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CASE REPORT

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Treatment of refractory seizures due to a benign mass present in the corpus callosum with an ion magnetic inductor: case report

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Abstract A 39-year-old female patient was having episodes of body stiffness that affected her motor abilities. A lipoma in the corpus callosum was identified by computed tomography. Her condition deteriorated rapidly, and seizures were refractory to any treatment. Seizure frequency and severity increased, incapacitating the patient completely. When seizure control was not achieved by any other treatment, the patient decided to undergo experimental therapy with the ion magnetic inductor. Treatment with the ion magnetic inductor notably reduced the seizure frequency and intensity. After treatment the patient was able to return to work and other normal activities. The long-term effects are not yet known, but there have been no adverse events to date. The patient is still undergoing ion magnetic inductor treatment daily in the same way other epileptic patients must continue with the use of antiepileptic drugs for life. There is evidence in the literature that other types of electromagnetic therapy, such as repetitive transcranial magnetic stimulation (rTMS), may be useful for treating refractory seizures. The potential advantage of the ion magnetic inductor over rTMS is that there is no need to locate precisely the epileptogenic focus, making the treatment procedure simpler and faster.

Key words Ion magnetic inductor · Seizures · Refractory · Stiff man's syndrome

Clinical summary

A 39-year-old female patient was having episodes of body stiffness that affected her motor abilities. Her condition started to deteriorate rapidly with a tendency to fall that caused serious injuries to his body (scapula and right hand fractures). One year after the first episode and after aggressive treatment with nimesulid, sodium diclofenac, and vitamins, the patient's condition continued to worsen.

In September 2000, the patient suffered her first epileptic seizure and was hospitalized for 1.5 months at the Aiginitio, University of Athens Hospital. She was diagnosed with stiff man's syndrome. A computed tomography (CT) scan was performed showing a mass identified as a lipoma in the corpus callosum. Paracentesis was performed twice on the breast bone and vertebral column. The results were not notable. At that time she was prescribed 45 mg of diazepam daily.

In November 2001 the patient suffered another epileptic seizure and was admitted to the Athens General Hospital to close an open wound to the head caused by a fall during the seizure. Another CT scan was performed, and the lipoma with probable partial agenesis of the corpus callosum was identified once again. The patient was prescribed sodium valproate to control seizures and thiocolchicoside (colchicine) for the muscle stiffness.

In December 2001 the patient suffered another seizure with loss of consciousness. Seizures then continued to increase in frequency and severity.

In May 2002 the patient was admitted again to Aiginitio, University of Athens Hospital because of uncontrolled seizures. The patient was prescribed 45 mg diazepam daily, and the doses of sodium valproate and thiocolchicoside were increased. Because of the worsening the medical condition, the patient started to experience speech impairment. Seizures become refractory to medication, and she was not able to perform basic daily activities, losing her independence and ability to work.

In July 2002 she nearly drowned while at the beach. She was admitted to the Lefkada Hospital in Greece where she was treated; she could not walk at all. Epileptic seizures increased in frequency and severity, and speech problems and difficulty breathing were exacerbated. The patient continued on sodium valproate, diazepam, and thiocolchicoside.

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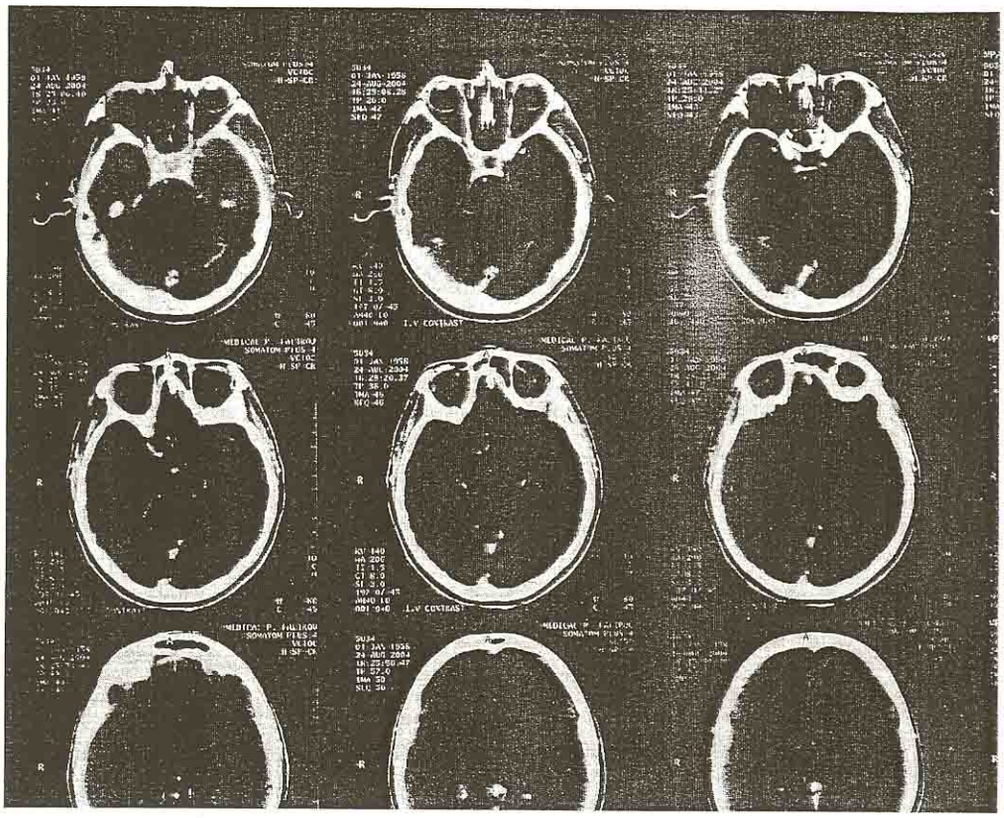

Fig. 1. Consecutive computed tomography films show a benign dense mass in the corpus callosum with a small diastalsis of the lapper part of the side ventricles. It suggests a lipoma with probable partial agenesia of the corpus callosum

By October 2002 the seizures were occurring almost every 3 h. She was again admitted to the Aiginitio, University of Athens Hospital, but she did not improve and was released from the hospital. No surgery or other type of new treatment was indicated. Her condition was extremely weak without possibility of improvement.

