Prognostic Significance of Postoperative In-Hospital Complications in Elderly Patients. II. Long-Term Quality of Life

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To determine the impact of nonfatal in-hospital postoperative complications on long-term quality of life and functional status, we studied consecutive patients ≥70 yr of age who had undergone noncardiac surgery. The association between the occurrence of nonfatal in-hospital postoperative complications and long-term quality of life (measured by the Medical Outcome Study Short form 36) and functional status was determined 2–3 yr after surgery. Independent predictors of quality of life and functional status were measured by multivariate logistic regression. Two-hundred-sixty-four of 353 patients (74.8%) responded to the survey. The mean Medical Outcome Study Short form 36 scores of patients with in-hospital postoperative complications were significantly lower than those without complications in the following domains: physical functioning (42.8 versus 53.9; $P = 0.029$), general health (52.3 versus 62.3; $P = 0.02$), and role emotional (45.7 versus 67.9; $P = 0.00058$). Patients who had postoperative complications were more likely to be dependent in daily living activities. Comparison with age-matched United States population showed that patients with postoperative complications had lower scores in physical functioning (42.8 versus 53.2; $P = 0.04$), role physical (26.6 versus 45.3; $P = 0.0078$), role emotional (45.7 versus 63.2; $P = 0.025$), and mental health (66 versus 74; $P = 0.024$). By multivariate logistic regression analysis, only a history of diabetes (odds ratios 4.2; 95% confidence interval, 1.7–10.3; $P < 0.002$ and new hospitalization because of medical reasons (odds ratio, 3.8; 95% confidence interval, 1.6–8.8; $P < 0.002$) were significant independent predictors of a long-term decrease in quality of life. Adjusting for other clinical factors, in-hospital complications no longer independently predicted changes in functional status. For geriatric patients, the occurrence of postoperative complications does not independently predict long-term quality of life or functional status. The important independent predictors are co-morbid conditions, age, and new hospitalization after discharge.

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The elderly population is the fastest growing segment in many parts of the world. Although increased longevity has been evident in many developed countries, increasing the number of healthy years lived beyond age 65 is an important health initiative that deserves special focus. Recent work by our group in elderly surgical patients undergoing noncardiac surgery demonstrated that 21% of patients developed one or more in-hospital postoperative adverse outcomes involving primarily the cardiovascular, neurological, and pulmonary systems (1). Whether the occurrence of in-hospital postoperative complications impacts the quality of life of such patients during long-term follow-up is unclear.

Although some previous studies have investigated the quality of life and functional status after certain types of operations, such as open heart surgery and orthopedic procedures (2–7), none has specifically examined the effect of noncardiac surgery on long-term quality of life in a group of nonselected elderly surgical patients. Our previous study demonstrated that health care resources consumption is increased in patients who developed an in-hospital postoperative complication (1). Specifically, patients who developed postoperative adverse outcomes had a longer median hospital stay than those without complications. In addition, more patients with postoperative complications (43%) were discharged to either a skilled nursing facility or nursing home after surgery versus those

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without complications (19%). Whether such patients ultimately regain independent function is unknown. Accordingly, the primary objective of this study was to evaluate the impact of nonfatal in-hospital postoperative complications on long-term quality of life and functional status controlling for other potential clinical predictors.

Methods

The study population and in-hospital follow-up methods were described in Part I of the study (8). A self-administered questionnaire was mailed in 2000, 2–3 yr after surgery, to those patients who survived the initial hospitalization. The quality-of-life assessment was based on the Medical Outcome Study Short form 36 (SF-36) format (9), which measures eight health concepts or domains including physical functioning, role limitation because of physical health, bodily pain, general health perception, vitality, social functioning, role limitation because of emotional health, and general mental health. The SF-36 was chosen because it is a widely used measure of health status because of its brevity. Furthermore, the SF-36 scales have been found to correspond well with other health measures (10–12), discriminate between healthy and sick populations (13), are sensitive to differences in disease severity (14), and have been shown to be valid in elderly populations (15,16). The scores of this questionnaire were tabulated using standard methodology as suggested by its developers (17).

In addition, we also measured self-reported health transition, functional status, and any new hospitalization. Functional status was measured according to independence in performing five types of activities of daily living (ADL), which included bathing, dressing, eating, using the toilet, and moving around and seven instrumental ADL (IADL), which included using transportation, shopping, telephoning, preparing meals, doing housework, taking medications, and managing finances. Social support measures included marital status, living arrangement, and whether there is a change compared with before surgery.

Nonresponders were contacted by phone to obtain the relevant information. Proxy response was included to increase the response rate. The identity and relationship of the proxy respondent to the patient was recorded.

