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REVIEW

Neurocognitive and Psychiatric Issues Post Cardiac Surgery

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Neurocognitive and psychiatric complications are common following cardiac surgery and impact on patient quality of life, recovery from surgery, participation in rehabilitation and long-term mortality. Postoperative cognitive decline, depressive disorders, post-traumatic stress disorder and neurocognitive impairment related to silent brain infarcts have all been linked to the perioperative period of cardiac surgery, and potentially have serious consequences. The accurate assessment of these conditions, particularly in determining the aetiology, and impact on patients is difficult due to the poorly recognised nature of these complications as well as similarities in presentation with postoperative delirium. This review aims to summarise current understanding surrounding psychiatric disturbances following cardiac surgery including the impact on patient quality of life and long-term outcomes.

Keywords Cardiac surgical procedures • Mental disorders • Neuropsychiatry • Postoperative cognitive dysfunction

Introduction

Neurologic injury, including stroke and transient ischaemic attack are important complications of cardiac surgery. A number of techniques have developed with the aim of reducing neurologic injury during cardiac surgical procedures. These include off-pump coronary artery bypass grafting, antegrade cerebral perfusion and hypothermia during aortic arch surgery, and distal aortic perfusion and cerebrospinal fluid drainage in thoracoabdominal aortic surgery [1].

These techniques have positively impacted on overt neurologic outcomes, and the focus has begun to shift towards less well-understood and often subtle neuro-psychiatric complications such as postoperative cognitive dysfunction (POCD), depression, dementia, and post-traumatic stress disorder (PTSD). These disorders have a significant impact on postoperative quality of life, and potentially negate the expected improvement in quality of life following successful surgery [2]. They may also affect functional independence, resulting in an increase in care requirements, reduction in workforce participation, and increased reliance on social

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welfare [3]. Furthermore, there is some evidence that POCD may be associated with an increased mortality long-term [3].

The precise aetiology of these conditions is not entirely clear but likely involves a number of mechanisms including cerebral hypoperfusion and oxygenation, microemboli causing silent brain infarcts or a systemic inflammatory response [4]. Known patient risk factors include age, preoperative cognitive function and cognitive reserve [5], and premorbid psychiatric disorders [6]. This review discusses the possible aetiology of these conditions and their effect on patient outcomes.

Postoperative Cognitive Dysfunction

Cognitive dysfunction after cardiac surgery, while well known to occur, is less clearly understood with regards to the true incidence, causative factors involved, extent of the damage, and long-term implications and prognosis. Similar to clinically apparent stroke, embolic injury is likely to be a dominant mechanism of injury, however as demonstrated by an inconsistent correlation between POCD and new diffusion weighted imaging (DWI) cerebral ischaemic lesions [7], there are likely other factors involved. Cerebral hypoperfusion [8], systemic inflammatory response, CPB circuit [9], and cerebral hyperthermia [10] are all recognised as potential mechanisms of brain injury in the perioperative period.

The definition of POCD is subject to considerable variation, which has made the true extent of this often sub-clinical brain injury difficult to determine. A 1995 statement of consensus for the diagnosis of POCD [11] recommended a core battery of tests, which included assessment of specific core cognitive domains including motor skill, verbal memory, attention and concentration, as well as assessing for effects of anxiety and depression, IQ testing, neurologic examination and accounting for learning effects and additional follow-up testing at least three months post procedure were all advocated. However in a review of POCD after cardiac surgery, which included 62 studies, high heterogeneity was found between the assessment batteries applied [12]. Further adding to heterogeneity was the finding that the statistical definition of POCD varied widely between studies with more than nine definitions (most notably including: percentage decline, standard deviation decline, factor analysis, individual test analysis) seen across the 62 studies with the threshold for cognitive decline being inconsistent between each [12].

Although heterogeneity in the definition of POCD remains, it can be generally described as a reduction in any cognitive domain following surgery – typically thinking and memory, without an obvious state of confusion [13]. This is important so as to distinguish POCD from postoperative delirium, which can best be described as an acute and fluctuating confusional state, with reduced attention, disorientation, and additional symptoms such as hallucinations and inappropriate behaviour [14]. The reported incidence of POCD is highly variable, as would be expected with the inconsistent definitions. A standard deviation (reduction of 1 SD) definition by Newman et al. has reported the incidence of POCD to be as high as 70% in the first week and 40% at 12 months [15]. Diagnosis of POCD early in the preoperative period is difficult due to many variables which may overestimate the diagnoses such as effects of anaesthetic drugs, narcotics and benzodiazepines [15] as well as misinterpretation of POCD in the presence of postoperative delirium [16]. Similarly, diagnosing POCD in the long-term has its own challenges, largely due to reduced cognition and associated increased incidence of silent brain infarcts (SBIs) with increasing age, potentially overestimating the effect of cognitive dysfunction actually related to the surgical procedure [17].

Cognitive dysfunction is a serious morbidity that can impact significantly on social function and independence. In a non-cardiac surgery study of POCD, in which 701 patients were followed up for 8.5 years, POCD present at one week postoperatively was associated with increased time receiving social welfare payments and earlier withdrawal from the labour market [3]. Self-care is an important factor of patient independence and their clinical outcomes [18] and in a study of patients with congestive heart failure, those who had cognitive impairment demonstrated difficulty in recognising symptom changes and thus had an impaired ability to make adequate self-care decisions over time [19]. Further to this, impairment of the executive function cognitive domain has been linked to a reduction in the ability to perform activities of daily living, specifically medication management [20], negatively impacting patient outcomes. In a long-term study of a median 11-year follow-up of patients following cardiac surgery, cognitive dysfunction present at six months was associated with increased long-term mortality [21], further demonstrating that the consequences of POCD are likely to have long-term implications that are more significant than just a transient postoperative state.

Perioperative Depression

Depression has been closely associated with cardiovascular disease, with major depressive disorder (MDD) reported to be present in up to 20% of patients [22]. It is not surprising, therefore, that depression is a notable comorbidity in patients undergoing cardiac surgery. Depression has been shown to be associated with extensive neural network abnormalities across the brain, hence both focal and global brain injuries may cause damage to these networks and predispose to increase risk of MDD [23]. Pre-morbid depressive disorders are the main risk factor for postoperative depression, with new postoperative depression relatively uncommon [24], so while cardiac surgery has not been shown to be a significant cause of depression it may be an important co-factor in inducing relapse as well as in contributing to postoperative morbidity and mortality.

In a study of 309 patients undergoing CABG, 20% met the criteria for MDD prior to discharge; of this group 27% had a cardiac event within the first 12 months [25]. This was compared to 10% of the group without MDD [25]. Further to this,

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