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Original Article

Faculty Development in Proficiency and Application of Point-Of-Care Ultrasound

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Abstract

Objective: To increase proficiency and comfort level with ultrasound skills, apply ultrasound skills to different clinical settings such as outpatient and inpatient, and address barriers to learning and improving ultrasound skills.

Design: We created a point-of-care ultrasound (POCUS) pilot program at a small academic center to assess faculty members' knowledge and perception of ultrasound in surgical settings**.** We conducted an observational cross-sectional study to test the hypothesis and hypothesized that members would have increased confidence in their proficiency. Participants attended a 2-hour session with expert faculty. During this session, participants took a pre-test assessment survey, attended a one-hour didactic lecture and a hands-on workshop with an ultrasound simulation machine and live standardized patient, and then took a post-test assessment survey. If desired, faculty were allowed to return for further self-directed learning with an ultrasound simulation machine after the pilot program.

Results: There was a statistically significant difference in pre- and post-survey questions that addressed comfort using ultrasound in a clinical setting and critical care setting, comfort in using ultrasound at bedside rounds, comfort in teaching medical students and residents, comfort performing FAST (Focused Abdominal Sonogram for Trauma) exam and comfort in doing basic bedside echocardiography. Faculty indicated time, availability of ultrasound equipment to faculty and house staff, and cost of equipment as important barriers to utilization of ultrasound in the clinical set.

Conclusions: Our pilot POCUS course showed improved confidence in ultrasound skills among faculty members. It is important to address barriers such as limited equipment availability and adequate preparation time for future POCUS curriculums.

Keywords: Point-of-Care Ultrasound, Sonography, Faculty Development, Barriers to Education, Case-Based Learning

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Introduction

Point-of-care ultrasound (POCUS) has been integrated into medical school and residency programs more recently, yet there is rarely a formal curriculum teaching and evaluating proficiency in the use of ultrasound. In a survey of critical care fellowship directors, less than 50% of program directors reported having a designated curriculum for teaching fellows. Of those without a curriculum, 91% planned on creating one in the next 5 years.[1] In a survey of Canada Internal Medicine (IM) program directors and division directors, half of the directors (9/17, 53%) reported POCUS use by their trainees. Still, only a quarter (4/16, 25%) reported having a formal ultrasound curriculum.[2] Medical house staff with limited training in POC echocardiography were able to assess LV function and pericardial effusion with a 3-hour training session but with lower accuracy than standard echocardiography.[3]

A longitudinal ultrasound curriculum may benefit more than a single session to preclinical medical students and residents.[4,5] A study of PGY-1 IM residents showed an increase in the correct identification of ultrasound images of ascites, kidney, and pleural effusions after 6 months with the introduction of a longitudinal curriculum involving teaching during morning report and ultrasound rounds.[5] POCUS has even been studied in pediatric residency through a structured pediatric intensive care unit rotation curriculum that showed increased comfort level with performing POCUS, improvement in self-test scores, and identifying appropriate indications.[6] There is potential for faculty and residents to benefit from a structured curriculum. In a 1-day POCUS training course in Japan, trainees and novice attending physicians showed similar improvement in pre-and post-test scores (65.5 to 83.9% for trainees, 66.7 to 81.5% for physicians).[7] Given the importance of POCUS in critical care, Lim et al. designed a two-day workshop for faculty intensivists and different subspecialists to further develop a standard curriculum for future critical care fellows.[8] The objective of our 1-day single session pilot program is to assess faculty members' proficiency and increased overall confidence in further ultrasound application.

Methods

We conducted an observational cross-sectional study to test the hypothesis that a POCUS pilot training program with didactics and hands-on training would improve faculty perceptions and knowledge about ultrasound in surgical settings. In our study, participants served as their own controls. The Quality Improvement (QI) study was approved by the Texas Tech University Health Sciences Center's Quality Improvement Review Board.

The study was conducted at a small academic medical center, using a sample of 15 faculty members from different areas of medicine. Self-selection bias was accounted for by informing faculty via email from a third party about the course. Participants reported they had limited or no previous exposure to ultrasound training. Didactic training was provided by faculty within the School of Medicine across various departments with expertise in POCUS. There were no exclusion criteria.

For statistical analysis, we used a non-parametric paired t-test, the Wilcoxon signed-rank test, to test for statistically significant differences between pre and post-test results. The sample size was small, so a non-parametric test was used. Analysis was conducted in GraphPad® prism.

Table 1: Faculty completed a 15-question pre-assessment survey before the course and an identical post-assessment survey immediately after. A combination of questions regarding prior and current experience in ultrasound with a scale of 1 (lowest) to 10 (highest) regarding comfort levels and beliefs about ultrasound education (Questions 4-13) were surveyed.

1.	How many years have you been in practice? (a) Still in training (b) 0-3 years (c) 4-7 years (d) 8-12 years (e) more than 12 years
2.	I have training in ultrasound. Yes/No
3.	How often do you use ultrasound in the clinic setting? (a) None (b) few times annually (c) few times monthly (d) few times weekly (e) daily
4.	There is an educational benefit of learning ultrasound in a clinical setting
5.	How comfortable are you in using ultrasound in clinical setting?
6.	How comfortable do you feel about using ultrasound at the bedside on rounds?
7.	All medical schools should incorporate ultrasound education into their clinical curriculum.
8.	How comfortable are you in teaching ultrasound to medical students/staff?
9.	I plan to incorporate ultrasound into my clinical practice.
10.	How comfortable do you feel about using ultrasound for the FAST exam (Focused Assessment with sonography for trauma)?
11.	How comfortable are you in using ultrasound in procedures like central line placement?
12.	How comfortable are you in doing bedside basic echocardiography?
13.	How comfortable do you feel about using ultrasound in the Critical care setting?
14.	List two or more important barriers to using ultrasound in the clinical setting.
15.	How many hours do you need to learn about basic ultrasound applications in the health care field? (a) < 5 hrs, (b) 5-10 hrs, (c) 100-15 hrs, (d) 15 to 20 hrs, (e) > 20 hrs

Participants attended a 2-hour session with trained faculty. The session consisted of a pre-test assessment survey, one-hour of didactic lecture, a hands-on workshop with an ultrasound simulation machine and live standardized patient, and a post-test assessment survey. Faculty were given the option to return for self-directed learning with an ultrasound simulation machine after the pilot program if desired. Course topics covered during the didactic session included the FAST/eFAST exam with respective standard views, echocardiography (i.e., parasternal long and short axis views, apical 4 and 2 chamber views, and abdominal views.

Each faculty assessment was paired, and de-identified before analysis. Twenty-five faculty members completed pre-test surveys, and 15 faculty members completed post-test surveys, so 10 assessment surveys were not included in the post-test analysis (Table 1). Pre and post-test assessment differences for questions 4-13 were evaluated by paired t-tests.

