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Reducing the risk of major elective surgery

Optimising oxygen delivery before surgery does work; now we have to implement it

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In this week's *BMJ* Wilson and colleagues report a randomised controlled trial in high risk surgical patients admitted to an intensive care unit at least four hours before elective operation for optimisation of cardiac output and oxygen delivery to >600 ml/min/m^2. This pre-emptive strategy was compared with usual practice, which is to monitor the cardiovascular system intraoperatively and to respond to changes in arterial and filling pressures. They showed a reduction in mortality from 17% (95% confidence interval 8% to 31%) to 3% (0.7% to 9%) and reduction of bed use by up to 40% (p 1099).[1] By the usual criteria their patients were high risk: about a third had known ischaemic heart disease and half of them were aged over 70. This finding is not unexpected, and the question now is what we should do about it.

Control of the circulation is one of the first tutorials in cardiovascular physiology. We teach how baroreceptors sense the resulting pressure between the force of the contracting heart and the resistance of the peripheral vasculature, illustrating the concept of negative feedback. While concentrating on arterial pressure, it is easy to forget that flow matters most, for it is that which determines oxygen delivery. Pressure tells us little about tissue perfusion: a surgeon will demonstrate for you the normal pressure in a completely occluded artery.

The opportunity to measure and intervene provided by the development of open heart surgery in the 1950s showed cardiac output to be the critical determinant of survival.[2] From the late 1960s the Guy's team advocated a combination of pharmacological manipulation and volume repletion to optimise flow. In clinical practice we used right atrial pressure to guide filling and big toe temperature to judge tissue perfusion; the pharmacological innovation was vasodilatation with small bolus doses of chlorpromazine.[3] Kirklin's group investigated means of maximising cardiac output by nitroprusside infusion and volume repletion, using left atrial pressure and dye dilution, refining the method but not changing the message.[4]

Anaesthetic and surgical teams quickly recognised that these lessons learnt in cardiac surgery were applicable to trauma management and emergency surgery. Central venous pressure measurement entered the repertoire, and resuscitation to volume repletion became the norm. Applying this to major elective surgery was logical. More of a challenge was the contention that elective patients should be admitted to an intensive care unit to have pulmonary artery and peripheral arterial catheters inserted, to be volume loaded, and to be treated with infusions of drugs to prepare them for major surgery.[5] The study by Shoemaker et al reported dramatic reductions in mortality,[5] a benefit replicated by Boyd et al[6] and now confirmed again by Wilson et al.[1] The background mortality in similar patients outside the trials is about 40%.[5]

There is a difficulty in deciding the clinical protocol for the control groups in randomised trials, other than that it should accord with best conventional practice. Mortality in control patients ranged from 17% to 28% (37/160 patients in all). In the optimised groups mortality was 3%,[1] 4%,[5] and 6%.[6] In line with the reduction in mortality were reductions in morbidity and hospital stay, in the most recent study from an average of 22 days for the control group to 13 days for those optimised with dopexamine.

There has been resistance to implementing optimisation protocols in clinical practice. Concern exists about the use of inotropes outside of the rescue of patients from cardiac arrest or profound hypotension, with a shop floor view that, as with many things in life, you do not get something for nothing, and there will come a payback time. Inotropes increase myocardial oxygen consumption, and there are examples of subendocardial ischaemia. In the double strategy of volume repletion and drug infusion, the "inodilator" dopexamine had advantages over adrenaline as the pharmacological side of the package,[1] and cardiac experience emphasises the use of dilators to aid delivery[2–4] rather than inotropes to drive it. Dopexamine may also have a role in reducing detrimental inflammatory responses.[1]

There has also been anxiety about the risks of pulmonary artery flotation catheters.[7 8] Trials of optimisation point consistently to benefit,[1 5 6 9] which has also been the case when flow is measured by less invasive doppler techniques in orthopaedic[10] and cardiac patients.[11] The benefits of optimisation protocols have been replicated outside trials.[12]

In England, Wales, and Northern Ireland almost 20 000 patients a year die within 30 days of a surgical procedure.[13] The findings of Wilson et al's study are important to all involved in providing resources as well as to those who care for these patients. Apart from reluctance to change practice, a major obstacle may be the limited resource of intensive care beds. When accident and emergency departments cannot find beds for emergencies, there is an understandable resistance to using intensive care units for all high risk elective cases. However, if it is agreed that the evidence is there to

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support the practice of optimisation its cost will have to be calculated into the price of operating on these patients. The benefits in survival, reduced morbidity, and shorter hospital stay are striking enough to justify it.

