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The ictal bradycardia syndrome

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Abstract

The ictal bradycardia syndrome is an uncommon diagnosis in which bradycardia is accompanied by simultaneous epileptic discharges in the EEG. We describe a patient who was referred to the emergency ward because of syncope. Ictal semeiology and EEG-EG findings are discussed and compared with those published in the literature. Therapeutic options are discussed in relation with those published in the literature. The ictal bradycardia syndrome is probably underdiagnosed, while its recognition is of utmost importance because of potential life threatening complications such as asystole. Up to now, its aetiology is poorly understood, its ictal semeiology is often described insufficiently and its therapy is still discussed.

Key words : Epilepsy ; ictal bradycardia syndrome ; EEG ; heart rate.

Introduction

Heart rate variations during epileptic seizures are well known : tachycardia is frequently observed, bradycardia seems to be less common (1, 2). The ictal bradycardia syndrome is an uncommon diagnosis in which bradycardia is accompanied by simultaneous epileptic discharges in the EEG (3).

Case

A 57 year old male was transferred to the emergency department because of syncope. Nine months before he had been diagnosed with a left frontotemporal astrocytoma grade IV and he was scheduled to undergo a debulking procedure. His medication was dexamethasone 2 mg twice a day. On the day of admission, he experienced a rising epigastric sensation, became pale and sweaty and was unconscious for several minutes. The patient did not remember this event. During transport to the hospital, a slowing of the pulse was noticed. Cardiac analysis however was normal. Neurological examination revealed that the right plantar reflex was in extension. During a 44 second left temporal epileptic discharge consisting of rhythmic slow activity a bradycardia down to 21 bpm occurred without other clinical abnormalities (Figs. 1-4). Based on these findings we concluded that the loss of consciousness may have been the result of an epileptic seizure and Levetiracetam 500 mg twice daily was started. The patient remained seizure free during a 8 months follow up.

Discussion

In 1906, before the introduction of EEG, Russell described the cessation of the pulse during a seizure in a young man (4). Since then, different anecdotal cases have been reported where ictal episodes were accompanied by a decrease of the heart rate or even asystole (5). In 1996, Reeves described the ictal bradycardia syndrome as "a syndrome that occurs when epileptic discharges profoundly disrupt normal cardiac rhythm, resulting in cardiogenic syncope during the ictal event" (3). Diagnosis of ictal bradycardia is based on documentation of bradycardia/asystole clearly produced by a concomitant ictal discharge documented on EEG.

Leutmezer *et al.* studied heart rate changes at the transition from the preictal to the ictal state during 145 seizures recorded with scalp EEG in 58 patients with focal epilepsies. Ictal onset tachycardia occurred in 86.9% of all seizures, whereas bradycardia was documented only in 1.4% (6).

The underlying pathophysiology is not well known. Tinuper reviewed 47 cases of ictal bradycardia documented by simultaneous EEG and EKG recordings during the attack. About 76% of patients where ictal discharges were recorded, had temporal or frontotemporal lobe seizures (5). Britton *et al.* reviewed the localization of seizure activity in 13 consecutive patients with ictal bradycardia diagnosed during prolonged video-EEG monitoring. All occurrences of ictal bradycardia in the 13 identified patients were associated with temporal lobe-onset seizures. Ictal bradycardia most often occurred in association with bilateral hemispheric seizure activity and was not a consistent lateralizing sign in localizing seizure onset (7).

FIG. 1-4 :
Source derivation, sensitivity 100 microvolt : During the EEG, we see frequent left frontal complexes, consisting of one or more δ-waves, superimposed with faster activity and with a voltage up to 100 μV and sometimes a spread to right frontal.