Results

Twenty-five faculty members at Texas Tech University Health Sciences Center Amarillo registered for and participated in the POCUS workshop, with 15 completing pre- and post-test surveys. Eight out of fifteen faculty members (53%) admitted to not using any ultrasound in the clinic setting. Of the 15 faculty members, 47% (7/15) reported more than 12 years in practice (Figure 1). When asked how many hours were needed to learn about basic ultrasound applications in the healthcare field, faculty indicated pre (6/15) and post (8/15) survey that >20 hours were needed, with no difference between pre- and post-test survey (p=0.5) (Figure 2). There was a

statistically significant difference between pre-and post-survey questions 5, 6, 7, 10, 12, & 13 (Table 2). These questions addressed comfort using ultrasound in clinical and critical care settings, bedside rounds, teaching medical students and residents, performing a FAST exam, and bedside echocardiography. Questions 4, 9, and 11 did not show a statistically significant response between pre- and post-assessment (Table 2). These questions involved the educational benefit of learning ultrasound, plans to incorporate ultrasound into clinical practice, and comfort level using ultrasound for central line placement. As assessed by question 14, faculty indicated time, availability of ultrasound equipment to faculty and house staff, and cost of equipment as important barriers to the utilization of ultrasound in the clinical setting.

Question	Pre-Test (Median)	Post-Test (Median)	p-value
Question 4	10	10	0.5
Question 5	4	7	0.03
Question 6	4	7	0.01
Question 7	10	10	0.055
Question 8	4	7	0.002
Question 9	9	9	0.55
Question 10	2.5	7	0.002
Question 11	9	9	0.24
Question 12	2	7	0.005
Question 13	3	7	0.02

Table 2: Survey question 4-13 responses

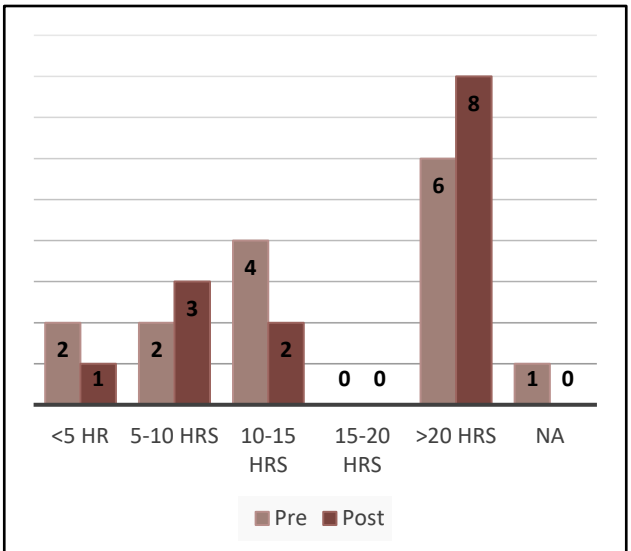

Figure 1: Question 15 - Number of hours to meet competency in basic ultrasound application based on faculty perception in re-and post- assessments.

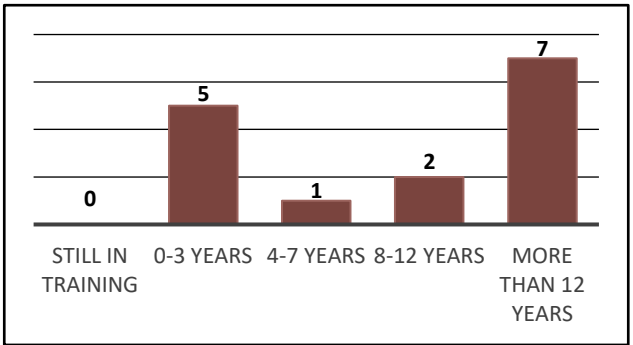

Figure 2: Question 1 - Number of years in practice among faculty participants.

Discussion

After a POCUS course designed for faculty members, participants had improved confidence levels in their ultrasound skills and a greater desire to adopt these skills into their future medical practice. Our educational course with faculty showed a statistically significant difference in pre-assessment and post-assessment survey questions regarding the following: comfort in using ultrasound in a clinical setting, critical care setting, and bedside rounds; belief that medical schools should incorporate ultrasound into their curriculum;

teaching ultrasound to medical students and other house staff; comfort in using ultrasound for FAST Exam; and comfort in doing bedside basic echocardiography. Questions 4, 9, and 11 did not show a statistically significant response between pre- and post-assessment. These questions involved the educational benefit of learning ultrasound, plan to incorporate ultrasound into clinical practice, and comfort level of using ultrasound for central line placement.

There is limited literature detailing faculty proficiency with ultrasound curriculum and the barriers that hinder faculty utilization of POCUS. Practicing anesthesiologists who underwent a 1-day standardized course and 3 video assessments had increased proficiency in ultrasound-guided perineural catheter insertion.[9] In a similar study, anesthesia faculty who completed a two-phase perioperative ultrasound training program had a statistically significant increase in quiz scores across six sessions and average mean and median scores on the three Objective Structured Clinical Examination (OSCE) stations of 95.63% and 98.33%.[10]

In a 10-week faculty development program in which 15 faculty members completed 2 hours of didactic training and 10 hours of hands-on training, statistically significant improvements in the ability to interpret images and make clinical decisions, perceptions of usefulness and limitations of POCUS, and perceptions of POCUS improving patient care.[11] Incorporating training by experienced faculty early in training, such as through orientation, can substantially improve proficiency. During internal medicine intern orientation at a tertiary academic medical center, interns had significantly higher OSCE scores in faculty-guided training vs. self-guided training.[12]

Several barriers can hinder faculty's consistent utilization of POCUS. In a survey of 44 participating academic emergency medicine faculty, barriers included lack of time (71%), consultants' request for comprehensive ultrasound (67%), and discomfort with operating machines such as patient information and saving clips (61%).[13] In our educational session, faculty indicated time, availability of ultrasound equipment to faculty and house staff, and equipment cost as important barriers to the utilization of ultrasound in the clinical setting. A combination of scheduled online and classroom ultrasound training may address some of these barriers in implementing an ultrasound curriculum.

We acknowledge some limitations of our study. Our study did involve a significant number of faculty members not completing post-assessment surveys, leaving a small sample size. Although there were faculty members across various fields of medicine, such as surgery, pediatrics, internal medicine, and obstetrics/gynecology, including more faculty members would be helpful. Also, the pre- and post-assessment surveys addressed the individual faculty member's perceptions of their improvements rather than objective quantitative results. Our results were limited to a single-day session rather than a longitudinal course. A future direction would be to assess and trend the progress of faculty members' proficiency in a longitudinal course at subsequent POCUS teaching sessions, such as in 3-month and 6-month intervals.

