Elective and emergency abdominal surgery in patients 90 years of age or older

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Background: Few studies have examined perioperative outcomes in nonagenarians undergoing abdominal surgery, and fewer have reported on 1-year mortality. Our objectives were to determine the outcomes of abdominal surgery in nonagenarians and to assess the performance of Physiologic and Operative Severity Score for enUmeration of Mortality and morbidity (POSSUM) and Portsmouth-POSSUM (p-POSSUM) as predictors of mortality.

Methods: We conducted a retrospective chart review of all patients 90 years and older who underwent abdominal surgery between 2000 and 2007 at a tertiary care hospital.

Results: We included 145 patients (median age 91, range 90–101 yr). The most common diagnoses were colorectal cancer (19.3%) and hernias (19.3%), and the most common procedures were bowel resection with anastomosis (25.5%) and hernia repair (18.6%). Overall in-hospital mortality was 15.2% (20.8% in the emergent group and 9.6% in the elective group; $p = 0.06$). The 1-year mortality (49.1% v. 27.8%; $p = 0.016$), complication (81.9% v. 61.6%; $p = 0.007$) and intensive care unit admission rates (44.4% v. 11.0%; $p < 0.001$) were significantly higher among emergent than elective surgical patients. The operative indications and procedures associated with the highest in-hospital mortality were large bowel obstruction (42.3%) and bowel resection with anastomosis (27.0%). Both the POSSUM and p-POSSUM scoring systems significantly overpredicted mortality, particularly in higher risk groups.

Conclusion: Nonagenarians undergoing abdominal surgery have substantial operative morbidity and mortality, particularly in emergent surgical cases. Nearly 50% of patients who undergo emergency procedures die within 1 year after surgery. The POSSUM and p-POSSUM scoring systems were not reliable predictors of in-hospital mortality.

Contexte : Peu d'études se sont penchées sur les résultats périopératoires de la chirurgie abdominale chez les nonagénaires, et moins encore ont mesuré leur mortalité à 1 an. Nous avions pour objectifs de déterminer l'issue de la chirurgie abdominale chez les nonagénaires et de mesurer les indices POSSUM (*Physiologic and Operative Severity Score for enUmeration of Mortality and morbidity*) et p-POSSUM (*Portsmouth-POSSUM*) en tant que prédicteurs de la mortalité.

Méthodes : Nous avons procédé à une analyse rétrospective des dossiers de tous les patients de 90 ans et plus ayant subi une chirurgie abdominale entre 2000 et 2007 dans un centre de soins tertiaires.

Résultats : Nous avons inclus 145 patients (âge médian 91 ans, éventail de 90 à 101 ans). Les diagnostics les plus fréquents étaient le cancer colorectal (19,3 %) et les hernies (19,3 %), tandis que les interventions les plus courantes ont été la résection intestinale avec anastomose (25,5 %) et la réparation de hernie (18,6 %). La mortalité perhospitalière globale a été de 15,2 % (20,8 % dans le groupe ayant subi une intervention d'urgence et de 9,6 % dans le groupe ayant subi une intervention élective; $p = 0,06$). Les taux à 1 an pour ce qui est de la mortalité (49,1 % c. 27,8 %; $p = 0,016$), des complications (81,9 % c. 61,6 %; $p = 0,007$) et des admissions aux unités de soins intensifs (44,4 % c. 11,0 %; $p < 0,001$) ont été significativement plus élevés chez les patients soumis à une chirurgie urgente que chez les patients soumis à une chirurgie élective. Les indications de la chirurgie et les interventions qui ont été associées à la mortalité perhospitalière la plus élevée ont été l'obstruction du côlon (42,3 %) et la résection intestinale avec anastomose (27,0 %). Les systèmes d'évaluation POSSUM et p-POSSUM ont significativement surévalué la mortalité, particulièrement dans les groupes à risque plus élevé.

Conclusion : Les nonagénaires qui subissent une chirurgie abdominale présentent un taux de morbidité et de mortalité opératoires substantiel, particulièrement en ce qui concerne les cas de chirurgie urgente. Près de 50 % des patients qui ont subi des interventions chirurgicales urgentes meurent dans l'année qui suit leur opération. Les systèmes d'évaluation POSSUM et p-POSSUM ne se sont pas révélés des prédicteurs fiables de la mortalité perhospitalière.

