Preoperative Assessment in the Elderly
Malcolm Savidge

An increasing elderly population and advances in surgical technology are challenging anaesthetists to provide safe, effective anaesthesia. The mean age of the population continues to rise and half of all patients over 65 years will undergo surgery before they die. Osteoarthritis is almost universal and many of these patients will require joint replacement surgery. This article concentrates on elderly and arthritic patients and their associated problems.

Increased age and pre-existing illness both increase the incidence of complications. A successful outcome depends on meticulous attention to preoperative assessment and an intelligent choice of suitable anaesthetic techniques. An understanding of the limitations of physiological function in the elderly and rheumatic patient enables an accurate assessment of the likely response to the stress of surgery and therefore the final outcome to be made. The anaesthetic technique used and the choice of perioperative monitoring often makes the difference between success and failure. Similarly, the opportunity to improve physiological function preoperatively, where applicable, should never be missed.

Elderly patients often present with a baffling array of pathologies. Most are chronic effects of the ageing process and the residual effects of past illnesses. Signs and symptoms are often masked by limitation of movement and lack of exercise because of the pain of arthritis. This enforced immobility often leads to weight gain and obesity, making pre-existing pathology in other systems worse and adding to the risks of anaesthesia and surgery.

The elderly and ageing
Old age is not a disease. The elderly undergo physiological and anatomical changes that evoke different responses to stress and anaesthesia. In 1982, the United Nations recognized this: ‘Support to the aged people must be provided by practitioners who are knowledgeable in the subject of ageing, are interested in ageing people and their families and are skilled in working with them as well as being concerned about the quality of care given’.

The process of ageing is one of continuous biological change. The number of parenchymal cells decreases, with a concomitant increase in inactive interstitial cells, triggering a progressive decline in physiological function. Gross morphological changes occur with contraction of vertebral bodies and discs. Kyphosis occurs and flexion of hips and knees. The long bones of the legs bow, but the arms remain unchanged in length. This reverses the height:span ratio. Muscle size and bulk decrease rapidly with advancing age, together with alterations in fat distribution. Skin becomes thinner and more fragile.

Cardiovascular system
In the heart, myofibrils enlarge but become less numerous. Collagen and fat replace a substantial volume of the muscle mass. Deposits of amyloid and subendocardial calcification impair conduction in the ventricle. This, combined with a reduction in pacemaker cells, makes the elderly prone to arrhythmias.

Progressive coronary arterial sclerosis leads to a reduction in maximal coronary artery blood flow. While the oxygen delivery is within the demand of the resting state, relatively small increases in cardiac work index or heart rate result in ischaemia. There is reduction in vasomotor tone; both vagal and sympathetic influences are minimized.

These changes make the heart less compliant. Stroke volume decreases; systole time is prolonged; and with a decrease in ventricular contractility, cardiac output and its reserve decline. Despite this, the average arterial pressure rises, with an increase in the systolic and a slight drop in the diastolic pressures, except in obesity. The mean arterial pressure remains unchanged. Peripheral vascular resistance increases progressively. Vessel walls become less compliant as smooth muscle is reduced and collagen replaces elastin. Major vessels become stretched and distended, damaging the endothelium and baroreceptors, making blood pressures labile. Importantly, any increase in intrathoracic pressure, passively or actively, causes greater decreases in blood pressure with little or no rebound elevation. Degenerative vasomotor control precipitates syncope in the presence of decreased cardiac output or peripheral resistance. Postural hypotension can be spontaneous or an effect of drugs.

Respiratory system
Dorsal kyphosis and curvature of the thorax alter the position of the ribs, forming a ‘barrel chest’. There is associated weakness of intercostal muscles and chest wall rigidity. This increases the work, and reduces the efficiency, of breathing. Cellular changes also occur in the lung parenchyma. Elastic recoil of the lungs is reduced, increasing the lung volume at end-expiration, thus increasing the residual volume. There is a parallel decrease in the vital capacity. Widening of the airways increases the anatomical dead space, together with increase in the size of the alveolar ducts. Reduction in elastic fibres in these ducts may explain why airway closure occurs at resting functional residual capacity. This premature closure of the airways further contributes to increases in residual volume.

