Surgery at the End of Life

A Pilot Study Comparing Decedents and Survivors at a Tertiary Care Center

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ABSTRACT

Background: More than a quarter of medical costs for Medicare beneficiaries are incurred in the last year of life; surgical intensity during this time is significant. This study was performed to determine types of operations patients undergo in their terminal year, and compare characteristics of decedents with those of survivors.

Methods: Population of 747 consecutive all-payer patients seen at the preoperative assessment center of a tertiary care hospital. Patient characteristics were obtained from the electronic medical record. Surgical indication (palliative, curative, diagnostic, elective) was assessed based on procedure performed and underlying diagnosis. Vital status was determined using the electronic medical record with confirmation *via* social security national death master file. Descriptive statistics were performed to compare patient characteristics and procedures performed on those who died within 1 yr of procedure with those of survivors.

Results: Thirty-seven patients (5%) were confirmed dead at 1 yr. Ten (27%) of these had palliative procedures, 11 (30%) diagnostic, 14 (38%) curative, and 2 (5%) elective. Decedents were more likely to have undergone a palliative (27 *vs.* 3%) or diagnostic (30 *vs.* 14%) procedure and less likely to have undergone an elective procedure (5 *vs.* 42%) than survivors ($P < 0.0001$). Nearly half of decedents did not have an advanced directive by the date of surgical intervention.

Conclusions: Nearly 1 in 20 patients seen at the preoperative assessment clinic of a tertiary care hospital died within 1 yr of their procedure. Patient characteristics and procedure indication for decedents differed from those of survivors. Similar analyses based on institution and region may provide methodologies to compare variation in surgical intensity and assist preoperative care providers in evaluating appropriateness of resource allocation.

What We Already Know about This Topic

- More than a quarter of medical costs for Medicare beneficiaries are incurred in the last year of life
- Although inpatient surgery is common in the terminal year of this population, whether this is true for outpatient surgery and the characteristics of procedures in decedents are unknown

What This Article Tells Us That Is New

- In 747 consecutive all-payer patients seen at a preoperative assessment center, 5% were dead within 1 yr
- Compared with survivors, decedents were more likely to undergo palliative or diagnostic rather than elective procedures

SURGICAL intensity at the end of life is significant. Among Medicare beneficiaries who died in 2008, 31.9% underwent inpatient surgical procedures during the final year of life.[1] In 1985, 17.8% of Medicare patients underwent an intensive procedure in their terminal admission, increasing to 30.3% by 1999.[2]

From the retrospective study of Medicare claims data, we know that spending in the last year of life accounts for more than 25% of Medicare expenditures,[3,4] and decedents, *per capita*, are six times as expensive as survivors.[5] Decedent cost has remained a stable percentage of total Medicare expenditure. Because total spending has increased with

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time, decedent cost has risen as well.[5] Although the cost of medical care at the end of life has been established, the intensity of surgical care performed during this period has only recently been described. The appropriate use of these surgical resources is under debate.

A report using administrative data from the Medicare database on surgical care in the last year of life determined that the rate of surgical intervention varies with patient age and geographical region.[1] Regional variation for surgical intervention has been demonstrated elsewhere in nonmoribund Medicare beneficiaries. In elderly patients with proximal humerus fractures, operative intervention including both open reduction internal fixation and hemiarthroplasty increased in incidence between 1999 and 2005 despite the stable incidence of proximal humerus fracture and controversy regarding the optimal treatment of these injuries. Furthermore, the proportion of patients with operative intervention varied by region.[6] Medicare spending in the last year of life and aggressiveness of medical treatment varies with age, particularly in patients who are more than 85 years of age.[7] This variation raises the question of differential healthcare provider decision making regarding which invasive interventions are deemed appropriate at the end of life and which are not.

