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An Economic Comparison of Enoxaparin and Warfarin in the Prevention of Deep Vein Thrombosis after Hip and Knee Replacement

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ABSTRACT

Background and Objective: Deep vein thrombosis is a common complication in patients who have undergone hip and knee surgery. It is the principal cause of pulmonary embolism, which can result in death. This study was undertaken to compare the costs associated with enoxaparin and standard warfarin therapy in cases of hip and knee arthroplasty.

Methods: This empiric cost comparison was based on patient-specific nursing workload, drug utilization, and diagnostic testing during the postoperative hospital stay. Multiple regression analysis was used to determine the impact of enoxaparin therapy on the cost per patient.

Results: The expected cost for a patient without symptomatic deep vein thrombosis or comorbid conditions who underwent hip surgery and received enoxaparin was $1,244; this cost was $312 less than for a similar patient who received warfarin. The relationship was reversed for patients undergoing knee surgery: the expected cost per patient was $315 less for those receiving warfarin. Treating deep vein thrombosis and comorbid conditions added $2,438 and $455 respectively to hospital costs, irrespective of whether hip or knee surgery was performed.

Conclusions: Enoxaparin anticoagulant therapy may yield economic benefits beyond the avoidance of deep vein thrombosis and pulmonary embolism. Hospital costs after hip surgery may be lower, primarily related to the use of nursing resources, even for patients who do not experience deep vein thrombosis.

Key words: deep vein thrombosis, cost analysis, enoxaparin, warfarin

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RÉSUMÉ

Généralités et objectif : La thrombose veineuse profonde est une complication courante chez les patients qui subissent une chirurgie de la hanche ou du genou. Elle est la cause principale de l'embolie pulmonaire qui peut entraîner la mort. Cette étude a été menée pour comparer les coûts associés au traitement à l'énoxaparine et au traitement standard à la warfarine dans les cas d'arthroplastie de la hanche et du genou.

Méthodes : Cette étude empirique de comparaison des coûts a évalué les données relatives à la charge de travail du personnel infirmier, aux épreuves diagnostiques et à l'utilisation des médicaments durant le séjour hospitalier postopératoire des patients ayant subi une arthroplastie de la hanche ou du genou. Une analyse de régression multiple a servi à déterminer l'incidence du traitement à l'énoxaparine sur les coûts pour chaque patient.

Résultats : Les coûts prévus pour un patient sans thrombose veineuse profonde symptomatique ou comorbidité, ayant subi une chirurgie de la hanche et reçu de l'énoxaparine étaient de 1 244 $, soit 312 $ inférieurs à ceux d'un patient présentant un état semblable et ayant reçu de la warfarine. La relation était toutefois inverses pour les patients ayant subi une chirurgie du genou ; les coûts prévus étaient de 315 $ inférieurs pour ceux ayant reçu de la warfarine. Le traitement d'une thrombose veineuse profonde et d'une comorbidité ont fait augmenter les frais hospitaliers de 2 438 $ et de 455 $ respectivement, peu importe s'il s'agissait d'une chirurgie de la hanche ou du genou.

Conclusions : L'anticoagulothérapie à l'énoxaparine peut présenter un avantage économique, outre l'évitement de la thrombose veineuse profonde et l'embolie pulmonaire. Elle peut contribuer à réduire les frais hospitaliers suite à une chirurgie de la hanche, principalement par une charge de travail moindre pour le personnel infirmier, même dans le cas des patients qui ne souffrent pas de thrombose veineuse profonde.

Mots clés : thrombose veineuse profonde, analyse de coûts, énoxaparine, warfarine

INTRODUCTION

Venous thrombosis or deep vein thrombosis is a common complication in patients who have undergone hip or knee surgery and may result in pulmonary embolism, especially without prophylaxis.[1]

Development of deep vein thrombosis after knee replacement or revision appears to be slightly more frequent than after hip arthroplasty.[2] However, only about 20% of cases of deep vein thrombosis are symptomatic and treatable.[3] About 20% of the undetected thrombi progress to pulmonary embolism.[3] Typically, treatment of deep vein thrombosis extends a patient's length of stay (by about 1 week) or, if the patient is discharged home, he or she will require additional health care resources (e.g., patient education for drug self-administration, treatment drugs, and monitoring by health care providers). The development of pulmonary embolism may add another week to a patient's stay, at higher levels of care and cost.[4]

