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Trends in utilization and complications of catheter ablation for atrial fibrillation in Medicare beneficiaries

Ethan R. Ellis, MD^{*}, Steven D. Culler, PhD[†], April W. Simon, MSN[‡], and Matthew R. Reynolds, MD, MSc^{*}

^{*}Division of Cardiology, Beth Israel Deaconess Medical Center, Boston, Massachusetts

[†]Rollins School of Public Health and Emory Center on Health Outcomes and Quality, Emory University, Atlanta, Georgia

[‡]Cardiac Data Solutions Inc., Atlanta, Georgia.

Abstract

BACKGROUND—Utilization of radiofrequency catheter ablation (RFA) for treatment of atrial fibrillation (AF) is increasing. Data regarding the safety of RFA for AF outside of selected centers of excellence and in older patients are limited.

OBJECTIVE—The purpose of this study was to quantify utilization of RFA for treatment of AF and rates of adverse events over time in unselected U.S. Medicare patients.

METHODS—Using Medicare Provider Analysis and Review (MedPAR) files for fiscal years 2001–2006, we developed a coding algorithm to identify AF patients treated with RFA. The number of hospitals performing the procedure, the number of procedures performed, and the frequency of eight RFA complications were determined. The impact of patient characteristics on complication rates was assessed using multivariable logistic regression.

RESULTS—For fiscal years 2001 to 2006, the number of hospitals performing RFA for AF in Medicare patients increased from 100 to 162, and the annual total procedure volume increased from 315 to 1975 cases. The overall complication rate was 9.1%. Annual complication rates increased from 6.7% in 2001 to 10.1% in 2006 (P for trend = .01), mainly due to an increase in rates of vascular access complications. Increasing patient age was not associated with a higher complication rate. Hospital procedural volume was not associated with the overall risk of complications but was associated with the probability of in-hospital death.

CONCLUSION—For fiscal years 2001–2006, use of RFA for treatment of AF increased markedly in the Medicare population. Overall complication rates rose during this time, with perforation/tamponade and vascular access complications accounting for the majority of events.

Keywords

Atrial fibrillation; Ablation; Pulmonary vein isolation; Complication; Medicare

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Address reprint requests and correspondence: Dr. Ethan R. Ellis, Division of Cardiology, Beth Israel Deaconess Medical Center, W/BA 4, 185 Pilgrim Rd, Boston, Massachusetts 02215. eellis@bidmc.harvard.edu..

Ms. Simon is president of Cardiac Data Solutions. Dr. Reynolds is a consultant to Biosense Webster Inc.

Appendix - Supplementary data: Supplementary data associated with this article can be found, in the online version, at 10.1016/j.hrthm.2009.06.009.

Introduction

Atrial fibrillation (AF) is the most common sustained arrhythmia in humans, and its incidence is increasing.¹ Radiofrequency catheter ablation (RFA) involving, but not limited to, electrical isolation of the pulmonary veins has evolved into an important treatment option for AF, and its utilization also is increasing.² Reported success rates and complication rates vary widely, with most studies suggesting major complication rates between 1% and 8%.^{2–6}

The majority of data regarding the safety of RFA for AF come from selected centers with considerable interest and experience in catheter ablation. Typically, these centers are teaching hospitals that perform a large volume of procedures⁷ and therefore might be expected to have better outcomes than smaller, less experienced centers. Furthermore, most studies on the outcomes of AF ablation have included relatively young patients⁸ despite the fact that most patients with AF are older than 65 years. Little is known about the utilization, success rates, and frequency of complications in older patient populations and in U.S. hospitals other than in selected, primarily academic centers.

Using a population of U.S. Medicare beneficiaries, the objectives of this study were to assess trends in the number of hospitals performing RFA for AF and the volume of cases performed; to identify the rates of significant procedural complications and changes in these rates over time; and to assess variation in complication rates according to patient demographics and clinical characteristics.