As a result of the changing demographic and an increase in life expectancy, more elderly patients are presenting with surgical pathologies.[1] Age and comorbidities affect outcome, and their synergistic effect is pronounced in elderly patients. To adequately explain the risks and benefits of surgery to elderly patients and their families or substitute decision-makers, accurate data on morbidity and mortality are needed. As medical experts, surgeons must decide whether surgical treatment is justified in these patients because greater risks are involved and benefits are not always predictable. Thus, surgeons should have accurate data on perioperative outcomes in elderly patients to guide therapeutic decision-making and provide sound advice. Studies examining the outcomes of surgery in extremely elderly patients have been limited, and in most cases the outcomes for various surgical indications and procedures were combined, thereby making it difficult to apply the results of these studies to a specific patient population.[2–6]

The Physiologic and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM) was first developed by Copeland and colleagues[7] as a means of predicting morbidity and mortality. The Portsmouth-POSSUM (p-POSSUM) was subsequently developed as an alternative to maximize the predictive accuracy of the model.[8] These 2 systems incorporate both physiologic parameters and details related to the surgical procedure, but use different regression equations to predict mortality. Although they have been applied to patients undergoing general, colorectal and vascular surgery, the performance of POSSUM and p-POSSUM in patients 90 years of age and older has not been validated.[7,9–13]

The objectives of our study were to determine the outcomes of elective and emergency abdominal surgery in patients 90 years of age or older and to assess the performance of the POSSUM and p-POSSUM systems as predictors of mortality.

Methods

Patients

We identified all patients 90 years of age or older who underwent abdominal surgery between 2000 and 2007 at London Health Sciences Centre (Victoria Hospital and University Hospital) using an archival database. London Health Sciences Centre is an 846-bed tertiary care facility affiliated with the University of Western Ontario Schulich School of Medicine and Dentistry, serving a population of about 1.5 million people. Abdominal surgery was defined as any surgery performed in the peritoneal cavity, including abdominal wall hernia repair. Endoscopic procedures were not included. Our study was reviewed and approved by the University of Western Ontario Health Services Review Board.

Data collection

We performed a retrospective chart review using standardized data abstraction sheets to assess several parameters, including age, sex, disposition at admission and discharge, medical history, body mass index (BMI), American Society of Anesthesiologists (ASA) score, diagnosis, date of surgery, type of admission (emergency or elective), procedure performed, medical or surgical complications, length of stay (d) in hospital and presence or absence of intensive care unit (ICU) admission.

Disposition at the time of admission was classified as follows: independent (resided in their own dwelling and required minimal or no assistance with activities of daily living), cohabitation (living with a family member or caregiver who provided a moderate level of assistance with activities of daily living), or convalescent (living in a nursing home, retirement home or peripheral hospital). Discharge disposition was defined in a similar fashion; however, respite care at a rehabilitation centre was also included. Respite care was considered a temporary place of residence required for completion of recovery before returning to independent living or cohabitation.

Each patient was classified preoperatively according to the physical status classification of the ASA. We determined preoperative medical conditions by individual chart review, noting the presence of pre-existing cardiac, respiratory, gastrointestinal, neurologic, renal, endocrine, vascular, hematologic and musculoskeletal conditions. Examples of comorbidities that were included under the cardiac category were hypertension, angina, coronary artery disease, myocardial infarction, congestive heart failure, arrhythmia and valvular heart disease. The neurologic category included cerebrovascular accident, Parkinson disease, Alzheimer disease, dementia, transient ischemic attacks and peripheral neuropathy. Prior cancer diagnoses and intra-abdominal surgery, either open or laparoscopic, were also recorded.

Specific details pertaining to each hospital admission were also recorded, including surgical indication, date and details of operative intervention and timing of surgery (emergent v. elective). All procedures planned in advance of admission or taking place more than 24 hours after admission were considered to be elective. Conversely, all unplanned procedures performed within 24 hours of admission were considered to be emergent. Information on clinical outcomes relating to operative intervention (in-hospital mortality, length of stay in hospital, ICU admission and complications) was also collected from either the patient's paper or electronic chart. We classified perioperative complications as surgical (e.g., bleeding, wound infection, intra-abdominal abscess, anastomotic leak, bowel obstruction) or medical (e.g., myocardial infarction, deep vein thrombosis, pulmonary embolism, pneumonia, cerebrovascular accident, urinary tract infection, renal failure, delirium). We obtained information on 1-year survival either by individual chart review or by contacting family physicians.

