Electronic health record cue identifies epilepsy patients at risk for obstructive sleep apnea

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Abstract

Background

Prior studies have reported that patients with epilepsy have a higher prevalence of obstructive sleep apnea (OSA) that contributes to poor seizure control. Detection and treatment of OSA can improve seizure control in some patients with epilepsy. In this study, we sought to develop, implement, and evaluate the effectiveness of an electronic health record (EHR) alert to screen for OSA in patients with epilepsy.

Methods

A 3-month retrospective chart review was conducted of all patients with epilepsy >18 years of age who were evaluated in our epilepsy clinics prior to the intervention. An assessment for obstructive sleep apnea (AOSA) consisting of 12 recognized risk factors for OSA was subsequently developed and embedded in the EHR. The AOSA was utilized for a 3-month period. Patients identified with 2 or more risk factors were referred for polysomnography. A comparison was made to determine if there was a difference in the number of patients at risk for OSA detected and referred for polysomnography with and without an EHR alert to screen for OSA.

Results

There was a significant increase in OSA patient recognition. Prior to the EHR alert, 25/346 (7.23%) patients with epilepsy were referred for a polysomnography. Postintervention, 405/414 patients were screened using an EHR alert for AOSA and 134/405 (33.1%) were referred for polysomnography ($p < 0.001$).

Conclusion

An intervention with AOSA cued in the EHR demonstrated markedly improved identification of epilepsy patients at risk for OSA and referral for polysomnography.

▼ Assessment Obstructive Sleep Apnea (AOSA)

Risk Factors (Refer for PSG if > or =2 of the following factors):

- ☐ BMI > 30 kg/m²
- ☐ Snoring
- ☐ Choking or gasping in sleep
- ☐ Unexplained nighttime awakenings
- ☐ Morning headaches
- ☐ Dry Mouth, Sore throat, Chest tightness upon night or morning awake...
- ☐ Nocturia
- ☐ Decreased memory/concentration
- ☐ Large neck circumference > 17 in
- ☐ Small hypoplastic and/or retroposed mandible and maxilla
- ☐ Excessive daytime sleepiness
- ☐ Mallampati Grade III=Visualization of the soft palate and the base of t...
- ☐ Mallampati Grade IV=Soft palate is not visible at all

Sleep and epilepsy have a complex reciprocal relationship. Sleep can result in an activation of ictal and interictal discharges triggering seizures, often in non-REM (NREM) sleep and during sleep transition. Interictal epileptiform discharges, focal and generalized, become frequent with the increasing depth of NREM sleep.¹ Sleep deprivation and fragmentation can increase seizure frequency. Nocturnal tonic-clonic seizures are a risk factor for premature mortality and sudden unexpected death in epilepsy (SUDEP).² Obstructive sleep apnea (OSA) can negatively affect epilepsy, contributing to poor seizure control and SUDEP. The American Academy of Neurology established epilepsy quality measures that target decreasing seizure frequency and improving quality of life in patients with epilepsy.³

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Obstructive sleep apnea can negatively affect epilepsy, contributing to poor seizure control and SUDEP.

The American Academy of Sleep Medicine devised quality care measures to decrease the public health burden of OSA.⁴ OSA therefore should be screened and treated in patients with epilepsy.

Health information technologies designed to improve clinical decision-making with electronic health record (EHR) alerts are ideal for their ability to address the growing information overload clinicians face and to provide a platform for integrating evidence-based knowledge into care delivery.⁵ Using an alert in the EHR to routinely screen for OSA has the potential to improve the identification of OSA in epilepsy patients, thus improving seizure control. The objective of this pilot project is to develop and implement an EHR alert to screen for OSA and evaluate its effectiveness in the identification of epilepsy patients at risk for OSA.

Methods

Standard protocol approvals, registrations, and patient consents

Approval from our institutional ethical standards committee to conduct this research was obtained. The study was conducted in an urban university hospital.

Preintervention

Medical records of epilepsy patients >18 years of age seen in the epilepsy clinics from January 2017 to March 2017 were reviewed. The following data were collected: number of patients seen, age in years, sex, number of patients screened for OSA, and number of patients referred for polysomnography.

Intervention

After literature review of current questionnaires to assess for OSA, a provider-administered assessment was designed. This assessment comprised recognized OSA risk factors (specific questions relevant to sleep and physical examination findings) embedded in the EHR: body mass index >30 kg/m², snoring, choking/gasping in sleep, unexplained nighttime awakenings, morning headaches, dry mouth, sore throat, nocturia, decreased memory/concentration, neck circumference >17 inches, craniofacial dysmorphisms, excessive daytime sleepiness, and Mallampati classification score of III or IV.⁶ Assessment for OSA (AOSA) appeared in the

Figure Assessment of obstructive sleep apnea (AOSA) in the electronic health record

AOSA Screening - Assessment Obstructive Sleep Apnea

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activities bar once the clinic encounter was opened (figure). The risk factors were listed as clickable items and were checked only if they applied to the patient. The selected factors were populated automatically into the patient's note. A blank note was included for additional comments. A best practice advisory, not designated as a hard stop, notified the provider to complete the AOSA before the encounter was closed. Patients with 2 or more of the risk factors were referred for polysomnography by the provider. The AOSA and the best practice advisory were approved by our institution's EHR steering committee. The information technology team then built the application in the EHR.

Postintervention

The following data were collected for patients evaluated during May 2017–August 2017 after implementation of the EHR alert: number of patients seen, age in years, sex, number of patients screened for OSA, and number of patients referred for polysomnography.

