

## **Surgery in the elderly**

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The elderly (those 75 years of age or older) are a heterogeneous group. They present with both elective and urgent surgical problems, and risk assessment, decision-making and perioperative care are typically more challenging than in younger patients. An appreciation for this heterogeneity and an understanding of how physiologic changes of aging affect surgical care are essential if the best outcomes are to be achieved.

Les personnes âgées (qui ont 75 ans ou plus) constituent un groupe hétérogène. Elles ont des problèmes chirurgicaux à la fois électifs et urgents et l'évaluation des risques, la prise des décisions et les soins préopératoires posent habituellement des défis plus importants dans le cas des patients plus jeunes. Il est essentiel de comprendre cette hétérogénéité et l'effet que les changements physiologiques du vieillissement ont sur les soins chirurgicaux pour produire les meilleurs résultats.

Whatever their discipline, most surgeons are well acquainted with surgical problems in elderly patients. The number and proportion of the elderly in our population has increased progressively as a result of increased life expectancy, decreased birth rates and changing patterns of immigration. Improvements in anesthesia, perioperative care and surgical technique now allow many elective procedures to be conducted safely in elderly patients, and there is an increasing awareness of surgical options for a variety of clinical problems. This review will focus on evolving topics and recent developments pertinent to the elderly surgical patient. A comprehensive discussion of the scientific and clinical basis for the care of the elderly surgical patient can be found elsewhere.<sup>1</sup> Although not a uniform process, aging is accompanied by more or less predictable physiologic

changes, by changing patterns of surgical illness, and by increased morbidity and mortality after surgery, trauma and critical illness. Thus, age is a "surrogate" for a host of biologic, clinical, social and other variables. These relationships, and the heterogeneity of the elderly as a group, need to be kept in mind when considering the relevance of published material to one's own patients.

### **Bias in clinical care and research**

Advanced age has been an exclusion criterion for many research studies in the past, with the result that in important clinical areas there is a paucity of information pertaining to the elderly.<sup>2,3</sup> This has left possible age-related differences in diseases and in responses to therapy to be inferred and exposes elderly patients to

risk from inaccurate inferences. In addition, outcomes that may be of special interest to the elderly, such as those related to quality of life, are often not well addressed.

Age bias is also evident in clinical care. For example, approaches to the diagnosis and treatment of breast cancer differ significantly in older women.<sup>4</sup> Another example is suggested by an age-related decline in elective inguinal hernia repairs whereas rates of emergency repair increase exponentially.<sup>5</sup> There are several possible explanations for such observations, including physician concerns about comorbidity and the ability of patients to tolerate therapy, a reluctance to recommend adjunctive therapy (so that gaining additional knowledge is not useful) and patient preferences. The rationale for modifying standard approaches in the elderly may or may not be well

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founded, but clearly such decisions should reflect more than simple chronologic age and should be acknowledged explicitly. Nondefinitive therapy in older patients has been associated with worse outcomes, for example, in patients with colorectal and breast cancers.<sup>6</sup>

### **Decision-making: treatment goals and risk assessment in the elderly patient**

The outcomes we have traditionally focused on pertain to the safety (e.g., operative morbidity and mortality) and effectiveness of our therapy from the perspectives of the disease and health care system (e.g., length of hospital stay, recurrence rates, long-term survival and sometimes specific functional outcomes). Although these outcomes are of undoubted importance, the significance of more patient-centred outcomes, associated with health-related quality of life and satisfaction, for example, is being recognized increasingly. Addressing them is especially important for elderly patients because the relative importance of different outcomes changes with age, and the basis on which treatment decisions are made may differ significantly from that of younger patients. The elderly are more likely to be concerned about relieving symptoms and maintaining function and independence, relative to long-term survival alone. They may be less willing than young patients to accept the risks of major, potentially curative interventions and more willing to set more limited goals that carry less immediate risk.

