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Effects of Antiepileptic Medications on Bone Density in Individuals with Intellectual and Developmental Disabilities

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ABSTRACT

Individuals with intellectual and developmental disabilities (IDD) are commonly prescribed antiepileptic drugs (AEDs) to manage seizures, manage behavior, and stabilize mood. Though research has been done on the effects of antiepileptic medications in patients with epilepsy, little study has been done on the persons with intellectual and developmental disabilities population. After surveying IDD patients with a history and current use of AEDs on osteoprotective behaviors, we were unable to use SPSS due to incomplete surveys and low sample sizes. However, we were still able to analyze for common themes, and we found that the most prevalent use of AEDs was for the management of epileptic seizures. We also found that the majority of participants completed weight bearing exercise, including walking, running, or weight lifting, more than three times per week and felt that they consumed a balanced diet. Vitamin D was the most commonly used supplement, and calcium was only used by four participants. Future research collection needs to have a larger sample size as well as more knowledgeable and thorough completion of surveys.

INTRODUCTION

Antiepileptic drugs are medications commonly used for the control or management of seizures as well as mood stabilization drugs for psychiatric diagnoses (Fuleihan, Elsevier, 2008). Due to the complicated medical cases that many individuals with intellectual and developmental disabilities face, patients are commonly shuffled from doctor to doctor and overprescribed medications that have a potential for serious adverse drug reactions. Many IDD patients are prescribed AEDs as a means of behavior management. AEDs can be a large contributing factor in the increase of fractures and osteoporosis diagnoses due to the adverse drug reaction of causing low bone mineral density (BMD). (Fuleihan, Elsevier, 2008) Though much study has been done on epilepsy patients and the effects of AEDs on their BMD, due to changing medical terminology and development in the field of medical care for IDD patients, there is a lack of research in AEDs effect on BMD in patients with IDD. The purpose of this study was to analyze the impact of AEDs on BMD in IDD patients as indicated by the prevalence of fractures, ability to bear weight, and diagnoses of osteoporosis. Common factors that contribute to low BMD include tobacco use, (CDC, 2015) a diagnosis of overweight or obese, low vitamin D and calcium levels (Daniele, Pharm Research, 2004), decreased weight bearing status, poor diet, menopause, and lack of exercise (Center, Am.J.Ment.Retard, 1998). These factors are compounded in individuals with an IDD diagnosis because patients frequently make poor diet choices that lead to decreased levels of vitamins and minerals. This fact, combined with a low exercise rate, leads to the increased prevalence of IDD patient's diagnoses of overweight and obesity. These factors, when studied individually and combined, lead to a decrease in bone mineral density which in turn can lead to an increase in fracture rates and decreased mobility in patients with IDD. Because this is a multifaceted issue, we also studied other commonly implemented osteoprotective behaviors such as diet supplementation, exercise routines, and abstinence from tobacco use. We hypothesized that patients taking antiepileptic medications will have lower bone density, higher rate of osteoporosis, inability to bear weight, and increased fracture prevalence. Further, we hypothesized that an increase in osteoprotective behaviors would cause a decrease in fracture rate and diagnoses of osteoporosis, and an increase in ability to bear weight.

PURPOSE

The purpose of this study was to analyze the impact of AEDs on BMD in IDD patients as indicated by the prevalence of fractures, ability to bear weight, and diagnoses of osteoporosis.