Low-molecular-weight derivatives of heparin (LMWH) have been developed to overcome the limitations of treatment with warfarin alone or in combination with unfractionated heparin. The advantages of LMWH include administration of fixed doses and less hematological monitoring.[5]

The objective of this study was to compare the costs of enoxaparin with those of warfarin and unfractionated heparin in the prevention of deep vein thrombosis, on the basis of patient-specific costs for nursing, drug utilization, and diagnostic testing. The cost of nursing care is based on a nursing workload measure that varies with patient needs as well as with length of stay and costs. It is sensitive to differences in the use of nursing resources between patients and therefore between treatments. This study was an empirical analysis, which is a departure from previously published decision analysis models.[1]

Literature Review

Anderson and O'Brien[6] reviewed 14 economic evaluation studies, published between 1980 and 1995, relating to the use of preventive therapy after hip replacement. The 10 studies that compared prophylaxis with no intervention concluded that preventive therapy was both effective and less costly than no intervention. Seven of the 14 studies, all conducted since 1993, compared LMWH with either warfarin, heparin, or dextran. Six of these studies concluded that LMWH was more effective than the comparator treatment. Two of the 14 studies[1,3] compared enoxaparin with warfarin through meta-analyses, since there were no clinical trials that directly compared LMWH and warfarin. Both studies found that enoxaparin therapy was more effective in preventing deep vein thrombosis and pulmonary embolism, and both also determined that enoxaparin therapy was more costly. A subsequent study[7] found the opposite, that LMWH products were less costly, but more effective in preventing deep vein thrombosis, than warfarin after knee replacement.

Research over the past decade has shown that LMWH is the most effective therapeutic agent for the prevention of deep vein thrombosis and pulmonary embolism over the duration of the hospital stay. However, a recent large clinical trial, directly comparing enoxaparin with warfarin, found that the initial benefit of enoxaparin was lost at 12 weeks after discharge from hospital.[8] At the final endpoint there was no significant difference in the rate of deep vein thrombosis between the enoxaparin and warfarin groups. (There were more bleeding events in the enoxaparin group, but the data collection tool was not sensitive enough to distinguish bleeding events induced by concurrent illness and those induced by the operative procedure.) A subsequent meta-analysis[9] of 3 clinical trials concluded that 12 weeks after discharge enoxaparin treatment was more costly than, but provided no significant clinical benefit over, warfarin.

METHODS

Study Design

The study was a nonrandomized controlled study, approximately concurrent, based on retrospective data collected through patient chart review and from administrative databases.[10] All treatments had been performed at one site, the University of Alberta Hospital, Edmonton, Alberta. The enoxaparin study group was selected consecutively on the basis of the inclusion and exclusion criteria described in the next section. A contemporary group of patients who received standard anticoagulation therapy, warfarin and unfractionated heparin prophylaxis, were selected as the control group. The control group was matched for the key attributes of age and type of procedure (hip or knee surgery).

The enoxaparin group (25 patients) received treatment from September 3 to October 10, 1994, as part of a previous cohort study. The matched control group of 62 patients received treatment from April 1, 1994, to January 17, 1995. A longer time period was required for the control group to achieve the group size needed to offset the small size of the enoxaparin group.

Inclusion and Exclusion Criteria

Only patients undergoing unilateral hip or knee arthroplasty (total replacement or revision) were eligible for inclusion in the study. Patients with one or more of the following conditions or characteristics were excluded: previous deep vein thrombosis or pulmonary embolism, current malignancy, participation in other studies of thromboprophylaxis after orthopedic surgery, scheduled for tibial osteotomy, heparin allergy, history of or active heparin-induced thrombocytopenia, systemic bleeding disorder, hemorrhagic stroke within the past 3 months, uncontrolled hypertension (diastolic blood pressure greater than 120 mm Hg and/or systolic blood pressure greater than 200 mm Hg), continuing need for oral anticoagulants, and pregnancy.

Perspective

The analysis was conducted from the perspective of the hospital. Costs included in the analysis related to direct operational costs from the date of surgery to the date of discharge. The cost data excluded capital-related expenditures (equipment and facilities) and physician fees. Direct costs and productivity losses (wages) of patients and caregivers were also excluded.