Assessment of risk in the elderly patient requires consideration of patient factors, the surgical problem and treatment options. Risk assessment is typically more challenging and time-consuming than in younger patients and more often involves family members, the primary care physician, anesthesiologists, and other physicians and health care disciplines. Even in the fit elderly per-

son, the physiologic limitations of aging must be recognized (Table 1). They may not be apparent in symptoms or restrictions in activities of daily life but will limit the ability to maintain homeostasis in situations of stress.<sup>7</sup> Other patient factors are also important. For example, comorbidity increases with age and is a major contributor to adverse events in hospital and to mortality. Dementia and other cognitive impairments are associated with increased mortality in elderly surgical patients. Other variables that predict clinical outcomes in various settings are nutritional status, voluntary hand-grip strength and the presence of a spouse or adult child. Clearly, the risks associated with surgical illness are far greater in the frail, institutionalized, elderly person with multiple medical problems than in the healthy, community-dwelling person who is physically, mentally and socially active. Assessment of the elderly patient must go well beyond establishing a specific diagnosis and consider physical, cognitive and social function.<sup>8</sup> Specific instruments available to assist in this include the Mini-Mental State Assessment, Barthel Index, nutritional assessments and others.<sup>1</sup>

At 75 and 85 years of age, the number of additional years of life expected is 10 and 5 respectively on average for men in Canada, and 12 and 7 years for women. Thus, major surgical procedures with a long-term perspective may be appropriate in selected, fit elderly patients. However, life expectancy will be more limited in patients with significant comorbidity or functional impairment, and there is little value for such patients in undertaking a major intervention for a surgical problem that is unlikely to become significant during their lifetime. It occurs more frequently in caring for elderly patients that we must adapt and make compromises in our usual management according to the circumstances or choices of an individual patient.

Risk is also a function of the surgi-

cal problem and procedure. For example, major abdominal and thoracic procedures are associated with death rates that increase consistently with age, whereas inguinal hernia repair and cataract surgery can be conducted with near-zero mortality regardless of patient factors. In addition, carefully planned, elective procedures carry a much lower risk than do the corresponding procedures in an emergency setting. Presumably this is a result of the lack of opportunity to fully define and optimize comorbidities, the physiologic derangements accompanying the acute process and the increased complexities of the urgent surgical problem. Thus, elective surgical procedures may be very reasonable even in candidates whose condition is less than ideal.

### **Integrated, multidisciplinary, pre-planned care will achieve the best outcomes**

The best outcomes will be achieved in the elderly patient when clinical care is multidisciplinary and integrated, beginning with preoperative assessment and continuing through to supportive care after discharge. Consideration of the physiologic changes that accompany aging and the changes that accompany acute illness provides many examples of the concept that the elderly have less sensitive and efficient homeostatic mechanisms than younger patients and are thus predisposed to progressive physiologic derangements (Table 1). The complications that result are predictable and are likely to have greater consequences than in young patients. Perioperative care must be meticulous. The elderly patient is more likely to be harmed by errors in care, is twice as likely to suffer preventable adverse events in hospital as a younger patient, and is more likely to experience permanent disability or death as a result.<sup>7,9</sup> Convalescence should be planned preoperatively with full recognition of the magnitude and duration of functional impairment. Fam-

ily members, social workers, discharge planners, geriatricians and others may be involved. Programs of comprehensive discharge planning and follow-up seem to reduce readmission rates and promote a return to previous residential status.<sup>10,11</sup>

The physiological basis and multidisciplinary nature of perioperative care are well demonstrated by recent studies in which maintenance of normothermia during operation and oxygen supplementation in the im-

mediate postoperative period were accompanied by improved clinical outcomes, including reductions in wound infections and adverse cardiac events.<sup>12-14</sup> The substantial reduction in muscle mass and strength that occurs even in healthy older patients provides an important illustration of the relationship between age-related physiology and clinical outcomes (Table 1). Strength declines further after surgery, predisposing the patient to atelectasis, pneumonia, deep

vein thrombosis and other consequences of immobility and a supine position, among the most common and significant complications for the elderly patient. Typically, elderly patients require more physical assistance from clinical staff. Mobilization is greatly facilitated by effective pain relief, which itself has been associated with substantial improvements in subcutaneous oxygen tension.<sup>15</sup> Protein-calorie, vitamin and trace element supplementation should be consid-

