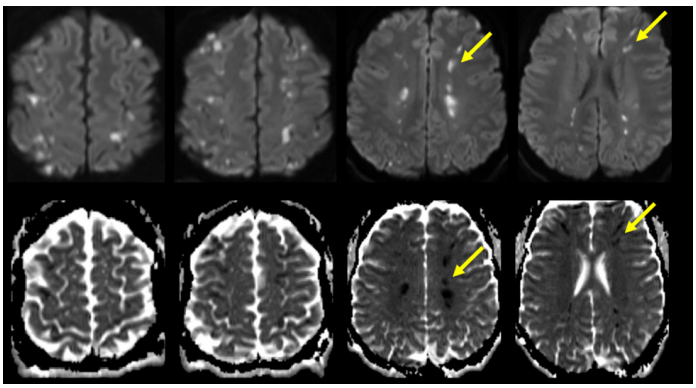

Figure 3. Axial Diffusion Weighted Imaging and ADC maps showing multiple foci of diffusion restriction in the bilateral internal and external border zones (see arrows).

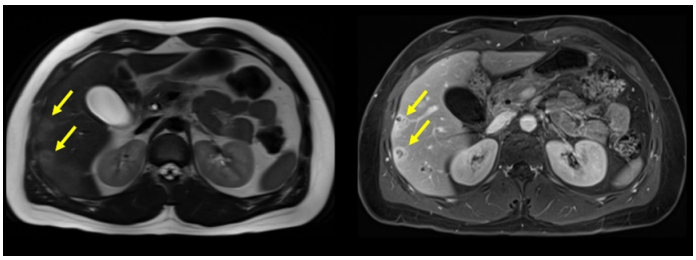

Figure 4. Axial T2 HASTE (left) and axial, gadobenate dimeglumine (MultiHance®)-enhanced postcontrast T1 (right) images of the abdomen demonstrate several small focal hepatic lesions with heterogenous intermediate T2 signal and postcontrast rim-enhancement (arrows).

DISCUSSION

Hypereosinophilic syndrome is a rare multisystem disorder characterized by a sustained elevation in absolute eosinophil count greater than 1500/µL for six months.[6] Based on its etiology, HES can be classified as either primary, caused by clonal proliferation of eosinophils associated with an underlying hematopoietic neoplasm, or secondary, resulting from parasitic, allergic, or autoimmune diseases.[1] In some cases, HES is idiopathic, with no identifiable cause.[2]

HES can present with acute or chronic symptoms affecting various organs and systems, including the brain, heart, lungs, liver, spleen, and bone marrow.[3,7] Neurological manifestations include ischemic stroke, venous sinus thrombosis, peripheral neuropathy, seizures, and encephalopathy.[3] Among these, HES-associated ischemic stroke is the most severe complication, occurring in 12% of patients with HES, with 10-15% of these cases affecting young adults.[8]

The primary pathophysiology of HES-associated stroke is believed to be cardiac emboli resulting from eosinophil-mediated cardiac damage.[3,9] In a study by Tennenbaum et al.,[9] 50% of patients with HES-associated ischemic stroke showed cardiac involvement, though only one had a detectable cardiac thrombus. The absence of cardiac thrombi, as seen in our patient, suggests the possibility of microemboli as the cause of infarcts. Other less common mechanisms include medium- or small-vessel vasculitis and blood hyperviscosity, both of which can lead to in-situ thrombus formation and occlusion of small perforating arteries.[6,10]

In some cases, an initial noncontrast CT of the head (NCCT) may appear normal in hypereosinophilia-associated stroke, though it can also reveal multiple small infarcts in the bilateral internal and external border zone territories.[3] Less commonly, HES may cause a large infarct in a major cerebral arterial territory.[3,4,11] Rarely, patients may present with venous sinus thrombosis, where NCCT reveals increased density and expansion of the dural venous sinuses or major cerebral veins.[12] Intracranial hemorrhage is another rare complication, which may result from venous infarction in the context of cerebral venous sinus thrombosis or hemorrhagic transformation of an ischemic infarct.[12,13] CT angiography of the head may be negative, as in our patient, or may show major cerebral arterial occlusion in cases of large territorial infarcts.[4] MRI typically reveals foci of diffusion restriction in a border zone distribution or in a major cerebral arterial territory.[11]