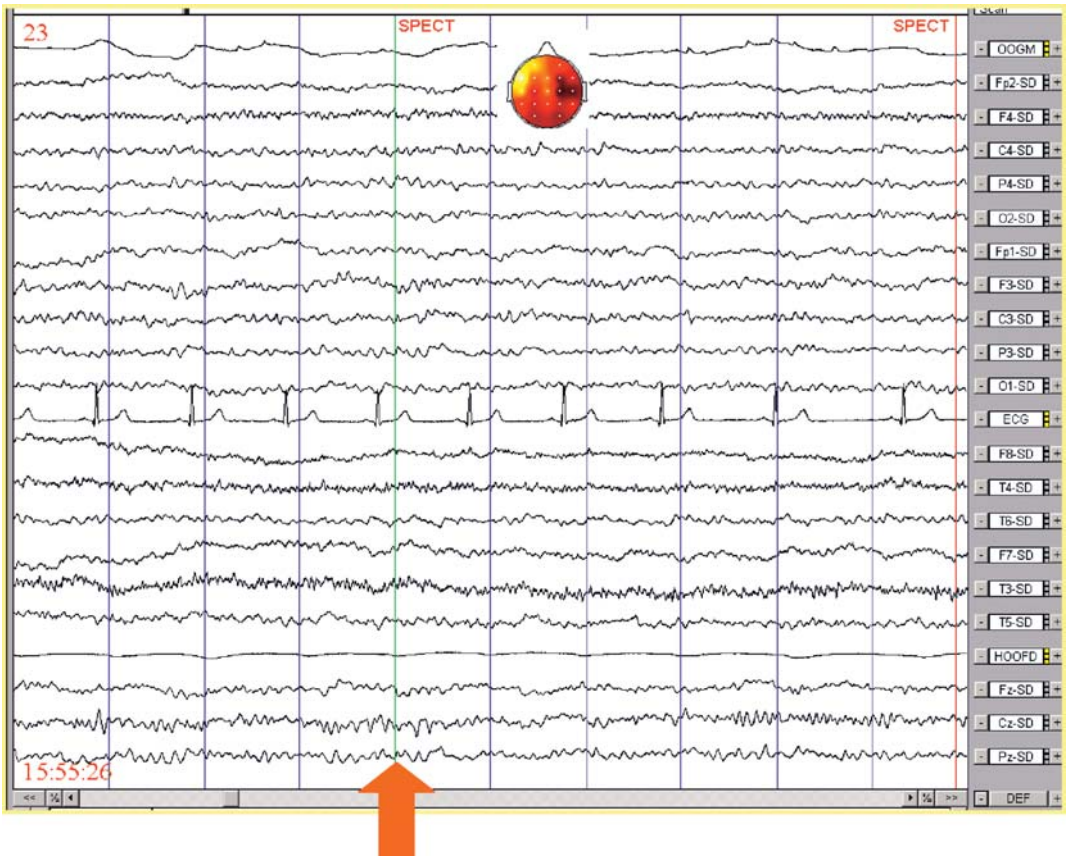

FIG. 1.

