

Bilateral simultaneous implant of electrodes within the subthalamic nucleus. Feasibility and advantages

Angelo Franzini · Giuseppe Messina · Michele Rizzi · Roberto Cordella · Paolo Mazzone

Received: 26 June 2013 / Accepted: 28 June 2013
© Springer-Verlag Wien 2013

Dear Editor,

Available stereotactic frames do not allow the simultaneous implant of electrodes within the right and left Stn nuclei. The standard surgical procedure is initially performed on one side and then on the contralateral side. We introduced a modification on a stereotactic frame in order to perform the implant simultaneously on both sides.

Between the available stereotactic frames we considered only the ones characterized by the half-arc system (Micromar, S. Paulo, Brasil; Maranello, Maranello, Italy) [2]. The original half-arcs have been cut at an 80 ° level each to allow their simultaneous mounting on the frame and to avoid the collision in the symmetrical configuration (Fig. 1). Two small cutaneous pre-coronal incisions located about 3 cm from the midline and two corresponding burr holes are performed, and the dura is opened as usual. The two modified half-arcs of the Maranello frame are mounted following the stereotactic coordinates derived from direct targeting procedure or from the digitalized stereotactic atlas of each side [1]. Two cannulas are then simultaneously inserted through two microdrives until they are 15 mm over the estimated targets. Then the microelectrodes are simultaneously inserted on both sides and progressively advanced to reach the final target. Microrecording is performed at every 0.5-mm step by step simultaneously on

both sides. The recorded neuronal activity from both sides is available in real time and the corresponding patterns may be matched at every level as far as the target. If one or both of the chosen trajectories present suboptimal results with regard to the electrical activity or to clinical response to intra-operative stimulation, they can be modified independently on each side as in the standard unilateral procedure.

The following advantages of the reported procedure are noted:

- 1) There is considerable reduction of brain shifting, which usually affects the procedure of implanting the electrode on the second side [3]. In fact, the implant on the second side is often more problematic due to the changes of the coordinates introduced by the cerebro-spinal fluid loss and by the pneumocephalus which often occurs at the end of the procedure on the first side.
- 2) There is considerable time saved, estimated to be about 1 h compared with the standard “side by side” procedure (average duration of the standard procedure: 5 h in our institute).
- 3) Simultaneous recording from symmetrical anatomic structures is provided. This may be useful to study the eventual reciprocal influences between the two subthalamic nuclei in different functional conditions, such as during unilateral voluntary or passive movements. Finally, the clinical prevalence of Parkinson disease on one side (“drive side”) may be investigated

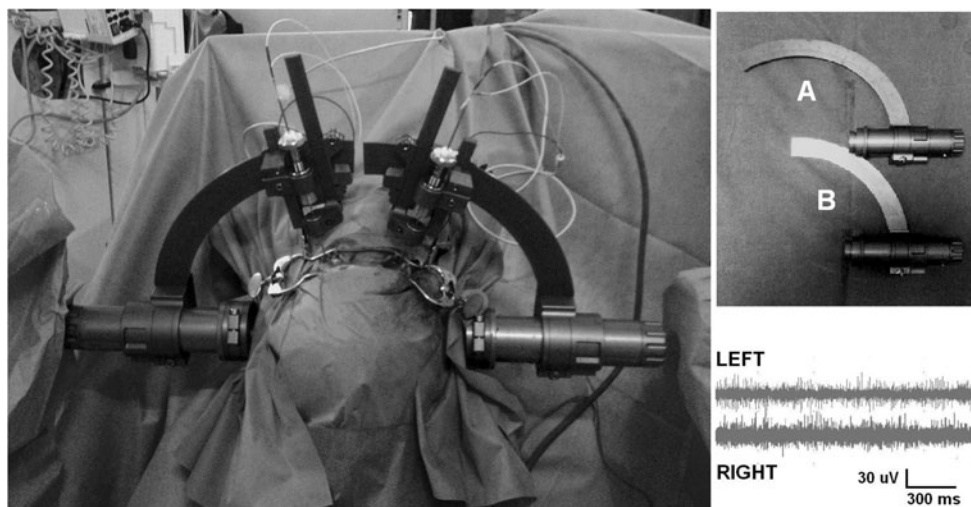
In conclusion, the simple modification of half-arcs of single-arc-based stereotactic frames allowed us to perform the bilateral, simultaneous implant of deep brain electrodes within the two subthalamic nuclei, with the subsequent advantage of avoidance of brain shift occurring between each of the two procedures. To our knowledge, this is the first report describing such a procedure.

A. Franzini · G. Messina · M. Rizzi · R. Cordella
Unit of Functional Neurosurgery, Istituto Neurologico
“Carlo Besta”, Milan, Italy

P. Mazzone
Functional and Stereotactic Neurosurgery Unit, CTO Hospital,
Rome, Italy

G. Messina (✉)
Istituto Neurologico Carlo Besta, Via Celoria 11,
20133 Milan, Italy
e-mail: giusmex@gmail.com

Fig. 1 *Left:* Intraoperative photo of bilateral STN DBS procedure; notice the two half-arcs mounted on the Maranello headframe; *upper right:* at the top, the original half arc of the frame, at the bottom, the same arc cut at 80°; *lower right:* intraoperative bilateral simultaneous subthalamic microrecording



Conflicts of interest None.

References

1. Foltynie T, Zrinzo L, Martinez-Torres I, Tripoliti E, Petersen E, Holl E, Aviles-Olmos I, Jahanshahi M, Hariz M, Limousin P (2011) MRI-guided STN DBS in Parkinson's disease without microelectrode recording: efficacy and safety. *J Neurol Neurosurg Psychiatry* 82(4):358–363
2. Mazzone P, Brown P, Dilazzaro V, Stanzione P, Oliviero A, Peppe A, Santilli V, Insola A, Altibrandi M (2005) Bilateral implantation in globus pallidus internus and in subthalamic nucleus in Parkinson's disease. *Neuromodulation* 8(1):1–6
3. Petersen EA, Holl EM, Martinez-Torres I, Foltynie T, Limousin P, Hariz MI, Zrinzo L (2010) Minimizing brain shift in stereotactic functional neurosurgery. *Neurosurgery* 67(3 Suppl Operative):213–221