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Can the Cost of Distal Vascular Reconstruction be Reduced Without Sacrificing Quality? Analysis of 500 Cases

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ABSTRACT

The goal of clinical pathways is to reduce the cost of the hospitalization while maintaining acceptable results (patency, morbidity, and mortality). Patients who present with lower extremity revascularization pose a difficult problem, for they have significant comorbid medical disease. In this study the authors analyze their results and the treatment cost for patients undergoing lower extremity revascularization before and after the institution of clinical pathways.

Data were collected independently by the hospital financial office, and surgical outcomes were derived from the prospectively collected computerized vascular registry. Data were analyzed for 12 months before and after institution of pathways. Cost, length of stay (LOS), and use of ancillary service as well as mortality, morbidity, and patency rates were evaluated. During each period, patients were selectively admitted to the intensive care unit based on perioperative risk factors independent of the pathway.

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(Abstract continued)

Three hundred ninety-nine patients with distal reconstructions were placed on the path during this time period. These were compared to a group of 286 patients who were not on the path in the year prior. The LOS decreased from 14.3 days to 9.2 days. Electrolyte laboratory panels decreased from 12 draws per patient per admission to two draws per patient per admission. This trend was also seen in complete blood count (11.8 to 6.8), glucose (12.6 to 2.1), and electrolytes (12.2 to 1.8). Perioperative mortality rates were similar (2.5% vs 1.9%) with no change in morbidity rates. Total cost for hospitalization decreased by 27% after institution of the clinical pathway.

From these data, the authors can demonstrate that the institution of clinical pathways not only decreased total cost, use of ancillary laboratory tests, and LOS but also did not negatively impact on outcome.

Introduction

In order to provide optimal care, systems must be developed that are effective, efficient, and easily implemented. Consumers, insurance companies, and government scrutinize health care dollars; consequently, changes have occurred during the past decades shaping the health care delivery system to reduce excess costs. However, the public is also coming to the realization that cheaper is not necessarily better. We are a nation with a split personality faced with a paradox choosing between cheaper and better.

In the midst of this tension, our institution established clinical pathways in order to minimize cost while maintaining quality-reviewed outcomes. Others are engaging in the same process as well.[1] The focus is the overall reduction in cost without sacrificing quality of care. The success of such projects necessitates the development of pathways that make sense to the caregivers, are easy to implement, and maintain the best interest of the patient.

We initiated clinical pathways for patients who presented for lower extremity revascularization in 1997. The goal of the pathway was to conduct an optimal sequence of diagnosis and treatment interventions, increase efficiency, and standardize quality of care. In this study, we analyze our experience before and after the institution of clinical pathways for this patient population and evaluate the effect of the pathways on outcome, safety, and cost of hospitalization.

Patients and Methods

From 1996 to 1998, data were collected independently by the hospital financial office, and surgical outcomes were derived from our prospectively maintained computerized vascular registry. The clinical pathway is described in detail in Table I. Cost, length of stay (LOS), use of ancillary services, outcomes, and patency were evaluated in the 12-month period before and after institution of the pathway. During each grouping, patients were only selectively admitted to the intensive care unit based on perioperative risk factors independent of the pathway. Financial analysis was conducted with the Transition Systems, Inc. (TSI) cost accounting system. Statistical analysis was performed with Fisher's Exact Test and Student's t test assuming significance for $p < 0.05$.

Results

Three hundred ninety-nine patients undergoing distal reconstructions entered a clinical pathway in 1997 compared to a group of 286 in 1996. Table II presents the demographics of the study populations with corresponding p values. Distribution is similar as far as gender, diabetes, smoking, and age, except more patients had coronary artery disease postpathway (72% vs 65%,

Table I

Pathway Model

Begins at surgery	Transfer patient to floor
POD #1	Ambulation, D/C Foley, diet, education
POD #2	Oral pain med, D/C IV, dressing, patient evaluation
POD #3	Discharge evaluation, wound care
POD #4	Nutrition education, orders, transportation
POD #5	Hospital discharge
Discharge criteria:	Afebrile with stable vital signs, safe ambulation, adequate PO, teaching, prescriptions, and follow-up in 2 weeks

Table II

Demographics

	Prepathway n=365	Postpathway n=428	p Value
Males	58%	64%	0.08
Diabetics	53%	54%	0.78
Smokers	38%	36%	0.56
CAD	65%	72%	0.03
Mean age	68	72	
Age range	7–97	25–95	

$p = 0.03$). Indications for operation are listed in Table III. The numbers of patients undergoing revascularization for limb-threatening ischemia were not different (84% vs 80%, $p = 0.15$). The distribution of outflow arteries before and after pathway is listed in Table IV with no significant difference. Perioperative mortality rate was 2.5% prepathway and 1.9% postpathway ($p = 0.56$). No difference in complication rates was identified (Table V). Outcomes are listed in Table VI. Patency (primary and secondary), limb salvage, and cumulative survival rates demonstrated no difference before and after pathway.