Methods

Analytic cohort

Data for the current analysis were obtained from Medicare Provider Analysis and Review (MedPAR) files for fiscal years 2001–2006. MedPAR files contain administrative data for all claims submitted to the Centers for Medicare and Medicaid Services (CMS) by U.S. short-stay hospitals for services provided to Medicare beneficiaries. For each hospitalization, the MedPAR files contain information on basic patient demographics (age, gender, race); quarter and year the admission and discharge occurred; principal discharge diagnosis, coded according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM); up to eight secondary ICD-9-CM diagnosis codes; up to six ICD-9-CM procedural codes; length of stay; and discharge status. The validity of identifying comorbid conditions from such administrative data has been previously established.⁹

Our target population consisted of Medicare patients who had undergone RFA for AF from October 1, 2001 to September 30, 2006. Currently, there is no unique procedure code for AF ablation. In order to identify this study population, each MedPAR file was searched for hospital admissions with a principal diagnosis of AF (ICD-9-CM code 427.31) during which a catheter ablation procedure (code 37.34) was performed. In order to remove ablations for arrhythmias other than AF, we excluded patients having a secondary diagnosis of atrial flutter, Wolff-Parkinson-White syndrome, nonparoxysmal AV nodal tachycardia, paroxysmal supraventricular tachycardia, paroxysmal ventricular tachycardia, and ventricular premature beats. Also, to avoid including patients undergoing only ablation of the AV junction, we excluded patients with diagnostic or procedural codes indicating prior or current implantation of a pacemaker or implantable cardioverter-defibrillator (ICD). Cases with open surgical ablations during the hospitalization also were excluded. The ICD-9-CM codes used to identify each of these diagnoses and procedures are listed in the Appendix. After application of the preceding criteria, we further excluded hospitals that performed fewer than 12 procedures during the 6-year study period (i.e., an average of <2 procedures per year) from further analysis

in order to avoid distortions from very-low-volume centers and to avoid inclusion of procedures unlikely to be RFA for AF.

Outcomes

Complications of interest for this analysis included cardiac perforation and/or tamponade, pneumothorax, stroke, transient ischemic attack (TIA), vascular access complication (consisting of hemorrhage/hematoma, vascular complication requiring surgical repair, and accidental puncture), and in-hospital death. These complications were selected based on review of pertinent clinical literature and identified from corresponding ICD-9-CM diagnosis and procedure codes, as listed in the Appendix. We also looked for phrenic nerve paralysis and pulmonary vein stenosis, but these diagnoses were very rarely observed in our dataset (<0.1%) and therefore were not analyzed further. Atrial–esophageal fistula was not assessed because this complication is rare, it usually is delayed in presentation beyond the index procedural hospitalization, and its coding is not clear.¹⁰ Complications were analyzed by fiscal year in which the procedure was performed to determine trends in complication rates.

Statistical analysis

Data are presented as frequencies for all discrete variables. Univariate between-group comparisons were performed using Chi-square tests for categorical and binary variables. To assess linear trends for complications across years, the Mantel-Haenszel Chi-square test was used. All reported *P* values are two-tailed, and *P* < .05 was considered significant.

To explore potential relationships between hospital procedure volume and complications, patients were divided into quartiles based on the aggregate hospital procedure volume over the 6-year study period. Pairwise comparisons were then made for both individual as well as overall complication rates between the highest volume quartile and each of the lesser volume quartiles.

Multivariate logistic regression was used to assess the impact of patient characteristics on the occurrence of any complication, adjusted for hospital volume. The regression model pooled data across the 6 years. Predictor variables used in the regression included patient demographics (age, gender, race category) and comorbidities and prior cardiac procedures as listed in the secondary diagnoses for the admission. The model was constructed using a forward selection algorithm, with the demographic variables and hospital volume (as a categorical variable) forced into the model. All other terms with a multivariate *P* > .15 were excluded from the model. To account for clustering of cases at the hospital level, the final model was constructed as a hierarchical model in which a grouping term for hospitals was entered as a random effect. The regression modeling was performed using STATA version 10.1 (StataCorp LP, College Station, TX, USA); all other analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC, USA).