Although two studies have sought to examine the intensity of inpatient surgical treatment at the end of life,[1,2] we know of no study that (1) includes both inpatient and outpatient procedures and (2) does not limit the study to Medicare beneficiaries. In addition, existing studies fail to fully characterize the types of procedures patients undergo at the end of life. If patients in their last year undergo palliative operations, there may be less of a question as to whether the intervention is appropriate. However, if the operations performed are primarily elective, appropriateness may be a matter of debate. Whether any single procedure is appropriate depends on consideration of not only surgical indications but also the complete social and medical context for that particular patient. In addition, the appropriateness of the procedure must also consider whether the goals of surgery are in concordance with the patient's goals.

Our study was undertaken to better understand the types of scheduled procedures patients undergo in the final year of life as well as to better understand the types of patients evaluated in the presurgical clinic, who died within 1 yr of their procedure. Unlike previous studies, our study used an all-payer nonadministrative database that included detailed information on types of surgery performed.

Materials and Methods

Population

Approval was obtained from the Partners Institutional Review Board, Boston, Massachusetts, with a waiver of a requirement for individual informed consent (Protocol Approval/Activation 2011-P-002182/1; Brigham and Women's Hospital). We studied 747 consecutive patients seen at the preoperative assessment center of our tertiary care hospital during a 1-month period (September 2010). Data were collected in the months of November and December 2011. This preoperative clinic sees approximately 90% of the patients scheduled to undergo procedures in our institution's operating rooms. All patients were scheduled for inpatient or outpatient procedures, interventional procedures outside of the operating room suite, or diagnostic procedures such as endoscopy and magnetic resonance imaging. There were no exclusion criteria for the study, and each person seen in clinic during the time period studied was included for further evaluation.

Data Collection

We obtained basic demographic information from the preoperative assessment center's patient tracking system, including age, sex, date of intervention, underlying diagnosis, and procedure to be performed. Medical record numbers were then used to look up each patient on the hospital's electronic longitudinal medical record to obtain more complete information. Surgical risk for all patients was assigned based on the accepted American College of Cardiology/American Heart Association definition of low-, intermediate-, and high-risk surgery.[8] Cardiac surgical procedures were assigned as high risk. Surgical classification (palliative, curative, diagnostic, or elective) was assessed based on the procedure performed, and the underlying diagnosis by consensus from two members of study staff (Drs. Barnet and Bader). If there was no consensus as to the assignment of surgical classification, a discussion took place between the two reviewers to reach a conclusion; this was sufficient to resolve all disagreements in assignment. Definitions used for these four surgical categories were created by study staff and can be seen in figure 1. Each procedure was assigned to one of the four classifications.

Additional in-depth information was collected on the decedents, including length of stay after operation, number of hospital readmissions, and American Society of Anesthesiologists status. This information was also collected for a sample of 120 consecutive survivors (approximately three times the number of decedents) to have increased power for comparisons given the relative scarcity of decedents (the ability to collect this in-depth information for all 747 patients was limited by resource constraints, as all data were collected by physician reviewers rather than from administrative data sets).

Assignment of Vital Status

The electronic longitudinal medical record (November to December, 2011) and the social security death master file (ssdmf.com, queries performed December 18 and 19, 2011) were used to assess whether the patient was alive or dead. A patient with encounters recorded at our institution more than 1 yr after the date of intervention was considered alive. If not seen here, and no death recorded in our system, the

