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Neurological Complications Following Cardiac Surgery and Percutaneous Valve Replacement Include Stroke, Hallucinations, and Postoperative Delirium

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Abstract

After heart surgery or percutaneous valve replacement, neurological problems including acute ischemic stroke or postoperative psychosis are common. The purpose of this study was to pinpoint pertinent risk variables. 297 patients who had undergone heart surgery or percutaneous valve replacement had postoperative checks for neurological issues such delirium, stroke, seizures, and hallucinations performed twice daily during three days. In a multivariate model, risk factors for pre- and postoperative complications were assessed. In 43.8% of cases (n=130), there were neurological complications, which included delirium (43.43%, n = 129), stroke (2.7%, n= 8), seizures (1.35%, n=4) and actual hallucinations (3.36%, n=10). Stroke and convulsions are uncommon following heart surgery, however postoperative delirium still happens often. For a challenging postoperative course, a preoperative risk profile with older age, a history of heart failure, and cognitive impairment was discovered. However, it is important to consider the effects of a severe inflammatory reaction.

Keywords: Cardiac surgery • Percutaneous valve replacement • Hallucination • Postoperative delirium

Introduction

Cardiovascular surgery and percutaneous valve replacement are invasive procedures that carry a high risk of problems during and after operation. Following surgery, neurological problems such Acute Ischemic Stroke (AIS), focal or widespread seizures, and hallucinations are known to have a negative impact on prognosis. According to earlier research, 1.5% to 4.5% of patients experience AIS after heart surgery. Diffusion-weighted MRI was used to identify clinically silent AIS in more than 52% of 197 patients who had cardiac surgery. After having cardiac surgery, up to 52% of patients experience Postoperative Delirium (POD) in addition to cerebrovascular problems. In comparison to those without, patients with severe neurological problems had longer stays in the Intensive Care Unit (ICU), more frequent hospitalizations, and higher in-hospital mortality rates. POD is also linked to high expenses, a slow rate of functional recovery, functional regression, and poor postoperative cognitive function. After surgery, neurological problems are sometimes overlooked. This is especially true for delirium that is hypoactive. There are few prospectively collected data on seizures, AIS, or hallucinations following heart surgery or percutaneous valve replacement. Particularly lacking are organized data on pseudo-hallucinations and data comparing cardiac surgery and percutaneous valve replacement. The purpose of the study is to identify potential risk factors and prospectively describe the various neurological complications following cardiac surgery or percutaneous valve replacement. Therefore, this research may provide justification for the necessity of routinely checking for neurological complications following surgery and contribute to a better understanding of risk factors.

Discussion

In this study, we prospectively assessed the frequency of postoperative neurological problems in a sizable cohort of 297 patients following percutaneous valve replacement or heart surgery. In-depth observations of the neurological events and their progression were made. The associated risk variables were also examined. Both percutaneous valve replacement and cardiac surgery had substantial rates of neurological problems in our population. POD was the most common neurological consequence, occurring in 43.43% of patients with AIS, seizures, or genuine hallucinations (n=129). All patients except one also experienced POD. POD, hallucinations, and AIS all occurred at similar rates to those reported in other investigations of patients who had undergone heart surgery. In our population, postoperative neurological problems were independently linked with decreased cognitive function, older age, more postoperative inflammation as assessed by biochemical blood markers, and more RBC transfusions. Increasing age, pre-existing cognitive impairment, cerebrovascular disease, and intraoperative blood transfusion are significant risk factors for POD, representing by far the most common neurological complications, according to the met analysis with trauma or orthopedic, cardiac, and vascular surgery. Our discovery of an independent relationship between elevated levels of inflammation (CRP values) following surgery and neurological sequelae supports the inflammation explanatory model of POD aetiology. According to a theory, surgery and anesthesia cause the Blood Brain Barrier (BBB) to become more permeable, allowing perioperatively elevated inflammatory mediators to pass through. In rats, neuroinflammation increased from the time following cardiac surgery until up to two weeks later. The study also showed how postoperative cognitive performance is impacted by elevated neuroinflammation. Following heart surgery, all rats displayed reduced spatial learning, memory, and object identification. The inflammatory hypothesis is also supported by the strong correlation between RBC transfusions and the development of neurological problems. It is generally known that transfusions can cause systemic inflammation. However, there are a number of factors, including intraoperative blood loss and hemodynamic instability, that are connected to transfusions and could confuse the association. Additionally, transient hypoxia in cases of significant blood loss intensifies inflammatory reactions and associated BBB leakages. In addition, patients with neurological problems postoperatively had considerably higher levels of CRP and lactate. Patients who underwent cardiac surgery had greater levels of CRP and lactate than those who underwent percutaneous valve replacement, which may indicate that the more invasive cardiac surgery had an impact. The substantial variations in test results for organ dysfunctions that raise the risk of POD include creatinine for renal failure and bilirubin for liver failure. Together, the data lend support to the idea that organ failure is caused by inflammation as a key pathogenic mechanism for POD. To lessen postoperative inflammation, minimally invasive surgery may be an option. However, more research is required to examine risk reduction measures, the frequency of AIS, seizures, and hallucinations following surgery in a wider population of patients.