Hepatic involvement in HES may present as focal lesions, as seen in our patient, or as eosinophilic cholangitis, chronic hepatitis, or Budd-Chiari syndrome.[14] The sparse eosinophilic presence on histopathology, as noted by other authors such as Minola et al.,[15] suggests that hepatic involvement may result from mediators secreted by peripheral eosinophils rather than direct eosinophilic infiltration.[14,15]

Treatment for HES-associated stroke focuses on rapidly reducing peripheral eosinophilia with high-dose glucocorticoids and addressing any underlying pathology if identified. Second-line therapies include hydroxyurea, methotrexate, interferon-alpha, and cyclosporine.[1,5]

CONCLUSIONS

In summary, HES can present with a broad spectrum of neurological manifestations, ranging from encephalopathy and seizures to more severe conditions such as cerebral venous sinus thrombosis and ischemic stroke. Early diagnosis of hypereosinophilia-associated stroke and prompt initiation of eosinophil-reducing therapy are crucial for improving clinical outcomes.

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Keywords: hypereosinophilic syndrome, stroke, ischemic stroke, embolic stroke, thromboembolism

KANSAS JOURNAL of MEDICINE

Case Report

Non-Typhoidal *Salmonella* Encephalopathy Infection: A Pediatric Case Report

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INTRODUCTION

Salmonella enterica subspecies *salamae* (*Salmonella salamae*) is an uncommon non-typhoidal *Salmonella* subspecies, accounting for less than 1% of reported human *Salmonella* isolates in the United States.[1] Between 2006 and 2016, 271 laboratory-confirmed cases of *Salmonella salamae* infection were identified in the United States.[2]

Individuals with *Salmonella* infections typically present with abdominal pain, diarrhea, and fever within 2 to 48 hours after exposure.[3] Most cases follow a self-limited and benign course. However, *Salmonella* enterocolitis remains a global public health concern due to potential complications, including severe extraintestinal manifestations such as sepsis, arthritis, meningitis, osteomyelitis, and acute encephalopathy.[4]

Here, we report a case of non-typhoidal *Salmonella* encephalopathy caused by *Salmonella salamae*, characterized by minimal gastrointestinal symptoms and an overall atypical presentation.

CASE REPORT

A previously healthy two-year-old boy presented to our institution with somnolence and decreased activity. He had a five-day history of fever and progressive lethargy, sleeping up to 22 hours daily, and a one-day history of non-bloody diarrhea. There was no history of emesis, rashes, stomatitis, conjunctivitis, or extremity swelling.

The patient had no recent travel outside of Oklahoma, nor a history of consuming unpasteurized dairy products, undercooked meats, or exposure to sick contacts. His mother managed an exotic pet store that he frequently visited, and the family kept a pet gecko at home. On examination, he was irritable but consolable, arousable but rapidly fell back asleep. There were no meningeal signs, rashes, conjunctivitis, lymphadenopathy, stomatitis, or extremity edema. His abdominal and the remainder of his physical exams were benign. Initial differential diagnoses included meningitis, herpes virus encephalitis, intracranial hemorrhage, thyroid dysfunction, and heavy metal toxicity.

On admission, his vital signs were temperature 36.3°C, heart rate 74 bpm, respiratory rate 28 breaths/min, and oxygen saturation 96% on room air. He remained afebrile throughout his stay. Initial lab work—including urinalysis, complete blood count, metabolic panel, C-reactive protein, respiratory pathogen panel (including Pertussis testing), and comprehensive urine drug screen—was unremarkable. A non-contrast computed tomography of the head was also normal.

Given his persistent somnolence and lack of improvement, a lumbar puncture was performed on day two, revealing normal opening pressure, glucose, and protein levels. However, the cerebrospinal fluid (CSF) cell count showed an elevated white blood cell count of 8/µL. CSF viral polymerase chain reaction (PCR) panel, viral antibodies, anti-Ma, anti-Ta antibodies, and autoantibody testing were all negative. Serum lactate and ammonia levels were within normal ranges (1.9 mmol/L and 50 µmol/L, respectively). A heavy metals panel for lead, arsenic, and mercury was negative, and his free T4 and anti-thyroid peroxidase antibodies were normal. Pyruvic acid was within normal limits (0.105 mmol/L). He tested negative for *Salmonella typhi* antibodies (O Type D, O Type Vi, H Type a, H Type b, and H Type D). CSF, urine, and blood cultures showed no growth during hospitalization.