Conclusions

After a POCUS course designed for faculty members, participants had improved confidence levels in their ultrasound skills and a greater desire to adopt these skills

into their future medical practice. As highlighted in other studies regarding barriers to ultrasound curriculum implementation, addressing barriers such as limited availability of ultrasound equipment and adequate time for preparation can assist faculty members in formalizing a curriculum for other faculty and house staff.

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Conflict of Interest Disclosures

None of the authors have any relevant conflict of interest or other financial disclosures.

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Original Article

Elucidating the Barriers to Colorectal Cancer Screening: A Cross-Sectional Survey Analysis of a Rural Population in West Texas

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Abstract

Background
The incidence of colorectal cancer (CRC) has increased steadily in the last decade in the United States and is one of the leading causes of death. However, screening rates for colorectal cancer continue to remain at an all-time low in the United States and worldwide. Cancer screening programs can effectively reduce the burden of cancer when designed properly to ensure compliance and efficacy.

Methodology
A cross sectional study conducted through distribution of a survey to observe trends in the West Texas population pertaining to colorectal cancer screening barriers. A quarter page short survey was distributed at a cancer screening events to identify possible barriers to cancer screening by providing participants with nine options to select from including: embarrassment, unpleasantness of test, transportation, cost/lack of insurance, fear of results, lack of symptoms, lack of physician recommendations, lack of awareness, language barriers, and other causes. The questionnaire also recorded patient demographics including age, gender, and race.

Results
A total of 194 patients responded to our survey. 122 (62.9%) females, 71 males (36.6 %) and one did not specify. Genders were generally equally represented among all races. The ages ranged from 13 to 86 years with a mean of 51.79 and a standard deviation of 13.5. The overwhelmingly main barrier for screening was lack of funding or insurance (66%).

Conclusion
Given low screening rates for CRC, collaborative efforts should be made to remind more patients and have close follow up with their primary care physicians. Multilevel interventions can help address these barriers in preventing this deadly disease.

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Introduction

The incidence of colorectal cancer (CRC) has increased steadily in the last decade in the United States.[1] Globally, CRC is the third most commonly diagnosed cancer and the second deadliest cancer.[2] However, screening rates for colorectal cancer continue to remain at an all-time low in the United States and worldwide.[1] The American Cancer Society recommends that for adults aged 45 or older be screened with either a high-sensitivity stool-based test (FIT test or Cologuard) or structural visual examination. Any positive stool-based tests must be followed up by colonoscopy or annual FIT tests, according to the U.S. Preventative Task Force (USPSTF) and the Centers for Disease Control and Prevention (CDC) recommendations.[3] Timely education and discussions during visits with primary care providers and additional education provided by community health care workers at screening fairs and public outreach events would provide additional screening opportunities to reduce the incidence of colorectal cancer.

Amarillo, Texas is primarily a rural area with a median household income of $52,941 and 15.4% of the population falling below the poverty line, according to the most recent US census data.[4] Comparatively, this places the Amarillo population above the 13.4% national poverty rate in the US. Low-income areas have been associated with an increased risk of low colorectal screening rates.[1] The uninsured population of Amarillo, Texas is 18.9% which is significantly higher than the US national average uninsured rate of 8.6%.[2] Evidence suggests that a lack of healthcare insurance in populations is associated with an elevated risk of developing CRC and with poorer outcomes.[1] The American Cancer Society recommends that all average risk adults start CRC screening at the age of 45 due to cost-effectiveness and improved outcomes.

Cancer screening programs can effectively reduce the burden of cancer when designed properly to ensure compliance and efficacy. The principal challenges 5-7 in optimizing the delivery of effective cancer screening services and reducing inappropriate testing are (1) recognizing the main barriers preventing the delivery of life-preserving cancer screening available to eligible and vulnerable populations; (2) changing the behaviors of health care providers to follow recommended cancer screening guidelines for all patient encounters; and (3) changing the behaviors of individuals to obtain recommended screening education, tests and pursue follow-up. While this survey-based quality improvement study demonstrates the barriers preventing our local community from getting the proper indicated cancer screening, a clear delineation of the barriers to screening can help formulate targeted solutions to eliminate them. Along with increasing patient knowledge, the primary goal of this study was to reduce the risk of colorectal cancer (CRC) via screening through both fecal immunochemical tests (FIT) and a subsequent colonoscopy after a positive FIT.

Materials and Methods

Study Design

A cross sectional study was conducted through the distribution of a survey to observe trends in the West Texas population pertaining to colorectal cancer screening

barriers. A questionnaire (Appendix A) was created with the intent to accurately represent the general Amarillo population. The survey was provided to participants during a cancer screening event in the Amarillo area in October 2019. The screening event was representative of the general Amarillo population.

Participants were provided a short, anonymous, optional survey distributed by event volunteers. The questionnaire was anonymous, thus negating the need for additional data blinding. The questionnaire included one single question: "What barriers do you experience with cancer screening? Please mark all that apply:" Follow-up, education, and referral information was provided to participants at the cancer screening event.

Inclusion and Exclusion Criteria

All participants were included in the study if they agreed to complete the anonymous, optional survey. No participants were excluded.

Data collection

The barriers to cancer screening listed on the questionnaire were embarrassment, unpleasantness of test, transportation, cost/lack of insurance, fear of results, lack of symptoms, lack of physician recommendations, lack of awareness, language barriers, and other causes. The questionnaire also recorded patient demographics including age, gender, and race. A summary of complete data collection is presented below in categorical graphs.

Statistical Analysis

All results were evaluated through descriptive statistics only.

Results

A total of 194 patients responded to our survey. There were 122 (62.9%) females, 71 males (36.6 %), and one respondent who did not specify. Gender was generally equally represented among all races. The ages ranged from 13 to 86 years with a mean of 51.79 and a standard deviation of 13.5. The overwhelmingly main barrier to screening was lack of funding or insurance (66%).

As can be seen in Table 1, the majority of respondents to the survey identified as Hispanic (55.2% of total respondents) followed by White (39.2% of total respondents). The two least common ethnic identifications were Black (3.1% of total respondents) and Asian (2% of respondents).