Clinical variables were used to calculate the POSSUM and p-POSSUM scores (Box 1). Any missing values were considered to be normal, as this strategy has not been shown to degrade the adequacy or validity of the risk assessment with any of the POSSUM variations.[10]

Data analysis

We compared elective and emergent groups using the Pearson χ^2 test or Fisher exact test for categorical data and the Mann–Whitney *U* test for continuous data. The association between ASA class and mortality was assessed using the χ^2 test for trend. We compared the performance of the POSSUM and p-POSSUM scores using the Hosmer–Lemeshow goodness of fit test,[14] which compares the predicted number of deaths within similar risk categories with the number of observed deaths using the χ^2 test statistic and allows one to assess the accuracy of predictive models. All statistical tests were 2 sided, with significance set at $p = 0.05$.

Box 1. Parameters used in the POSSUM and p-POSSUM scoring systems[7]

Physiologic parameters

- Age
- Cardiac signs
- Respiratory history
- Systolic blood pressure
- Pulse
- Glasgow coma score
- Hemoglobin
- White cell count
- Urea
- Sodium
- Potassium
- Electrocardiogram results

Operative parameters

- Operative severity
- Multiple procedures
- Total blood loss
- Peritoneal soiling
- Presence of malignancy
- Mode of surgery

POSSUM = Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; p-POSSUM = Portsmouth-POSSUM.

Results

In all, 174 patients were identified. After further evaluation, 29 patients were excluded from analysis (27 owing to duplicate entries in the surgical database and 2 owing to extra-abdominal procedures), leaving 145 patients in the cohort. Of these 145 patients, 73 underwent elective surgery and 72 had emergent procedures. The median age was 91 (range 90–98) years in the elective group and 91.5 (range 90–101) years in the emergent group; 67.1% and 59.7% of patients undergoing elective and emergent procedures, respectively, were women. Other demographic information is summarized in Table 1.

Comorbidities were extremely common, and many patients had multiple medical diagnoses (Table 2). Of those undergoing elective procedures, 84.9%, 57.5% and 64.4% had underlying cardiac, gastrointestinal and musculoskeletal conditions, respectively. These conditions were seen in 88.9%, 69.4% and 58.3%, respectively, of patients undergoing emergent procedures (Table 2). We found no significant differences in the number and type of comorbidities present between the groups.

Hernias and colorectal cancer were the 2 most common indications for operative intervention, each comprising

Table 1. Patient demographic characteristics, *n* = 145

Characteristic	Elective, *n* = 73	Emergent, *n* = 72
Age, median (range) yr	91 (90–98)	91.5 (90–101)
Female sex, no. (%)	49 (67.1)	43 (59.7)
BMI, median (IQR)	23.9 (20.9–26.5)	22.2 (19.8–25.7)
ASA score, no. (%)		
1	0 (0.0)	0 (0.0)
2	9 (12.3)	6 (8.3)
3	40 (54.8)	14 (19.4)
4	23 (31.5)	42 (58.3)
5	1 (1.4)	10 (13.9)

ASA = American Society of Anesthesiologists; BMI = body mass index; IQR = interquartile range.

Table 2. Preoperative patient comorbidities, *n* = 145

Comorbidity, no. (%)	Elective, *n* = 73	Emergent, *n* = 72
Cardiac	62 (84.9)	64 (88.9)
Respiratory	32 (43.8)	32 (44.4)
Gastrointestinal	42 (57.5)	50 (69.4)
Neurologic	24 (32.9)	34 (47.3)
Genitourinary	20 (27.4)	27 (37.5)
Endocrine	16 (21.9)	18 (25.0)
Vascular	10 (13.7)	9 (12.5)
Malignant	26 (35.6)	23 (31.9)
Hematologic	18 (24.7)	9 (12.5)
Musculoskeletal	47 (64.4)	42 (58.3)

19.3% of patients, followed by small bowel obstruction accounting for 12.4% of all patients. The operative indication associated with the highest in-hospital mortality (42.3%) was large bowel obstruction (Table 3). This was significant compared with all other surgical indications ($p = 0.001$). All patients with large bowel obstruction underwent surgery within 24 hours of admission, and 2 patients with small bowel obstruction underwent surgery more than 24 hours after admission. Bowel resection with anastomosis (25.5%) and hernia repair (18.6%) were the most common surgical procedures performed (Table 4). The former was associated with a 27.0% in-hospital mortality, or a total of 10 deaths. The causes of death were cardiorespiratory failure ($n = 6$), acute coronary syndrome ($n = 1$) and multisystem organ failure ($n = 2$); the cause was unknown for 1 patient. In contrast, bowel resection without an anastomosis (i.e., with an ostomy) accounted for only 10.3% of operative procedures and was associated with an in-hospital mortality of 13.3%. Of note, 7.6% of patients underwent 2 or more simultaneous procedures, with only 1 in-hospital death (9.1%).