Patients who underwent percutaneous valve replacement demonstrated a significantly decreased incidence of postoperative neurological problems when compared to those who underwent cardiac surgery. It should be

remembered, too, that the number of patients who underwent percutaneous valve replacement was somewhat low. Patients who underwent percutaneous valve replacement had a significant preoperative risk profile, including preoperative cognitive impairment and older age, both of which are documented risk factors for POD. The development of postoperative neurological problems appears to be more influenced by other important perioperative factors, such as postoperative inflammation or transfusions related to more extensive surgery, and these factors should be the focus of future prospective research. Each patient should be assessed individually in light of any existing conditions and the intended type of planned surgery because risk factors can be divided into those that can be changed (like transfusions) and those that cannot (like age or preoperative cognitive impairment). The incidence of postoperative delirium following percutaneous valve replacement ranged from 0% to 44.6% in earlier investigations. Comparatively, the data reveals a sizable proportion of these patients (36.1%). Although there is a lesser difference between the two groups of patients in the study with postoperative delirium, our incidence of postoperative delirium is higher in patients having heart surgery, which is consistent with earlier prospective studies. There may be a chance to prevent or at least lessen the severity of POD and its subsequent complications when the risk profile of patients is thoroughly assessed. However, the majority of the risk factors cannot be changed. In order to provide patients with better treatment options, it is crucial to identify postoperative neurological problems early on through a standardized assessment. A recent meta-analysis has demonstrated that a restrictive transfusion regimen is at least similar to a liberal transfusion management when it comes to modifiable risk factors for the development of delirium and postoperative AIS in patients with cardiac surgery. Even worse, a liberal transfusion management increased 30-day mortality was discovered. The finding that RBC transfusion is independently associated with a higher risk of postoperative neurological problems may suggest the value of a restrictive transfusion management, but we are unable to substantiate this concept because transfusion was not our study's primary endpoint. Additionally, the requirement for transfusions suggests severe conditions with potentially higher levels of inflammation and noticeably higher hypoxemia. We also used the mean MAP, MAP below 60 mmHg, and variation of MAP to analyze the impact of the intraoperative MAP on postoperative neurological problems from many known perspectives. None of these factors have been proven to be a reliable predictor of the emergence of postoperative neurologic complications.

The second-most frequent postoperative neurological consequence in our population was hallucinations. We could confirm the incidence of 21.21%, which was comparable to earlier research, in a larger prospective cohort. According to past studies for patients after heart surgery and non-psychiatric patients with delirium, visual hallucinations made up the majority of cases. Both true hallucinations and false ones have important clinical repercussions: patients who experience hallucinations are more likely to experience a challenging postoperative recovery like Post Intensive Care Syndrome (PICS), which is linked to a longer stay in the intensive care unit and postoperative complications. Additionally, people who are experiencing hallucinations are more prone to hurt themselves. In our group, neurotrauma history and arterial hypertension were found to be novel risk factors for postoperative hallucinations. While revealed that alcohol use, benzodiazepine withdrawal, use of angiotensin II receptor blockers and dopamine receptor agonists are more common in patients with postoperative hallucinations. It should be noted that individuals who abused alcohol or benzodiazepines were not included in the study. In our investigation, four patients who underwent heart surgery experienced a seizure or status epilepticus on the first postoperative day. It is very possible that the operation acts as a metabolic or inflammatory seizure trigger. One of the patients had pre-existing epilepsy, thus the medication was stopped the day before surgery. That demonstrates the need of continuing anticonvulsant drug treatment on the day of surgery. Another patient experienced a seizure following an AIS in the MCA region, which was explained by an acute brain lesion as the cause of the seizure. However, because imaging was not done, we cannot rule out the possibility that a quiet brain infarction was the source of the additional seizures.

Non-convulsive status epilepticus may be an underappreciated cause of postoperative delirium in individuals who have undergone heart surgery. Not to mention that delirium may appear during the ictal period, postictally, or after non-convulsive seizures, respectively. Therefore, if in doubt, a postoperative EEG diagnosis for patients exhibiting delirium signs should be taken into account. The direct manipulation at the heart and major thoracic vessels, as well as the cardio-pulmonary bypass, are prominent sources of AIS, according to the patients with AIS following cardiac surgery who have the primary cardio-embolic aetiology. Even though we didn't see any AIS in patients who had percutaneous valve replacement, earlier research had suggested that silent brain injuries were very common.

A significant prevalence of postoperative neurological problems were found by the systematic assessment, which has been linked to worse outcomes and higher in hospital mortality in previous research. Despite having a greater preoperative risk profile, patients who underwent percutaneous valve replacement had a similar frequency of POD but no AIS or seizures compared to patients who underwent cardiac surgery. In order to lessen neurological complications, it may be wise to turn to minimally invasive surgical and interventional techniques.

The relatively small number of patients who underwent percutaneous valve replacement, despite the fact that this is one of a few prospective studies on neurological problems following heart surgery and valve replacement, can be seen as a drawback. We most likely missed several POD events since delirium can set in after the third postoperative day. Furthermore, patients with severe POD had trouble communicating, and those who actually had hallucinations were unable to recognize or recall them. As a result, the incidence of hallucinations may be understated.

Conclusion

The most common neurological postoperative complication in patients undergoing heart surgery or percutaneous valve replacement is POD. Although they happen less frequently, AIS, focal or generalized seizures, and hallucinations are also significant. No AIS or seizures occurred in patients who received percutaneous valve replacement. The findings imply that patients who experience neurological difficulties have a preoperative risk profile that includes advanced age, a history of heart failure, and cognitive decline. A more significant catalyst for postoperative neurological problems, however, may be a difficult intra- and postoperative course with a strong inflammatory response and various organ failure.

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