Aborting seizures by painful stimulation

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It has been well established that serious consequences may result from allowing seizures to continue. The opportunities for early interruption of seizures by medication is often restricted to medical personnel, leaving non-trained bystanders unable to intervene. We were able to interrupt seizures (including status epilepticus) by application of painful dorsiflexion. The mode of action that enables pain to elevate the seizure threshold remains to be elucidated, although the phenomenon is consistent with earlier laboratory studies in experimental epilepsy. The technique may be recommended as an effective and easily learned procedure that may have wide applicability.

Keywords: Convulsions – Dorsiflexion – Fits – Pain – Seizure interruption

INTRODUCTION

The need to abort epileptic seizures as soon as possible has long been advocated by many epileptologists. The warning of brain damage caused by anoxia by uninterrupted seizures has been extensively publicized, and generally, it takes a long and often precious time until the patient reaches the hospital. The mechanisms or environmental conditions that can account for aborting seizures are not yet delineated, although we have shown that pain stimulation elevates the threshold for chemical induced seizures in rats (Yehuda *et al.*, 1991). The termination of seizures in a clinical context has not been extensively emphasized, and to the extent to which it is discussed, the reliance is almost exclusively a pharmacological one. Until now only a trained medical team is authorized to administer intravenous medications to stop the seizures when it is so desired. Although most individual seizures are in the order of 1 to 1.5 min and will stop spontaneously, the duration of the clinical convulsions are often sufficiently long that attending health care personnel or the casual bystander feels impelled to intervene. Even though automatisms and other non-convulsive seizures do not present a serious risk for anoxic tissue damage, there are certainly no benefits to allow them to continue unabated, and indeed there would seem to be reasonable grounds for bringing them to a stop. We propose here a simple method that can interrupt and abort most seizures, namely: dorsiflexion of the palm. The procedure has been applied to numerous types of seizure

disorders and to patients of various ages and severity of seizure, including status epilepticus. In cases of status epilepticus, the seizures may be interrupted and even stopped for brief periods of time only to return later in the same intensity. It is then possible to repeat the dorsiflexion procedure several times, until the patient can be brought to the hospital and appropriate medical treatment may begin to take effect. The development of this procedure was experimental and has been refined over a 10-year period involving hundreds of convulsive episodes that successfully responded to the proposed method.

By application of this technique one is able to stop both focal and generalized attacks. The technique is also effective with status, albeit its ability to interrupt the seizure may last for shorter intervals and may not provide a complete resolution of the crisis. One important added advantage of the technique is that it is simple enough to be taught to family members and to paramedic personnel that might otherwise transfer such patients to the hospital, incurring unneeded expense and inconvenience.

The technique is based on generating a strong painful stimulation in one of the limbs through dorsiflexion. It has been our impression that when the seizure is focal in nature, the contralateral application of pain is most effective; for general seizures there does not appear to be a major preference. We cannot yet conclusively confirm this impression. We have found the most effective procedure

FIG. 1. Case 1 (S.R.). Application of dorsiflexion ending at arrow, followed by cessation of seizure. See text for details.

for inducing the pain stimulation to be dorsiflexion of the palm, with pressure being continually applied until the convulsive frequency is visibly reduced. At this point, rather than maintaining a continuing pain-pressure, the stimulation is applied rhythmically so as to precede and anticipate the convulsions, with the application maintained until the complete cessation of the seizure episodes. In approximately 90% of the incidences, the seizures are brought to a stop within 30–45 s. In the case of status it may return after several minutes, at which time the procedure may be repeated.

CLINICAL CASES

Despite the extensive application of this procedure, it has not always been possible to obtain a correlative EEG record of ongoing activity. Understandably the condition of a patient admitted to the emergency ward (EW) does not permit the neurologist the luxury of first obtaining baseline EEG data to be followed by post monitoring of the intervening manipulations. We are, however, able to present several representative cases for which complete EEG records were obtained. In several instances the patient was being routinely monitored during which time the seizure episode became manifest.

1. (S.R.) A 25-year-old female with a long history of epilepsy starting at 12 years of age had been controlled by a program of carbamazepine (Tegretol) 300 mg daily. She was admitted to EW with severe episodes; most probably due to 39°C fever from a viral infection. Before the team

could inject medication i.v., the pain technique was applied. Within 40 s the seizures were stopped.