Overall in-hospital mortality was 15.2%, with greater mortality in the emergent group (20.8%) than the elective group (9.6%; $p = 0.06$). The in-hospital mortality for the various surgical procedures comparing the emergent and elective cases is seen in Table 5. The overall complication rate was significantly higher in the emergent group (81.9% v. 61.6%, $p = 0.007$; Table 6). Medical complications in particular were significantly more frequent in the emergent versus the elective group ($p = 0.049$); however, surgical complications were not ($p = 0.81$).

Emergency surgery was also associated with an increased length of stay in hospital and admission to the ICU. Patients undergoing emergent procedures stayed on average 4 more days in hospital, and almost half (44.4%) required ICU admission (Table 6). The 1-year mortality in the emergent group was 49.1% versus 27.8% in the elective group ($p = 0.016$).

We compared disposition at the time of admission and discharge in patients who survived surgery ($n = 123$). Of the 70 patients who were living independently before surgery, only half (35) were fit to return to independent living after their discharge. A further 21 patients required temporary rehabilitation and completion of recovery before returning to their original dwelling (Table 7). Only 40 of 123 patients (32.5%) were in institutionalized care before surgery, whereas 81 of 123 (65.8%) patients required institutional

Table 3. In-hospital mortality and operative indication, $n = 145$

Operative indication	Patients, no. (%)	Mortality, no. (%)
Small bowel obstruction	18 (12.4)	4 (22.2)
Large bowel obstruction	14 (9.7)	6 (42.3)*
Perforated viscus	16 (11.0)	4 (25.0)
Symptomatic gallstones	10 (6.9)	0 (0)
Appendicitis	4 (2.8)	0 (0)
Hernia	28 (19.3)	3 (10.7)
Colorectal cancer	28 (19.3)	4 (14.3)
Other†	27 (18.6)	1 (3.7)

*$p = 0.001$ for large bowel obstruction versus all other procedures.
†Includes abdominal aortic aneurysm, pelvic mass, gastric cancer, endometrial cancer, peritonitis, renal mass, gastric outlet obstruction, achalasia, rectal prolapse and lower gastrointestinal bleeding.

Table 4. In-hospital mortality and surgical procedure

Surgical procedure	Patients, no. (%)	Mortality, no. (%)
Cholecystectomy	12 (8.3)	0 (0)
Appendectomy	4 (2.8)	1 (25.0)
Hernia repair*	27 (18.6)	2 (7.4)
Resection and anastomosis	37 (25.5)	10 (27.0)
Resection and ostomy	15 (10.3)	2 (13.3)
Gastrointestinal bypass	8 (5.5)	2 (25.0)
Lysis of adhesions	12 (8.3)	2 (16.7)
Gynecologic	5 (3.4)	0 (0)
Other†	14 (9.7)	2 (14.3)
Multiple‡	11 (7.6)	1 (9.1)

*One patient had 2 hernia repairs.
†Includes abdominal aortic aneurysm repair, Graham patch repair, nephrectomy, esophageal myotomy, gastrectomy and splenectomy.
‡Two or more simultaneous procedures.

Table 5. In-hospital mortality for emergent and elective surgical procedures

Surgical procedure	Elective, no. (%)	Emergent, no. (%)
Cholecystectomy	0/6 (0)	0/6 (0)
Appendectomy	0 (0)	1/4 (25.0)
Hernia repair*	1/14 (7.1)	2/13 (15.4)
Resection and anastomosis	4/28 (14.3)	6/9 (66.7)
Resection and ostomy	0/2 (0)	2/13 (14.5)
Gastrointestinal bypass	0/4 (0)	2/4 (50.0)
Lysis of adhesions	1/2 (50.0)	1/10 (10.0)
Gynecologic	0/4 (0)	0/1 (0)
Other†	2/7 (28.6)	0/7 (0)
Multiple‡	0/6 (0)	1/5 (20.0)

*One patient had 2 hernia repairs.
†Includes abdominal aortic aneurysm repair, Graham patch repair, nephrectomy, esophageal myotomy, gastrectomy and splenectomy.
‡Two or more simultaneous procedures.