Table 1: Survey participant characteristics

	Participants, n =194 (%)
Male	71 (36.6)
Ethnicity	
White	76 (39.2)
Hispanic	107 (55.2)
Black	6 (3.1)
Asian	4 (2)
Other	1 (0.5)
Age (mean +/- SD)	51.8 (+/- 13.5)

Legend for Figures 1-3

Figure Variable	**Barrier**
A	Cost/Lacking Insurance
B	Embarrassment
C	Unpleasantness of Test
D	Transportation
E	Fear of Results
F	Lack of Physician Recommendation
G	Lack of Awareness
H	Travel
I	Language Barrier
J	Lack of Symptoms
K	Other Causes

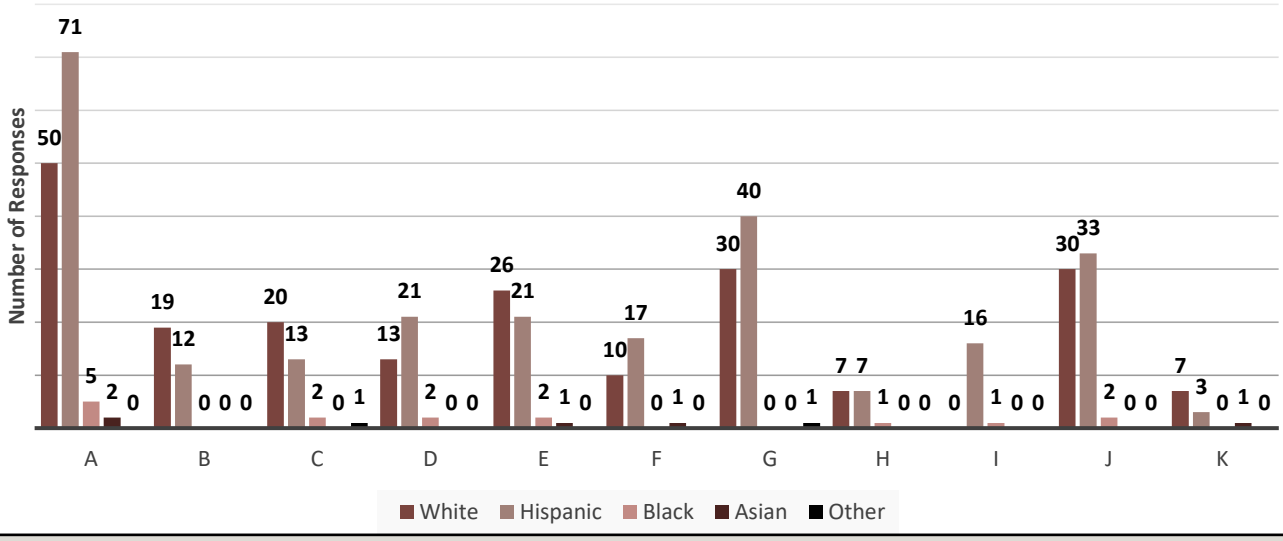


Figure 1: Barriers to CRC screening selected by of respondents categorized by self-identified ethnicity.

The largest ethnic group surveyed were Hispanics, shown in Figure 1. The primary barriers to CRC screening reported by them were a cost/lack of insurance (66.3% of Hispanic respondents) followed by a lack of awareness (37.4% of Hispanic respondents) and a lack of symptoms (37.4% of Hispanic respondents).

Figure 2 shows the most commonly selected survey responses of reported barriers to CRC screening. Based on survey responses, the most common barrier reported was the sum of cost/lack of insurance (66% of total survey respondents), followed by lack of awareness (33.5% of total survey respondents) and the lack of symptoms (25.8% of survey respondents).

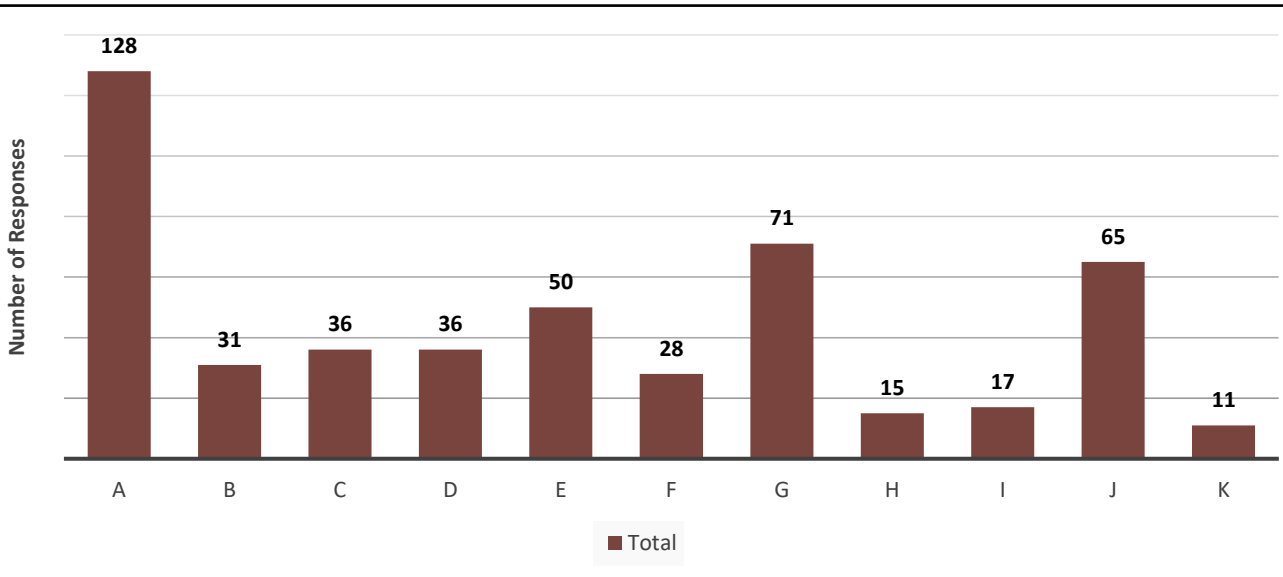


Figure 2: Compiled total of barriers to CRC screening based on survey responses.

