

## **Age, comorbidities, frailty: who comes first?**

### *Surgery in the Elderly*

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Cardiac surgery in the elderly has been a debated topic for many years. This “unmodifiable” risk factor has been investigated in relation to other risk factors, either modifiable or not, to understand which factor may impact the most on the patient's overall risk. The relevance of this topic has increased exponentially over time due to two quantitative factors: (i) the growing number of elderly patients undergoing surgery, as a result of the development of minimally invasive and optimized anesthetic techniques; (ii) the increasing prevalence of the elderly population in the industrialized world, as a result of reduced birth rates and extended average lifespan.

That said, the analysis by Volk and colleagues can represent a basis for further studies on this topic, as this patient population will be substantial in the coming years and the one surgeons, anesthesiologists, and, more generally, the heart team will be called to face more frequently.

In order to draw reliable conclusions, high numbers such as those of Volk and colleagues who evaluated almost 400,000 patients, are needed. Nonetheless, the results recorded leave some of the outstanding questions still open.

In general, elderly patients and patients with multiple comorbidities have a higher mortality risk. At the same time, elderly patients are more often affected by comorbidities, thus raising the question “who comes first, the chicken or the egg?”. In other words, the results obtained by Volk et al. show that patients over 80 have a higher mortality than patients aged 65 to 79 who underwent coronary heart or aortic valve surgery (5.7% versus 3.2%). However, is this result due to more advanced age *per se* or to the higher number of associated risk factors (i.e. female sex, heart or renal failure, combined and non-elective surgery) (1)?

It is also worth noting that this study does not reflect current surgical management as it included patients undergoing surgery over the time period 2004-2014. Since 2010, there has been a real revolution in this field. As for aortic valve surgery, the recent two-year follow-up data from the PARTNER 3 trial support the use of transcatheter aortic valve implantation (TAVI) also in patients at low surgical risk. At present, it is widely accepted that patients over 80 years with severe symptomatic aortic valve stenosis should preferentially undergo TAVI. Volk's study, therefore, would nowadays lose one of its three arms. Additionally, in the latest

guidelines, even in the case of critical left main coronary artery stenosis, there is an indication for evaluation within the heart team to decide as to whether perform coronary artery bypass surgery or percutaneous coronary angioplasty. Also in these circumstances and in the presence of a favorable anatomy, a percutaneous approach is preferred over surgery in patients aged >80 years. Thus, a second arm of the Volk's study will also lose patients in favor of the transcatheter procedure.

It would be interesting to evaluate how these data will change over the next 10 years (2015-2025). Despite the absolute increase in the number of people over 80 in the overall population, it is likely that there will be a reduced relative value of elderly patients undergoing cardiac surgery.

Several limitations of the retrospective analysis by Volk et al. should also be acknowledged, including a higher proportion of female patients and of those who had undergone combined surgery in the 80-year-old group, and a higher proportion of obese patients in the younger group benefiting from the protective effect of overweight (*obesity paradox*) (2).

Both the younger and elderly groups, though in different proportions (2.8% versus 4.7%), included frail patients. What results would we obtain by comparing frail versus non-frail patients regardless of age? Frailty is the first of the two aspects that should be taken into consideration when extending the analysis to the years 2015-2025: given that "simply" elderly patients will be fewer and fewer because they will undergo a transcatheter procedure, it will be important to understand if "frail" patients, even the young ones, would have a worse outcome than non-frail patients (3). In this case, a young patient with risk factors for frailty is amenable to a minimally invasive/transcatheter procedure that results in better outcome than surgery (4).

The second aspect that should be considered relates to cost-effectiveness. If all elderly patients would undergo a transcatheter procedure, given the high costs of TAVI devices the increasing number of patients over 80, this would translate in high healthcare costs allocated to a patient population which has per se a limited life expectancy despite optimal treatment of heart disease (5-7).

Beyond age, a correct analysis of risk factors and the use of appropriate diagnostic and therapeutic technologies can still allow elderly patients to undergo surgery, with results similar to that of their younger counterparts (8,9). Obviously, minimally invasive techniques should be adopted which, though entailing additional costs, ultimately lead to a reduction in the overall healthcare costs (10).

In conclusion, the study by Volk and colleagues provides a picture of cardiac surgery in the years 2004-2014, which will be no longer duplicated for the years 2015-2025. It can be speculated that the new framework will achieve even better results, but this is because the older and at-risk patients of the years 2004-2014 will no longer form the study population of future investigations. But at what cost to society? In this sense, the commitment must be multidisciplinary through a heart team analysis that allows a "tailored" therapeutic approach to the patient with a personalized on-pump/off-pump or mini-pump (*MiECC*) strategy (11,12), a risk analysis (e.g. due to the presence of plaques or vascular calcifications) both in the pre- and intraoperative phase (13), the use of minimally invasive incisions and technologies aimed at reducing surgical times (14,15) and the biological impact (16,17). Also the anesthetic approach must have a "mini" impact.

Further, all these considerations have a social impact: a society with limited economic resources, with citizens increasing their health expectations, should try to guarantee healthcare for all applicants, independent of the market push but only based on the results from clinical studies; not only sponsored trials, but also "real life" settings such as that described by Volk and colleagues.

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