Loss of recoil, increasing dependence on the diaphragm and abdominal muscles and reduced vital capacity all produce an uneven distribution of ventilation, without change in tidal volume at rest. The alveolar–arterial oxygen tension difference increases causing a decrease in the partial pressure of oxygen in arterial blood (PaO₂). The PaCO₂ remains unchanged. However, a

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greater contribution to progressive reduction in arterial oxygenation comes from reduced perfusion. Fibrous replacement of the muscular arterial media and reduction in the number of capillaries increases the pulmonary vascular resistance and shunting. Maximal pulmonary blood flow, and therefore perfusion, is lowered. The additional oxygen demand caused by increased activity induces increased ventilation in the presence of a diminished maximum breathing capacity. This leads to dyspnoea in the absence of underlying pulmonary disease.

Progressive weakness of intercostal and accessory muscles reduces the ability to cough forcibly. The bronchial mucosa degenerate because of impaired blood supply and the cilia are not always able to keep the small airways clean. Suppressed glottic reflexes make pulmonary infections common.

Circulation
In addition to reduced haemoglobin and haematocrit, older people have reduced marrow iron stores and can suffer anaemia following small haemorrhages. The temptation to transfuse red cells immediately should be resisted. One large retrospective observational study showed no increase in mortality provided the haemoglobin concentration was kept above 8 g/dl, even in the elderly. It recommended that an indication for transfusion is haemoglobin below 7 g/dl. However, if elderly patients do not respond to treatment of anaemia other causes should be sought, such as occult malignancy, chronic infection or poor nutrition.

Other haematological changes include reduced cellular immune response because of thymic atrophy and reduction in the number of T cells. Lymphocytosis within the marrow results in susceptibility to proliferative disorders and infections.

Renal function
The nephron mass in the kidney can decline by 30% between 60 and 70 years of age. This is reflected in changes in lean body mass and basal metabolic rate as a result of loss of functioning tissue. Vascular changes may initiate this deterioration. As renal blood flow is reduced, glomerular filtration and concentrating ability decline linearly at 1% per annum from 30 to 80 years. Large acid or alkali loads can overwhelm the ability of the kidney to maintain acid–base homeostasis. The serum creatinine level can be misleading because it does not necessarily increase in response to declining creatinine clearance rates, but reflects muscle turnover when muscle mass is reduced.

Nervous system
Changes in cognitive function are multifactorial. 20% of octogenarians have some degree of dementia, but this diagnosis should be made only when other causes have been excluded. Organic causes of dementia include hypoxia, infection, drugs, hypoperfusion, hypothyroidism, constipation and impaired sight or hearing.

Temperature regulation, together with heat and cold homeostasis, is impaired in the elderly; they do not often shiver. Hypothalamic hunger and thirst centres are down-regulated and antidiuretic hormone is less effective, leaving these people vulnerable to dehydration and malnutrition. The peripheral nervous system declines in a similar manner. Nerve conduction velocity decreases and appreciation of pain reduces; the elderly complain less of pain.

Care must be taken to ensure nerves are not compressed or stretched, particularly in the neck. Many elderly patients have a reduced cerebral blood supply as a result of atheroma or sclerosis. Vertebrobasilar insufficiency is not uncommon. Flexion or extension of the neck can compromise cerebral oxygen delivery. Osteoporosis and laxity of ligaments is common in old age. Care should be taken in moving the neck lest dislocation or fracture occurs in the cervical vertebrae.

