

What has been the most important advancement in neurosurgical practice, over the last 10 years?

DISCUSSION STARTERS

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ABSTRACT

Neurosurgery is considered one of the oldest specialties, with evidence of surgical intervention being observed in skull specimens dating back to pre-history. Yet, the modern idea of neurosurgery is a very recent concept. Increasingly sophisticated technology has revolutionised the field, but arguably the greatest impact on patient outcomes has come from an only seemingly less exciting reform, which has transformed the structure of the service.

Over the last decade, efforts have been made to redefine the relationship between patients and healthcare practitioners, in favour of a more holistic and collaborative approach with the patient being placed at the centre of their own care. This shift has particularly impacted specialties like neurosurgery, where meticulous care planning frequently involves input from several other experts and healthcare professionals. Furthermore, advancements in the field of neurosurgery tend to stem from the process of optimisation of techniques, or tool kits, that were actually devised decades ago.

True paradigm shifts simply do not occur as frequently, and they are the result of new ways of understanding disease, or new ways of working. The work towards multidisciplinary approaches, patient centred care and social care constitutes the most significant advancement for patient outcomes and satisfaction in the field of neurosurgery over the last decade.

The genesis of surgical procedures on the human skull dates back to prehistory, with archaeological specimens showing compelling evidence of humans performing trephinations even at that time. (1) The earliest unequivocal evidence of this practice comes from the work of Alt et al in 1997 on the skeleton retrieved from the Ensisheim burial site in France in 1996, where the archaeological data dates to more than 7000 years ago. (2) Researchers observed evidence of healing patterns on the skull which strongly indicate that the likely cause of the wound was surgical, as opposed to traumatic. (2) The literature is clear that this practice has developed in a variety of ancient cultures and societies, separated both in time and space, from the Old World of Eurasia to the New World. (3) It is believed that a major indication for these practices was mental illness, manifested as what was considered abnormal behaviour at the time. (3) This was certainly the case in the Middle Ages, as depicted in the oil painting by Hieronymus Bosch titled: "The extraction of the stone of madness", dated around 1494. (3) It is thus evident that the idea of surgical intervention on a person's skull with therapeutic intent was conceived by mankind millennia ago. However, the practice of neurosurgery, in its modern sense, is much more recent. Propelled by advancements in neuroimaging and neuro-anaesthetics, this field has been revolutionised by increasingly sophisticated technology. One of the most important areas of research aims at perfecting minimally invasive approaches, which have proved truly ground breaking in terms of their impact on recovery time and patient outcomes. The first part of the following essay will provide a brief overview of two techniques which have revolutionised the field by offering increased precision and reduced risk of adverse outcomes. In the second section, it will be argued that advancements in the field of neurosurgery tend to stem from the process of optimisation of techniques, or tool kits, that were actually devised decades ago. True paradigm shifts simply do not occur as frequently, and they are the result of new ways of understanding disease, or new ways of working. In recent times, efforts have been made to redefine the relationship between patients and healthcare practitioners, in favour of a more holistic and collaborative approach with the patient being placed at the centre of their own care. This shift has particularly impacted specialities like neurosurgery, where meticulous care planning frequently involves input from several other experts and healthcare professionals. The following essay will argue that the work towards multidisciplinary approaches, patient centred care and social care constitutes the most significant advancement for patient outcomes and satisfaction in the field of neurosurgery over the last decade.

MINIMALLY INVASIVE APPROACHES IN NEUROSURGERY

In modern times, neurosurgery has grown considerably thanks to the development of new equipment and new techniques which have empowered a shift towards a minimally invasive approach. Such advancements have considerably increased the precision and the safety of neurosurgical procedures, reducing the chance of morbidity and mortality post-surgery. (4) Two excellent examples are stereotactic radiosurgery and endoscopic brain surgery. Stereotactic radiosurgery aims at destroying tumour cells using multiple converging beams of high energy rays, devised as a superior alternative over conventional whole brain radiotherapy. (5) The key is that

this treatment can be delivered very precisely, with rapid dissipation of energy beyond the margins of the treatment volume, thus limiting toxicity to surrounding tissues and maintaining safety. (6) Over the years, it has established itself as an invaluable tool for the treatment of metastatic disease of the brain and spinal cord, primary tumours and vascular conditions. (7) Similarly, the advent of endoscopic brain surgery has proved decisive in minimising morbidity and hospital stay, particularly in central skull base surgery. Endoscopic techniques require fewer and smaller incisions, which results in improved recovery, decreased risk of adverse effects and less scarring than alternative options such as craniotomy. (8) With refinements addressing the complications initially associated with the transsphenoidal approach, including facial pain, swelling and sinonasal adverse effects, endoscopic transsphenoidal surgery has truly revolutionised the field of minimal access skull base surgery, paving the way for future advancements in this area. (9)

However, it should be noted that the birth of these revolutionary techniques is decades old, with the seminal paper of stereotactic radiosurgery being published in 1951 by Swedish physician Lars Leksell, (10) and endoscopic brain surgery being first described and popularised even in the 1910s by Harvey Cushing and Oskar Hirsch. (8) Despite the pursuit of perfecting innovative techniques being central to the progression of the field as a whole, it is worth reflecting on the fact that most of the advancements in any field of medicine tend to be refinements. Indeed, true paradigm shifts are much rarer to come by, being only achieved through new ways of understanding the disease, or new ways of working.

