SUDEP and Autonomic Instability During Sleep

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Abstract

Sudden unexpected death in epilepsy (SUDEP) is a leading cause of epilepsy-related mortality, with a substantial proportion of cases occurring during sleep. Although its etiology remains complex, current research suggests a critical role for peri-ictal autonomic instability in the context of circadian rhythms and sleep stages. Nocturnal generalized tonic-clonic seizures (GTCS) represent one of the most important risk factors for SUDEP. During and immediately after seizures occurring in sleep, marked autonomic dysregulation may develop, involving changes in sympathetic and parasympathetic activity. Several mechanisms may contribute to SUDEP. Respiratory dysfunction includes seizure-induced central apnea, which may be associated with postictal generalized EEG suppression (PGES). Cardiac dysregulation may involve severe disturbances in cardiac rhythm, including postictal asystole. Impaired arousal is another potentially important factor, as sleep increases the threshold for awakening and may limit the patient's ability to respond to airway obstruction or severe hypoxemia. SUDEP occurring during sleep may therefore result from the interaction between seizure-related neurological activity and vulnerability of autonomic and cardiorespiratory regulation. Early identification of patients at increased risk, consideration of long-term monitoring and appropriate nocturnal supervision, and optimization of individualized antiseizure treatment are important components of risk reduction. A better understanding of the relationship between sleep, seizures, and autonomic dysfunction may contribute to improved risk stratification and preventive strategies.

Keywords: SUDEP; autonomic instability; nocturnal seizures; cardiorespiratory monitoring; sleep

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SUDEP i autonomna nestabilnost tijekom spavanja

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Sažetak

Iznenadna neočekivana smrt u epilepsiji (SUDEP) jedan je od vodećih uzroka mortaliteta povezanog s epilepsijom, pri čemu se znatan dio slučajeva događa tijekom spavanja. Iako je etiologija složena, suvremena istraživanja upućuju na ključnu ulogu periiktalne autonomne nestabilnosti u kontekstu cirkadijanih ritmova i stadija spavanja. Noćni generalizirani toničko-klonički napadaji (GTKN) predstavljaju jedan od najvažnijih čimbenika rizika za SUDEP. Tijekom napadaja koji se javljaju u spavanju i neposredno nakon njih može nastati izražena autonomna disregulacija, praćena promjenama simpatičke i parasimpatičke aktivnosti. Nekoliko mehanizama može pridonijeti nastanku SUDEP-a. Respiratorna disfunkcija uključuje centralnu apneju induciranu napadajem, koja može biti povezana s postiktalnom generaliziranom supresijom EEG aktivnosti (PGES). Srčana disregulacija može uključivati teške poremećaje srčanog ritma, uključujući postiktalnu asistoliju. Oslabljen odgovor na podražaje i buđenje također je potencijalno važan čimbenik jer spavanje povisuje prag buđenja i može ograničiti sposobnost bolesnika da reagira na opstrukciju dišnih putova ili tešku hipoksemiju. SUDEP tijekom spavanja stoga može biti posljedica međudjelovanja neurološke aktivnosti povezane s napadajem i ranjivosti autonomne i kardiorespiratorne regulacije. Rano prepoznavanje bolesnika s povećanim rizikom, razmatranje dugotrajnog monitoriranja i odgovarajućeg noćnog nadzora te optimizacija individualiziranog liječenja antiseizurnim lijekovima važne su sastavnice smanjenja rizika. Bolje razumijevanje povezanosti spavanja, epileptičkih napadaja i autonomne disfunkcije može pridonijeti kvalitetnijoj stratifikaciji rizika i razvoju preventivnih strategija.

Ključne riječi: SUDEP; autonomna nestabilnost; noćni epileptički napadaji; kardiorespiratorno monitoriranje; spavanje

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