Neuro-anesthesia Question of the Month

How long should elective surgery be delayed following a concussion?

Determining how long to delay an elective surgery following a concussion is a complex question with no established guidelines. However, having a better understanding of where concussions lie on the spectrum of TBI, the potentially lasting pathophysiologic effects on the brain, and the so-called "window of vulnerability" will help clinicians make more informed decisions around when to proceed with surgery following a concussion and how best to prevent further damage.

A concussion is a TBI in its mildest form, most often the result of biomechanical forces from sports-related injuries, falls, MVCs, that is associated with temporary impairment of neurological function. It is a clinical diagnosis with the most common symptoms being headache (93%), unsteadiness (75%), difficulty concentrating (67%), and confusion, photophobia, nausea, drowsiness, amnesia, and sonophobia being less common[1]; however, patients with concussions often do not seek medical attention and up to 50% of cases go unreported.[2] The mainstay of treatment is essentially rest – removal from regular activities, both physical and cognitive, with gradual return while monitoring for worsening of symptoms. Most will have symptomatic resolution within 1-2 weeks, though, some can go on to have symptoms for up to a month, called Post-concussive Syndrome.[1]

Despite structurally normal appearing brains on imaging following concussion, it is well known that the brain is physiologically abnormal. Acutely following a concussion, cerebral flow-metabolism becomes uncoupled with increased CMR and decreased global CBF. In the subacute period, the opposite occurs: increased CBF, decreased CMR, and furthermore, impairment in the brain's intrinsic responsiveness to MAP (ie. autoregulation) and PaCO2.[3] This is likely related to damaged cells and neurons causing ionic shifts, disruptions in cellular metabolism and neurotransmission, and expression of inflammatory cytokines.[4] However, these pathophysiologic changes may persist for weeks beyond resolution of concussive symptoms, which poses a major clinical consideration that without intact cerebral homeostatic mechanisms, the brain is vulnerable to secondary injury from even minor physiologic derangements.

During a time when the brain should be rested, surgery is not ideal. The perioperative period is often stressful and demanding; encountering foreign environments, new people, endless questions, important decisions, bright lights, loud noises, poor sleep, and painful procedures is the antithesis of rest. Compounded with the intraoperative physiologic changes associated with intubation, surgical stimulation, pain, blood loss, and pharmacology make the recently concussed brain highly susceptible to secondary insults.[1] The intraoperative factors that have been linked to secondary brain injuries in the "window of vulnerability" include hypotension, decreased CPP, intracranial hypertension, abnormal capnography, hyperthermia, and abnormal glucose levels. Hypotension, in particular, was associated with worse postoperative neuroimaging results, lower GCS scores, and the need for extended or higher levels of care.[4,5] And yet, anesthetics post-concussion are common! A retrospective review of over 1000

concussed patients found that more than half had an orthopedic or general surgery procedure performed within a week of injury and another 5% underwent elective procedures completely unrelated to the injury within a week.[6]

In summary, a concussion is not just a benign head injury, but has the potential for long-term consequences if the brain is not rested properly or suffers secondary brain injuries in the perioperative period. Given the high incidence of concussions in patients who present for both emergent and elective procedures within weeks of their injury, it is recommended that anesthesia providers have a heightened awareness of concussions, especially in trauma patients, and screen appropriate patients using tools such as the Concussion Symptom Checklist or Sports Concussion Assessment Tool (SCAT 5), which are rarely implemented preoperatively.[7] Many authors recommend delaying elective surgery until at least symptoms of concussion resolve, or perhaps, even 2 weeks later given the delay in metabolic recovery.[1,3,4,7] However, there is currently no evidence that shows any benefit to delaying elective surgery following concussion and, furthermore, without prospective randomized controlled trials, the effects of surgery and anesthesia on long-term outcomes following concussion remain largely unknown. If the decision to proceed with surgery post-concussion is made, it would be prudent to discuss the risk of exacerbating or prolonging symptoms with the patient and to pay special attention to minimizing the risk of secondary brain injury by maintaining physiological homeostasis – most importantly, maintaining MAP at the patient's baseline or higher and maintaining normocarbia.[1,2] Ultimately, decisions on how to manage recently concussed patients in the perioperative period must be made based on individual patient and physiologic considerations until new data produces established, evidence-based guidelines.

There is ongoing research around methods of rapidly detecting or quantifying a concussion to help clinicians determine when it is safe to proceed with elective surgery. Biomarkers, including beta-amyloid peptide, S-100 calcium-binding protein B, total Tau, and glial fibrillary acid protein, are being studied as markers of progression and resolution of biochemical disturbances in the brain, but the results so far are inconclusive.[3] Other multicentre studies are assessing the use of transcranial doppler (TCD) to predict worse neurological outcome on day 7 following mild-moderate TBI; a normal TCD at presentation of injury was shown to have a 98% NPV.[8] Lastly, brain function index (BFI), which detects features pathognomonic for functional brain impairment on EEG, has been used to show normalization of BFI by day 45 in concussed athletes – a non-invasive test that may indicate when patients are ready to proceed with elective surgery.[9] Despite this, no single test currently has been validated to tell us when the brain has normalized or when the "window of vulnerability" has closed, and more research is needed.

References

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