Resource utilization is listed in Table VII. The average number of tests per admission was significantly lowered in all tests analyzed. Electro-

Table III

Indications for Operation

	Prepathway	Postpathway	p Value
Limb-threatening ischemia	84%	80%	0.15
Rest pain	26%	22%	0.19
Gangrene	21%	13%	0.003
Ulcer	37%	45%	0.03
Claudication	11%	17%	0.02
Other	5%	3%	0.15

Table IV

Outflow

	Prepathway	Postpathway	p Value
Above-knee popliteal	19%	24%	0.09
Below-knee popliteal	20%	16%	0.14
Tibial	61%	60%	0.77
Dorsalis pedis	7%	10%	0.13

lyte laboratory panels decreased from 12 draws per admission to two draws. Complete blood count (CBC) and glucose draws averaged 11.8 and 12.6 draws per admission, respectively, prepathway, and 6.8 and 2.1, respectively, postpathway. LOS significantly decreased from 14.3 days to 9.2 days ($p < 0.05$). This contributed to lowering hospitalization cost as calculated by TSI from a prepathway cost of \$16,846 ±1,188 to a postpathway cost of \$12,232 ±844 ($p < 0.0001$). Translated, total cost for hospitalization decreased by 27%. Sixty-three percent of all patients met pathway criteria (LOS ≤ 5 days) with an average LOS of 4.63 days. The remaining 37% of patients did not meet the pathway and had an average LOS of 12.8 days. Unfortunately, prepathway disposition was unavailable, but postpathway analysis revealed that 41% went home with no services, 38% went home with a home health aide, 10% were placed in a rehabilitation facility, 7% were transferred to a nursing home, and 4% had some combination of these dispositions.

Table V

Morbidity

	Prepathway	Postpathway	p Value
Mortality rate	2.5%	1.9%	0.56
Bleeding	4%	4%	1.00
Wound infection	5%	4%	0.50
Graft infection	1%	1%	1.00
Cardiac	1%	1%	1.00
Stroke	0.5%	0%	0.14
Renal	0%	0.5%	0.18

Table VI

Outcomes

	Prepathway	Postpathway	p Value
Primary patency			
1 Year	83%	78%	0.08
3 Year	67%	62%	0.14
Secondary patency			
1 Year	87%	83%	0.12
3 Year	77%	71%	0.06
Limb salvage			
1 Year	90%	91%	0.63
3 Year	84%	81%	0.27
Cumulative survival			
3 Year	84%	81%	0.27

Table VII

Resource Utilization

Average No. of Tests per Admission	Prepathway	Postpathway	p Value
Electrolytes	12.2 ±6.4	1.8 ±.8	<0.05
Glucose	12.6 ±5.8	2.1 ±.7	<0.05
CBC	11.8 ±4.6	6.8 ±1.3	<0.05
Length of stay (LOS)	14.3 ±8.8 days	9.2 ±3.4 days	<0.05
Total cost	$16,846 ±1,188	$12,232 ±844	<0.0001

Discussion

Health care costs are perpetually rising: $300 billion was spent on U.S. hospital care in 1993 compared to $100 billion in 1980; $170 billion was spent on physician services compared to $45 billion in the same respective periods; $750 billion was the total expenditure on national health in 1991 compared to $27 billion in 1960, an increase from 5.3 to 13.2 as a percent of Gross Domestic Product.[2] National life expectancy is on the rise.[3,4] The population is growing, and medical technology is advancing exponentially to meet the needs of this aging population. A plateau in the growth of health care costs is not within sight.