Table 1

**Physiologic Limitations of Aging, Their Clinical Consequences and "Best Practices" in the Elderly Surgical Patient**

Age-related changes	Clinical consequences	Best practices
<b>Body composition</b> Significantly decreased muscle mass, accounting for much of decreased lean tissue mass Increased fat mass	Erosion of muscle mass during acute illness may result in strength rapidly falling below important clinical thresholds: e.g., impaired coughing, decreased mobility, increased risk of venous thrombosis. Altered volumes of drug distribution	Maintain physical function through effective pain relief, avoiding tubes, drains and other "restraints," early mobilization and assistance with mobilization. Minimize fasting, provide early nutritional supplementation or support (both protein-calorie and micronutrient). Adjust drug dosages for volume of distribution.
<b>Respiratory</b> Decreased vital capacity Increased closing volume Decreased airway sensitivity and clearance Decreased partial pressure of oxygen	Less effective cough Predisposition to aspiration Increased closure of small airways during tidal respiration, especially postoperatively and when supine, leading to increased atelectasis and shunting Predisposition to hypoxemia	Provide early mobilization, assumption of upright rather than supine position. Ensure effective pain relief to allow mobilization, deep breathing. Provide routine supplemental oxygen in the immediate postoperative period, and then as needed. Minimize use of nasogastric tubes.
<b>Cardiovascular</b> Decreased maximal heart rate, cardiac output, ejection fraction Reliance on increased end-diastolic volume to increase cardiac output Slowed ventricular filling, increased reliance on atrial contribution Decreased baroreceptor sensitivity	Greater reliance on ventricular filling and increases in stroke volume (rather than ejection fraction) to achieve increases in cardiac output Intolerant of hypovolemia Intolerant of tachycardia, dysrhythmias, including atrial fibrillation	Use vigorous fluid resuscitation to achieve optimal ventricular filling. Non-vasoconstricting inotropes and afterload reduction may be more effective, if pharmacologic support is required.
<b>Thermoregulation</b> Diminished sensitivity to ambient temperature and less efficient mechanisms of heat conservation, production and dissipation Febrile responses to infection may be blunted in frail or malnourished elderly and those at extreme old age.	Predisposition to hypothermia: e.g., decline in body temperature during surgery is more marked unless preventive measures are taken. If there is hypothermia, shivering may result, associated with marked increases in oxygen consumption and cardiopulmonary demands. Fever may be absent despite serious infections, especially in frail elderly.	Use active measures to maintain normothermia during surgical procedures and to re-warm after trauma: warmed intravenous fluids, humidified gases, warm air. Maintaining intraoperative normothermia reduces wound infections, adverse cardiac events and length of hospital stay. Be aware of hypothermia in trauma resuscitation.
<b>Renal function, fluid-electrolyte homeostasis</b> Decreased sensitivity to fluid, electrolyte perturbations Decreased efficiency of solute, water conservation and excretion Decreased renal mass, renal blood flow and glomerular filtration rate Increased renal glucose threshold	Predisposition to hypovolemia Predisposition to electrolyte disorders, e.g., hyponatremia Predisposition to hyperglycemia Predisposition to hyperosmolar states	Pay meticulous attention to fluid and electrolyte management. Recognize that a "normal" serum creatinine value reflects decreased creatinine clearance since muscle mass (i.e., creatinine production) is decreased concurrently. Select drugs carefully; avoid those that may be nephrotoxic, e.g., aminoglycosides, or adversely affect renal blood flow, e.g., nonsteroidal anti-inflammatory drugs. Adjust drug dosages as appropriate for altered pharmacokinetics.

ered in all elderly surgical patients, preoperatively if feasible, to limit losses of muscle mass and strength. Formal nutrition support should be considered early when the postoperative course is not one of straightforward recovery.

