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Incidence and predictors of delirium after cardiac surgery: Results from The IPDACS Study

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Abstract

Objective: Delirium after cardiac surgery is a serious complication that results in higher morbidity and mortality rates, and prolongs hospitalisation. However, the knowledge base regarding the issue of postoperative delirium is still limited. Therefore, in the current study, we evaluated the incidence and independent perioperative risk factors of delirium after cardiac surgery. **Methods:** The IPDACS Study recruited 563 consecutive patients undergoing cardiac surgery with cardiopulmonary bypass. The subjects were preoperatively examined by psychiatrists using the Mini-Mental State Examination and the Mini International Neuropsychiatric Interview to assess psychiatric comorbidity. Additionally, other variables connected to the patients' medical condition and surgical and anaesthetic procedures were evaluated. A diagnosis of delirium following surgical intervention was based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) criteria. **Results:** The incidence of postoperative delirium according to *DSM-IV* criteria was 16.3% (95% confidence interval: 13.5–19.6). Multivariate stepwise logistic regression analysis revealed that advanced age, preoperative cognitive impairment, an ongoing episode of major depression, anaemia, atrial fibrillation, prolonged intubation and postoperative hypoxia were independently associated with delirium after cardiac surgery. **Conclusion:** According to the current analysis, the aforementioned conditions independently predispose to delirium following cardiac surgery. Since some of these factors can be successfully treated and eliminated preoperatively and postoperatively, this study should be helpful in reducing the risk of delirium and in improving the medical care of patients undergoing cardiac surgery (Clinical Trials Identifier: NCT00784576).

Keywords: Anaemia; Atrial fibrillation; Cardiac surgery; Cognitive impairment; Delirium; Depression

Introduction

The first successful cardiac surgery with extracorporeal circulation was performed in 1953 by John Gibbon. Since 1954, the issue of delirium as a complication following cardiac surgery has been extensively investigated [1]. Postoperative delirium remains a serious event that results in higher morbidity and mortality rates, prolongs

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hospitalisation and increases the risk of patients' institutionalisation [2,3]. Moreover, there is a considerable discrepancy between studies on the incidence and risk factors of delirium among cardiac surgery patients. A review of studies performed from 1963 to 1994 found that the incidence of delirium ranges between 3% and 47% [4]. Similarly, the estimates reported in studies published after 1994 vary from 3% (mean age of participants: 70.6 and 64.8 years for delirium and non-delirium groups, respectively) to 50% (mean age of participants: 74.9 years) [5,6]. In addition, many factors are inconsistently associated with postoperative delirium. In recent studies, independent associations have been observed for older age [2,7] and physical condition of patients, including a history of somatic illnesses such as atrial fibrillation (AF) [2], prior stroke [7], peripheral vascular disease [8], renal failure [9]. Delirium after cardiac surgery has also been associated with perioperative biochemical disturbances influencing cerebral activity [10], as well as the duration and the type of surgical procedure performed [2]. Furthermore, some reports have indicated a putative role for preoperative depression and disturbed cognition in the pathogenesis of postoperative delirium [7,11]. Thus, the question of predictors and the incidence of delirium after cardiac surgery remains unanswered.

The first potential reason for the discrepancy in delirium estimates is the retrospective design of some studies [5]. Second, numerous prospective studies involve a modest number of participants, which does not provide strong statistical power to select patients with delirium and to detect the risk factors of this complication [12,13]. Unfortunately, studies with a greater number of patients often have methodological limitations (e.g., authors do not define the diagnostic criteria or tools they use to diagnose delirium) [14], assessment of patients is performed in a short or undefined period after surgery (delirium diagnosed on the first day or after the sixth day following cardiac surgery might not be directly connected to the surgery) [2,7,15] and the experience of persons who diagnose delirium is not specified [2,5]. Moreover, in a number of large cohort studies, only patients with overt symptoms of delirium (agitation, hallucinations and delusions) undergo psychiatric evaluation, and the evaluation is not made by investigators adhering to a protocol but rather by members of the medical staff involved in routine daily care [2,9]. Additionally, in previous studies, the authors usually analysed preoperative and intraoperative variables while ignoring potential postoperative risk factors of delirium.

Finally, some variables that seem to have a role in the aetiology of delirium after cardiac surgery, particularly perioperative hypoxia, anaemia and various preoperative psychiatric disorders, have not been investigated to date.

Therefore, we present a prospective study on the incidence and predictors of delirium after different types of cardiac surgery. The study was conducted by experienced investigators using rigorous methodology on a large group of patients. The present results are also discussed in the light of our previously published preliminary studies [11,16,17].

Methods

Patient population

After approval by the Ethics Committee of the Medical University of Lodz, 846 patients consecutively admitted to the Department of Cardiac Surgery in Lodz for a heart operation between November 2004 and April 2007 were assessed for eligibility criteria. Subjects who were 18 years old or older and were scheduled for cardiac surgery with cardiopulmonary bypass were candidates for inclusion in the study.

Of these patients, 271 were excluded for the following reasons: 152 individuals declined to participate, 55 underwent urgent surgery and 53 were in poor general condition that precluded their participation (e.g., severe circulatory failure, cardiogenic shock). In these groups of participants, preoperative psychiatric assessment could not be conducted or completed. Ten other excluded subjects had preoperatively diagnosed dementia, 1 was illiterate and 12 were lost to follow-up since they died during the first 6 days after surgery (period of postoperative assessment). The remaining 563 patients signed an informed consent form and completed the study.

Preoperative procedures

The study population was examined by two psychiatrists (J.K. and M.K.) on the day prior to the scheduled operation using the Mini-Mental State Examination (MMSE) to screen for possible cognitive impairment (MMSE score $\leq$24) [18]. The Mini International Neuropsychiatric Interview (MINI) was employed as a structured adjunct to a regular psychiatric examination to assess preoperative psychiatric comorbidity [19].

The MINI is a structured diagnostic interview, developed jointly by psychiatrists and clinicians in the United States and Europe, for *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) and *International Classification of Diseases, Tenth Revision* psychiatric disorders.

In the present study, the interobserver reliability of investigators, calculated from a random sample of 10 paired assessments, was κ=1.0 for the MINI.

None of the patients had preoperative delirium while being assessed according to *DSM-IV* criteria for delirium [20]. Other preoperative variables included in the database are listed in Table 1.

Intraoperative procedures

Intraoperative measures were recorded based on the "protocol of surgical anaesthesia" and "protocol of