Data were analyzed using Stata 5.0 (Stata Co, College Station, TX). Categorical variables with two levels such as a history of hypertension, diabetes mellitus, heart disease, or co-morbid diseases were coded as 0 (absent), 1 (present), and unknown (missing) if information could not be determined from medical record review. Non-ordered categorical data with more than two levels (types of surgery or anesthesia) were entered as K-1 dummy variables (indicator variables).

Domain scores from the SF-36 data were calculated according to published guidelines (17). Unpaired *t*-tests were used to compare the scores between patients with and without postoperative complications. The impact of surgical risk on specific SF-36 domains was evaluated using analysis of variance. The association of in-hospital postoperative complications and other risk factors with low SF-36 scores (lowest quartile) and functional status as measured by dependency in at least one domain of ADL and IADL was determined by univariate analysis using χ^2 analysis. Those variables that had significant association with lower scores on univariate analysis ($P \leq 0.1$) were entered in a stepwise multivariate logistic regression model. Odds ratios (OR) and 95% confidence interval (CI) were reported. In addition, the baseline SF-36 variables were compared with normative data for the age-matched United States (US) population using an unpaired *t*-test. $P < 0.05$ was considered statistically significant.

Results

A total of 353 patients were alive at the time of long-term follow-up. This group was part of the original cohort of 517 patients who underwent noncardiac surgery and survived the initial hospitalization. The general and demographic data of the study patients were reported in Part I of the report (8).

The mean age of the patients alive was significantly younger than the patients who were deceased (77 ± 5 versus 80 ± 7 yr; $P < 0.00001$). Overall, 264 of 353 patients (74.8%) responded to the survey. Of the 89 nonresponders, 74 could not be contacted, and 15 declined to participate. Proxy information was provided for 47 of 264 (17.8%) patients. Because there was no difference between the responders and patients using proxy responses with respect to age, surgery risk, and in-hospital postoperative complications, the data were combined for subsequent analysis.

Self-rated general health, marital status, and living arrangement results are summarized in Table 1. Overall, 212 of 255 (83.1%) patients had similar living arrangements as before surgery, whereas the remainder, 43 of 255 (16.9%), had either moved in with family or friends, needed home care, or needed nursing home care. One-hundred-eighty-six of 261 (71.3%) patients reported their health status to be good to excellent, and 197 of 261 (75.5%) patients reported their health to have either improved or remained the same as compared with before surgery. The detailed SF-36 summary responses were tabulated in Table 2. Of note is that during the survey, 75.3% of the patients responded that they had bodily pain, and 61.4% reported that pain interfered with their daily activities.

The only domain affected by surgical risk was vitality. Patients who underwent high-risk surgery had

Table 1. Demographic and General Health[a]

	n	Percent of those responded
Marital Status		
Married	99	41.6
Single/widowed	118	49.6
Divorced	21	8.8
Did not answer	26	
Living arrangement		
Same	212	83.1
Changed (become dependent)	43	16.9
Did not answer	7	
General Health		
Poor	18	6.9
Fair	57	21.8
Good	103	39.5
Very good	61	23.4
Excellent	22	8.4
Did not answer	3	
Health compared to before surgery		
Much worse	19	7.3
Somewhat worse	45	17.2
About same	95	36.4
Somewhat better	51	19.5
Much better	51	19.5
Did not answer	3	

[a] Because not every patient who responded provided an answer for each question in the questionnaire, we tabulated the total number of responses for each question separately.

Table 2. SF-36 Scores by Domains

Domain	Score (mean ± SE)
Physical functioning	53.2 ± 1.8
Role physical	45.3 ± 2.6
Role emotional	63.2 ± 2.6
Body pain	60.9 ± 1.6
Vitality	50.4 ± 1.5
Mental health	74.0 ± 1.2
Social functioning	73.9 ± 1.8
General health	56.7 ± 1.3

The score shown is the mean ± SE for the entire study population. The Medical Outcome Study Short Form 36 (SF-36) measures global health status with a 0–100 point system. The best possible score is equal to 100. Anytime a scale score is below 50, health status is below average. See text and Reference 17 for additional details.

lower scores on vitality when compared with those undergoing low- or intermediate-risk surgery ($P = 0.03$).