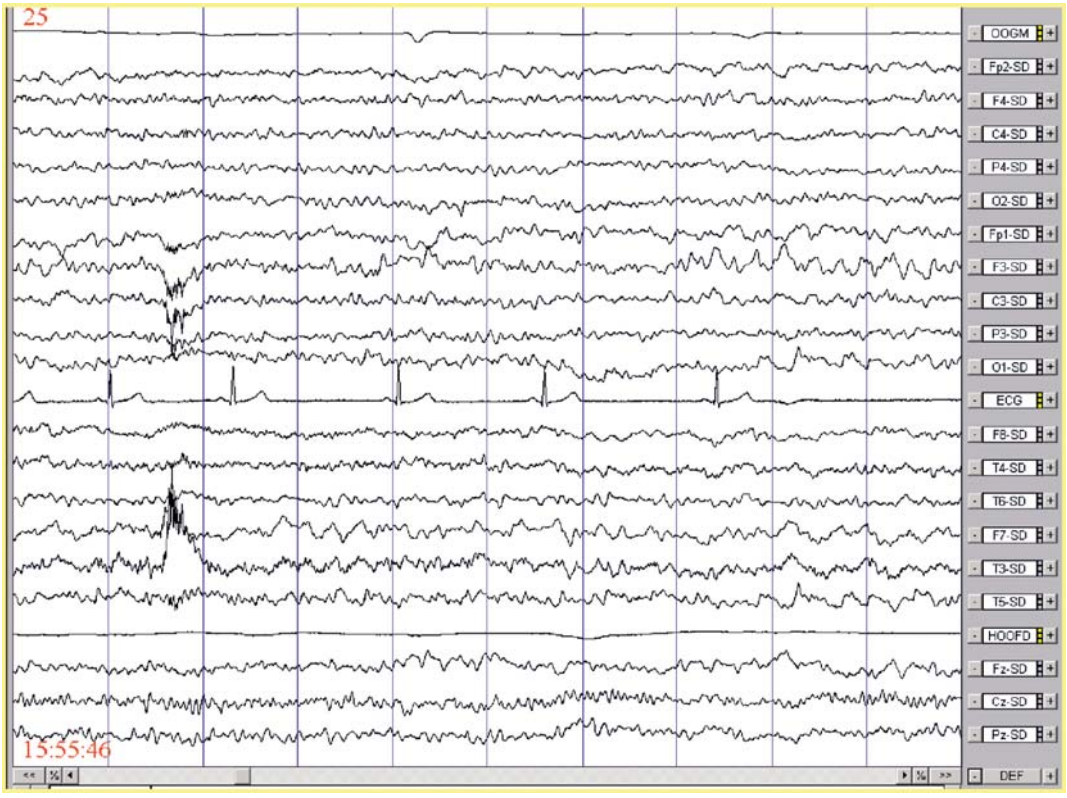

FIG. 2.

FIGS. 1-2. — Once, this δ-activity becomes rhythmic and also appears in the left temporal lobe (orange arrow)

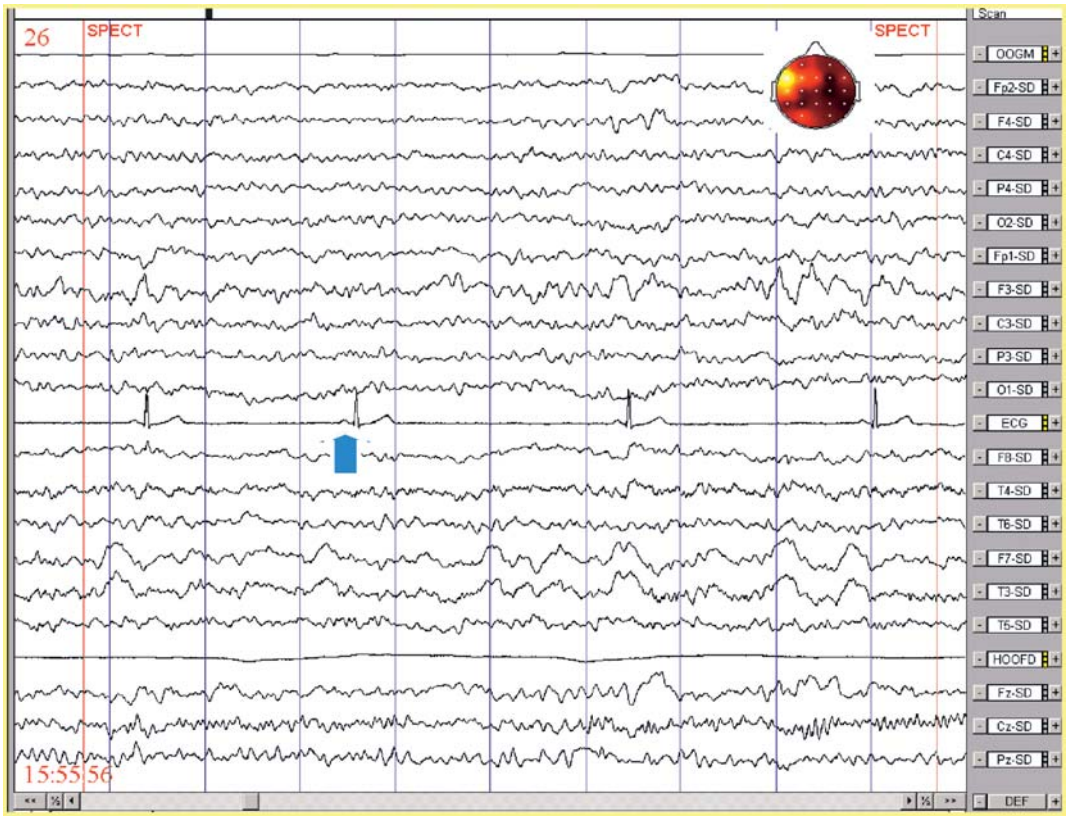

FIG. 3. — During this rhytmic δ-activity, the heart rate decreases with an RR-interval increasing up to 3 seconds (big blue arrow)