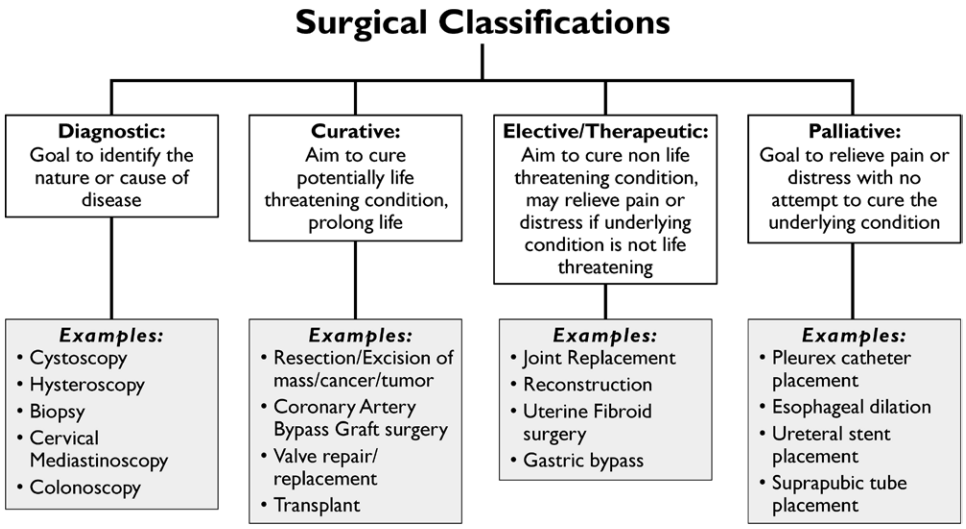

Fig. 1. Classifications of surgeries performed in the final year of life with examples of each.

patient was cross referenced using a social security number with the social security national death master file.

Statistical Analysis

Descriptive statistics were performed to compare the characteristics of those who died within 1 yr of their procedure with the rest of the patient sample. A convenience subset of 120 consecutive survivors was used for a more detailed analysis of a small subset of data. *t* Tests were used to compare means for normally distributed continuous variables and Wilcoxon rank sum tests for continuous variables that were not normally distributed. Fisher exact tests were used to compare the binary and categorical data. All *P* values were two-sided, and *P* values less than 0.05 were considered statistically significant. All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC).

Results

The population consisted of 747 consecutive patients who were seen at the preoperative assessment center of our tertiary care hospital during September 2010. Demographic information for the study population is listed in table 1. Mean age of study population was 59.6 yr. Sixty-eight percent of study participants were women, which reflects the large volume of gynecology service at our hospital (17.5% rate of gynecologic procedures for all comers during the study period). The majority of interventions performed were of intermediate surgical risk. Overall, most patients underwent either elective (41%) or curative (40%) procedures. Fifteen percent of patients underwent diagnostic procedures and only 4.6% palliative.

Of 747 patients included in the study, 37 were confirmed dead at 365 days after surgery (5%). The median time to death was 208 days [interquartile range: 125–302 days]. A total of 263 patients had to be cross-referenced with the social security death master file because vitality information was absent from the electronic medical record. We were unable to obtain vitality status of nine patients. The comparisons of patient characteristics of survivors and decedents are included in tables 2 and 3. Those who died were older than survivors (68.4 *vs.* 59.2 yr; $P = 0.0002$). Decedents were 51% men and 49% women. Surgical risk profiles for the two groups were not distinct ($P = 0.918$). However, the indication for surgery was different. Decedents underwent more palliative (27 *vs.* 3%) and diagnostic (30 *vs.* 14%) procedures and less elective surgery (5 *vs.* 42%) as compared with survivors ($P < 0.0001$). Decedents were more likely than a consecutive series of survivors (convenience sample of 120 survivors) to have a higher American Society

Table 1. Demographic Characteristics of Patients

Number, N	747
Age in years (mean ± SD)	59.6 ± 14.5
Sex, N (%)	
Men	240 (32.1)
Women	507 (67.9)
Surgical risk, N (%)	
Low	204 (27.3%)
Intermediate	498 (66.7%)
High	45 (6.0%)
Surgical procedure type (top five procedure types, by percentage, are shown)	
Gynecologic	17.5
General	15.3
Orthopedic	15.4
Thoracic	11
Urologic	9.1
Indication, N (%)	
Diagnostic	112 (15)
Curative	298 (39.9)
Elective	303 (40.6)
Palliative	34 (4.6)

of Anesthesiologists classification ($P < 0.0001$) and more readmissions ($P < 0.0001$). Fifty-four percent of decedents had an advanced directive (healthcare proxy or living will) on the date of procedure. Of these, only seven (19%) had a living will.