A comparison with the age-matched US population showed that patients with in-hospital postoperative complications had lower scores in physical functioning (42.8 versus 53.2; $P = 0.04$), role physical (26.6 versus 45.3; $P = 0.0078$), role emotional (45.7 versus 63.2; $P = 0.025$), and mental health (66 versus 74; $P = 0.024$) (Fig. 1). In contrast, patients without in-hospital complications scored significantly higher in vitality (60.3 versus 50.1; $P < 0.00001$) and general health (62.3 versus 56.7; $P = 0.0083$) than the age-matched US population. The only exception was for role physical

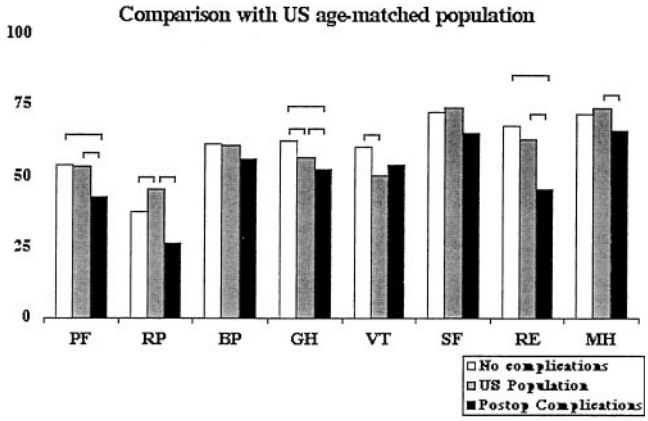

Figure 1. The total mean Medical Outcome Study Short form 36 (SF-36) scores for the United States age-matched population are compared with those from patients with no complications and those with postoperative complications. The eight domains are described on the horizontal axis, and the number on the vertical axis represents the mean SF-36 scores. PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role emotional; MH, mental health; Postop, postoperative. Brackets represent significant differences. See text for additional details.

score, which was lower than that for the US population (37.5 versus 45.3; $P = 0.048$).

Functional status results are summarized in Table 3. Overall, most of the patients who responded could independently perform ADL and IADL. Patients who had in-hospital postoperative complications were less likely to independently perform these tasks compared with those without complications (bathing, dressing, moving around, shopping, preparing meals, and doing housework) (Table 3).

The mean SF-36 scores of patients with in-hospital postoperative complications were lower than those without complications in the following domains: physical functioning (42.8 versus 53.9; $P = 0.029$), general health (52.3 versus 62.3; $P = 0.02$), and role emotional (45.7 versus 67.9; $P = 0.00058$) (Fig. 1).

To evaluate the relative importance of the various clinical factors on influencing quality-of-life measurements, we performed additional analysis to determine the independent predictors of poor quality of life (lowest quartile on the total mean score of the SF-36 measurement). In the final model, only a history of diabetes (OR, 4.2; 95% CI, 1.7–10.3; $P < 0.002$) and new hospitalization because of medical reasons (OR, 3.8; 95% CI, 1.6–8.8; $P < 0.002$) were significant independent predictors of long-term decrease in quality of life after a major surgical procedure.

Similarly, by multivariate logistic regression analyses, the independent predictors of dependency in at least one domain in ADL included a history of diabetes (OR, 13.4; 95% CI, 2.7–66.4; $P = 0.001$), a history of congestive heart failure (OR, 6.4; 95% CI, 1.1–37.3; $P = 0.040$), and age (OR, 1.2; 95% CI, 1.02–1.4; $P = 0.019$).

Table 3. The Impact of Postoperative Complications on ADL and IADL

	Estimates (odds ratio [OR]) of differences on dependency on ADL and IADL between patients with and without postoperative complications			
Activities type	Percent of patients who can independently perform	OR	95% CI	*P*-value
Bathing	85.8	2.3	1.0–5.2	0.041
Dressing	88.9	2.8	1.2–6.6	0.016
Eating	94.2	2.0	0.7–6.4	0.24
Using toilet	92.7	2.7	1.0–7.4	0.05
Moving around	89.3	2.6	1.19–6.4	0.031
Telephoning	90.3	1.4	0.5–3.7	0.56
Shopping	73.5	2.3	1.2–4.6	0.018
Using transportation	73.2	1.7	0.9–3.5	0.12
Preparing meals	79.1	2.7	1.3–5.5	0.0068
Doing housework	72.8	2.2	1.1–4.3	0.026
Taking medications	88.7	2.3	0.9–5.4	0.069
Managing finances	79.1	1.5	0.70–3.2	0.31

ADL = activities of daily living; IADL = instrumental activities of daily living; CI = confidence interval.

The independent predictors of dependency in at least one domain in IADL included a history of neurological disease (OR, 6.4; 95% CI, 2.1–18.9; $P = 0.001$), new hospitalization during the 3-yr follow-up period (OR, 4.9; 95% CI, 1.4–16.9; $P = 0.012$), and age (OR, 1.1; 95% CI, 1.03–1.2; $P = 0.008$). The occurrence of in-hospital complications did not predict the decrease in functional status as measured by ADL or IADL.