Statistical analysis

A nominal scale was used for labeling variables: yes or no for screening OSA with and without AOSA and for referral of polysomnography. The Pearson χ^2 test was used to demonstrate whether there was a significant increase in the proportion of patients referred for polysomnography pre-intervention and postintervention.

Data availability

The anonymized data of this report will be shared by request from any qualified investigator.

Results

Preintervention

A total of 346 epilepsy patients were identified and none was formally screened for OSA. Twenty-five patients (7.2%) were

The available postintervention polysomnography results indicate that use of the AOSA captures an increased number of epilepsy patients with OSA.

referred for polysomnography. A total of 14 of 25 (56%) patients showed apnea-hypopnea index (AHI) >5 per hour (table).

Postintervention

A total of 405 of 414 patients (97.8%) were screened for OSA using AOSA with EHR alert. A total of 134 of 405 (33.1%) patients had 2 or more risk factors for OSA and were referred for polysomnography. A total of 82 of 134 patients completed polysomnography thus far, and 71 (86.6%) showed AHI >5 per hour.

There was a significant increase in the number of epilepsy patients identified at risk for OSA and referred for polysomnography postintervention (χ^2 74.7, 1 df, $p < 0.001$).

Discussion

This pilot project demonstrated that almost all epilepsy patients were screened for OSA with an EHR alert. The alert increased the identification of patients at risk for OSA, necessitating a referral for polysomnography. A recent study⁷ used the patient self-administered STOP-BANG questionnaire to screen for OSA in epilepsy patients and exhibited that only 41.6% were screened, as compared to 97.8% in our study. The percentage of patients identified at risk for OSA (31.2%) was identical to our study. Although questionnaires are commonly used to assess OSA and have modest accuracy, models that incorporate symptom reviews with simple clinical measurements are superior.⁸ Further, self-reported questionnaires can be challenging for patients with epilepsy due to impaired cognitive abilities and memory. Adoption of provider-driven EHR screening, as utilized in our study, facilitates practice transformation⁹ and increases the opportunity to screen patients with the ease of a prompt. Obtaining approval for implementation of the AOSA was relatively uncomplicated. Providing a clear prototype for the AOSA expedited the process. In addition, ≥ 2 risk factors were used to refer a patient for polysomnography, as opposed to ≥ 3 risk factors, as designated in the STOP-BANG questionnaire, to increase sensitivity of screening.

The available postintervention polysomnography results indicate that use of the AOSA captures an increased number of

Table Preintervention and postintervention results

	Preintervention (January–March 2017)	Postintervention (May–August 2017)	<i>p</i> Value
Total patients	346	414	
Age, y	19–93	18–93	
M/F	177/169	180/225	
Patients screened for OSA, n (%)	0	405 (97.8)	
Patients not screened for OSA	346	9	
Patients referred for polysomnography, n (%)	25 (7.23)	134 (33.1)	<0.001

Abbreviation: OSA = obstructive sleep apnea.

epilepsy patients with OSA. A current follow-up study is collecting polysomnography results of the remaining patients and evaluating the effects of treating OSA by reported seizure frequency and antiepileptic medications prescribed. AOSA can be expanded for use in primary care and pediatric epilepsy, which can strengthen the reliability of this electronic assessment. A future study to validate AOSA against polysomnography in a cohort of patients to determine AOSA sensitivity and specificity is planned.

In view of the clinical and public health implications of untreated OSA, screening in high-risk diseases like epilepsy warrants implementation of a screening instrument such as the AOSA with an EHR alert. This represents a powerful imperative to fill the gap in the safety of epilepsy care. The potential concerns of an EHR assessment in clinical practice can include delay in chart closure, alert fatigue, and provider nonadherence, which may be addressed in a subsequent study. Documentation of assessing for OSA in the EHR provides evidence of meaningful use compliance, quality improvement in practice, and adherence with regulatory reporting programs.¹⁰ Further, this type of data procured may be integrated in The Axon Registry of the American Academy of Neurology to improve care in epilepsy if a practice is enrolled.

An EHR alert to screen for OSA using AOSA markedly increases the detection of epilepsy patients at risk for OSA. Such screening can lead to early detection and treatment, which may potentially decrease seizure frequency, morbidity and mortality, the number of antiepileptic medications, and invasive surgeries, thereby improving the quality of life of patients with epilepsy and OSA.

Author contributions

Martha A. Mulvey: study concept, design, data acquisition, analysis, interpretation, drafting, and critical revision of the manuscript. Aravindhan Veerapandiyan: data acquisition, analysis, interpretation, and critical revision of the manuscript. David A. Marks: data interpretation and critical revision of the manuscript. Xue Ming: study design, data analysis, interpretation, and critical revision of the manuscript.

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TAKE-HOME POINTS

- An alert in the electronic health record increases the identification of epilepsy patients at risk for obstructive sleep apnea.
- Patients were screened using a simple assessment for obstructive sleep apnea consisting of 12 recognized risk factors set in the electronic health record.
- Routine screening by the provider using an electronic health record alert can lead to early identification of obstructive sleep apnea in patients with epilepsy.

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Disclosure

M. Mulvey and A. Veerapandiyan report no disclosures. D. Marks serves on the speakers' bureau for Sunovion Pharmaceuticals. X. Ming serves as Editor for *Journal of Pediatric Neurology* and on the editorial board of *Journal of Sleep Disorders and Therapy* and is author on a patent re: polyunsaturated fatty acids interactions and oxidative stress disorders. Full disclosure form information provided by the authors is available with the full text of this article at Neurology.org/cp.

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