Results

For fiscal years 2001–2006, we identified 32,463 hospitalizations with a principal diagnosis of AF and procedure code for RFA. Of these, 24,175 met one or more of the exclusion criteria and were not included in the analysis (Figure 1). The most common exclusions were secondary diagnosis of atrial flutter (6,021 cases) and pacemaker implantation prior to or during the index hospitalization (13,813 cases). Of the remaining 8,288 admissions, an additional 2,223 from 562 different hospitals were removed due to an annual hospital volume of fewer than two cases per year. This left a total of 6,065 admissions from 168 hospitals.

Trends in the utilization of RFA for this cohort are listed in Table 1. From 2001 to 2006, the number of hospitals performing pulmonary vein isolations had grown by more than 50%, and

the number of procedures performed per year had increased more than sixfold. Due to the many exclusion criteria applied, these values likely are underestimates of true procedural volume.

Table 2 summarizes the baseline characteristics of the cases we identified, stratified by whether or not complications occurred. A slight majority (57%) of the procedures were performed in men. Approximately 95% of the procedures identified were performed on white patients. The majority of patients were younger than 75 years, with a declining number of procedures performed in the older age categories.

The study sample had a fairly typical profile of comorbid conditions for an AF population, including hypertension (52%), coronary artery disease (23%), heart failure (15%), pulmonary disease (14%), and diabetes mellitus (13%). The characteristics that were significantly correlated with the rates of complications in univariate analysis included age ≥ 85 years, obesity, unstable angina, hyperlipidemia, coronary artery disease, and prior myocardial infarction. The group with complications also had a slightly higher proportion of women than did the group without complications (46.6% vs 42.5%, $P = .07$).

Not surprisingly, patients with complications had longer lengths of stay than did those who had no complications. The mean length of stay for patients with no complications was 2.5 days (median 1 day) compared with 5.8 days (median 3 days) for patients with complications.

The rates of individual and total complications by year are given in Table 3. The annual rate of any complication increased from 6.7% in 2001 to 10.1% in 2006 (P for trend = .01). This increased rate of overall complications was driven mainly by an increase in vascular access complications and cardiac perforation/tamponade. The rates of pneumothorax, stroke, TIA, and death were all $<0.5\%$ in aggregate.

Table 4 lists the frequency of complications grouped according to hospital procedure volume by quartile, with quartile 1 including the highest-volume centers. As shown, the highest-volume quartile had the lowest rate of overall complications, and the lowest-volume quartile had the highest rate of overall complications. However, these differences were small, and the rates for most of the individual complications did not follow obvious linear trends. Statistically significant differences were observed only for in-hospital death (quartile 1 vs quartiles 3 and 4) and pneumothorax (quartile 1 vs quartile 4 only).

Baseline characteristics that were independently associated with rates of complications in multivariate analysis and those that approached significance are listed in Table 5. Obesity and hyperlipidemia were associated with a reduced risk of any complication. Patients coded as having unstable angina (odds ratio [OR] 3.76, confidence interval [CI] 1.19 – 11.92) and chronic obstructive pulmonary disease (OR 1.33, CI 1.03–1.72) during their hospitalization had a significantly increased risk of complications. With the exception of the oldest (and smallest) category, increasing age was not associated with risk of complications.

To further explore the impact of procedural complications on the risk of in-hospital death, we compared complication rates in the 25 patients who died with the remainder of the sample. The overall rate of complications among patients who died was 28% vs 8.7% in the remainder of the study sample ($P < .0001$). Patients who died experienced higher rates of perforation/tamponade (12.0% vs 3.1%, $P = .01$), pneumothorax (12.0% vs 0.3%, $P < .0001$), and vascular access complication (20.0% vs 5.6%, $P < .01$).

Discussion

In this analysis of Medicare claims data, we found a $>50\%$ increase in the number of hospitals performing catheter ablation for AF and a more than sixfold increase in the annual volume of

procedures for fiscal years 2001–2006. During this time, the annual probability of an in-hospital complication increased significantly from 6.7% to 10.1%, driven mainly by the occurrence of vascular access complications and cardiac perforation/tamponade. Baseline demographic and clinical variables as well as hospital procedural volume had relatively little impact on the overall risk of complications. However, an association between hospital procedural volume and in-hospital death was observed.