Discussion

Nearly 1 in 20 patients seen in this tertiary care hospital's preoperative assessment center over a 1-month period died within 1 yr of the date of their procedure. The preoperative assessment center evaluates patients having day surgery, patients being admitted to the hospital after surgery, and patients who are having procedures with anesthesia outside the operating-room areas. The preoperative clinic does not evaluate patients who go directly to the operating room as emergency cases or those who are already admitted to the hospital before the date of procedures. One might predict that the percentage of deaths would have been higher if these two groups had been included.

We found that decedents had a different profile of procedure type and surgical classification than that of survivors. A third of the patients who died underwent palliative procedures, and another third of patients underwent diagnostic procedures. Decedents underwent a lower percentage of elective procedures than survivors (5 *vs.* 42%). Discerning the types of procedures (elective, diagnostic, palliative, or curative) patients undergo in the last year of life is particularly important in understanding decision making and resource allocation, particularly if these data can be used to understand demonstrated regional variation in surgical intensity. It would be hard to argue that a palliative procedure is an inappropriate use of surgical resources if it is aligned with the patient's healthcare goals. Similarly, patients who undergo diagnostic procedures may not be aware of their terminal diagnosis at the time of intervention. Perhaps decisional differences result in the wish to avoid elective procedures in patients who have significantly reduced life expectancy and may not reach the time period required to achieve benefit from these procedures. Patients and providers need to have complete and honest discussions about patient risk factors, surgical risk factors, and both operative and nonoperative options at the time of surgical decision making.

Nearly half of decedents in our study did not have advanced care directives at the time of intervention. Previous publications addressing invasive interventions at the end of life[1,2] do not describe data on patient preparedness for surgery. Previous data on patients planning to have high-risk procedures indicates that patients may not be adequately informed or prepared.[9] In a study of preoperative clinic patients, half of those scheduled for an intensive care unit admission postprocedure were not aware of this fact. Approximately half the patients in that study did not have an advanced directive, a similar number to that found among decedents in our study. A significant number of patients reported feeling conflicted about the decision to have surgery.[9]

Table 2. Patient Characteristics by Vital Status with Comparison

Number, N	Survivors (N = 701)		Decedents (N = 37)		*P* Value*
Age in years (mean ± SD)	59.2 ± 14.5		68.4 ± 11.7		0.0002
Sex, N (%)					0.018
Men	219 (31.2)		19 (51.4)		
Women	482 (68.7)		18 (48.7)		
Surgical risk, N (%)					0.918
Low	190 (27.1)		11 (29.7)		
Intermediate	468 (66.8)		24 (64.9)		
High	43 (6.1)		2 (5.4)		
Surgical procedure type (top five procedure types, by percentage, are shown)	Gynecologic	18	Thoracic	48.7	<0.0001
	General	15.8	Urologic	13.5	
	Orthopedic	14.1	Oncologic	10.8	
	Thoracic	9.1	Otolaryngology	10.8	
	Urologic	9	Neurosurgical	5.4	
			General	5.4	
Indication, N (%)					<0.0001
Diagnostic	99 (14.1)		11 (29.7)		
Curative	281 (40.1)		14 (37.8)		
Elective	297 (42.4)		2 (5.4)		
Palliative	24 (3.4)		10 (27)		

* *P* values comparing decedents with survivors. All *P* values are two-sided. *t* tests were used to compare means, and Fisher exact tests were used to compare the binary and categorical data.

Table 3. Additional Comparison of Decedents with a Consecutive Sample of 120 Survivors

	Survivors (n = 120)	Decedents (n = 37)	*P* Value*
Information on hospital stay			
Number of readmissions			<0.0001
0	97 (81%)	15 (41%)	
1	10 (8%)	9 (24%)	
2	5 (4%)	6 (16%)	
3	4 (3%)	2 (5%)	
4 or more	4 (4%)	5 (14%)	
Length of stay (median number of days); [IQR])	1; [0–4]	1; [0–4]	0.765
American Society of Anesthesiology classification			
1	10 (8%)	0 (0%)	<0.0001
2	66 (55%)	3 (8%)	
3	39 (33%)	32 (86%)	
4	5 (4%)	2 (5%)	

* *P* values comparing decedents with survivors. All *P* values are two-sided. Fisher exact tests were used to compare categorical data and the Wilcoxon rank sum test was used to compare length of stay (a length of stay of zero denotes that the patient was discharged on the day of the procedure).