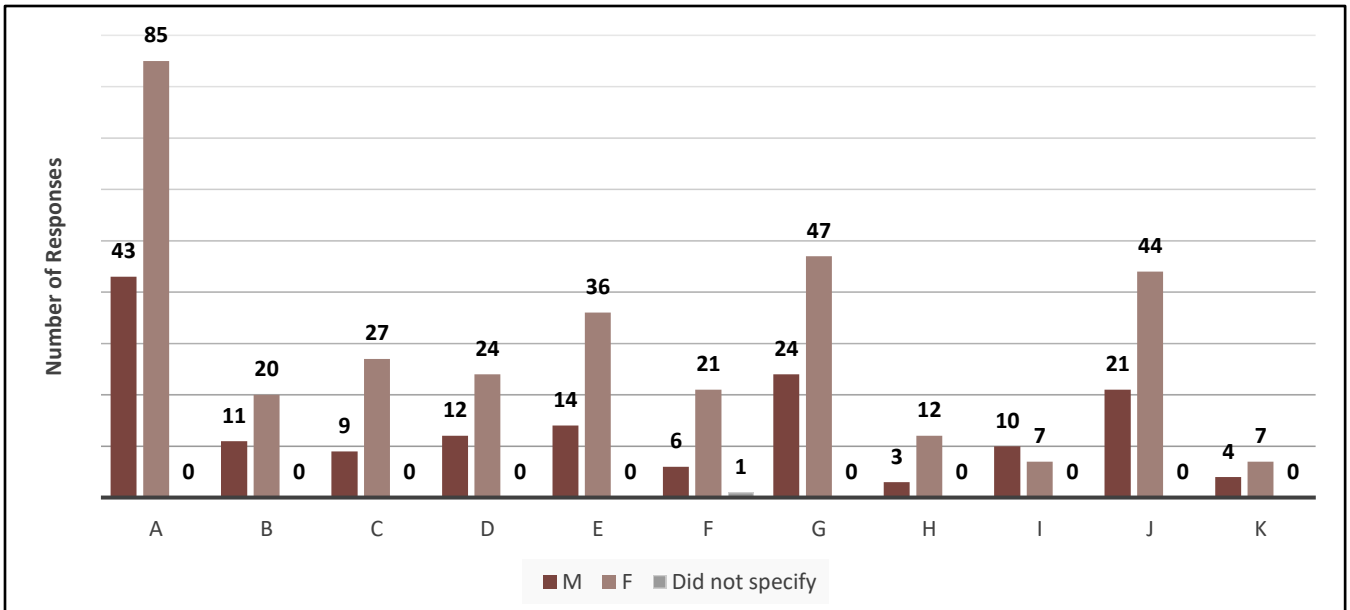


Figure 3: Barriers to CRC screening categorized by respondent self-identified gender.

Figure 3 illustrates the most commonly selected barriers to CRC screening according to gender. Based on survey responses, the most commonly selected barrier was the sum of cost and/or lack of insurance. Due to the nature of the survey, the "other causes" selections were not further analyzed for interpretation.

Discussion

The population surveyed was primarily Amarillo residents and residents of the surrounding rural communities. Most respondents identified as Hispanic or Latino and the second largest group was Caucasian (Table 1). The demographics of our survey are comparable to demographics reported by the US census for Amarillo. The vast majority of Amarillo's population reported as Caucasian; however, the largest ethnic group in our survey was Hispanic or Latino.[6] The distribution of ages in our survey was also similar to the age distribution reported by the US census for Amarillo (Table 2).[6] Compared to the urban population of the United States, rural areas such as the one surveyed are expected to have lower adherence to colorectal cancer screening guidelines.[7] This is significant because the incidence of CRC was reported to be declining in the past decade by about 3% per year in those aged 65 and older.[8] However, there is a lack of data concerning this specific population in rural, West Texas. Cancer is a worldwide leading cause of death, yet mortality and morbidity can be reduced primarily through regular screening for cervical, breast, skin, and colorectal cancer.[9] Our survey evaluated colorectal cancer barriers in an effort to increase future adherence to national recommendations.

There has been a recorded 21% risk reduction of colorectal cancer with appropriate screening.[10] This is significant when attempting to alleviate the strain of such a prevalent disease. Age of diagnosis is very important when it comes to colorectal cancer. The median age for diagnosis of colorectal cancer is 69 in men and 73 in women, respectively, and clearly delineates the need for screening once a certain age is achieved due to average incidence.[11]

A multidisciplinary approach using primary care providers and community health workers (CHWs) play an important role in screening - identifying and approaching eligible patients, providing counseling on the risks and benefits of screening, and performing relevant recommended tests. The evidence supporting the use of community health workers show that CHWs reduce the marginalized population's rate of screening guideline non-adherence.[12] The Community Healthcare workers have also been found to effectively change population attitudes and awareness leading to a well-documented increase in screening rates by providing targeted outreach and testing in communities that were well received.[13] There is also evidence supporting the significant impact that primary care physicians have on increasing colorectal cancer screening.[14] Finally, nurses have been found to play a central role in coordinating cancer screening care with patients and their relatives through educational sessions focused on the risks and benefits of screening, continuity of care, and through the distribution of available options for screening.[15] Current guidelines by The American Cancer Society recommend that adults aged 45 years and older with an average risk of CRC undergo regular screening with either a high sensitivity stool-based test or structural (visual) examination, depending on patient preference and test availability.[16] These guidelines were updated in 2018 from the previous recommendation of screening which began at the age of 50 due to the increased number of colorectal cancer cases among young and middle aged people.[17]

The survey results show that lack of insurance is the leading barrier to appropriate cancer screening followed by inadequate education over the cancer screening process in the given population. This finding is consistent with other findings regarding barriers to colorectal cancer screening and its relationship to insurance status.[8,18] The lack of insurance is mainly influenced by the structure of the U.S. healthcare system, which makes a large proportion of the eligible population unable to have adequate access to health care due to its cost. The benefits of increased insurance coverage for these affected individuals could potentially reduce morbidity and increase survival rates of patients from multiple types of cancer.[19] Recent data claims that among average-risk adults, a colonoscopy is the most common CRC screening method with an average cost of $2,125 and a mean out-of-pocket costs of $79 post insurance.[20]

The second leading barrier to appropriate CRC screening according to the survey was lack of awareness (Figure 2). This category ranked second across the demographics surveyed which included gender and ethnicity. This is similar to other studies which have documented low interest in screening as a contributing factor to the lack of proper cancer screening.[18] This could potentially be reduced through close interactions and coordination of care between patients and primary care physicians to promote patient overall awareness and improve attitudes.

Finally, the third leading barrier to appropriate CRC screening according to the survey was lack of symptoms (Figure 2). This ranked third among all of the barriers surveyed between the different demographic groups. Symptoms associated with CRC include hematochezia, weight loss, anemia, abdominal pain, and other symptoms. In some cases, the presentation of symptoms is associated with a poor prognosis due to diagnosing the advanced stage of the disease. Symptoms such as anemia on

initial presentation are associated with a higher mortality rate due to advanced staging while rectal bleeding is generally associated with a better prognosis.[21] CRC screening reduces the risk of patients presenting to a healthcare provider with a symptom that could have an unfavorable prognosis. The survey shows that there are patients in the population who may believe that they do not need to seek healthcare/CRC screening until they have the onset of new symptoms. This negates some of the value of preventative CRC screening which is done to reduce mortality and morbidity rates in the population.

