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Anaesthesia and the preparation and management of elderly patients undergoing surgery

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ABSTRACT

With increasing life expectancy, the number of very elderly patients requiring surgery and anaesthesia is increasing. Age, co-morbidity and altered pharmacokinetics clearly need to be considered in assessment of surgical risk but even in the apparently well older person there is a loss of physiological reserve that may be overlooked on cursory examination. Cognitive impairment after surgery may seriously hinder older people. This paper looks at these factors in detail and provides some remedies.

1. Introduction

The use of the American Society of Anaesthesiology (ASA) Physical Status scoring system, a simple five point scoring tool widespread in practice, is an attempt to make comparisons of co-morbidity and case mix between groups. This system has been used to risk stratify operative patients for 50 years, but was never intended to be a predictive system. If anaesthesia is going to influence surgical decision making, such that appropriate resources are targeted to the patients who will derive most benefit, then we must look at other ways of describing or predicting operative risk. In order to do this, alterations in the physiology of elderly people must be taken into consideration as well as the presence of co-morbidities. This article considers what the alterations are and which risk factors may be identified as indicators of patient fitness.

2. Patient fitness

2.1. *The cardiovascular system*

The process of arteriosclerosis is distinct from the atheromatous process that characterises cardiovascular disease, and may well be ignored erroneously, in our assessment of the aged patient. It is helpful to think of the two processes occurring simultaneously in an aging population, but the contribution of each differs depending on the presence or absence of risk factors for atheroma. Arteriosclerosis, the normal process of cardiovascular aging,[1] is characterised by the age related changes in physical arterial features, resulting functional consequences, and in the autonomic system (Table 1).

To the surgeon and anaesthetist this means that the heart is less able to increase its rate in response to changes in blood pressure. Increases in cardiac output that can be

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Table 1 – Age related changes related to arteriosclersosis

Directly
- loss of large artery elastin
- fracturing of blood vessel laminae
- calcium disposition
- fibrotic degeneration of the myocardium

Indirectly in the vascular system
- increase in the pulse wave velocity
- increase in systolic pressure
- raise in end systolic afterload

Indirectly in the autonomic nervous system
- baroreceptors respond less readily to changes in carotid pressure
- reduced synthesis of noradrenaline by the postganglionic sympathetic fibres
- reduction of sympathetic postsynaptic receptors
- functional chronic beta blockade of the cardiovascular system

achieved must be due to increases in stroke volume. The concept that systolic blood pressure is raised as a consequence of these changes contrasts with models of hypertension in which the renin–angiotensin axis is involved as a consequence of disease.[1] In these cases, the rise in blood pressure is manifested as an increased diastolic pressure. In the last three decades our interest in peri-operative blood pressure management for the prevention of myocardial ischaemia has tended to emphasise the importance of the latter at the expense of the former.[1]

2.2. *The nervous system in old age*

In terms of gross population changes, there is a 30% reduction in brain mass of an 80-year-old compared with a younger person. There is an age related fall in velocity of conduction, a loss of afferent fibres and a loss of neurotransmitters. Older individuals need lower concentrations of volatile agents such as isoflurane and sevoflurane in the inspired gas to effect similar inhibition of movement in response to surgical stimulus.

The altered response of the sensory nervous system accounts for such oddities as silent myocardial infarction and atypical peritonitis where pain perception is reduced. Then there is also the disease associated with herpes zoster, shingles, and its dreadful complication, post herpetic neuralgia which is, for all relevant purposes, a disease of older individuals.

There is a possibility that the way we interpret pain in elderly people is occasionally deficient.[2] The problem is with ourselves and our staff, culturally and linguistically. Older patients may have different expectations of a health care system than younger patients, and are perhaps less inclined to demand attention, and maybe as survivors of a world war, more stoical. They may, as a consequence, tend to suffer silently. A robust and objective way of evaluating pain is thus needed to deliver good peri-operative care. When words fail to describe pain, non verbal cues, such as facial expression or behaviour, become important.