THE PATIENT AS THE CENTRE OF NEUROSURGICAL CARE

In recent times, efforts have been made to rethink the concept of care in favour of a view that places the patient at the centre of the process, encouraging teamwork and multidisciplinary input in order to provide quality holistic care. Contemporary patient care goes beyond the mere surgical procedure: it aims to implement a multifaceted approach to the patient's many care needs, as well as their views. In this regard, the collaborative efforts of multiple specialists and healthcare professionals are a necessity to obtain favourable patient outcomes. (11) This is especially true given the level of subspecialisation and expertise achieved by physicians within our healthcare system, such that it would not be feasible nor realistic for a single doctor to provide comprehensive holistic care. Neurosurgical patients in particular tend to receive input from many different specialists, such as (depending on the specific health condition and treatment plan) head and neck surgeons, plastic surgeons, pathologists, neuroradiologists, oncologists, to name a few. Studies have highlighted some of the advantages and the additive value of the combined experience, judgement and scope of knowledge from all team members. A retrospective study by Friedland et al reported improved survival of head and neck cancer patients as a result of multimodality treatment offered to those managed under an interdisciplinary team setting as opposed to a non-MDT setting. (12) Another prospective investigation aimed at observing whether a tumour board conference would significantly affect diagnostic and management decisions. Out of 120 patients with newly diagnosed head and neck tumours, 27%

saw changes in diagnosis, staging or management plan, concluding that a multidisciplinary approach is effective, especially for malignant tumours. (13) Furthermore, Lutterbach et al evaluated a newly established brain tumour board at Freiburg University Hospital, in Germany, (14) observing that the recommendations of an interdisciplinary group of experts are more likely to be acted on. Head and neck surgeons have led the way in the research on multidisciplinary approaches, but additional studies are required to accurately present a perspective specific to neurosurgery.

In parallel with this nation-wide effort to adopt a more holistic and collaborative approach to healthcare, the United Kingdom has advocated for the patient to be placed at the centre of the process. In other words, in a system which aims to bring together multiple healthcare professionals, it has been recognised that it is critical to support patients in being actively involved in their own care and in the decision making process. This commitment was expressed in the NHS Five Year Forward View, published in October 2014, which set out a shared vision for the National Health Service (NHS), acknowledging the need to reform the relationship between the patient and healthcare professionals. The scientific literature is rich in articles discussing the importance of understanding how considering the patient's views interacts and synergises with the delivery of quality evidence based medicine. (15) Indeed, some reviews have expressed the idea that the concepts of patient centred care and evidence based medicine are incomplete in isolation and the value each one brings cannot be disentangled from the other. (16) However, research on the processes and outcomes of patient-centred care is largely heterogeneous and inconsistent, arguably as a result of poor clarity around the definition and specific dimensions of patient-centredness. (17) Despite the concept being unanimously endorsed in the literature, further research is undoubtedly needed to overcome barriers at all levels of care and to make it a reality.

Finally, the past decade has also seen an increased focus on an integrated model of health and social care, an aspect that must be touched upon in the discussion about the collective effort to reform the concept of delivery of care. Indeed, extensive research has shown that socioeconomic factors are of great significance in determining health-related outcomes. Population health management (PHM) is increasingly recognised as a more sustainable and complete approach, seeking improvement of population health as a means of supporting the growth of the quality of healthcare while reducing its cost. (18, 19) The aim is to address the full range of determinants of health, from personal to social and economic, in order to build healthier communities. In the UK, the introduction of this new model of care bringing together both health and social care in the community is one of the core ideas brought forward in the recently published NHS Long Term Plan. (20) However, increasing efforts are required to oppose inequalities within the healthcare system. Martin Luther King Jr once said: "of all forms of inequality, injustice in health care is the most shocking and inhumane". Sadly, the echo of his words reverberates to the present day and resonates deeply with the ideas of social justice scholars. (21, 22) Healthcare inequalities reflect a wider social, economic and political context, as highlighted in the Marmot Review in 2010. (23)

The central thesis presented in their manuscript is that healthcare inequalities are rooted in a multifaceted issue, such that it is not possible to consider them but as a reflection of the broader social and political context. Therefore, intervention must be universal, but implemented with greater intensity in the most disadvantaged social classes, a concept that Marmot and colleagues referred to as proportionate universalism.

In conclusion, neurosurgery is a field in constant evolution. The many technical advancements achieved in modern times project an exciting future for the specialty. However, it can be argued that most of such developments consist of refinements of techniques that were conceived decades ahead. Of course, this reflection does not detract any value to this research, which is indubitably critical for the progression of the field. Simply, true paradigm shifts do not occur frequently in history, as they stem from looking through a new lens at disease, or at the way in which care is provided. Recently, in particular over the last decade, considerable effort has gone into redefining the concept of care. Three core principles emerge from this new model, with action being taken to implement them in the very structure and essence of the healthcare system: collaborative multidisciplinary approach, patient centred care, and population health management. New research is tasked with addressing the barriers that this system faces. Despite perhaps not being as sensational as one of the technological marvels introduced in neurosurgical practice, this shift has had a striking impact in terms of patient outcomes and satisfaction, and has set out the course towards a stronger, principle-based framework for the growth of neurosurgery and the whole of medicine.

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