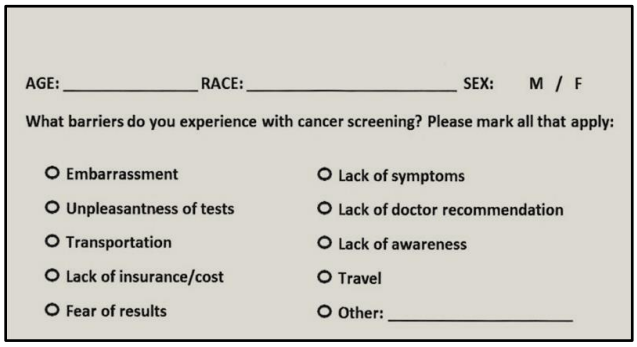
Limitations of our study include the demographic data of our respondents compared to that presented by the US census. Majority of respondents from our surveys identified as Hispanic or Latino while the US census states that this surveyed population is primarily Caucasian. This difference is likely due to a significant Hispanic or Latino population in rural Texas and the makeup of respondents from the surrounding rural areas included in the study. Another limitation includes the collection of data pertaining to the type of insurance coverage that the participants had. This could be helpful in assessing correlations between the most cited barrier to CRC screening as determined by the study results. Another limitation is the lack of documentation of the refusal and noncompletion rates for the survey. Since the survey was completed on an optional basis, there could have been a statistically significant number of people from a singular or multiple categories who declined to participate thus impacting the results.

Conclusion

The objectives of this survey-based study were to recognize the main challenges in the local community area which prevent the population from getting the appropriate recommended cancer screening and to analyze and suggest methods of resolving these challenges. The most important barrier identified in this survey to cancer screening in rural west Texas was the lack of insurance, followed by lack of awareness and lack of symptoms. The overarching issue related to all these barriers appears to be a lack of education. Proper education is necessary to inform patient populations that symptom presentation is not necessary to inquire about screening and to educate the appropriate age screening populations that CRC screening has a stronger positive impact if conducted prior to symptom presentation.

The implementation of future cancer screening barriers programs to educate patients on the reduced morbidity and mortality associated with following the current CRC screening guidelines could reduce colorectal cancer rates in rural, west Texas. A combined multidisciplinary effort between social workers, primary care physicians, physician assistants, and nurses can be clinically effective in improving cancer screening rates. Data suggest that educational outreach provided at each medical visit improves screening in marginalized populations. Due to the collaborative nature of healthcare, educating and improving the knowledge of all healthcare workers will greatly improve outreach rates and patient education. The implementation of such models could drastically improve CRC screening rates in the surveyed population and further studies assessing the effects of such implementations could have significant implications for other rural populations similar to the one surveyed.

Appendix:



AGE: _____ RACE: _____ SEX: M / F

What barriers do you experience with cancer screening? Please mark all that apply:

- O Embarrassment
- O Unpleasantness of tests
- O Transportation
- O Lack of insurance/cost
- O Fear of results
- O Lack of symptoms
- O Lack of doctor recommendation
- O Lack of awareness
- O Travel
- O Other: _____

Appendix A: Survey Questionnaire

This survey was distributed to patients who voluntarily agreed to participate in the CRC screening barriers data collection process.

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Case Report

Vertex Venous Epidural Hematoma: A Case Report

Tyler Morgan[1]; Dylan Murray[2], Matthew Murray[3], Richard Murray, MD[4]

Abstract

Epidural hematomas are blood collections in the subdural space that typically occur secondary to head trauma. Generally, epidural hematomas result from arterial bleeding, but on infrequent occasions, they may be secondary to venous bleeding. We present a case of epidural hematoma due to venous bleeding resulting from traumatic disruption of the superior sagittal sinus.

Keywords: trauma, epidural hematoma, venous bleeding

Introduction

Head trauma can occur in various settings including traffic accidents, falls, and assaults, and can result in various complications, including epidural hematoma (EDH). While EDHs are typically arterial in origin, a small subset is due to disruption of venous vasculature. These hematomas present clinically similar to arterial EDH but on imaging, frequently present in locations unseen in their arterial counterparts and with different features, including the occasional crossing of suture lines.[1] This case report examines one atypical venous cause of epidural hematoma and the effective management of such a presentation.

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Case Presentation

In December 2021, a 47-year-old Hispanic male was transferred to a local hospital from a free-standing emergency department. The previous night, the patient awoke and got out of bed complaining of nausea. He attempted to walk to the bathroom but collapsed and hit his head. His wife found him on the floor, unconscious. She called 911, but upon EMS arrival, the patient, now conscious but confused, refused EMS transportation. He failed to improve, and hours later, his wife convinced him to go to a free-standing emergency department. A head CT was performed and noted an acute nondisplaced calvarial fracture at the vertex with acute epidural hematoma along the falx, a parafalcine traumatic subdural hematoma, and evidence of traumatic subarachnoid bleeding.

He was transferred to the local hospital for urgent neurosurgical evaluation. Repeat CT of the head was consistent with prior imaging. No immediate surgical intervention was recommended. Tranexamic acid and levetiracetam were initiated for traumatic brain injury. Repeat CT of the head the following day was unchanged. Internal medicine was consulted for syncopal workup, which was largely benign. Outpatient follow-up with cardiology was recommended to the patient.

The patient continued to improve and was discharged on hospital day 7 with instructions to return to the clinic in two weeks. A follow-up CT of the head demonstrated a decrease in both the size and radio density of the previous EDH consistent with resolving hematoma and interval resolution of scattered traumatic subarachnoid hemorrhage.

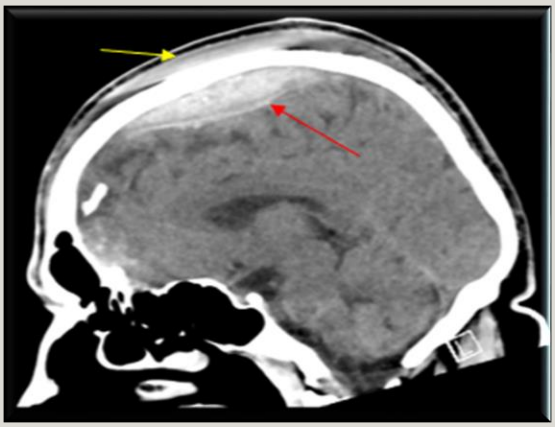

Figure 1a: Sagittal view

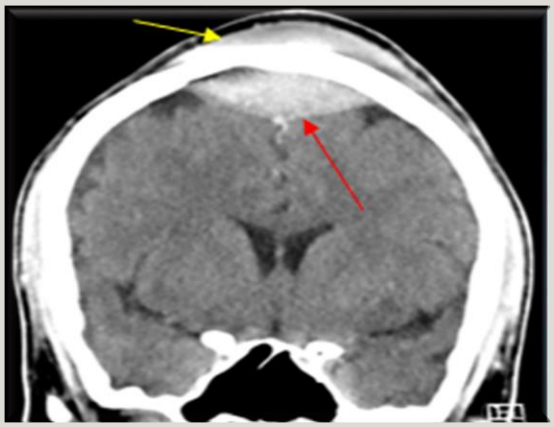

Figure 1b: Coronal view

Figure 1: Head CT without contrast taken on initial presentation demonstrating the vertex epidural hematoma. The red arrow points to the venous epidural hematoma, and the yellow arrow to a traumatic subcutaneous hematoma