3. The elderly brain: cognitive failure and surgery/anaesthesia

Increasingly, the phenomenon of postoperative brain failure is recognised. Precise diagnosis and estimate of risk may be difficult, but anecdotal reports of 'granddad was never the same after his operation' have been confirmed with questions to larger numbers of older patients and their relatives. It is not a trivial problem for the older patient who is just about managing to live an independent life. Furthermore, its causes are elusive and its impact is indiscriminate.

Is it reasonable to blame anaesthetic drugs for the problem? Retrospective review comparing elderly patients who became confused after surgery with case matched controls who did not, suggests that part of the problem lies with benzodiazepines with active metabolites such as diazepam, flurazepam and, specifically amongst opioids, pethidine.[3] The situation with pethidine is revealing: those who received it via the intravenous or even epidural route were more likely to become confused than those who received other opioids. Pethidine, possibly by virtue of its active metabolite, norpethidine, is not a good drug for elderly patients. There is another reason which will be considered below.

Formal assessment of cognitive function requires at the very least a simple clinical test. For research purposes a complex battery of psychological tests may be appropriate. The mini-mental state (MMSE) challenges a patient with questions on orientation, memory and simple tasks, such as drawing a clock face. It can easily be undertaken in the outpatient clinic or at the bedside. The test result is expressed out of 30, with scores of less than 24 indicating significant cognitive impairment. It is possible to track postoperative changes in mental functioning with this test. When this was done for a series of 60 relatively young patients undergoing hip replacement,[4] 20% had not recovered by the third day and some 12% were still not back to normal functioning by the sixth day. Unfortunately, there is no data on the anaesthetic technique in this particular study.

Understanding brain failure in the context of surgery/anaesthesia requires clinicians to be able to speak the same technical language as experts in geriatric medicine and psychiatry. There is a difference between an acute confusional state, a reversible state associated with injury, pain or infection and a chronic brain syndrome, such as dementia. The latter may exist before the patient is admitted. To make a positive diagnosis, there should be a corroborative history from a general practitioner or nursing home. The existence of a condition of chronic minor cognitive impairment, as evidenced by minor changes on MMSE testing is important to note: such patients are particularly prone to develop acute confusion after surgery/anaesthesia. In practice however, the admitting hospital too often fails to distinguish acute confusion from a pre-existing dementia. In addition, patients who cannot answer simple questions for a variety of reasons, including poor hearing or language difficulties, risk being mislabelled as 'demented'. Patients so labelled may be considered unsuitable for certain techniques of pain relief or may not be consulted about treatment. Worse still, their

Table 2 – Cognitive deficit in older patients after surgery

25% of patients >60 years a week after surgery
10% of patients >60 years 3 months after surgery
14% of patients >70 years 3 months after surgery

needs may be simply ignored, because the staff is unable to understand their demands.

Formal investigation of chronic brain failure after surgery/anaesthesia was recorded by the International Study of Perioperative Cognitive Dysfunction (ISPOCD) and in its later studies.[5] The methodology sought to describe the condition in terms of a statistical aberration in a battery of psychological tests. ISPOCD findings on 1200 patients receiving non-cardiac surgery was followed by a comparison between spinal and general anaesthesia using the same methodology (Table 2).

Surgical factors such as sepsis did not affect outcome at 3 months and neither did anaesthetic factors such as hypotension, and spinal anaesthesia did not protect against the risk of deficit.[6]

There are many interpretations for these surprising results. The idea that spinal anaesthesia does not protect suggests that the neuroendocrine response to surgery, which outlasts the duration of conventional spinal anaesthesia, may be responsible. In terms of general anaesthetic agents or analgesics, there is suspicion that the cholinergic system is in part responsible; this might explain why pethidine, a drug with anticholinergic properties, is so unsuitable for older patients. More recently it has been suggested that certain volatile anaesthetic agents (i.e. halothane) are implicated in the *in vitro* production of proteins associated with Alzheimer's disease, and that possibly these agents may be neurotoxic.[7]

Alternatively, the problem of cognitive dysfunction might just be the effect of depriving elderly independent people of their customary liberties and lifestyle in the harsh regime of a surgical ward: hence an argument for day case surgery irrespective of age, when it is socially acceptable and safe.