IQR = interquartile range.

In patients with levels of illness severe enough to result in death during the year after their preoperative visit, ensuring adequate preprocedure discussion and documentation of patient wishes in the form of an advanced directive is critical. The potential inability to predict who would be in the decedent population at 1 yr underscores the importance of adequate discussions about patient goals and wishes in all patients. Perhaps a larger multiinstitutional study using a similar methodology as described here could tease out more information regarding what predictors exist for high likelihood of death at 1 yr. Of particular interest would be to use combinations of patient demographics, comorbidities, and functional limitations that are more highly associated with 1-yr mortality to better inform the shared decision-making process. In this way, patients can be appropriately counseled on risks and benefits not only as they pertain to the procedure, but also as they pertain to the patient's particular medical situation. The physician at the time of preoperative evaluation may have a unique opportunity to discuss the impact of all comorbidities and functional limitations on the risk of proposed intervention, as well as to ensure that discussions have occurred that address the alignment of surgical and patient goals.

The results of this study should be interpreted within the context of the study design. Our study was limited to scheduled procedures at one large academic tertiary care hospital over a 1-month period. Our patient population may be distinct from the populations seen at other institutions. Perhaps a higher percentage of patients seen at our institution (given multiple comorbidities, high acuity) will die within 1 yr as compared with patients at a community hospital. In addition, the differences we observed in sex for survivors *versus* decedents may reflect institution-specific variation. A different month may have yielded different results, particularly if our results reflected the availability of specific surgeons. However, there may be an advantage to the institutional specificity inherent in our results. Obtaining similar data from other institutions could provide a method for comparison of regional and institutional variation. Previous work demonstrated that some areas of the country have end-of-life surgical intensity three times higher than others.[1] Comparing the types of procedures done in higher– and lower–surgical-intensity areas could give insight into patterns of resource use. This could be an initial step in determining the reasons why regional variation exists. Institutions that are positive or negative outliers could be identified and studied to determine contributing factors. Institutions with similar acuity could be compared with each other. Institutions that specialize in specific types of surgery (*e.g.*, cancer centers) would be expected to be outliers by the nature of their patient populations but could also be compared.

Approximately 5% patients seen at the preoperative clinic of an all-payer tertiary care academic medical center died within a year of the date of their procedure. These patients had a different profile of procedure type and patient characteristics than survivors. The preoperative assessment may be an important time to leverage the expertise of the anesthesiologist in overall assessment of comorbidities, functional status, risk of proposed procedure, and alignment of patient and provider goals. Further research in this area could be useful to better identify predictors for patients who would benefit from a more detailed assessment. This could help guide appropriate use of resources and the development of interventions to help preoperative providers ensure higher-quality shared decision making.

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De la Fuÿe's *L'acupuncture chinoise sans mystère …*

The son of a French army general who had served in Indochina, Dr. Roger de la Fuÿe (1890–1961) founded both the Société française de l'acupuncture (1943) and the Société internationale de l'acupuncture (1946). In 1947 he published the first edition of his text *L'acupuncture chinoise sans mystère; traité d'acupuncture et de l'homéopathie l'homéosiniatrie diathermique*. Beginning at 1 a.m. and linked to each day's successive 2-hour intervals, the 12 classic meridians are depicted (*right*) in that classic by de la Fuÿe as correlated to the liver, lung, large intestine, stomach, spleen, heart, small intestine, bladder, kidney, pericardium, triple heater, and gall bladder, respectively. De la Fuÿe may be best known for laying the foundation for others' claims that acupuncture points are associated with lower electrical resistance—a concept that only some follow-up studies have supported. (Copyright © the American Society of Anesthesiologists, Inc.)

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