

Nucleus accumbens stereotactic surgery: Achieving accuracy through area M

Ioannis N Mavridis

Ioannis N Mavridis, Medical office of the Command of the Hellenic Navy General Staff (Naval Hospital of Athens), 15561 Athens, Greece

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Correspondence to: Ioannis N Mavridis, MD, PhD, Medical office of the Command of the Hellenic Navy General Staff (Naval Hospital of Athens), Mesogion Av. 229, Chologos, 15561 Athens, Greece. pap-van@otenet.gr

Telephone: +30-697-8327199 Fax: +30-210-2833600

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Abstract

The nucleus accumbens (NA), a major pleasure center of the human brain, is a limbic-motor interface involved in several neurological and psychiatric disorders. During the last decade, this nucleus is also a deep brain stimulation target for selected patients. Purpose of this paper is to comment on the article entitled "Stereotactic anatomy of the human nucleus accumbens: from applied mathematics to microsurgical accuracy" which was recently published in "Surgical and Radiologic Anatomy" and is one of the latest articles on NA anatomy and surgery. The described results included a probability-based guide for *in vivo* (side-depended) stereotactic localization of the human NA and a standard for the NA, specific stereotactic zone of the human brain (which can be used in combination for an accurate stereotactic NA targeting). Furthermore, two specific stereotactically standard NA areas were found which could be used as abundant stereotactic guides for targeting of the anterior limb of the internal capsule, with electrode's contact 0 (lowest) placed in the vicinity of the NA. However, the most important finding of this paper was standard area M (Mavridis' area), which is the most reliable stereotactically standard area of the human NA, regardless of side or gender, useful for highly accurate stereotactic

NA targeting.

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Key words: Mavridis' area; Deep brain stimulation; Neuropsychiatric disorders; Nucleus accumbens; Stereotactic surgery; Surgical accuracy

Core tip: Nucleus accumbens (NA), a major pleasure center of the human brain, is a limbic-motor interface involved in several neurological and psychiatric disorders. It is also a deep brain stimulation target for selected patients. Purpose of this paper is to comment on the article entitled "Stereotactic anatomy of the human nucleus accumbens: from applied mathematics to microsurgical accuracy" which was recently published in "Surgical and Radiologic Anatomy". Its most important finding was standard area M (Mavridis' area), which is the most reliable stereotactically standard area of the human NA, regardless of side or gender, useful for highly accurate stereotactic NA targeting.

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COMMENTARY ON HOT TOPICS

Purpose of this paper is to comment on the recent article entitled "Stereotactic anatomy of the human nucleus accumbens: from applied mathematics to microsurgical accuracy"^[1]. It is one of the latest articles on nucleus accumbens (NA) anatomy and surgery.

The NA, a major pleasure center of the human brain (Figure 1), is a limbic-motor interface involved in several neurological and psychiatric disorders^[2]. During the last decade, this nucleus became also a deep brain stimulation

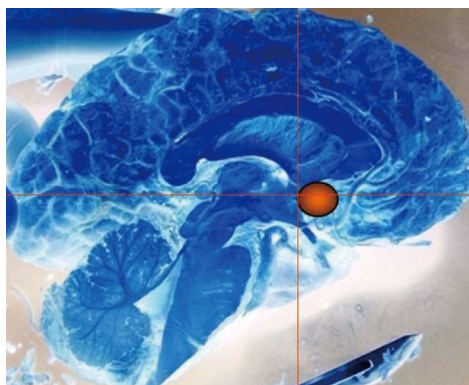


Figure 1 Nucleus accumbens location. Schematic representation of the nucleus accumbens contour on internal hemispheric surface (human brain, left hemisphere, lines represent stereotactic reference system) (modified from Mavridis^[2]).

(DBS) target for selected patients mainly suffering from refractory major depression^[3], obsessive-compulsive disorder^[4] and Tourette syndrome^[5].

According to the commended article, NA coordinates were measured at five different neurosurgically important three-dimensional levels, through two clinically oriented stereotactic studies, a magnetic resonance imaging and a gross anatomical (with totally 84 NAs studied). The study offered a stereotactic anatomic guide for some common targeting needs of the NA stereotactic surgery, resulted from detailed analysis and careful combination of the measured data^[1].

The results included a probability-based guide for *in vivo* (side-dependent) stereotactic localization of the human NA and a standard for the NA, specific stereotactic zone of the human brain (which can be used in combination for an accurate stereotactic NA targeting). Furthermore, two specific stereotactically standard NA areas were found which could be used as abundant stereotactic guides for targeting of the anterior limb of the internal capsule, with electrode's contact 0 (lowest) placed in the vicinity of the NA^[1].

However, the most important finding of this paper was standard area M (Mavridis' area), which is the most reliable stereotactically standard area of the human NA, regardless of side or gender, useful for highly accurate stereotactic NA targeting. Standard area M is defined by coordinates (X, X', Y, Y', Z, Z') = (6, 9, 2, 2, -0.8, -2) and represents the most reliable standard part of the NA (of those revealed by the coordinates' analysis) within the human brain, regardless of side or gender. The surface of this area is 3.6 mm²^[1]. Area M consists a revolutionary finding because it is expected to be applicable in every adult human hemisphere. Additionally it offers a compass for neurosurgeons given the relative variety of NA target coordinates used in the past by several authors^[3-16].

It is clear that the described study offered a necessary (considering the expanding dynamics of NA DBS) deep insight into the stereotactic anatomy of the human NA, missing from the literature^[1]. Clinical research, more difficult of course, always requires a stable ground of basic

research in order to bring successful treatment strategies as a result. Now that a safe anatomical basis for achieving surgical accuracy exists, problems that remain to be resolved are mainly related to NA DBS clinical application. Consequently, future research directions should focus on microelectrode recordings interpretation, establishing guidelines for stimulation parameters, minimizing complications and safely expanding respective therapeutic indications, if possible. Such efforts should always be made by multidisciplinary teams of experienced clinicians.

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