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Reincarnating the Oxford Cingulectomy in the Epoch of Stereotaxy and Resurrecting Lesions in the Era of Deep Brain Stimulation

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Sir Hugh Cairns, the first Nuffield Professor of Surgery and founder of neurosurgery at Oxford, one of Cushing's three trainees alongside Jefferson and Dott who established neurosurgery in the UK, pioneered a handful of enduring clinical contributions [1–3]. Well known are his introduction of wartime field neurosurgical hospitals, crash helmets for motorcyclists, antibiotics in neurosurgery and the 'Oxford' hemispherectomy for epilepsy [4–7]. Less publicized is his cingulectomy for psychiatric disorders. Cairns extirpated by freehand craniotomy and interhemispheric approach the anterior 4 cm of rostral cingulate gyrus (Brodmann's area 24). He published long-term outcomes from 24 of 29 treated patients with psychiatric disorders, showing improvements in many without detrimental changes in behaviour and finding it least effective in psychoses and most useful in 'certain types of mental illness marked by obsessions, tension and anxiety, in which the basic personality is preserved' [6].

Obsessive-compulsive disorder (OCD) can be debilitating and neurosurgical treatments for refractory patients have evolved to stereotactic lesional and now deep brain stimulation (DBS) therapies, most focused upon either the anterior cingulate cortex or anterior limb of the internal capsule. A wealth of animal experiments and human neuroimaging evidence have continued to implicate both in underlying aberrant neural circuitry since the time of first Papez's then MacLean's conceptualizations of the limbic system [8, 9].

Here, Zhang et al. [10] present results of 7 patients with refractory OCD treated by combined bilateral anterior cingulotomy and anterior capsulotomy, with 5 improving after 1 year. Using a cingulate target much more anterior than other series [11], follow-up was short, assessment potentially unblinded and no comparison made to control groups receiving one lesional target alone. Nevertheless, the outcomes appear to improve promisingly the adage in neurosurgery for psychiatric disorders from 'one third improved, one third unchanged and one third worse' to 'two thirds improved' by combining the lesions, implying a synergistic behavioural effect from their disruption of aberrant limbic circuitry. Their results are best contextualized firstly by the enormous 800-patient experience over 4 decades from the Massachusetts General Hospital by Ballantine et al. [12] then Cosgrove and Rauch [13]. Of Ballantine's

198-patient retrospective case series, 62% improved at a mean follow-up of 8.6 years, with 56% of OCD patients improving [12]. Their overall impression was of 60–70% subjective improvement in refractory OCD patients dropping to a 30–40% response using objective rating scales [13]. The second historical context arises from Leksell's adaptation of Talairach's capsulotomy [14, 15]. Of Leksell's first 116 patients, 50% with OCD responded satisfactorily and 3 patients worsened [14]. Of note, Kullberg [16] attempted to compare cingulotomy and capsulotomy in 26 randomized patients, with 6 of 13 improving after capsulotomy and 13 after cingulotomy, although transient deterioration was more common in capsulotomy. It should be mentioned that targets in ablative neurosurgery for psychiatric disorders have often followed geographical and historical trends intrinsic to the neurosurgical craft apprenticeship, with capsulotomy more common in Europe and cingulotomy in North America.

While outcomes of 40–70% improvement in OCD appear similar for both DBS and lesioning [17], the authors' bravery should be commended for undertaking ablative neurosurgery for psychiatric disorders in an era where DBS appeals to most and, to quote Patrick Kelly, 'lesions separate the men from the boys' [Hariz M.I., pers. commun., London, 2004]. DBS may have superseded ablative surgery in most instances due not just to its superficial seductiveness and so-called reversibility, but also theoretically lower mortality rates and reductions in both serious complications such as haemorrhage and adverse effects upon cognition. However, DBS confers higher costs, greater risks of infection due to the neuroprosthesis and of complications related to the frequently longer operative duration. Ablative stereotactic surgical procedures that continue to be practiced include pallidotomy for Parkinson's disease and dystonia [18, 19], thalamotomy for tremor [20], cingulotomy and anterior capsulotomy for OCD and depression [21], and cingulotomy for cancer pain [13].

Ablation can always be considered if DBS fails, but may be appropriate as first-line surgical therapy rather than DBS where the efficacy of the former is better established – for example in psychiatric disorders [13]. It is also of utility in patients refractory to or unsuitable for DBS, for example cingulotomy for obsessive-compulsive head bangers who may damage their indwelling neuroprostheses or those with cancer pain in whom the tolerance effect seen a year later may occur beyond their limited lifespan. In contexts where DBS may be impractical due to cost and lack of follow-up such as rural, developing world settings, other lesioning procedures not widely performed like subthalamotomy for Parkinson's disease might be indicated [22].

The status of lesioning in movement disorders was well summarized by Blomstedt and Hariz [23] in this journal: 'Unilateral ablative surgery may not harbour more postoperative complications or side effects than DBS. Some of the side effects following lesioning are transient and most but not all DBS side effects are reversible. In the Vim DBS is safer than lesioning, while in the pallidum, unilateral lesions are well tolerated.'

A quarter of a century of contemporary DBS has begun to clarify its limitations and opportunities for neurosurgical alternatives, as happened for the levodopa that heralded it. While narrative reviews of lesioning exist [24, 25], a systematic appraisal of the contemporary literature for deep brain ablation in the era of DBS is desirable. Psychiatric disorders, cancer pain and selected patients with movement disorders remain appropriate indications. Furthermore, we predict a resurgence in ablative surgery driven by the encouraging renaissance of stereotactic and functional neurosurgery in resource-limited, developing world settings.

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