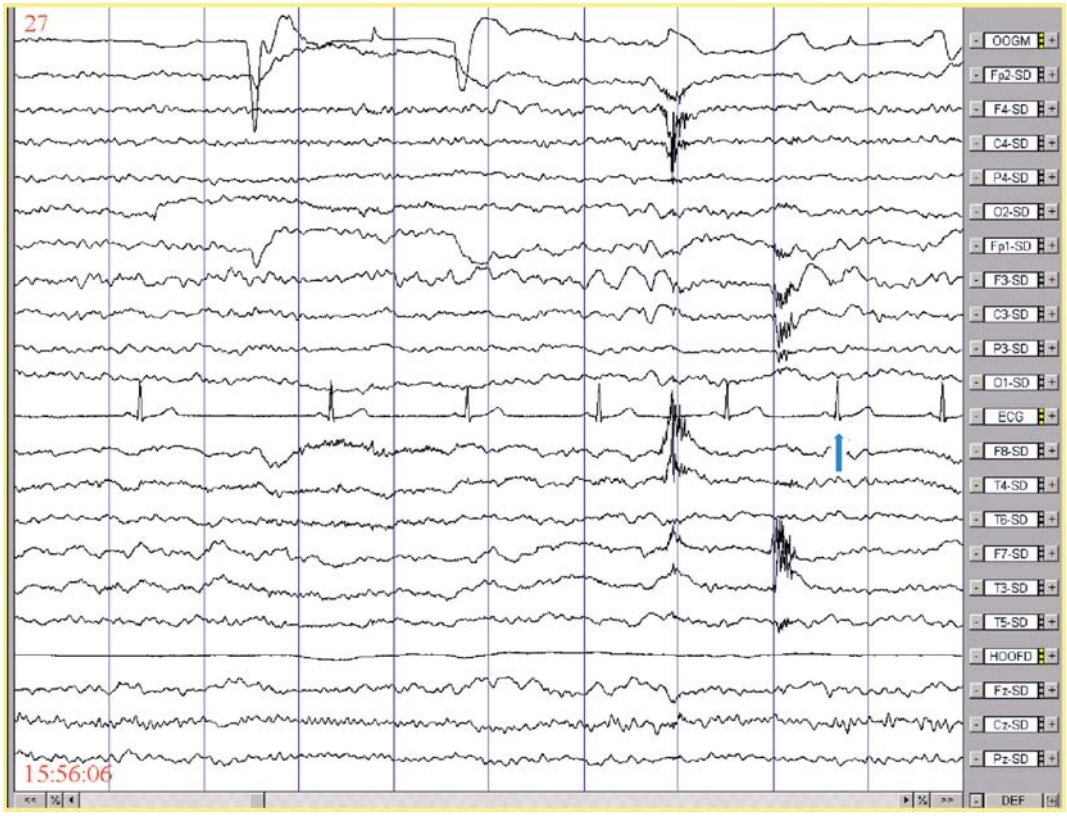

FIG. 4. — The rhytmic δ-activity than diminishes and the heart rate increases to the baseline heart rate, 60 bpm (small blue arrow)

A higher occurrence of temporal lobe epilepsy in this population may be because more temporal as compared to extratemporal seizures are recorded or it may be a true physiological difference relating to anatomical connections and seizure spread. One might speculate this phenomenon was related to epileptic discharges confined to a brain area too small or too deep to be detected on scalp EEG (8). Nevertheless, such epileptic activity might directly influence parts of the central autonomic network, thus producing heart rate changes.

There is no consensus regarding management of patients who develop decreases of heart rate during seizures. To our knowledge, the preferential choice of a specific antiepileptic drug in patients with ictal arrhythmia has not been studied. Antiepileptic drugs that however should be avoided in the presence of bradyarrhythmia include carbamazepine, phenytoin, barbiturates, and benzodiazepines (9). Carbamazepine can lengthen the EKG Q–T interval and increase the arrhythmic effects of epileptic seizures, and made part of chronic therapy in some series of epileptic patients presenting with sudden unexpected death (SUDEP) (10). Moreover, carbamazepine has been implicated in the development of asystole, sinoatrial, atrioventricular block and decreased Purkinje automaticity in elderly patients with trigeminal neuralgia (11).