Table 6. Comparison of outcomes between elective and emergent surgical procedures

Outcome	Elective, $n = 73$	Emergent, $n = 72$	p value
In-hospital mortality, no. (%)	7 (9.6)	15 (20.8)	0.06
Complications, no. (%)			
Overall	45 (61.6)	59 (81.9)	0.007
Medical*	38 (52.0)	49 (68.1)	0.049
Surgical†	19 (26.0)	20 (27.8)	0.81
Length of stay, median (range) d	8 (1–93)	12 (2–76)	< 0.001
ICU admission, no. (%)	8 (11.0)	32 (44.4)	< 0.001
1-year mortality, no. (%)	17 (27.8)	30 (49.1)	0.016

ICU = intensive care unit.
*Includes pneumonia, acute coronary syndrome, delirium, sepsis and deep venous thrombosis.
†Includes wound infection, ileus, anastomotic dehiscence and hematoma.

care after surgery. In-hospital mortality did not differ significantly between patients admitted from home and those admitted from alternate institutions ($p = 0.72$).

To evaluate the POSSUM and p-POSSUM scoring systems as predictors of mortality, we compared the observed in-hospital mortality in our study with the predictive values for each decile of mortality risk (Table 8). To generate the deciles of risk, the individual risk of death was determined for each patient based on the p-POSSUM equation. For example, 25 patients had a predicted risk of death between 0% and 10%. Both the POSSUM and p-POSSUM scoring systems significantly overpredicted mortality, as assessed by the Hosmer–Lemeshow goodness of fit test ($p < 0.001$), particularly in the higher risk groups. Whereas this trend was most pronounced in higher risk groups owing to a larger number of patients with elevated predicted mortality, it was also evident at lower levels of risk. The ASA score, in contrast, correlated significantly with in-hospital mortality ($p < 0.001$; Table 9).

Discussion

Demographic trends in Western countries have led to substantial increases in the number of elderly patients presenting with surgical pathology, and it has become increasingly important to consider the impact of surgical intervention in this population. It is often problematic to strongly recommend surgical intervention to these patients, even in the face of a clear-cut indication, given the high incidence of concomitant disease, limited functional reserve and requirement for institutionalized care. Accordingly, accurate information regarding the risks and benefits of surgical intervention in this age group is required to help surgeons provide prognostic information to both patients and their families.

Although several previous reports have evaluated perioperative outcomes in elderly patients, few have focused on perioperative morbidity and mortality in patients aged 90 years or older. Furthermore, analyzing and comparing the published results has been difficult, as most studies grouped different surgical procedures and indications together. Our analysis was restricted only to elective and emergent abdominal surgery in this elderly group, and we were able to document specific morbidity and mortality for specific diagnoses and operations. We found that the surgical risks were substantial, complications were frequent, and the vast majority of patients were incapable of independent living after discharge from hospital. Our analysis was restricted to patients who underwent surgery. We do not have information on nonagernarians with surgical problems who were not offered surgery. We have no way of knowing how many elderly patients may have been seen in surgeons' offices or clinics and who were either refused surgery or who declined elective procedures. Nor do we have data on nonagernarians who presented to the emergency department and for whom no surgery was performed for whatever reason.

Half of the 145 patients in our study required emergency surgery, a finding similar to previously reported rates for both octogenarians and nonagenarians, which ranged from 37.5% to 72%.[1,2,15–17] There also appears to have been a steady rise in emergent cases over the past 30 years, a trend that parallels the increase in observed life expectancy. Overall in-hospital mortality in our series was 15.2%, which is similar to that reported in previous studies, ranging from

Table 7. Disposition at admission versus discharge in surviving patients, *n* = 123

Disposition	Admission, no. (%)	Discharge, no. (%)
Independent	70 (56.9)	35 (28.5)
Cohabitation	13 (10.6)	7 (5.7)
Nursing home	20 (16.3)	24 (19.5)
Retirement home	15 (12.2)	17 (13.8)
Home hospital	5 (4.1)	19 (15.4)
Respite care	—	21 (17.1)

Table 8. Observed and predicted mortality according to the POSSUM and p-POSSUM surgical scoring systems

Mortality rate*	Patients, no.	POSSUM†, no.	p-POSSUM†, no.	Observed, no.
0–10	25	3	1	1
11–20	12	3	2	0
21–30	10	4	4	1
31–40	15	7	5	0
41–50	14	8	6	2
51–60	12	8	7	1
61–70	9	6	6	2
71–80	15	12	11	7
81–90	15	13	13	4
91–100	18	17	17	4
Total, no. (%)	145	81 (56)	72 (50)	22 (15)

POSSUM = Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; p-POSSUM = Portsmouth-POSSUM.
*Based on p-POSSUM predicted mortality.
†Both POSSUM and p-POSSUM significantly overpredicted death ($p < 0.001$) when analyzed using the Hosmer–Lemeshow goodness of fit test.

