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Editorial

What can be done to reduce the risk of SUDEP?

The epilepsies constitute one of the most common serious brain disorders; the condition knows no age, racial, social class, geographic, or national boundary [1]. Approximately 50 million people worldwide have epilepsy. Between 70 and 80% of people who develop epilepsy and are appropriately treated enter remission, whereas the remaining patients continue to have seizures and are refractory to treatment with currently available therapies [2,3]. Each year approximately 1 in 1000 treated patients with chronic epilepsy dies suddenly, unexpectedly, and without explanation [4]; this is known as sudden unexplained death in epilepsy (SUDEP). Epilepsy is associated with a two- to threefold increase in mortality rates compared with those for the general population, and SUDEP is the most important direct epilepsy-related cause of death [5].

To date, a number of potential risk factors for SUDEP have been assessed, but reports of the role of particular risk factors in various studies are not entirely consistent [6,7]. The risk factors examined include refractoriness of the epileptic condition, occurrence of generalized tonic–clonic seizures, antiepileptic medication (polytherapy with antiepileptic drugs), young age, duration of the seizure disorder, and early onset of epilepsy [7,8]. Knowledge of risk factors underlying SUDEP could guide investigations into its pathophysiological mechanisms [9], and an understanding of the mechanisms underlying SUDEP may lead to identification of previously unrecognized risk factors that are more amenable to correction [9]. In this context, although different mechanisms may apply in different cases [7], the two major types of mechanisms underlying SUDEP are autonomic, that is, cardiovascular, and respiratory [9].

It is clear that SUDEP is mainly (but not exclusively) a problem for people with chronic uncontrolled epilepsy [10], but our understanding of the best way to prevent it is still incomplete. Strategies have been suggested that could be useful in reducing the risk of SUDEP [8,10], although strict evidence of their effectiveness is lacking:

1. **Good control of seizures.** The first line of defense is good control of seizures, and the best conventional way to achieve this is with antiepileptic drug therapy. Medication adherence (taking medications correctly) involves factors such as getting prescriptions filled, remembering to take medication on time, and understanding the instructions. If that approach is unsuccessful, however, other therapies that could be considered are epilepsy surgery, vagus nerve stimulation, and dietary management (e.g., ketogenic diet and omega-3 supplementation) [6,8,10,11].
2. **Reduction of stress.** Following much research in this area, the majority of studies define *stress* as circumstances that people would find stressful [12]. It has been established that a diagnosis of epilepsy may bring with it many potential stresses, many of which are chronic [12]. The seizures, and in particular their unpredictability, are a major source of stress for the person with epilepsy [12]. Furthermore, stress may cause people to miss medications, leading to an increase in seizures; stress can trigger an increase in breathing rate (hyperventilation) and provoke seizures in certain patients, especially those with absence seizures; negative emotions related to stress (worry or fright) may cause seizures, especially in people with temporal lobe epilepsy; stress increases cortisol levels, which also may influence seizure activity [12].
3. **Participation in physical activity and sports.** Physical activity should have the same benefits on maximal aerobic and work capacity, body weight, and self-esteem in individuals with epilepsy as it does in those without epilepsy. Furthermore, as physical activity has been considered to have an anticonvulsant effect, it is rational to believe that regular physical activity (with appropriate professional supervision) may attenuate the frequency of seizures and cardiac abnormalities that could predispose to SUDEP [13,14].
4. **Supervision at night.** Nighttime supervision involves the presence in the bedroom of an individual of normal intelligence and at least 10 years old, or the use of special precautions (bed seizure monitor or breathing alarm) [15,16]. Bed seizure monitors and breathing alarms are designed to detect and alert family members to the occurrence of nocturnal generalized tonic–clonic seizures, allowing them to render any aid necessary in the ictal or postictal setting [15,16].
5. **Family members' knowledge of cardiopulmonary resuscitation (CPR) techniques and the basics of defibrillator use.** More work is needed in this area; however, the use of these techniques by trained family members can lead to improved survival from cardiac arrest, which may occur during the ictal or postictal period.

We agree with the suggestion [4] that, if there is a reasonable chance of preventing SUDEP, it must be discussed with all patients with epilepsy at the highest risk of SUDEP. The physician can then explain possible strategies that people with epilepsy and their families can take to try to reduce their risk of SUDEP. As a complete understanding of all the risk factors, mechanisms, and specific methods to prevent SUDEP is yet to be obtained, caution is prudent.

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References

[1] De Boer HM, Mula M, Sander JW. The global burden and stigma of epilepsy. Epilepsy Behav 2008;12:540–6.
[2] Sander JW. The epidemiology of epilepsy revisited. Curr Opin Neurol 2003;16:165–70.
[3] Kwan P, Sander JW. The natural history of epilepsy: an epidemiological view. J Neurol Neurosurg Psychiatry 2004;75:1376–81.
[4] Hirsch LJ, Hauser WA. Can sudden unexplained death in epilepsy be prevented? Lancet 2004;364:2157–8.

1525-5050/$ – see front matter
doi:10.1016/j.yebeh.2010.04.046

[5] Duncan JS, Sander JW, Sisodiya SM, Walker MC. Adult epilepsy. Lancet 2006;367:1087–100.
[6] Surges R, Thijs RD, Tan HL, Sander JW. Sudden unexpected death in epilepsy: risk factors and potential pathomechanisms. Nat Rev Neurol 2009;5:492–504.
[7] Stollberger C, Finsterer J. Cardiorespiratory findings in sudden unexplained/unexpected death in epilepsy (SUDEP). Epilepsy Res 2004;59:51–60.
[8] Scorza FA, Colugnati DB, Pansani AP, Sonoda EY, Arida RM, Cavalheiro EA. Preventing tomorrow's sudden cardiac death in epilepsy today: what should physicians know about this? Clinics 2008;63:389–94.
[9] So EL. What is known about the mechanisms underlying SUDEP? Epilepsia 2008;49:93–8.
[10] Tomson T, Nashef L, Ryvlin P. Sudden unexpected death in epilepsy: current knowledge and future directions. Lancet Neurol 2008;7:1021–31.
[11] Scorza FA, Cysneiros RM, Arida RM, Terra-Bustamante VC, de Albuquerque M, Cavalheiro EA. The other side of the coin: beneficiary effect of omega-3 fatty acids in sudden unexpected death in epilepsy. Epilepsy Behav 2008;13:279–83.
[12] Yuen AW, Thompson PJ, Flugel D, Bell GS, Sander JW. Mortality and morbidity rates are increased in people with epilepsy: is stress part of the equation? Epilepsy Behav 2007;10:1–7.
[13] Arida RM, Scorza FA, Scorza CA, Cavalheiro EA. Is physical activity beneficial for recovery in temporal lobe epilepsy? Evidence from animal studies. Neurosci Biobehav Rev 2009;33:422–31.
[14] Arida RM, Scorza CA, Schmidt B, de Albuquerque M, Cavalheiro EA, Scorza FA. Physical activity in sudden unexpected death in epilepsy: much more than a simple sport. Neurosci Bull 2008;24:374–80.
[15] Langan Y, Nashef L, Sander JW. Case–control study of SUDEP. Neurology 2005;64:1131–3.
[16] Nashef L, Ryvlin P. Sudden unexpected death in epilepsy (SUDEP): update and reflections. Neurol Clin 2009;27:1063–74.

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