The elderly are at increased risk for cognitive as well as physical impairment after surgery or during acute illness. Intervention targeting risk factors (e.g., sleep deprivation, immobility, visual and hearing impairment, dehydration) is effective in reducing the number and duration of episodes of delirium in hospitalized elderly patients.<sup>16</sup>

An important example of integrated, multidisciplinary care is the so-called "fast-track" or accelerated approach, the basis of which is prevention of the usual metabolic consequences of surgery by minimizing or avoiding the contributing factors, such as pain, starvation and immobility. Pain is minimized by epidural anesthesia and analgesia, narcotics and their effects on the gut are avoided, and oral intake and mobilization are resumed very early. Attention to detail and close involvement of several disciplines are required. When applied to unselected older patients undergoing elective colon resection, length of stay as short as 2 days has been demonstrated, with minimal morbidity or loss of function and a high level of patient satisfaction.<sup>17</sup> Comparable approaches have been used in patients undergoing thoracotomy, carotid endarterectomy and other procedures.

### Surgery in the "nursing home" patient

Whereas most elderly people live independently and function well, those in nursing homes or similar facilities are often especially frail, have significant comorbidity and functional limitations, and usually have a relatively short life expectancy. A range of general, orthopedic, vascular and other surgical problems occur in

such patients and are often dealt with as emergencies. The presentation of surgical illness may well be atypical or nonspecific, such as a fall, acute confusion, hypothermia, vague abdominal discomfort or other symptoms. The goals of surgical therapy are usually modest: to correct conditions that are immediately life-threatening or to address problems related to quality of life. Comfort, function and dignity are more often the major goals, rather than achieving major gains in survival. How well we achieve these goals with current surgical care is uncertain. Dementia and other cognitive impairments are predictive of increased mortality, perhaps because of delays in presentation and diagnosis of the surgical problem and the co-morbidities that are frequently present. The importance of precise diagnosis to surgical care is unquestioned, but, particularly in the frail, high-risk patient, it must be kept in mind that diagnosis is just one means (although usually the most satisfactory one) of relieving suffering and achieving the other goals of importance to the elderly patient.<sup>18</sup>

Advance decisions to limit the use of specific therapies have been made and documented by some elderly individuals. These may take many forms.<sup>19</sup> Patients generally welcome the opportunity to discuss such issues, and surgeons should be encouraged to raise them. Indeed, the discussion that patients have with their families or their caregivers regarding end-of-life issues may be more important than the signing of a specific document. Surgical care should not be denied to patients who have chosen not to be resuscitated in the event of critical cardiopulmonary deterioration. Outcomes in such patients are not necessarily worse than in other frail patients and agreement to rescind the DNR order temporarily should be sought since the causes of cardiopulmonary arrest in the immediate perioperative period may be rapidly and readily correctable.

Surgical problems in nursing home patients should be addressed actively since they may be managed more easily and safely when the condition is elective rather than be allowed to evolve into a difficult, high-risk, emergency condition. The care of such patients is especially challenging and should be undertaken by surgeons who are interested and knowledgeable in the problems that arise, who are prepared to deal with the complexities of comorbidity, cognitive and functional impairments, and who will educate their colleagues, patients and families about the full range of therapies available for surgical problems.<sup>20</sup>

### Summary

Relief of symptoms, maintenance of function and autonomy, and health-related quality of life are of particular importance to the elderly patient. There are predictable physiological and metabolic changes typical of aging that limit the ability of the elderly patient to respond to acute stress. Surgery can often be safely conducted but requires meticulous perioperative care to avoid complications and is best accomplished with an integrated, multidisciplinary approach. The frail elderly patient with multiple medical problems and functional impairments is best served by a surgeon with a particular interest who is prepared to address the complex issues that arise.

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