METHODS

A convenience sample of twelve subjects was selected from Lee Specialty Clinic (LSC) in Louisville, Kentucky. Inclusion criteria included a past history or current use of AEDs and a diagnosis of an intellectual or developmental disability. Exclusion criteria included no past history/current use of AEDs and no diagnosis of intellectual or developmental disability. Of the selected participants, there were ten males and two females. All participants had been previously diagnosed with an intellectual or developmental disability and these participants also had a past history or current use of antiepileptic drugs. Groups were assigned as having a diagnosis of osteoporosis or no diagnosis of osteoporosis. There were three and nine participants in each group respectively. Before participating in the study, all subjects read and signed an informed consent form approved by the University's Institutional Review Board for the Protection of Human Subjects as well as the Cabinet for Health and Family Services Institutional Review Board of Frankfort, Kentucky, which also approved the study. Data collection was completed with a twenty-one question survey which included questions pertaining to demographics, past medical history, diet, tobacco use, and osteoprotective behaviors. Questions were open and closed ended and included both qualitative and quantitative data. The survey (included in Appendix A) was adapted from a survey of risk factors for osteoporosis and osteoprotective behaviors among patients with epilepsy, which had not been validated. Participants first received a copy of the informed consent which they read and signed. If participants were unable to complete the documentation, their primary care provider or guardian completed the paperwork. After completion of informed consent, each participant was given a survey and asked to complete the information to the best of their ability. Upon completion, surveys were analyzed for common themes and patterns.

RESULTS

Of the data collected, three of the twelve participants were diagnosed with osteoporosis (DXO). All three of those with a DXO were taking AEDs for seizure management, which was the most common answer for use of medication at 75%, the second being behavior management, and lastly, mood stabilization. None of those with DXO had a family history of osteoporosis, but two of the other participants did, both cases being in their grandmothers. All participants with DXO were male, and two of the three participated in weight bearing exercise more than three times a week. The third DXO participant was non-weight bearing, used a wheelchair, and participated in pool therapy at least one time a week. 58% of participants, including all with DXO believed they consumed a balanced diet and did not leave out a particular food group. No tobacco use was reported from participants. History of fracture was recorded in four of the twelve participants. Two of those with fracture history also had DXO, and one participant without DXO did not answer. The most commonly used AED was Valproic acid, which 50% of participants were currently taking at the time of the survey. Only one participant with DXO had a past history and was currently using valproic acid. The most common supplement was Vitamin D, which 66% of participants were taking more than three times per week. The second most prevalent supplement was a multivitamin which 58% of participants were taking more than three times per week. Only 41% of participants had received a dual x-ray absorptiometry scan (DXA), which is the gold standard for detecting osteoporosis.

DISCUSSION

There has been little research collected on the impact of AEDs on bone density, especially in those with intellectual and developmental disabilities. Due to the complicated medical cases that IDD patients present with, they are an underserved patient population. Due to decreased levels of health care, overmedication is common. This overmedication can be seen in the use of AEDs for behavior management and mood stabilization. This use of drugs to regulate patient behavior can be necessary, but is at times an easy way to deal with patients. This can lead to a diagnosis of osteoporosis due to AEDs and their impact on bone health. Because the IDD population has not been thoroughly studied, more research needs to be completed to better understand the patients that need more complicated and in-depth care.

The purpose of the study was to examine the impact of antiepileptic medications on bone density as indicated by fractures, osteoporosis, and ability to bear weight in patients with intellectual and developmental disabilities. While the fracture rate was increased for those with DXO, the fracture dates were not reported, and therefore it couldn't be determined if these fractures occurred before or after the start of AEDs. Of those with DXO, only one was unable to bear weight, and the other two were completing weight bearing exercise more than three times per week. These weight bearing exercises could include walking, running, and weight lifting. Though the two were participating in weight bearing exercise, they were the two who had sustained fractures. This could be confounded by the variable of the third DXO diagnosis being wheel chair dependent. It is important to acknowledge the risk of weight bearing activities. Though weight bearing activities are osteoprotective behaviors, they also put the patient at greater risk of falls and fractures. Therefore, patients participating in weight bearing exercises should be monitored the entire time, and they should also wear a gait belt to assist in walking and to decrease the severity of falls when they do occur. An alternative to full weight bearing exercises is pool therapy in which patients can bear a portion of their weight and are at much lower risk of falling and hurting themselves. Only 25% of participants utilized pool therapy, which allows for patients who are unable to walk or support their full weight to exercise freely without the use of assistive devices. Even with decreased weight bearing, pool therapy has been shown to improve bone health (Morgan, Int J Exerc Sci, 2015). It has been shown that drug monotherapy and polytherapy with AEDs both have a negative impact on BMD (Fuleihan, Elsevier, 2008), and in other studies it has shown that polytherapy has a larger negative impact on BMD (Lee, Elsevier, 2015). It has also been shown that long term use has a greater negative impact on BMD (Pluskiewicz, Elsevier, 1997). All participants in our study were participating in drug polytherapy, with varying times of being on the medications. Only one participant was on their AEDs for life, and this patient did have a DXO, which is consistent with research on epileptic patients.

