Annals of Surgery

DOI: 10.1097/SLA.0000000000005287

# Is it time to assess neurological status before surgery to improve postoperative outcomes?

**Subtitle:** Neurological status and surgical care

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**Mini**

The focus of perioperative optimisation remains on traditional organ systems, such as the cardiovascular and respiratory systems. It is time for greater awareness and appreciation of neurological status in the perioperative period to ensure that patients achieve the best possible postoperative neurological outcomes to facilitate their return back to their families, workplaces and society.

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The preoperative evaluation of the function of vital organs, including the heart, lungs, liver, and kidneys, is established practice across essentially all surgical specialities and is accepted by both medical professionals and the public. The purpose of preoperative evaluation is to evaluate and implement approaches to prepare and optimise high-risk patients for surgery. Preoperative medical evaluation is designed to achieve a single aim – to make surgery safer. Preoperative evaluation encourages collaboration between surgeons and non-surgeons, with the use of diagnostic tests and therapeutic interventions to identify and manage modifiable risks. Effective perioperative evaluation and optimisation, particularly of older people undergoing surgery, has been shown to reduce postoperative medical complications, delirium, 30-day mortality, and reduce the length of hospital stay [1] . Additionally, 20% of surgeries in older people delayed for preventable medical reasons, which further highlights the importance of mitigating delays in surgical intervention [1]. In terms of preoperative evaluation, most guidelines and approaches focus on risk factors for cardiac, pulmonary, renal, and metabolic-related complications [2]. For example, a typical pre-operative assessment often includes cardiac investigations, including an electrocardiogram and echocardiogram, respiratory investigations such as spirometry, if there is a history of chronic lung disease, and routine blood tests. However, there is currently a lack of focus on brain health.

There is evidence to suggest that surgery, and its associated trauma, may cause significant systemic effects including surgical stress and systemic inflammation, leading to neuroinflammation *per se* and subsequent neural connectivity impairment and neurological complications [3]. This is an association that remains poorly recognised by the clinical and scientific communities. Surgery has been shown to be associated with delirium, cognitive impairment, and stroke [4]. These adverse neurological outcomes associated with surgery significantly impact patients' recovery post-operatively and contribute to poorer outcomes in terms of morbidity and mortality and are associated with recognised risk factors and morbidities including increasing age, depression, previous stroke, postoperative infection, and the use of sedative drugs. Delirium remains the most common surgical complication in the elderly population, affecting up to 50% of older patients post-operatively and is associated with an increase in mortality, and prolonged intensive care and hospital length of stay. Postoperative delirium is thought to be a marker of cerebral vulnerability and points towards the possibility of underlying neurological disease, such as preclinical dementia. Remarkably, the peri-operative period is even thought to be associated with a pro-inflammatory stress response which potentially extends significantly beyond the precise time of surgery, with recent evidence suggesting that post-operative delirium may be associated with delayed neurocognitive recovery [3]. In addition to delirium and post-operative cognitive dysfunction, the phenomenon of perioperative covert stroke remains underappreciated and poorly understood, despite being shown to increase the risk of cognitive decline [5]. Overall, the traditional perioperative anaesthetic management focus on cardiac risk optimisation and cardiopulmonary monitoring, alongside the numerous unknown variables within perioperative neuroscience, seems to have resulted in an inadequate appreciation of measures to confer neuroprotection and optimise neurological status within the perioperative period [6]. Healthy neurological status is known to be affected by various risk factors such as increasing

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age and co-morbidities, such as neurodegenerative disease, and all these factors can contribute towards the deterioration of brain function post-operatively and even death. There are also important potentially modifiable risk factors which may negatively impact neurological function, such as poor dietary habits and malnutrition, and poor physical function, which are also inextricably linked to the multifaceted and complex concept of frailty, which should ideally be addressed during the peri-operative period.

So, what is the answer? There is no single investigation that will effectively risk stratify each patient's peri-operative neurological status, and there is no single therapeutic tool to confer neuroprotection. For progress to be made, significant financial investment is required to gain a deeper academic understanding of the investigative and therapeutic avenues to ameliorate peri-operative neurological sequalae, and various novel strategies have been investigated for this reason. For example, the use intraoperative electroencephalography (EEG) monitoring has recently been advocated to more precisely dictate anaesthetic titration to reduce the rate of perioperative neurocognitive disorders in older patients [7]. It has also been suggested that intraoperative EEG monitoring may be used as a warning signal to detect patients with brains vulnerable to neurocognitive disorders [7]. Its use in other forms of neurological monitoring, such as to detect cerebral ischaemia intraoperatively, remains debated. Additionally, post-operative biomarkers of neuronal damage have been investigated to potentially predict postoperative cognitive dysfunction and other neurological complications. For example, brain cellular injury, as demonstrated by elevated plasma glial fibrillary acid protein concentrations, has been shown to be associated with a decline in cognition one month after shoulder surgery [8]. Furthermore, the precise role of preoperative neuroimaging in patients at high-risk of postoperative neurological complications remains controversial and requires further investigation. As well as the need for financial investment to develop further diagnostic and therapeutic tools, costs are also implicated in ensuring that clinical peri-operative services are available to patients that focus on peri-operative neurological optimisation, based on the best available evidence. For example, proactive care of older patients undergoing surgery (POPS) is a geriatrician led service in the United Kingdom which focusses on medically optimising patients peri-operatively and reducing risks and complications in elderly patients undergoing elective surgery using comprehensive geriatric assessment [1].

It is vital that the neurological system is not neglected in favour of traditionally optimised organ systems during the peri-operative period. But what are some recommendations which should be considered? Whilst pre-operative cognitive screening is frequently performed, evidence is strengthening for the association of delirium with frailty and the need to link frailty screening with preoperative cognitive screening to identify patients at high risk of postoperative delirium [9]. Whilst assessing preoperative cognition and frailty is certainly valuable, the question remains as to whether the presence and detection of mental health disorders should also play a role in identifying patients at risk of postoperative neurological complications. For instance, depression screening prior to cardiac surgery may be effective in identifying patients at higher risk of postoperative delirium, whilst preoperative anxiety has been shown to be associated with an increased risk of executive function decline following

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oncological surgery [10] . Therefore, perhaps a preoperative combination of assessing cognition, frailty and mental health disorders for patients (for example, older than 65 years) may confer a more robust approach to identifying patients at high-risk of postoperative neurological complications. The POPS service in the United Kingdom is a positive and demonstratable example of the feasibility and efficacy of identifying and optimising elderly patients at high-risk of perioperative complications using comprehensive geriatric assessment [1]. Perhaps healthcare systems should consider implementing stratification systems and formalised assessment practices encompassing a combination of additional variables alongside age and physical co-morbidities, such as mental health disorders and frailty, alongside cognition, to identify patients that would benefit most from comprehensive assessment and optimisation, potentially using the POPS model as an example of an established clinical approach to implementing such as service across surgical specialities. Overall, ensuring that patients achieve the best possible peri-operative neurological outcomes will require time, research, financial investment, re-education, and re-organisation of current practice to encourage the safe and expedient recovery of patients back to their families, workplaces, and society.

**Funding:**

Prof Ma's current research is supported by the grants from British Journal of Anaesthesia, Royal College of Anaesthetists and National Institute for Health Research (NIHR), London, UK

**Conflicts of interest:** None

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