Treatment Comparators

The standard dosage of enoxaparin was 30 mg given by injection twice daily for 7 days or until discharge. Warfarin 5 mg was typically administered orally once a day until discharge, with some modification of dose on the basis of the patient's coagulation status. Heparin 5000 IU tid was frequently used in conjunction with warfarin.

Cost Measurement

Data on 3 resource categories were obtained on a patient-specific basis: nursing, medications, and diagnostic tests.

Nursing workload data, obtained from the University of Alberta Hospital nursing workload administrative database, were used to estimate total nursing hours per day for each patient. (See page 18 in O'Brien-Pallas and others[11] for a description of the method, relating to the Medicus nursing workload system, for estimating nursing hours from workload points.) The data relate to all nursing personnel involved in direct patient care (except nursing unit administration), primarily registered nurses, but also unit clerk and licensed practical nurse positions. We chose to focus on nursing costs because the workload data available were sensitive to differences between patients.

The medications administered to each patient were determined from a chart review; medications administered in the operating and recovery rooms were excluded.

Chart reviews were also used to collect data on the international normalized ratio (INR), partial thromboplastin time (PTT), blood gas analyses, venography, and ventilation–perfusion lung scanning. Hemoglobin and hematocrit laboratory tests and ultrasound imaging procedures were excluded, to avoid bias, since the protocol for these tests was not the same for the 2 study groups (the enoxaparin study group was part of a separate study, in which these tests were routinely administered).

Unit costs for all resources (shown in the final column of Appendix 1) were defined as direct operating costs, excluding overhead costs, as well as capital costs of equipment and buildings. Nursing unit costs (dollars per hour) are the average salaries and benefits of nursing personnel working in the orthopedic nursing units from April 1994 to January 1995. The cost of medical supplies (such as syringes and dressings) are not included. The drug costs reflect the acquisition costs at the time of the study, and exclude pharmacy dispensing and other administrative costs. Nursing time required to administer medication is included in the nursing costs.

The unit costs for laboratory testing and diagnostic imaging incorporated direct costs (wages, benefits, and supplies), including department administration and information system costs. Laboratory costs do not include the costs of collecting samples; however, collection done by nursing staff is reflected in nursing costs. It was assumed that venography procedures were unilateral.[1] Laboratory cost data were from 1994/95; the 1997/98 imaging data were assumed to reflect 1994/95 costs. (This assumption is based on the very low price inflation during the study period for both salaries and nonsalary inputs. The validity of this assumption was verified with the administrative director responsible for diagnostic imaging.)

RESULTS

Baseline Data

The key characteristics of the 2 study groups were similar at baseline (Table 1). As indicated by the *p* values, none of the characteristics was significantly different between the study groups. The age and sex of the study groups was nearly identical, the mean age being 67 years and the proportion of females about 60%. Approximately 65% of both groups underwent hip surgery. The type of procedure varied slightly between groups, 81% of the control (warfarin) group and 92% of

Table 1. Baseline Characteristics of Patients Who Received Enoxaparin or Warfarin as Prophylactic Therapy in Conjunction with Hip or Knee Arthroplasty

Variable	Treatment; No. (and %) of Patients*		*p* value
	Enoxaparin	Warfarin	
Sample size	25	62	
Age (years)			
Mean	67.2	67.3	0.9593
SD	10.2	9.1	
Range	48–82	46–80	
Sex			
Female	14 (56)	37 (60)	0.7560
Male	11 (44)	25 (40)	
Procedure			
Hip replacement	16 (64)	39 (63)	0.9246
Knee replacement	9 (36)	23 (37)	
Type of procedure			
Replacement	23 (92)	50 (81)	0.1964
Revision	2 (8)	12 (19)	
Pre-existing conditions†	8 (32)	16 (26)	0.5639

SD = standard deviation.
*Except where indicated otherwise.
†Preadmission comorbidity status, as identified in the discharge file.

Table 2. Average Costs of Treatment (Nursing, Medication, and Diagnostic Testing)*

Health Care Resource	Treatment Group; Average Cost per Patient ($)		Difference	*p* value
	Enoxaparin	Warfarin		
Nursing care	1,421	1,540	–119	0.4775
Medication				
Anticoagulation therapy	122	3	119	NA
Other medications	33	47	–14	0.3701
Diagnostic testing				
Laboratory	10	40	–30	0.0001
Imaging	16	7	9	0.4134
Average total cost	1,601	1,637	–36	0.8475
SD	892	731		

NA = not applicable, SD = standard deviation.
*Some totals may differ from the sums of components because of rounding.

the treatment (enoxaparin) group undergoing replacement. The enoxaparin group had a slightly higher proportion of pre-existing comorbid conditions. More details about the distribution of comorbid cases by procedure and study group is presented in Appendix 2.