2. (M.R.) A 64-year-old male with no history of seizures had a CVA 1½ years earlier. He was admitted to EW with status. Diazepam (Valium) was administered i.v., the seizure stopped, and he was referred to both X-ray and EEG. During the EEG exam the seizures returned. The pain technique was applied and it interrupted the seizures. After 7 min the seizures returned and were stopped once again 12 min later when the technique was applied a second time. This time the seizures were completely stopped. Because of the delay it is uncertain whether the techniques were truly responsible or perhaps the anticonvulsant effect of the Valium began to assert itself.

3. (J.X.) A 24-year-old male with post traumatic epilepsy suffered 5 years earlier. He was admitted to EW with right focal seizures. Immediate manual stimulation to the left hand stopped the seizures after 35 s with no further recurrence.

4. (B.P.) A 32-year-old male with post operative epilepsy due to extraction of an oligodendroglioma from the right hemisphere. He was stabilized with Dilantin (400 mg) and carbamazepine (Tegretol 400 mg). He was admitted to EW because of a fever from an intercurrent upper respiratory tract infection. Approximately 50 s after application of the procedure the seizures stopped.

5. (S.C.) A 30-year-old female with a history of epilepsy dating since she was 4 years old was treated with carbamazepine (Tegretol 350 mg). She was brought to EW having seizures and within 48 s following application of the technique the seizures were stopped. Blood serum examinations showed she was undertreated.

FIG. 2. Case 2 (S.R.). Dorsiflexion begun at left arrow and maintained until seizure stops (right arrow). Vertical column (asterisks) indicates discontinuity in EEG record. See text for details.

FIG. 3. Case 2 continued. Record of seizures and artifacts during application of technique (Solid bar). Recording was then stopped because of movement artifacts while technique was continued. Subsequent recording indicates stopped seizure. See text for details.

DISCUSSION

Within the last 10 years more than 120 patients in which some 200 seizure attacks were observed were all successfully treated with this technique. The attacks included both grand mal and focal seizures. Some 90% were stopped clinically and electrically and did not return within a 24-h period. Thirty percent of the cases responded *completely* with one or two brief stimulations. In the majority of cases, the treatment effect was variable, such that the required duration of dorsiflexion necessary for adequately stopping the attacks varied from 3-5 min, after which conventional pharmacological management was able to maintain the seizure free state. In addition, it was often necessary to repeat the dorsiflexion procedure several times before the cessation of the seizures was achieved.

The emergency nature of prolonged seizures was noted by Uthman and Wilder (1989): "Experimental studies have shown that permanent cell damage in the hippocampus, amygdala, cerebellum, thalamus, and middle cerebral cortical layers may develop . . . by the continuously firing neurons." Together with other physiological complications and even the risk of mortality, early intervention is warranted. Because of such serious concern, Lombroso (1989) has urged consideration of the administration of dose prepared oral or rectal diazepam (Lombroso, 1989). The technique we propose does not rule out other concurrent interventions. It is, however, a faster and easier emergency procedure. Our success with aborting seizures by induction of pain seems to stand alone against commonly accepted neurological dogma that seizures, once begun, cannot be easily or benignly aborted. Yet the

FIG. 4. Case 3 (J.X.). Application of technique ends focal seizure (at arrow) followed by normalization of EEG shortly thereafter. See text for details.

FIG. 5. Case 4 (B.P.). Focal seizure stopped (at arrow). Application of technique to right hand maintained until EEG normalizes (star). See text for details.

phenomenon we report is reliable. The consistently rapid termination of seizures (usually within 30-60 s) provides compelling support that the dorsiflexion contributed to the cessation of an individual seizure at a much sooner time than it might have terminated spontaneously. The causal relation between the painful stimulation and the seizures seen from the EEG argues for the reliability of this effect. Obviously a fully balanced controlled experimental design would be most desirable, but this was neither a

realistic nor practical possibility. Indeed numerous other clinical and laboratory demonstrations have scientifically established that there is a poorly understood role of the complexity of stimulation that may act on seizure generation and its maintenance (Ounstead *et al.*, 1986; Uthman and Wilder, 1989). We believe that our technique offers a rapid and effective treatment in the face of morbidity risks, where left untreated these risks are substantially increased with the passage of time.

FIG. 6. Case 5 (S.C.). Recording of final phase of seizure during dorsiflexion. Clinical seizure ending at arrow, with gradual return of EEG to normal. See text for details.

Above all, we would emphasize that the procedure we have developed is not seen as a substitute for accepted medical treatment or for ordering further workup. Rather its utility is to cause a cessation of ongoing clinical and electrical epileptic activity by application of a technique that can readily be learned by both medical personnel and others.

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