Health Maintenance Organizations and other hybrid forms of health insurance structures are evolving as our society has become increasingly intolerant of the spiraling rise in medical care expenses. Consequently, these institutions are perpetually trying to cut reimbursements. Some deny procedure coverage while others employ sophisticated tactics in reducing expenses. One cost-saving measure involves placement of low-cost patients to fee-for-service hospitals and high-cost patients to hospitals where reimbursement is contractually capped.[5] Consumers are, however, no longer passive about how their health is maintained and how their illnesses are treated. Consequently, the consumer market is a factor in health care. Institutions are evaluating policies and practices to save costs and improve outcome. Advances in technology may help sick patients get better sooner. An example is the decrease in LOS in cardiovascular patients owing to better technologies.[6] However, this can be a two-edged sword since technology has a cost to acquire.

The art of infrainguinal arterial reconstruction has evolved over the past few decades. The success of these procedures is measured by maintenance of primary and secondary patency rates and quality of life. Our institution is an example. One study demonstrated a primary patency rate of 55% at 10 years, secondary patency rate of 70% out to 10 years, and limb salvage rate of 90% at 10 years in a 2,058-case analysis.[7] Different methods of performing leg bypass surgery have been extensively evaluated. A study examining 5-year patency rates at our institution revealed that in-situ bypass yields a patency rate of 80%, free vein graft of 70%, and synthetic material of 33%.[8] Aside from type, the length of infrainguinal bypass has been studied. Long vein reconstructions from groin to ankle are procedures effective in bypassing all occlusive disease and maintaining perfusion to the lower extremity.[9] Data additionally support the effectiveness of distal bypass from 1989 to 1998 in a cohort of 629 octogenarians. These elderly patients were comparable to a younger cohort of 3,257 patients during the same

period demonstrating age should not be a contraindication to distal bypass surgery.[10]

The next step is in efficiency. Integrated care pathways (ICP) for elective vascular procedures have produced good outcomes. A 12-month prospective study on abdominal aortic aneurysm repair, carotid endarterectomy, and femoropopliteal bypass grafting with patient care in ICP indicates benefit in specific situations such as high throughput and high-cost procedures. The authors state that success relied on "clinical champions," effective management, sufficient resources, and training.[11] Another paper addressing the cost/quality paradox studied 1,524 patients and concluded that clinical pathways for cerebral revascularization and femoral revascularization produced a reduction in total hospital cost from $7,223 to $4,490 (37.8%) and $14,332 to $5,541 (59%), respectively without an increase in morbidity or mortality rates.[12] Other studies realized decreased hospital cost and LOS after ICP institution.[1] Simple changes in anesthesia and extubation practices reduce hospital stay and associated complications in cardiac surgery.[13-15]

Numerous ICPs are available and utilized. They modify clinical practice by addressing issues of preoperative conditions, postoperative care in the hospital, and the use of other care providers such as nurse practitioners, dedicated units, rehabilitation units, and home care.[16] One study reviewed 284 patients who underwent vascular surgery and the cost savings made possible by changing postoperative clinical practices.[17] An estimated $1.25 million was saved when compared to standard Medicare reimbursement. Favorable factors identified included outpatient arteriography, same-day admission, early ambulation, physical therapy, home care, use of intensive care units on a selective basis, and early discharge. Unfavorable factors were emergency admission, inpatient arteriography, thrombolytic therapy, complications, dialysis, and anticoagulation. Another study indicates that the cost savings realized in their analysis may have been due to the discharge of patients to intermediate-care facilities.[18] If a patient needed long-term hospitalization, there was no reduction in cost. Studies such as the one from Taheri demonstrate how complicated it is to undertake this task of cost reduction and how elusive implementation remains.[19] The issues that still remain include the following: Are these pathways actually reducing costs and not simply a shift in cost accounting? How easy are they to implement? Are there hidden costs involved in retooling, retraining, and managing the ICP?

Our pathway was set up to eliminate unnecessary laboratory tests and ensure that the patient does not stay in the hospital longer than necessary. Longer LOS has been associated with an increase in morbidity and mortality rates (especially due to infections).[20] The pathway as described above lays out a course of care and discharge for the patient. The plan is simple, easy to implement, and reproducible.

Cost control and quality care are not mutually exclusive. Once quality of care has been established, the system can be examined and streamlined to find ways to make it more efficient. ICP that reduces LOS without increasing mortality and morbidity rates is beneficial to the patient and to society. Our study shows no statistical difference in the outcome of the patient before and after the pathway. There is, however, a dramatic 27% decrease in cost from prepathway to postpathway. There is much room to institute simple modifications that can make large differences in the way we spend health care dollars. More complex pathways that involve elaborate implementation strategies can also be prioritized and put into practice to continue the process of saving costs.

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