Cost Analysis

Nursing was the largest cost component, constituting about 89% and 94% of the average total costs for the enoxaparin and warfarin study groups respectively (Table 2). Nursing costs for the warfarin group were $119 per patient greater than for the enoxaparin group, which exactly offset the greater medication costs for the latter. The wide disparity in acquisition cost between enoxaparin and warfarin is reflected in the average costs of anticoagulation therapy. The difference in the cost of other medications during the hospital stay was much smaller than for anticoagulation medication; on average, these costs were lower for the enoxaparin study group. Diagnostic testing costs constituted the smallest component of total costs. Ongoing laboratory testing for coagulation was more frequent for patients receiving warfarin therapy. Imaging costs were slightly higher for the enoxaparin group; the difference can be attributed to the lung scan that was performed for one patient in the enoxaparin group. Average total costs were nearly equivalent for the 2 study groups, and the small difference was not significant (unpaired *t*-test).

Table 3. Results of Linear Regression (with Cost per Patient as Dependent Variable)*

Independent Variable	Coefficient	SE	*p* value
Intercept	1556	100	<0.0001
Study group (enoxaparin = 1, warfarin = 0)	–312	175	0.0791
Procedure (knee = 1, hip = 0)	–311	157	0.0510
Interaction term (enoxaparin/knee = 1, other = 0)	627	291	0.0342
DVT (observed = 1, not observed = 0)	2438	361	<0.0001
Preadmission comorbidity (comorbidity = 1, other = 0)	455	144	0.0022

SE = standard error, DVT = deep vein thrombosis.
*n = 87, R^2 (adjusted) = 0.429.

The use of average costs in this analysis masks the relative effect of specific cost drivers. Therefore, we used a multiple linear regression model to control for confounding variables, namely comorbidity, and to distinguish between costs related to anticoagulation therapy and those for treatment of deep vein thrombosis. Four independent variables and one interaction term ($p < 0.10$) were entered into the final model. Because all of the independent variables were dummy variables (i.e., taking a value of either 0 or 1), the regression analysis was equivalent to the two-way analysis of variance with interactions technique.[12] No major violations of the assumptions underlying linear regression were observed. The regression model accounted for 43% of the variation in average costs per patient (adjusted $R^2 = 0.429$). The estimated coefficients and standard errors, as well as p values of the full regression model are shown in Table 3.

The estimated intercept term (Table 3) is equivalent to the average cost for patients without comorbidity or deep vein thrombosis who underwent hip surgery and received warfarin therapy. The coefficients of the other variables represent incremental costs beyond this base case. The inclusion of a term for the interaction between the study group and procedure variables means that the effect of the study group variable (i.e., anticoagulation therapy) on cost varies according to surgical procedure. The coefficients of the study group, procedure, and interaction terms are interpreted together in Table 4. With no interaction terms, the comorbidity and deep vein thrombosis factors affect both study groups to the same degree.

The expected cost for patients without symptomatic deep vein thrombosis or comorbid conditions undergoing hip surgery and receiving enoxaparin was $1,244 or $312 less per case than for patients receiving warfarin (Table 4). The results were reversed for patients undergoing knee surgery, for whom expected costs were $315 less for patients receiving warfarin than for those receiving enoxaparin. These results are consistent with the data relating to nursing costs per case and mean length of stay, by study group and procedure (see Appendices 1 and 3). Treating comorbid conditions and deep vein thrombosis added $455 and $2,438 respectively to the hospital costs of patients with these conditions. To illustrate the calculation, the expected cost for a patient undergoing hip surgery who receives warfarin, who had a pre-existing comorbid condition, and who experiences a deep vein thrombotic complication would be $1,556 + $455 + $2,438, for a total of $4,449. Several other plausible independent variables — occurrence of bleeding, receipt of at least one blood transfusion, patient age, patient sex, and type of arthroplasty (replacement or revision) — were not significant in the regression model.

