Clinical note

Treatment of severe diabetic neuropathy with spinal cord stimulation

Tratamiento de la neuropatía diabética grave mediante estimulación medular

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Abstract

Diabetes mellitus (DM) is a widespread disease among the general population which, because of the damaging effect of hyperglycemia on the nervous or vascular structures, may lead to complications which in many cases are difficult to treat. In general, neurological disorders secondary to DM cause severe, painful processes. A great many clinical practice guidelines are available providing recommendations about different drugs to be used as a monotherapy or in combination, with varying degrees of evidence. Nevertheless, certain clinical situations show no response to pharmacological therapies and, therefore, other resources have to be found and implemented to achieve analgesia. We present a case that was resistant to traditional pharmacological treatments, in which analgesic control was achieved through spinal cord stimulation systems.

Keywords: diabetic neuropathy, spinal cord stimulation, polyneuropathy.

Case description

The neuropathic pain associated to the diabetes mellitus (DM) is sometimes so serious that the conventional therapies are not sufficient; therefore technical procedures have to be used in order to improve the quality of life.

We present the case report of a male aged 52, with allergy to beta lactamases history, DM over 20 years of evolution under treatment with insulin, temporary hyperparathyroidism, high blood pressure (HBP) under treatment with angiotensin-converting enzyme inhibitors (ACEI), chronic pancreatitis and previous events of nephritic spasms.

The patient was referred due to a serious neuropathic pain in the upper limbs (ULL) and lower limbs (LLLL), described as electric, burning pain with associated feeling disorders in hands and feet bilaterally, of 3 years of evolution. The patient did not show visual or vascular impairments. The pain interfered in the night rest. The patient associated back and cervical osteoarthritic degenerative phenomena and the surgical approach.
The exploration showed a bilateral hypoesthesia in ULL/LLLL, with mild skin excoriations and impairment of the osteotendinous reflex. The patient showed a reduction of touch feeling with monofilament and the vibration with tuning fork. The diagnosis was performed, after ruling out other causes by means of imaging, analytic studies and electromyography (EMG) of the ULL/LLLL, which was informed as diabetic mixed polyneuropathy (sensory-motor), following the recommendations of the Consensus Guideline of the Clínica Mayo.1

The previous treatment for this process indicated by other specialists (traumatology, endocrinology) have been taken into account in the therapeutic proposal, as pregabalin, gabapentin, oxcarbazepine or duloxetine, all of them up to maximum doses, associated to level 2 analgesics of the World Health Organization (tramadol, codeine). Considering the scarce response, a stimulation protocol was started and the indication of a double spinal cord stimulation (SCS), cervical and lumbar.

After the evaluation by the psychologist, the patient was informed accordingly about the complete form technique, and was included in the waiting list. The patient underwent surgery on April 19th 2005 and a cervical and stimulation of posterior spinal cords system was implanted, Synergy Model (Medtronic Neurological Inc., Minneapolis, United States). An electrode Pisces Quad Compact 3890 (Medtronic Neurological Inc, Minneapolis, United States) with electrode point was placed between the spinal body of C4-C5 for ULL, and an electrode Pisces Quad 3890 (Medtronic Neurological Inc, Minneapolis, United States) with electrode point was placed in the spinal body D10-D111 for LLLL.

After 2 months from the implant, the patient recognized an improvement superior to 80%, he perceived paresthesia in the affected zone, and the pain was reduced to baseline levels if he put the stimulator off. In November 2006, he showed a worsening, with an intense pain in the waist, especially on the left side and numbness in the left groin. After revising the stimulation system, a breakage of the lumbar electrode has been determined. The patient underwent surgery on April 26th 2007 in order to withdraw the broken electrode and implantation of a new one with point in T9, with stimulation in LLLL. Since then, the patient keeps pain control, together with adjuvant medication (pregabalin 150 mg/12 h, tramadol 150 mg/day and clonazepam, 3 drops in night doses).

Discussion
The DM is the most common cause of neuropathy in occidental countries. It is described in 20-24% of the diabetic patients and affects especially the patients with long evolution DM (15-20 years).1

Antidepressant drugs (duloxetine, amitriptyline) are recommended in most of the clinical practice guidelines as well as anticonvulsants (pregabalin, gabapentin, oxcarbazepine) as first line treatment of the diabetic polyneuropathy, and the opioids as tramadol and oxycodone as second line.1 In general, the pregabalin and the duloxetine are considered a first choice and event the joint use of them.1,2

If the patients do not respond to standard treatment schemes, the invasive measures might be indicated. Thus, the neuro-modulation techniques, as the SCS, used in other pathologies (eg. post-surgical spine pain and syndrome of complex regional pain) or even in advanced therapies in coccygodynia, might be useful in the treatment of these patients.

The SCS is based in the “gate control theory” of Melzack and Wall,3 which states that the painful stimulation might be blocked by an electric or tactile stimulation, mediated by the nervous A-beta, myelinic and fast conduction fibers. From the neuro-chemical point of view, it might act restoring the GABA levels in the posterior spinal horn and probably on the release of adenosine, reducing the neuropathic pain.4

A few studies have been performed with spinal stimulation in patients with diabetic neuropathy. The work of Tesfaye et al.5 has been publish in 1996 in which ten diabetic patients were studied and who were implanted with spinal stimulators. Neuro-stimulators were implanted in 5 patients and placebo stimulators in the rest. The tolerability of the exercise on the treadmill after 3 months has been evaluated. At the end of the study it could be observed that both groups improved the pain compared to the baseline pain, but with a greater difference in the patients with active stimulator (1.5-31.3; p= 0.002) compared to the placebo group (15.5-56.3; p= 0.005), which were related with an improvement in the blood flow in the peripheral nerves by a dorsal stimulation of the A-beta fibers an inhibition of the C fibers. The authors recommend the performance of more studies about the diabetic neuropathy, as the safety and efficacy of the
SCS has been determined in the chronic pain of different etiology, though not in diabetic patients.

Petrakis and Sciaccia conducted a study in 60 diabetic patients classified as Fontaine III or IV phases (28 with diabetic neuropathy), who underwent SCS after having received a conservative or non efficacious treatment. The transcutaneous oxygen pressure (TcpO₂) was measured in patients before and after 2 and 4 weeks of the implant. A pain improvement was found in 35 patients, while 12 showed a partial relief, within 6 months after the implantation. Only 3 from the 28 patients with neuropathy obtained a benefit at long term. As conclusion of this study, it is stated that in patients with a relevant increase of the TcpO₂ post-stimulation, with a relief during a period of 2 weeks, the treatment with SCS might be beneficial at long term, unless the neuropathy is an advanced phase, as it has been observed that it was related inversely to the therapy success.

The SCS is minimal invasive and reversible technique that since it has been used for the first time in 1967 by Shealy, showed a great efficiency and safety in the treatment of the especially neuropathic chronic pain and in other processes, as the ischemic cardiopathy. However, it is not a technique free of possible complications (headache, infection, bruises, hygroma, opening of the surgical wound and displacement or breakage of the electrode).

In conclusion, we believe that the presentation of this case opens an innovative possibility in the therapeutic approach of the serious neuropathic pain in the diabetic patients.

Declaration of potential conflict of interests
V.L. Villanueva Pérez, M.V. Silva Cedeño, L. Vaquer Quiles and J.A. de Andrés Ibáñez state that there are no conflicts of interests as regards to the content of this article.

References