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Managing atrial fibrillation in elderly people

Active management of atrial fibrillation should include elderly people

Chronic atrial fibrillation is the commonest arrhythmia seen in clinical practice. Not only does it cause increased morbidity and mortality among affected individuals; it also adds a significant burden to healthcare costs. The prevalence of atrial fibrillation increases steadily with age (from 0.5% of those aged 50-59 years to 8.8% of those aged 80-89 years), as do the associated risks.[1] Even in the absence of rheumatic heart disease, there is a sixfold increase in thromboembolic phenomena, and atrial fibrillation accounts for up to 36% of all strokes in elderly people.[2] It is the commonest arrhythmia requiring admission to hospital and is the primary diagnosis in 20% of all new outpatient cardiology appointments. As the population ages so these effects will be exacerbated.

Patients who develop atrial fibrillation are likely to present to their general practitioner with palpitations, shortness of breath, and fatigue. The loss of atrial systolic function can reduce cardiac output by up to 50%, especially in those with coincident ventricular impairment.[3] Older patients, who are particularly vulnerable to these effects, may develop exercise intolerance, which is reversible when sinus rhythm is re-established,[4] or may decompensate and develop frank heart failure.

The most effective way of minimising the increased thromboembolic risk and treating symptoms is to return the heart rhythm to sustained sinus rhythm by electrical or chemical cardioversion. Cardioversion is safe, with an estimated risk of thromboembolism of $<1\%$, even among those at highest risk,[5] which compares favourably with that seen in chronic atrial fibrillation. Cardioversion is most effective when delivered soon after the onset of atrial fibrillation because of structural changes in the atria which perpetuate the arrhythmia.[6 7] Moreover, when the arrhythmia has been present for less than 48 hours cardioversion is safe without prior anticoagulation.[8] Early diagnosis and treatment are therefore important, but how can they be achieved? Once the condition has been identified in the community, assessment in hospital is essential since cardioversion remains a secondary care service.

Large series have shown initial success rates for cardioversion of around 75%-91% in patients of all ages. Factors shown to reduce the likelihood of successful cardioversion include increased duration of arrhythmia (over 12 months), increased left atrial diameter (>45 mm), and heart failure of New York Heart Association class II or greater. Most studies found that increased age itself had no independent effect on the success of cardioversion.[9] Restoration and maintenance of sinus rhythm after successful cardioversion may be enhanced by the use of antiarrhythmic therapy,[10] though optimal drug therapy has yet to be determined.

Failing conversion to sustained sinus rhythm, antithrombotic treatment with warfarin reduces the risk of stroke in patients with atrial fibrillation by about 70%.[11] Many physicians do not use anticoagulation in elderly people, perceiving the risk:benefit ratio to be too high, and continue to prescribe aspirin instead,[12] despite its lack of efficacy in this age group.[11] Although anticoagulation in those aged over 75 is associated with greater risk when the international normalised ratio (INR) is maintained at 2.0-4.5, both the BAATAF and SPAF III trials showed that anticoagulation to a lower INR of 1.5-3.0 is both safe and effective in reducing the risk of stroke in this age group.[11] Starting warfarin therapy in the community is logistically difficult, requiring daily visits for blood sampling, frequent communication, and dose adjustments by patients, all of which are more difficult in elderly people. New low dose starting regimens for the outpatient initiation of warfarin, particularly in elderly patients with atrial fibrillation, should help facilitate its more widespread use.[13]

Wide variations exist in the current management of elderly patients with atrial fibrillation.[12] Surveys of use of anticoagulation show consistently that elderly people are less likely to receive anticoagulants than younger ones on the grounds of age alone, even when

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