Table 4. Expected Costs by Study Group and Procedure

	Treatment; Expected Cost per Patient ($)		
Cost Component	Enoxaparin	Warfarin	Difference
Procedure			
Hip replacement	1244*	1556†	–312
Knee replacement	1560‡	1245§	315
Additional treatment costs			
Deep vein thrombosis	2438	2438	0
Preadmission comorbidity	455	455	0

Relationship between expected costs and regression coefficients:
*Intercept + study group.
†Intercept.
‡Intercept + study group + procedure + interaction term.
§Intercept + procedure.

Sensitivity Analysis

A sensitivity analysis was undertaken because the 1994 acquisition cost of enoxaparin reflected the price for the purchase of small quantities, whereas the warfarin and heparin prices were based on large-volume purchases, since they were the standard therapy at that time. Furthermore, the absolute and relative prices of enoxaparin and warfarin have changed significantly since 1994. The regression analysis based on alternative pricing produced estimated coefficients and probability values virtually identical with those in the original analysis, probably because of the small share of total cost expended on medication.

DISCUSSION

Previous cost studies comparing LMWH with either heparin or warfarin have generally incorporated nursing costs only for the treatment of confirmed deep vein thrombosis or pulmonary embolism. Many studies[1,3,4,7,9,13,14] have measured the cost of additional laboratory testing associated with heparin and warfarin treatment, and several studies[1,3,4,6,7] have measured the diagnostic testing costs related to false-positive diagnosis of deep vein thrombosis. A few studies have attempted to measure the treatment costs of excessive bleeding.[6,7,13,14] We were able to measure the labour costs associated with warfarin dosage adjustment and the costs of treating bleeding and other adverse events through the use of patient-specific nursing costs.

The regression analysis indicated that after hip surgery the average total costs for patients receiving enoxaparin (excluding treatment of deep vein thrombosis and comorbid conditions) were significantly lower than those for patients receiving warfarin therapy. This result was unexpected in light of previous studies reporting higher total costs per patient for enoxaparin.[1,3,9] All 3 of these previous studies found that enoxaparin therapy incurred a net incremental cost compared with warfarin. However, they were based on decision analysis models, which assumed equal hospital stays (and therefore equal nursing costs) for all patients, except those who experienced deep vein thrombosis or pulmonary embolism. Anderson and others[9] also incorporated the inpatient costs of treating major bleeding events.

Although it was not possible to identify the specific reasons for the differential cost of the 2 treatments in this study, there are some plausible explanations. The nursing costs associated with adjusting the dosage for patients receiving warfarin would account for part of the cost differential between the 2 study groups. Although the results of previous research have been inconclusive as to which anticoagulation therapy presents a lower risk for bleeding complications, it is possible that the incidence of major bleeding requiring treatment was less for the enoxaparin group.

The regression results for patients undergoing knee surgery were the opposite of those for patients undergoing hip surgery: the average cost for the enoxaparin patients who underwent knee surgery (excluding treatment of deep vein thrombosis and comorbid conditions) was significantly greater than for warfarin patients. These results are consistent with those of most previous studies comparing the cost of warfarin and LMWH products (including enoxaparin).[7,9,13] Hawkins and others[7] and Anderson and others[9] found that enoxaparin was more costly than warfarin. In a large North American clinical trial, Hull and others[13] found differing results between the United States and Canada in a comparison of tinzaparin (a LMWH product) and warfarin: treatment costs for tinzaparin were less than those for warfarin in Canada, but more expensive in the United States. This result illustrates the important role of changing prices and the introduction of new products on any economic evaluation of drug treatments.

This study was subject to the same limitations as other retrospective studies: the patients were not randomly assigned to treatment groups, there was no blinding during the course of treatment, and there were a limited number of economic variables available for the statistical analysis. An attempt was made to minimize the potential bias of the nonrandom selection of study groups by close adherence to the inclusion and exclusion criteria for patient selection and use of a systematic consecutive selection strategy. The control group was selected so that age and procedure attributes were similar to those of the treatment group. Table 1 indicates that the study groups were very similar at baseline across several characteristics.