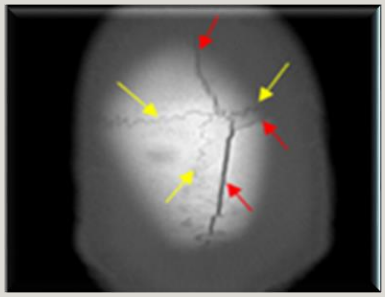

Figure 2a: Axial view

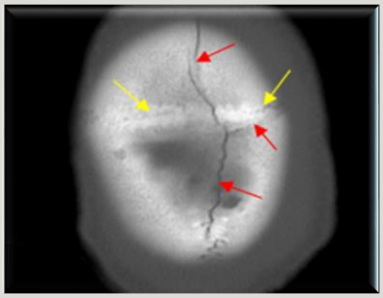

Figure 2b: Slightly inferior axial view

Figure 2: Axial view of the head CT (bone window) taken on initial presentation demonstrating the vertex fracture. The red arrows point to the fractures and the yellow arrows point to the normal physiologic sutures.

Figure 3: Coronal view head CT without contrast taken on presentation demonstrating the vertex fracture. The red arrow points to the fracture.

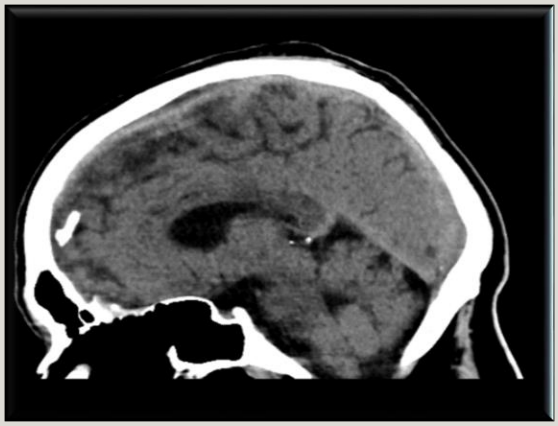

Figure 4a: Sagittal view

Figure 4b: Coronal view

Figure 1: Head CT without contrast taken at 2-week follow up.

The patient presented for additional follow-up two months after discharge from the hospital. He was doing well, and repeat head CT showed mild bilateral inferior and medial frontal lobe post-traumatic encephalomalacia with no additional evidence of large territory cerebral edema.

Discussion

Epidural hematomas occur in roughly 2% of all head injuries.[2] Classically, they result from arterial bleeding from a damaged middle meningeal artery into the endosteal layer between the skull's inner surface and the dura's outer surface.[3] They present as a hyperdense biconvex “lens” shape that is limited by cranial sutures. On rare occasions, this pathology may be the result of venous bleeding. In these cases, damage to the dural venous sinuses is the precipitating injury.[1] These venous epidural hematomas characteristically occur in three locations: the anterior, middle cranial fossa, likely due to damage of the sphenoparietal sinus along the greater wing of the sphenoid; the occipital posterior fossa due to damage to the transverse sinus; and the vertex, as seen in the patient presented, secondary to damage to the falx and the enclosed superior sagittal sinus.[1,4,5] These vertex venous EDHs are one of the few occasions in which an epidural hematoma will cross suture lines since the sagittal suture is disrupted, but they are quite rare. One retrospective analysis in India found that vertex epidural hematomas comprised only 0.47% of all epidural hematomas analyzed from 1995 to 2012.[6]

Stereotypically, epidural hematomas present with an initial loss of consciousness, a lucid interval, and deterioration with symptoms including headache, confusion, drowsiness, and seizures.[7,8,9] Hematoma expansion can lead to increased intracranial pressure (ICP), which may result in the Cushing reflex or uncal herniation with compression of the oculomotor nerve and, subsequently an ipsilateral dilated pupil. An eventual sequela of such a presentation without immediate intervention is brain herniation and death. The most common symptom of vertex epidural hematoma is severe headache.[6] Some patients may present with symptomatic elevated ICP and

pure lower limb weakness without sensory involvement. Ramesh et al., noted that none of the patients with a vertex epidural hematoma presented with any cranial nerve involvement; however, one previous case report described a patient with a unilateral oculomotor nerve palsy in the setting of vertex EDH.[6,10]

Head CT remains the most common imaging modality used to identify epidural hematomas. This imaging is fast, widely available, and effective in the identification of most epidural hematomas.[11] However, up to 8% of acute epidural hematomas may not be identified on an initial CT.[2,12,13] This may result from EDH secondary to venous bleeding due to slower accumulation of blood. Brain MRI is slower and more expensive than CT but more sensitive for the identification of intracranial bleeding. It is beneficial in identification of epidural hematoma located at the vertex.[2,14]

Epidural hematomas require immediate neurosurgical evaluation, but management varies on a case-to-case basis.[14,15] In 2006, the Surgical Management of Traumatic Brain Injury Author Group stated that an epidural hematoma with any of the following features should be managed surgically: GCS <9 and pupillary abnormalities, hematoma volume greater than 30 mL, and/or hematoma expansion leading to elevated ICP or neurologic deterioration.[7] Surgical management in cases of vertex EDH involves a wide craniotomy to the margins of the hematoma with evacuation and control of the bleeding.[6] Superior sagittal sinus tears can be directly sutured or controlled with hemostatic devices. Ramesh et al., found that over 80% of patients with a vertex epidural hematoma improved with conservative medical management.[6] These patients should have a full neurologic assessment every one to two hours for at least the first 24 hours after presentation and repeat head CT 6 to 8 hours after initial imaging and in all patients with neurologic deterioration.[7,16] The patient presented in this case was managed similarly conservatively. He had a largely benign clinical course without evidence of deterioration. Follow-up imaging showed gradual resolution of his vertex EDH and a positive clinical outcome.

Conclusion

While venous epidural hematomas, such as the one presented in this case, happen much less frequently than their arterial counterparts, limited literature suggests that they can generally be managed conservatively and result in benign clinical outcomes. That said, identification and monitoring of the hematoma with imaging are essential in guiding clinical decision-making.

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Image Challenge

Cervical Spine Injury Following Motor Vehicle Accident

Ranger Kile, MS, MBA[1], Miguel Pacheco[2], Niki Sankoorikkal[1], Tiffany Xu[1]

Case

A 28-year-old male was brought to the emergency department via air ambulance following a motor vehicle accident as an unrestrained passenger.