On day four, the patient passed his first stool, which tested positive for *Salmonella* by PCR. A subsequent culture confirmed *Salmonella salamae* (Table 1). Consultation with pediatric infectious disease specialists led to a decision against antibiotic treatment, as all other cultures were negative, and the patient had been afebrile since admission despite his five-day fever history before hospitalization.

Magnetic resonance imaging of the brain was unremarkable, but an electroencephalography demonstrated a slow background while awake, suggestive of nonspecific diffuse cerebral dysfunction. Given the patient's encephalopathy, positive stool culture for *Salmonella*, and negative results for other plausible causes, the most likely diagnosis was *Salmonella* encephalopathy.

Table 1. Centers for Disease Control and Prevention phenotypic results of *Salmonella enterica* subspecies *salamae*.

Fermentation	Positive/ Negative	Fermentation	Positive/ Negative
Malonate utilization	Positive at day 2	Lactose	Negative
Dulcitol fermentation	Positive at day 1	Salicin	Negative
Sorbitol (D-) fermentation	Positive at day 1	Mucate	Positive at day 1
Tartrate – Jordan's	Negative	Ortho-nitrophenyl-β-D-galactopyranoside (ONPG)	Positive at day 2
Galacturonate (D-) fermentation	Positive at day 1	4-Methylumbelliferyl-β-D-Glucuronide (MUG)	Negative

During hospitalization, his excessive sleepiness led to poor oral intake and the patient received intravenous fluids due to mild dehydration. He completed a five-day course of 5 mg/kg of intravenous methylprednisolone with increased alertness and activity. After a 10-day hospitalization, he was discharged with a steroid taper. Three weeks after discharge, his mother reported that he was back to his baseline state of health.

DISCUSSION

Encephalopathy caused by non-typhoidal *Salmonella* species is a rare phenomenon. Prior to 2001, non-typhoidal *Salmonella* was not recognized as a clinically significant pathogen, which can help explain the paucity of documented cases of pathogenic non-typhoidal *Salmonella*.[5] Over 50% of infections with *Salmonella salamae* occur in children less than four years of age.[6] While gastroenteritis is the most frequently seen malady with this infection, there are a few documented infections of bacteremia. No prior cases of encephalopathy with *Salmonella salamae* in pediatrics have been reported. There have been multiple cases of non-typhoidal *Salmonella enteritidis* encephalopathy in pediatric patients but the reports either did not specify subspecies or were a serotype of the enteritidis subspecies.[7-9]

The most common way individuals acquire *Salmonella salamae* infections is through ownership or exposure of a reptile, which is the presumed vector for our patient's infection. He had exposure both at home and at his mother's work. Reptiles as vectors are an emerging public health concern since owning a reptile as a pet has been increasing in popularity over the past decade. According to a 2021 survey conducted in the United States, there are 5.7 million households with pet reptiles, which has increased considerably since 1996 when there were only 2.5 million households with pet reptiles.[10,11] Therefore, it is increasingly likely that cases of *Salmonella salamae* will become more prevalent. The Centers for Disease Control and Prevention recommends that all households with anyone less than five years, older than 65 years, or immunocompromised refrain from having reptiles as pets, as they are at increased risk for serious infections due to *Salmonella*.[12]

The pathophysiology of non-typhoidal *Salmonella* encephalopathy is not completely elucidated. It is proposed that encephalopathy is either secondary to elevated cytokines in the CSF or it may arise due to bacterial endotoxin production.[13] Other cases have been reported in which steroids in conjunction with antibiotics is an effective treatment if the patient exhibits signs of hypercytokinemia due to sepsis.[4] Although enteric fever is caused by a different *Salmonella* subspecies, corticosteroids demonstrate efficacy in children with severe enteric fever characterized by delirium, obtundation, stupor, coma, or shock.[14] In the case of our patient, he began to improve clinically with methylprednisolone monotherapy.

CONCLUSIONS

We presented the first published case of *Salmonella* encephalopathy caused by *Salmonella salamae* in a previously healthy two-year-old, successfully treated with methylprednisone. Although encephalopathy due to non-typhoidal *Salmonella* is rare, it should remain a consideration in the differential diagnosis, even when gastrointestinal symptoms are minimal or absent. Given that reptiles are common carriers of *Salmonella*, individuals who own or are exposed to reptiles—particularly in households with children under five—should be educated on proper handling techniques to prevent infection.