Being diagnosed with an incapacitating condition without available treatment, the patient decided to undergo an experimental therapy for potential seizure control based on the principles of electromagnetic therapy. Medical inspectors of the Greek National Organization approved treatment with the experimental procedure because there was no alternative treatment available.

The patient was treated with an ion magnetic inductor (PAP IMI ion magnetic inductor, Asklepios model magnetic ion inductor). After the application of the first three to five pulses the seizures stopped momentarily. Sodium valproate was gradually discontinued owing to its lack of efficacy; thiocolchicoside was reduced, and diazepam was reduced to 25 mg per day. Oxygen was added to make the patient more comfortable. The patient was treated subsequently every 6 h with the ion magnetic inductor during that month. The seizure intensity and frequency were reduced to one every 8 h and then every 12 h. Treatment continued daily. During the following month the seizure frequency was reduced to about one per week.

In January 2003 the patient regained her ability to walk independently, and her speech was improved. Seizure control was achieved, with the severity and frequency dramatically reduced. By February the patient had only one or two seizures in total. By March 2003 the patient was able to return to normal activities, and her speech was completely restored. The one per day treatments continue to date.

Pathological findings

Consecutive CT scans (Fig. 1) show a benign dense mass in the corpus callosum with a small diastasis of the upper part of the side ventricles, suggesting the presence of a lipoma with probable partial agenesia of the corpus callosum. The patient is diagnosed with general dystonia, or stiff man syndrome.

Discussion

In this case report we present a 39-year-old woman with seizures refractory to any treatment that were due to an mass in the corpus callosum of benign nature. The seizures were refractory to antiepileptic therapy but could can be satisfactorily controlled with ion magnetic inductor therapy. The long-term effects are not yet known, however, but there have been no adverse events to date. The patient is still undergoing ion magnetic inductor treatment daily,

as other epileptic patients must continue with the use of antiepileptic drugs (AEDs) for life.

The prognosis in patients with epilepsy refractory to any known treatment including surgery, or when surgery is not an option, is poor because the quality of life is affected and their income potential is not achieved. These patients are isolated and ostracized owing to the condition. Alternative experimental treatments include magnetic stimulation of the epileptogenic focus (foci). Magnetic stimulation may be useful for treating refractory seizures, as it was reported to "normalize" pathologically decreased or increased levels of cortical activity.[1]

The ion magnetic inductor achieves therapeutic effects by generating high-amplitude electromagnetic pulses of very rapid rise time (nanoseconds) and short duration (microseconds) that are produced by a plasma chamber specifically designed for that purpose. The applicator probe of the device is a low-impedance 6 inches diameter loop that is held flat against the crown of the head for a maximum of 9 min. The magnetic field penetrates the tissue about 6 inches into the body. The loop produces a magnetic field that is distributed omnidirectionally.

Unlike other pulsed electromagnetic field devices, the ion magnetic inductor generates its oscillating current by momentarily storing up energy in a capacitor bank and discharging it though a plasma gap into its inductor probe. The pulses generated by the device are conducted by a heavy-gauge cable to the probe's insulated donut shape coil. Each pulse of electrical energy is discharged down and around the coil to generate a fast-rise, short-duration, oscillating electrical pulse current that consists of a short burst of high-frequency magnetic field oscillations. The oscillating electrical pulse current, in turn, generates a magnetic field with the same characteristics as the electrical pulse current (fast rise time, power, and short duration). All the cells in the body have a weak natural electric current flowing through them. Those currents are caused by electrically charged particles called ions.

The ion concentration, distribution, and flux affect the homeostasis of the cell and therefore of the entire area. The application of a magnetic field around the affected tissue should prompt the cell to respond with the generation of weak microelectrical currents that would influence the concentration, distribution, and flux of ions.

One possible mechanism of action is targeting sodium channels, preventing the return of these channels to the active state by stabilizing the inactive form of the channels. In doing so, repetitive firing of the axons is prevented. Ion magnetic induction may possibly act by inhibiting or normalizing the flow of sodium and calcium, resulting in a normal excitatory state preempting the misfiring that is due to overexcitation.

There is evidence in the literature that other types of electromagnetic therapy, such as transcranial magnetic stimulation (TMS), may be useful for treating refractory seizures. A report by Tergau and colleagues described "encouraging results" with repetitive transcranial magnetic stimulation (rTMS) in the treatment of epilepsy where nine patients who were refractory to AEDs were stimulated by a low frequency from a repetitive magnetic stimulator placed against the head. Most of the patients described an improvement in the number or severity of their seizures. However, the effects of that treatment decline after 6–8 weeks.[2]

The potential advantage of the Ion Magnetic Inductor over the rTMS is that there is not a need to locate precisely the epileptogenic focus (ci) making the treatment procedure simpler and faster.

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