The lack of blinding introduced potential bias since the patients knew which treatment they were receiving and the health care providers knew which patients had received specific treatments. Several steps were taken to ensure that there was no systematic bias in treatment received, other than the drug therapy under study. For example, variables subject to protocol-driven bias were excluded, but the most important such measure was the regression analysis, which reduced the confounding effects of factors other than the treatment drugs. Unfortunately it was impossible to match the 2 study groups according to surgeon, but there was an attempt to minimize the difference in medical practice between study groups by selecting an approximately concurrent control group.

The lack of economic variables available, relative to those that would be available in a prospective study, accounted for omitted explanatory variables and the moderately low R^2 of the regression model. The variables available from chart review were supplemented by data from administrative databases, principally nursing workload data. Nevertheless, the omission of relevant explanatory variables is a limitation of this study.

The small size of the sample is another important limitation. For the comparison of average cost between the 2 study groups, the sample sizes were probably adequate, as they were close to the target sample sizes. However, the subgroup analysis of the regression model was susceptible to problems of small numbers. The principal problem was that the standard error of the estimates was large, which meant that the estimates

might be unstable over repeated samples. In addition, the size of the enoxaparin group was too small to allow for observation of all potential clinical outcomes. This limitation is consistent with the very low rates of symptomatic deep vein thrombosis and pulmonary embolism reported in other studies.[1,3,4] Finally, the study did not take account of recurrence of deep vein thrombosis and postphlebitic syndrome after hospital discharge.

This study is unique among recent research projects on anticoagulant therapy, in that it was based on patient-specific hospital costs, including nursing labour costs as well as the costs of diagnostic tests and medications. This approach allowed for a stochastic analysis, based on a multiple regression model, and allowed statistical tests to be performed on the results, which would not have been possible with a deterministic decision analysis model. With regression analysis the confounding effect of preadmission comorbidity on the cost of hospital care could be excluded. The analysis of enoxaparin therapy after hip surgery was based on the symptomatic occurrence of deep vein thrombosis, which relates more closely to clinical practice. This approach has greater external validity than one based on deep vein thrombosis identified through venography of all patients.

In conclusion, the results of this study suggest that enoxaparin anticoagulation therapy may yield economic benefits beyond the avoidance of deep vein thrombosis and pulmonary embolism. There may be savings in hospital costs after hip replacement, primarily relating to the fewer nursing resources needed for the majority of patients.

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Appendix 1. Resource Utilization by Study Group and Procedure

Resource Category	Enoxaparin		Warfarin		Unit Cost* ($/Unit)
	Hip	Knee	Hip	Knee	
Nursing care (mean hours/case)	54.8	73.6	67.8	64.8	23.09
Laboratory tests (mean tests/case)					
International normalized ratio	0.6	2.0	7.9	8.0	4.67
Partial thromboplastin time	0.5	1.4	0.3	0.5	5.19
Blood gases	0.1	0.2	0.3	0.0	5.19
Diagnostic imaging (total no. of tests/group)					
Venography	0	1	0	3	134.69
Lung scanning	0	1	0	0	269.38

*The unit cost is expressed as dollars per test, except for nursing care, which is expressed as dollars per hour.

Appendix 2. Number of Cases by Study Group and Procedure

Patient Group	Study Group and Procedure; No. of Cases			
	Enoxaparin		Warfarin	
	Hip	Knee	Hip	Knee
Patients with no preadmission comorbidity or deep vein thrombosis	10	7	30	15
Patients with preadmission comorbidity but no deep vein thrombosis	16	1	9	6
Patients with deep vein thrombosis but no preadmission comorbidity	0	0	0	1
Patients with both preadmission comorbidity and deep vein thrombosis	0	1	0	1
Total	16	9	39	23

Appendix 3. Mean Postoperative Length of Stay by Study Group and Procedure

Patient Group	Study Group and Procedure; Mean Length of Stay* (days)			
	Enoxaparin		Warfarin	
	Hip	Knee	Hip	Knee
Patients with no preadmission comorbidity or deep vein thrombosis	6.4	7.0	7.4	6.7
Patients with preadmission comorbidity but no deep vein thrombosis	6.7	10.0	10.0	7.7
Patients with deep vein thrombosis but no preadmission comorbidity	–	–	–	20.0
Patients with both preadmission comorbidity and deep vein thrombosis	–	24.0	–	14.0
Total	6.5	9.2	8.0	7.9

*The unit cost is expressed as dollars per test, except for nursing care, which is expressed as dollars per hour.