after surgery. Infection is otherwise a well-known trigger of delirium [22]. In contrast to our finding, a low intraoperative body temperature has also been found relevant [16, 19]. Intraoperative temperatures were not recorded in our study. However, the cooling during CPB interferes with this issue with a low CPB temperature reflecting a complex and long-duration procedure probably being more important than the temperature as such. An unexpected finding in our study was that patients reporting gastritis and/or peptic ulcer problems had an increased risk of delirium. This observation showed a borderline significance and must be considered with caution. The multivariable model was also tested without this variable included without affecting the results notably.

This study reports the results from consecutive older patients undergoing cardiac surgery. The study was based on comprehensive assessments including cognitive testing both before and repeatedly after surgery. All assessments were performed by two trained research nurses. Similarly, a large number of variables were systematically extracted for analysis, pre-, intra- and early postoperatively. Unfortunately, pharmacological interactions were not explored. Our study is also limited from its relatively small sample size in relation to the surplus of variables analysed. Therefore, our findings should be validated in future studies. Certainly, contributing factors behind delirium are to be sought among a variety of factors beyond those tested in our study, for example, inflammatory and embolic mechanisms. Also, our results are valid only for the cohort studied of older patients during their period of hospitalization.

In conclusion, delirium was common among older patients undergoing cardiac surgery. Both predisposing and precipitating factors contributed to delirium and it is potentially possible to modify several of these factors in daily clinical practice. The strongest precipitating factor for delirium was an increased volume load during operation. An association between delirium and volume load has not been previously identified, a detail that it may be possible to investigate in a randomized study.

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eComment. Genetics and delirium after heart surgery

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Besides the widely known predisposing factors of age and diabetes mellitus, the authors of this interesting article present intraoperative volume overload and sodium concentration as factors leading to the development of postoperative delirium [1]. What we would like to add is that as delirium is a neurocognitive and neuropsychiatric disorder, the role of genetic contributors, eg. in the form of genetic polymorphisms related to the genesis of dementia/neurocogntive malfunction in its various forms, should also be taken into account for a more thorough investigation of the subject. Older studies [2–4] have not confirmed the putative relationship between genetics and delirium after heart surgery. However, as new knowledge emerges, novel research items, such as the variants of gene TREM2 [5] should also get under the scope of investigation, as they might elucidate the pathogenesis of postoperative delirium.

Conflict of interest: none declared

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eComment. Delirium after cardiac surgery: incidence and risk factors

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Smulter *et al.* provide a very detailed study on an important postoperative issue following cardiac surgery, that is associated with increased morbidity and mortality [1]. Their work, however, raises a number of issues.

Smulter *et al.* identified maximum temperature in the intensive care unit as a risk factor for delirium. As hyperpyrexia is caused by an excessive inflammatory response, this finding is not unexpected. However, no mention is made of the rate of rewarming and the maximum temperature at the end of cardiopulmonary bypass (CPB). Both the rate and the final temperature are known risk factors post-CPB for cerebral damage [2].

A difference exists with regard to cerebral embolic load and whether a cardiac procedure is open (valve replacement), or closed [coronary artery bypass surgery (CABG)]. No mention is made about whether open or closed procedures were utilised as independent covariates in their analysis. We would recommend that isolated CABG should be separately analysed from isolated valve procedures, as they are fundamentally different operations with regard to neurological risk [3].

The identification of sodium as an independent risk factor for postoperative delirium confirms previous work [4]. Valve replacement patients are more likely to suffer from this complication secondary to diuretic therapy. Unfortunately, preoperative sodium levels were not reported.

Identification of volume loading during surgery as being a significant risk factor raises the possibility of reduced oxygen delivery being an issue. Quantifying reduced oxygen delivery is difficult, and may involve epoch analysis [5].

The finding of gastritis and peptic ulcer history as a significant risk factor is difficult to interpret, as pointed out by Smulter *et al.* No comment on an interaction analysis with other covariates was mentioned. In our practice, urgent (not emergency) CABG patients have a high incidence of gastric issues secondary to intense dual antiplatelet therapy. Urgent CABG is a known risk factor for neurological issues.

As the Mini-Mental State Examination (MMSE) and the Organic Brain Syndrome Scale (OBS) used are linear scales, and delirium is not a binary issue, it would be interesting if multiple linear regression analysis would reveal the same risk factors as logistic regression, as used by Smulter *et al.* With regard to the logistic regression, it is customary to use a maximum of 10 events per covariate. In this study, this would limit covariate numbers to a maximum of 8, however, 18 variables from univariate analysis were utilised to develop their final model of 7 variables.

Conflict of interest: none declared

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eComment. Postoperative delirium in elderly cardiac surgery patients

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I read with great interest the paper by Smulter *et al.* [1]. The authors aimed at determining the incidence of and risk factors for postoperative delirium (POD), in older patients undergoing cardiac surgery. They reported an incidence of POD of 54.9% and confirmed many of the previously suggested risk factors. In their study, POD was strongly associated with an increased volume load during surgery. I would like to add some comment on this important topic.

POD is a common and serious complication in elderly cardiac surgery patients. It is defined as an acute and fluctuating disturbance in consciousness, characterized by disorientation, a disturbed sleep-wake cycle, memory impairment, perceptual disturbances, and altered psychomotor activity [2,3]. POD is an important cause of prolonged hospital stay (economic burden), nursing home placement, and increased morbidity and mortality after cardiovascular surgery. In addition, it is associated with late death, hospital readmission, and reduced cognitive and functional recovery. The reported incidence of POD ranges from 30 to 73% depending on the diagnostic method used to define POD, study design, and type of cardiovascular procedure [2-5].

The exact pathophysiology of POD is unknown. There are several potential mechanisms including perioperative cerebral hypoperfusion, alterations in the levels of neurotransmitters, systemic inflammation and physiologic stresses. This pathophysiologic complexity contributes to high incidence of POD [3,4]. Elderly cardiac surgery patients are at a particularly high risk for POD owing to the use of cardiopulmonary bypass, the presence of macro- or microemboli resulting from aortic and cardiac manipulation, the complexity and duration of surgical procedure, cerebral reperfusion injury, and large volume and pressure shifts [3].

The likelihood of developing POD increases proportionally with the number of existing risk factors [4]. Identification of risk factors for developing POD allows surgeons to implement interventions aimed at reducing the incidence of POD in these high risk patients. There are many patient (predisposing) and surgery (precipitating) risk factors related to POD. These risk factors include advanced age, pre-existing dementia, depression, functional impairment, cognitive impairment, hearing and visual impairment, alcohol abuse, smoking, decreased left ventricular ejection fraction, pre-existing pulmonary disease, hypertension, atrial fibrillation, laboratory abnormalities, cerebrovascular disease, decreased albumin level, lower hematocrit, postoperative hypotension and increased blood transfusion [2-5].

The most critical steps in management of POD are prevention and early recognition. Both prevention and treatment should focus on the minimization and/or