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Keywords: salmonella, reptiles, bacterial zoonoses, sleepiness

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Dissecting Cellulitis of the Scalp

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INTRODUCTION

A 32-year-old man presented to a free dermatology clinic with a nine-month history of painful, pruritic lesions on his scalp, accompanied by hair loss. The condition started at the base of the posterior scalp and gradually spread upwards. Despite multiple courses of antibiotics, the lesions did not improve. Dermatologic examination revealed multiple boggy, fluctuant nodules with purulent drainage and overlying alopecic patches on the vertex and occipital scalp (Figure 1). He was diagnosed with dissecting cellulitis of the scalp and began treatment with acitretin 25 mg daily. Acitretin was chosen due to its low cost through the 340B Drug Pricing Program.

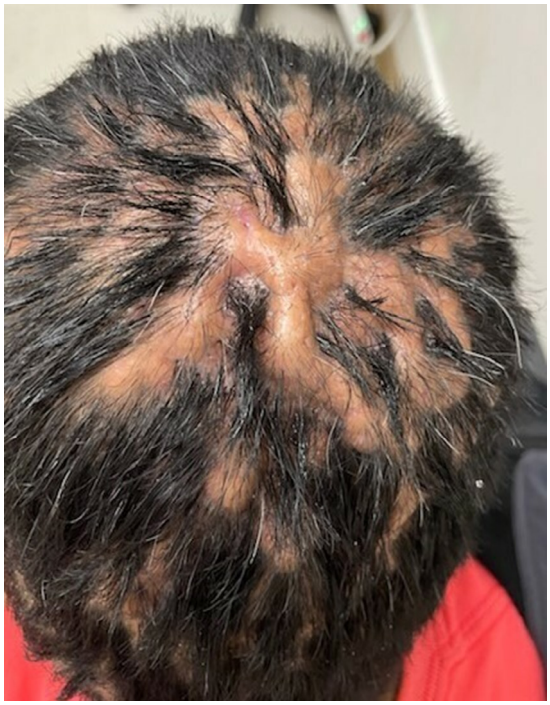

Figure 1. Multiple boggy, fluctuant nodules with purulent drainage and overlying alopecic patches.

DISCUSSION

Dissecting cellulitis of the scalp, also known as perifolliculitis capitis abscedens et suffodiens, is a chronic inflammatory condition affecting the hair follicles of the scalp, found predominantly in African American men aged 20 to 40.[1] Clinically, it is characterized by multiple painful, boggy, fluctuant nodules with interconnecting sinus tracts and overlying alopecic patches, typically located on the vertex and occipital regions of the scalp.[2] Follicular papules and pustules also may be present.[3] Although the exact pathogenesis of dissecting cellulitis remains unclear, it is considered a part of the follicular occlusion syndrome, which also includes acne conglobata, hidradenitis suppurativa, and pilonidal cysts. These conditions are thought to share a common pathogenic mechanism, where follicular obstruction leads to the accumulation of keratinous material and subsequent follicular rupture.[1] This process triggers a neutrophilic and granulomatous response, followed by bacterial infection or colonization. Other associated conditions include arthritis, keratitis, pyoderma gangrenosum, and osteomyelitis.[4]

While the diagnosis of dissecting cellulitis of the scalp often can be made clinically, a biopsy may be necessary for histopathologic analysis if the diagnosis is uncertain. Histopathologic findings vary depending on the stage of the disease. Early stages show acneiform dilation of the follicular infundibula with intrafollicular and perifollicular neutrophilic inflammation. As the disease progresses, perifollicular and deep dermal abscess formation occurs, with sinus tracts lined by stratified squamous epithelium—a hallmark of the disease. In late stages, the follicles are destroyed and replaced by dermal fibrosis and scarring.[5]

The course of dissecting cellulitis of the scalp is typically relapsing, and treatment can be challenging.[1] The primary goals of treatment are to reduce inflammation and prevent further hair loss. Treatment options include isotretinoin or other retinoids like acitretin, antibiotics, steroids, dapsone, TNF-α inhibitors, zinc, laser epilation, radiation therapy, and surgical excision.[5] The differential diagnosis includes folliculitis decalvans, discoid lupus erythematosus, pseudopelade of Brocq, and acne keloidalis nuchae.[3,5] Dissecting cellulitis of the scalp should be strongly considered in patients presenting with painful, pruritic, boggy nodules with purulent drainage and overlying alopecia.

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Keywords: alopecia, folliculitis, scalp dermatoses, skin diseases

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