Some authors advise a combination of antiepileptic drugs and a pacemaker implantation. It is not known if pacemaker implantation is medically indicated in all patients with seizure related or induced bradycardia, however, in those with asystole it seems prudent to do so (12).

The true incidence of bradycardia related to epileptic seizures is probably underestimated. There are likely to exist two different groups in which the diagnosis of the ictal bradycardia syndrome is missed. The first is the group of patients known to have partial epilepsy, in whom episodic loss of consciousness is attributed only to the cerebral effects of the seizures. The second is the group of patients in whom episodes of syncope are attributed to intrinsic cardiac disease, without appreciation that cardiac dysfunction is the result of a seizure (3).

Some patients with seizures with bradycardia also had seizures with asystole. Theoretically these asystoles could contribute to the incidence of sudden unexpected death in epilepsy patients (SUDEP) and one might speculate that the presence of ictal bradycardia is a risk factor for SUDEP. Getting the correct diagnosis is essential because appropriate treatment may prevent SUDEP, which is thought to be related to potentially lethal arrhythmias, such as asystole induced by epileptic seizures (13, 14), and to prevent cardiac side effects of specific anti-epileptic drugs.

Futher research is necessary either by epidemiological studies in large cohorts of epilepsy patients or by detailed case reports with respect to age at onset of the seizures, age at the time of diagnosis of the syndrome, sex, semeiology in relation to EKG and EEG, imaging according to international criteria, therapy and follow up.

REFERENCES

1. Schernthaner C., Lindinger G., Pötzelberger, Zeiler K., Baumgartner C. Autonomic epilepsy-the influence of epileptic discharges on heart rate and rhythm. Wien Klin Wochenschr, 1999, **111** (10) : 392-401.
2. Zijlmans M., Flanagan D., Gotman J. Heart rate changes and ECG abnormalities during epileptic seizures : prevalence and definition of an objective clinical sign. *Epilepsia*, 2002, **43** (8) : 847-854.
3. Reeves A. L., Nollet K. E., Klass D. W., Sharbrough W., So E. L. The ictal bradycardia syndrome. *Epilepsia*, 1996, **37** (10) : 983-987.
4. Russell A. E. Cessation of the pulse during the onset of epileptic fits. *Lancet*, 1906, **2** : 152-154.
5. Tinuper P., Bisulli F., Cerullo A., Carcangiu R., Marini C., Pierangeli G., Cortelli P. Ictal bradycardia in partial epileptic seizures Autonomic investigation in three cases and literature review. Brain, 2001, **124** (Pt 12) : 2361-2371.
6. Leutmezer F., Schernthaner C., Lurger S., Pötzelberger K., Baumgartner C. Electrocardiographic Changes at the onset of epileptic seizures. *Epilepsia*, 2003, **44** (3) : 348-354.
7. Britton J. W., Ghearing G. R., Benarroch E. E., Cascino G. D. The ictal bradycardia syndrome : localization and lateralization. *Epilepsia*, 2006, **47** (4) : 737-744.
8. Scott C. A., Fish D. R. Cardiac asystole in partial seizures. *Epileptic Disord.*, 2000, **2** : 89-92.
9. Lim E. C. H., Lim S.-H., Wilder-Smith E. Brain seizures, heart ceases : a case of ictal asystole. *J. Neurol. Neurosurg. Psychiatr.*, 2000, **69** : 557-559.
10. Timmings P. L. Sudden unexpected death in epilepsy : is carbamazepine implicated ? *Seizure*, 1998, **7** (4) : 289-291.
11. Hamilton D. V. Carbamazepine and heart block (letter). *Lancet*, 1978, **1** : 1365.
12. Carvalho K. S., Salanova V., Markand O. N. Cardiac asystole during a temporal lobe seizure. *Seizure*, 2004, **13** (8), 595-599.
13. Opeskin K., Thomas A., Berkovic S. F. Does cardiac conduction pathology contribute to sudden unexpected death in epilepsy ? *Epilepsy Res.*, 2000, **40** (1) : 17-24.
14. Leestma J. E., Walczak T., Hughes J. R., Kalelkar M. B., Teas S. S. A prospective study on Sudden unexpected death in epilepsy. *Annals of Neurology*, 1989, **26** : 195-203.

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