The cholinergic hypothesis is of considerable interest: we know that both consciousness and learning involve the cholinergic system, and that anaesthesia affects this. Defects in the same system are found in dementia, and acetylcholine replacement therapy (or inhibition of the cholinesterase enzyme) is now used in dementia care. A possible conclusion is that if the brain is beginning to suffer from cholinergic dysfunction with age, then a drug that depresses the cholinergic system may further affect memory and learning.[8] Such changes might be irreversible in certain patients; this could influence our decision not to offer surgery although, if the surgery is for cancer, refusing surgery may be less of an option than in elective orthopaedic surgery.

4. The elderly, anaesthetists, resources and predictions

Intensive care medicine has had to come to terms with the needs of an elderly population. Of the patients admitted to the Intensive Care/High Dependency Unit at the Royal Lancaster Infirmary, approximately 32% are over 74 years old. The APACHE2 physiological scoring system has an adjustment for age and it is noted that if the score for age is deducted from the raw score, the patients have broadly similar scores, while mortality increases with age (Fig. 1).

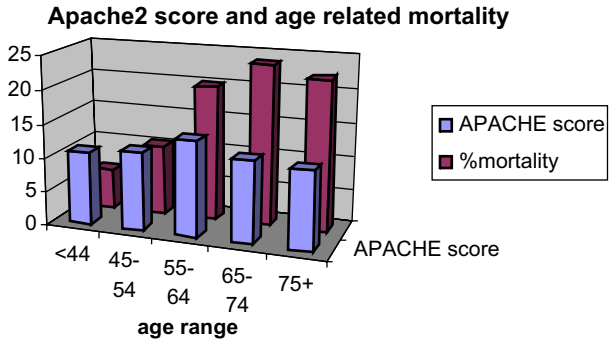

Fig. 1 – APACHE score by age (after subtracting the points that are added for age, blue), the resulting score becomes remarkably consistent across the range of ages. (Longworth M, unpublished data).

It is of course inappropriate to use data from APACHE or any other scoring system as a surrogate for good clinical judgment: such scoring systems are designed to allow comparison between units and for allocation of resources, rather than for the purpose of describing an individual risk.

POSSUM aside, anaesthetists have several scoring systems looking at cardiovascular risk[9]: this gives a figure, based on medical history, which alerts an anaesthetist to the need for extra postoperative vigilance. The real shortcoming of scoring systems is that they are looking at the severity of co-morbid disease, rather than at the effect of aging *per se*. Therefore, it is probably more appropriate to consider screening tests that look at physiological reserve. The concepts of metabolic equivalents (METS) and anaerobic threshold (AT) have caught on in sports medicine, but have not widely become available in the preoperative surgical context. However, there is some evidence that they may provide a key to unlock the problem of deciding who are poor candidates for surgery. Using a simple clinical scoring system, maximal activity levels of less than 4 METS (2 METS is the metabolic equivalent of climbing a flight of stairs) are associated with a higher risk of cardiovascular complications.[10] An anaerobic threshold of less than 11 ml/kg/min is also associated with a greater risk of complications.

It is one thing to provide an assessment of risk, another to use the data in the patient who does opt for surgery, and in case of cancer, there may be no alternative. On the principle that a job worth doing is a job worth doing properly, the demonstration of reduced physiological reserve allows appropriate provision such as intensive care, or an attempt to modify the neuroendocrine response by prolonged epidural blockade for the patient at risk.

5. Conclusions

Several physiological alterations occur with the aging process but do not necessarily represent a strict contraindication to offering the elderly cancer patient a general anaesthetic in order to allow optimal surgical management.

When dealing with elderly patients it is not only helpful to be aware of age-related diseases, but it is also crucial to appreciate the reduced physiological reserve affecting senior patients, even when they appear to be perfectly normal on all tests. Anaesthetists and surgeons need to think more about physiological reserve and plan management in ways that deplete this reserve to the least degree.

Conflict of interest statement

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