History of Present Illness

Upon arrival, the patient was intubated and a cervical collar was in place. On exam, he was found to have multiple traumatic injuries and pupils were unequal and sluggish. A longitudinal computed tomography (CT) scan of the cervical spine without contrast was performed.

Differential Diagnoses

- Occipital-condyle fracture
- Jefferson fracture
- Atlanto-occipital dislocation
- Wedge fracture
- Spinous process fracture
- Rheumatoid Arthritis
- Odontoid fracture

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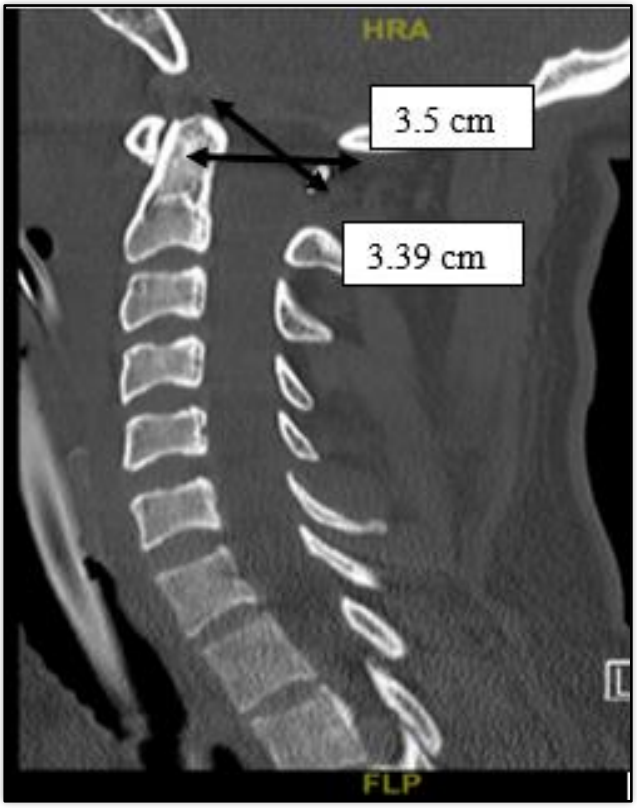
Discussion

This image demonstrates atlanto-occipital dislocation. Atlanto-occipital dislocation occurs when severe flexion and extension exists at the upper cervical level. Atlanto-occipital dislocation is a disruption of the ligaments located between the occiput and upper cervical spine often without concurrent bony fractures.[2] Due to the forces needed to produce this injury, most patients do not survive the inciting event.

Diagnosis

'Powers ratio' and 'Harris rule of 12' can be used to diagnose atlanto-occipital dislocation. Powers ratio is used to diagnose atlanto-occipital dislocation. The distance from basion to posterior arch (3.39 cm) is divided by the distance from the anterior arch to opisthion (3.50 cm). Ratio of greater than 1.0 suggests anterior dislocation.[1]

Ratio of less than 1.0 raises concern for posterior dislocation or odontoid fracture. Harris Rule of 12: Basion-dens interval or basion-posterior axial interval >12 mm suggest occipitocervical dissociation.



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Pharmacotherapy Consult

Angiotensin-Converting Enzyme Inhibitor Overdose: from the Desk of the Editors

Neely C. Hudson, PharmD, Maegan M. Whitworth, PharmD

Case Presentation

A 67-year-old female presents to the emergency department with confirmed ingestion of 82 tablets of lisinopril 40 mg.

The patient is hypotensive, with a blood pressure of 72/51 mmHg via arterial line, heart rate of 106 beats per minute, respiratory rate of 22 breaths per minute, weight of 78 kilograms, and Glasgow coma scale of 14. A comprehensive metabolic panel and complete blood count are currently pending. The patient's initial point of care blood glucose is 92 mg/dL. Physical exam findings include cool, clammy extremities, pupils 3 mm equal and reactive, and otherwise normal.

In addition to initial stabilization and decontamination, which of the following acute care plan is most appropriate to initiate first?

A. 50 mL bolus of dextrose 50%, 78 units of regular insulin intravenous (IV) bolus, followed by regular insulin IV continuous infusion at 40 units/hour, and dextrose 50% IV at 150 mL/hr titrated to blood glucose and hemodynamics.
B. Glucagon 10 mg IV bolus, followed by 5 mg/hour
C. 1-liter bolus of lactated Ringer's
D. 10 mg bolus of naloxone

Discussion

Lisinopril is an angiotensin-converting enzyme (ACE) inhibitor, which mechanistically inhibits the conversion of angiotensin I to angiotensin II, resulting in lower levels of angiotensin II, a potent vasoconstrictor. With the lack of circulating angiotensin II, patients with ACE inhibitor overdose are likely to present with hypotension and a benign toxic response compared to other anti-hypertensives. Based on the mechanism of action of ACE inhibitors, patients may develop acute renal failure and electrolyte abnormalities, including hyperkalemia, with toxic ingestion.

The most appropriate course of action for an acute ACE-inhibitor overdose is supportive care, which in this case, would be an intravenous (IV) fluid bolus to increase the patient's blood pressure acutely (Answer choice C). If the patient's blood pressure rises appropriately after fluid resuscitation, no further intervention would be required.[1] If the patient remains hypotensive, additional fluid administration could be warranted, and vasopressors initiated. No specific antidote for ACE-inhibitor toxicity has been identified.

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Initiating a 50 mL bolus of dextrose 50%, 78 units of regular insulin IV bolus, followed by regular insulin IV continuous infusion at 40 units/hour, and dextrose 50% IV at 150 mL/hr titrated to blood glucose and hemodynamics, would likely be ineffective for ACE-inhibitor overdose. The patient would not likely present with profound hypotension. High-dose insulin euglycemic therapy (HIET) is more likely to be effective in treating hypotension from calcium channel blockers or beta blockers.[2,3] HIET helps to improve carbohydrate utilization by cardiac myocytes, improving cardiac function but not combating vasodilation.

A glucagon 10 mg IV bolus, followed by 5 mg/hour would also likely be ineffective for treating hypotension associated with ACE-inhibitor overdose. Like HIET, glucagon can help combat cardiac conduction abnormalities associated with beta-blockers and calcium channel blockers.[3] Glucagon works by increasing cyclic adenosine monophosphate (cAMP) at the sinoatrial node and atrioventricular node, improving cardiac contractility. Unlike HIET therapy, tachyphylaxis to glucagon can develop.

Administration of a 10 mg bolus of naloxone would not likely have any physiologic effect on this hypotensive patient. Naloxone can be administered to improve central nervous suppression in patients presenting with clonidine overdose.[4,5] In a clonidine overdose, naloxone would not improve cardiovascular effects; therefore, supportive care would also be recommended.

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