Table 9. Perioperative mortality, disposition at admission and ASA score

Characteristic	Patients, no. (%)	In-hospital mortality, no. (%)
Disposition at admission		
Home	97 (66.9)	14 (14.4)*
Institution	48 (33.1)	8 (16.7)
ASA score		
1	0 (0)	0 (0)
2	15 (10.3)	0 (0)
3	54 (37.2)	4 (7.4)
4	65 (44.8)	12 (18.5)
5	11 (7.6)	6 (54.5)†

ASA = American Society of Anesthesiologists.
*$p = 0.72$ comparing in-hospital mortality between home and institution.
†$p < 0.001$, χ^2 test for trend.

8.0% to 24.0%.[1–3,5,15,16,18] As expected, emergent morbidity (81.9%) and mortality (20.8%) were much higher than elective morbidity (61.6%) and mortality (9.6%). These results were comparable to or slightly lower than those reported in other studies that focused on nonagenarians; however, perioperative morbidity for elective surgery in our study was significantly greater.[1,15–17] Not surprisingly, postoperative morbidity (22.5%) and mortality (1.6%) in a large group of octogenarians undergoing elective procedures were markedly better than those observed for nonagenarians in our study.[2]

The 1-year mortality in our study was higher than that observed by Hosking and colleagues,[4] particularly for emergency operations in which the 1-year mortality approached 50%. However, these values must be interpreted in view of the mortality expected among all nonagenarians. According to the 2000–02 life tables for the province of Ontario, men and women who reach the age of 91 (the median age of patients in this study) have a 1-year mortality of 19% and 15%, respectively.[19] The 1-year mortality following elective abdominal surgery (27.8%) represents a relatively small increase beyond that expected without surgical intervention in this age group.

If we consider the average life expectancy of nonagenarian men (93.89 yr) and women (94.76 yr) in general, one might argue that the benefits in terms of quantity of future life outweigh the risks of surgical intervention, even when one considers what appears to be a high operative mortality. With the increasing rate of surgery secondary to increased life expectancy and the potential for patients to survive several more years if they undergo surgery, future costs of medical care for this segment of the population may be even greater than currently projected, and additional surgical resources will be required.

When comparing our data to that from previous studies on octogenarians and nonagenarians undergoing colonic surgery or other major general surgical operative procedures, there is a comparable increase in complication rate, length of stay in hospital and ICU admission in those undergoing emergent procedures.[15,17] On average, nonagenarians undergoing emergent abdominal surgery had an increase in length of stay of 4 days and required ICU admission 4 times as often as their elective counterparts. This has important implications in terms of hospital resource utilization and is yet another factor that must be considered in the process of therapeutic decision-making.

When attempting to predict mortality, both the POSSUM and p-POSSUM systems consistently overpredicted the risk of death, particularly in the highest risk groups. Both scoring systems place a great deal of weight on the presence of cardiac comorbidities, as 3 physiologic parameters (cardiac signs, respiratory status and electrocardiogram results) are related to the presence or absence of heart conditions. The high prevalence of heart failure and other cardiac comorbidities in patients 90 years of age or older likely explains the overprediction in this population. It is clear that these scores should not be used as predictive tools given their systematic overprediction. Surprisingly, disposition at admission to hospital (home v. institutionalized care) did not predict similar mortality between the groups (14.4% v. 16.7%). The ASA score was the most predictive factor analyzed, with a clear trend to increasing mortality with a higher score. Given the small number of categories and its relative crudeness, the ASA score can be used as a rough guide but lacks the resolution and sensitivity required to be used as a sophisticated predictive tool.

Perhaps more important than predicting mortality is the dramatic loss of independence and change in quality of life experienced by nonagenarians who undergo abdominal surgery. Prior to surgery, only 16.3% of patients were in some form of institutionalized care, but 65.8% of postoperative patients went to institutionalized care (i.e., nursing home, retirement home, hospital, respite care). This loss of independence and change in lifestyle must be considered not only by the patients, but also by their families, during the decision-making process.

Conclusion

Although the overall in-hospital mortality for nonagenarians who undergo abdominal operations is acceptable (15.2%), the 1-year mortality for those who undergo emergent procedures approaches 50%. It is a sobering statistic and may be an important consideration when advising relatives about realistic expectations if the patients survive the immediate postoperative period.

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