Discussion

Our study of unselected geriatric surgical patients demonstrated that those with in-hospital postoperative complications had lower mean SF-36 scores as compared with those without complications. Furthermore, patients who had in-hospital postoperative complications were more likely to be dependent in several ADL and IADL. However, when controlling for other clinical factors, only co-morbid conditions, age, and new hospitalization after discharge predicted a decrease in quality of life and functional status on long-term follow-up.

Our findings of preoperative co-morbid conditions relating to a decrease in quality-of-life and functional status measurements are similar to those reported in nonsurgical studies. For example, Incalzi et al. (18) reported that cardiovascular and neoplastic diseases were related to poorer function at home one year after discharge from an acute care hospital in those ≥70 years old. Inouye et al. (19) found in medical patients aged ≥70 years that the presence of a decubitus ulcer, cognitive impairment, functional impairment, and low level of social activity at the time of hospitalization were related to functional decline. Among the co-morbid conditions, diabetes mellitus, in particular, has been found to adversely influence the quality of life in both cardiac surgical patients (7) and also in a population study (20) similar to our current findings. The latter report, which was part of the MacArthur Studies of Successful Aging, found that hospitalizations during follow-up among other conditions were associated with declines in physical performance, as also reported in our study.

Whether sex has an impact on influencing postoperative long-term quality of life is more controversial. Our study agrees with the report by Mor et al. (21), a study of Medicare claims, which found that sex did not influence changes in physical functioning when adjusting for the initial disability and competing risks. In contrast, there are other studies that reported female sex to be an important risk factor for long-term quality of life (7). It is likely that sex may be a surrogate marker and becomes less important when other competing clinical conditions are being measured and controlled for.

Our study revealed pain as another potential health-related issue worthy of further investigation. In our study, despite a majority of patients (71.3%) rating their general health to be good to excellent, a moderate proportion (45.8%) reported that they have moderate to very severe bodily pain, and 41.7% thought the pain interfered with their activities from a moderate to extreme fashion. Our finding agrees with the report by Mangione et al. (22) who reported that in a group of elderly patients undergoing elective noncardiac surgery, their overall health perception did not correlate with role function and pain scores, the latter being worse in the older subjects. These results suggest that health status measurements in the elderly are complex and worthy of further investigation.

Our survey did not investigate the origin (surgical versus nonsurgical), chronology, or pattern of the perceived pain, and there is little information to allow a comparison of our results with studies of nonselected geriatric patients who have undergone noncardiac surgery. Because a substantial proportion of patients indicated that pain significantly interfered with their activities, longitudinal studies with pain as the predominant focus of attention including the determination of whether these individuals receive adequate pain management are required. Quality of life and functional status will likely be affected if pain remains an important component contributing to the disability of the elderly population.

There are several potential study limitations that should be taken into consideration when interpreting our results. First, data missing from the patients

who were lost to follow-up may have biased the findings. Although the proportion of patients lost to follow-up was relatively small in our study (25.2%), it is possible that those who were less functional were less likely to respond to our survey. As a result, our study may have underestimated the prevalence of a decrease in quality of life and functional status and possibly the impact of postoperative complications on these measurements.

Second, because the study was conducted at two to three years after surgery, no information on early postdischarge data was available. Studies of patients who have undergone total hip replacement or radical prostatectomy reported that the average recovery time back to baseline health-related quality of life was three to six months (6,23). As a result, the possible association of postoperative complications with decrease in quality of life measurements may have been stronger if early postdischarge data had been available. Furthermore, there are limits to making long-term predictions of a dynamic process such as quality of life and functional status (24). Studies in nonsurgical geriatric patients found that prediction of short-term functional outcomes was more reliable than prediction of long-term outcomes (24). Patients with short-term functional and quality-of-life deterioration may be less likely to survive and be counted during long-term follow-up. This possibility is supported by our data on survival demonstrating that in-hospital nonfatal postoperative complications adversely affect the postdischarge survival, particularly in the first three postoperative months (8). Therefore, our data are applicable only to patients who survived and for whom functional and quality-of-life data were available.

Third, we chose a self-administered questionnaire as the survey method. Patients who could not read or write for either educational, cultural, or health reasons were excluded. We corrected for this limitation, in part, by using a proxy response and follow-up phone calls.

We conclude that for geriatric patients who survived their initial noncardiac surgery, the occurrence of nonfatal in-hospital postoperative complications was less important than preoperative co-morbid conditions, age, and new hospitalization after discharge in impacting long-term quality of life and functional status. Future studies should focus on whether in-hospital postoperative complications more adversely affect short-term quality of life and functional status after surgery.

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