Rheumatoid arthritis
Rheumatoid arthritis is an inflammatory proliferative disease of synovium with a familial association with the DRW 4 allagen. 70% of sufferers are female and 85% show anti IgG or IgM antibodies. It is thought to be caused by defective cell-mediated immunity, characterized by lymphocytic proliferation involving macrophages and complement activation on joint surfaces giving rise to symmetrical polyarthritis with a centrifugal distribution. Clinical features include insidious or sudden onset of pain, swelling and stiffness in peripheral joints. Weakening of the joint capsules leads to subluxation and permanent deformity. It is associated with tenosynovitis and muscle wasting.

Anaesthetic implications: advance of rheumatoid arthritis affects most systems. The airway is often compromised and involvement of the temporomandibular joint restricts mouth opening. Atlanto-occipital instability is not uncommon and 25% of patients admitted to hospital with rheumatoid disease have subluxation of that joint.

Hyperflexion of the neck may induce vertebrobasilar insufficiency or paraesthesia. Crico-arytenoid involvement may present with stridor. Associated lung conditions include fibrosing alveolitis, pleural effusion and Caplan’s syndrome. Pericarditis can be associated with pericardial effusions. Valvular nodules cause aortic or mitral stenosis. These nodules are sometimes due to amyloid, which also causes nephrotic syndrome. Renal failure can occur through vasculitis or as a result of the drugs used to treat rheumatoid arthritis (e.g. penicillamine, non-steroidal anti-inflammatory drugs). Usually, these patients suffer anaemia, which may be haemolytic, chronic normochromic or iron-deficient. They may also have pancytopenia and hypersplenism (Felty’s syndrome). Fragile skin and veins are also associated with this condition together with a predisposition to carpal tunnel syndrome, polyneuritis and neuropathy. Special care is needed when positioning these patients for surgery.

History
Obtaining a clear history may prove difficult in elderly patients. Sensory perception is impaired and misunderstandings occur because of failure to hear. Sight may be compromised, distorting perception of surroundings. There may also be age-related generalized neurological degeneration. Recall of past events is usually clear but recall of recent episodes of illness and their significance can be hazy. Relatives often fill in important gaps and reference to medical notes and letters is invaluable. The history should include:

- previous anaesthetics, especially any problems
- previous medical history, especially heart, lungs, kidneys, blood pressure, oesophageal reflux
- allergies
The medical history and current medication provide important clues about the patient’s underlying state of health.

Examination

The patient should be sufficiently exposed to enable accurate observation, palpation, percussion and auscultation, while ensuring warmth, comfort and dignity. Palpation of the pulses cannot be over-emphasized; it often reveals clear indications of severe cardiovascular disease. Thorough examination of the cardiovascular and respiratory systems is often rewarded by eliciting signs absent in younger patients. Cardiac murmurs should be carefully classified according to site heard loudest, pitch, length and timing in the cardiac cycle. Irregularities of the pulse should be noted as well as abnormalities of the jugular venous pulsation.

Tests of respiratory function include the ability to count to 10 in one breath, breathlessness on dressing and ability to walk up a flight of stairs. Palpation of chest expansion, percussion and auscultation should be performed on anterior and posterior aspects of the chest. Unexpected signs are often found, which prove important in future management decisions. A hyperdynamic pulse may sometimes indicate hypercarbia.

Although cognitive function is not usually directly related to anaesthetic processes, postoperative confusion and delirium are not uncommon. A simple mental test score such as that given in Figure 1 can be a useful marker and may highlight patients at special risk.

Investigations

Together with haematology and biochemistry blood assays, a recent ECG should be available. Chest radiography may help to evaluate degrees of cardiac and respiratory disease. Occasionally surprise findings may occur (Figure 2).

The value of 2D echocardiography is limited but can be useful in valvular heart disease in determining degrees of incompetence or stenosis. Assessment of hypokinetic ventricular damage in ischaemic heart disease is also possible. Ejection fractions are often not repeatable and can be misleading. If an estimation of ventricular function is required a multigated scintigraph scan (MUGA) may give a more reliable figure. Peak flow measurement can be easily performed. This simple test gives good quantitative estimates of pulmonary function, and in this context, is often as valuable as formal pulmonary function testing.

FURTHER READING