Diet is also another main consideration when studying osteoporosis. The majority of participants stated that they believed they consumed a balanced diet. However, when asked the next question (describe a typical meal) there were many answers of hamburgers, fries, and soft drinks. This disparity in thought of nutritional health and true nutritional health is a problem not only for the participants in the survey but also the primary care providers and guardians. These poor diets lead to a decrease in macro and micro nutrients. It has been shown that supplementation of calcium and vitamin D have a positive impact on BMD and can slow and reverse the effects of low BMD (Wagemans, Intellect Disabil Res, 1998, Daniele, Pharm Res, 2004). Vitamin D was the most commonly used supplement, but calcium was only used by four participants. While supplementation is important, a more balanced diet with natural consumption of nutrients could in the end save money as well as decrease medications. Nutritional education is needed to teach all of those working with patients with increased risk of osteoporosis so that there will be a decreased risk of obesity, inability to bear weight, and the comorbid conditions associated with these problems.

Only 41% of participants had received a DXA scan and there are many reasons that this could be. DXA scans are expensive and they require the patient to lie very still which is not always feasible for IDD patients. However, it has shown that the completion of a DXA scan alone leads patients to begin osteoprotective behaviors (Foster, Adapt Phys Activity Q, 2004, Marci, Calcif Tissue Int, 2000). The cost and inability of DXA scans to be completed without patient cooperation reveals the need for another diagnostic tool to screen for osteoporosis.

CONCLUSION

Unfortunately, the limitations for our research were great. Due to the unforeseen necessity of approval from the Health and Family Services Institutional Review Board of Frankfort, Kentucky, research collection began later than desired. This limited research time window allowed for fewer surveys to be collected. The Health and Family Services Institutional Review Board of Frankfort, Kentucky also required that the primary care provider, guardian, or the participant fill out the survey themselves, which was contrary to our original research design of allowing the physicians to fill surveys out on behalf of the patient. Some of the potential participants at LSC have guardians of the state, and those guardians were unable to respond in a timely manner, which led to lower response rates. The care providers and participants themselves are also not very knowledgeable about their medical history. This resulted in only three of the twelve surveys collected being filled out completely. All other surveys left at least one question unanswered or with an answer of unknown. The small sample size and lack of complete surveys allowed for only descriptive statistics and the analysis of common themes. While this has hindered the results of our survey, it is not surprising. The lack of complete information and ability to participate only confirms this analysis that participants, care providers, and guardians have a low level educations of their conditions and the implications that come from them.

Future research to be conducted on this population should include a greater population sample. It would also be helpful to analyze fewer variables to try and determine which variable truly causes an increase in DXO, such as the different effects of the different types of AEDs (Salimipour, J Nucl Med Technol, 2013, Kim, Epilepsy and Behavior, 2007, Koo, Elsevier, 2013). While this elimination of other variables is important, many times IDD patients are such complex medical cases that the actual determination of one single variable may be impossible. While a large scale study of the population would be helpful for medical professionals, a small scale study of individual patients would be beneficial for primary care providers and guardians. Patient care is most important both at the office and at home, and therefore an in-depth patient knowledge would be helpful for both physicians and family members taking care of the complex medical cases that IDD patients present with.

Survey Question	Total Participant % yes
Vitamin D Use	75%
Tobacco Use	0%
DXA Scan	41%
Polytherapy	100%