Numerous studies have reported complication rates following catheter ablation for AF, but nearly all the studies were conducted at academic centers that are highly skilled in catheter ablation and enrolled relatively young patients. A voluntary worldwide survey of AF ablation collected in 2002–2003 reported an overall complication rate of 6%, including both early complications as assessed in the present study and late complications such as pulmonary vein stenosis.¹¹ In 2007, a multicenter Italian registry reported a comparable 3.9% rate of complications within 30 days of an AF ablation procedure.¹² However, several small randomized studies have reported significantly lower overall complication rates.^{4,6,13–15} Therefore, the complication rates observed in the present cohort appear to be higher than those reported in clinical trials and voluntary registries.

Safety outcomes of AF ablation specifically in the elderly are limited. A single-center study from 2008 reported major complication rates of 1.7% and 2.9% and minor complication rates of 3% and 6% in patients aged 65–74 years and ≥ 75 years, respectively.¹⁶ The authors concluded that the incidence of complications was unrelated to the age group of the patients; however, of note, the age category ≥ 75 years consisted of only 32 patients. By contrast, a 2008 series from a different center reported that age > 70 years was significantly associated with the risk of complication, with 10% of patients in this category experiencing a major complication.² Our findings are more comparable with these results than with most other AF ablation literature.

Within our Medicare cohort, we did not find evidence of a relationship between increasing age and an increased risk of procedural complication. In fact, the most elderly portion of our sample unexpectedly was found to have a significantly lower rate of complications than younger patients. There is at present no clear explanation for this finding. We specifically examined how patients aged ≥ 85 years in the cohort differed from younger patients, and in univariate comparisons found that these very elderly patients were less likely to have a documented history of smoking, obesity, or hyperlipidemia and were significantly more likely to be female and to have recorded diagnoses of chronic obstructive pulmonary disease, heart failure, or cardiomyopathy. Additionally, the age group ≥ 85 years was more likely to be treated at low-volume centers (quartile 4 hospitals in Table 4) than in high-volume centers. Adjustment for these factors in multivariate analysis did not significantly alter the odds ratio for complications in the age group ≥ 85 years. Given the improbably low complication rate (2.5%) in this group, we suspect that some of these patients actually underwent AV junction ablations rather than true AF ablations, despite our efforts to exclude patients with prior or concurrent pacemaker implantation.

Most of the individual complication rates we observed were consistent with previously published data. Specifically, the rates of stroke, TIA, pneumothorax, and in-hospital death all were $< 0.5\%$ overall. Confirmation of the relatively low rates of these serious events in the Medicare population is reassuring. In contrast, the rates of perforation/tamponade and vascular access complications (the two most common events in our data) are somewhat higher than expected and appeared to increase over time. We do find the approximately 3% rate of perforation/tamponade, a well-known risk of AF ablation, concerning. The combined rates of these two complications are chiefly responsible for the overall complication rate appearing higher than in studies of mainly younger patients.

It is possible that relatively minor vascular access complications (e.g., hematoma, which constituted the largest number of events in our data) were underreported in prior series given their typically benign nature. However, at least in the setting of percutaneous coronary intervention, even relatively minor bleeding complications have been associated with significant increases in hospital costs and length of stay.¹⁷

Our multivariate analysis suggests that patient factors exert only limited influence on the likelihood of procedural complications. The association between coronary artery disease and the risk of complication with AF ablation was reported in one prior study and may relate to more aggressive use of antiplatelet drugs in these patients.¹² The observation that women had a slightly higher complication rate than men is consistent with many studies of other cardiovascular procedures.¹⁸ Although somewhat counterintuitive, previous data also suggest that increased body mass index is associated with a reduced rate of complications in the setting of percutaneous coronary intervention.¹⁹

Additional factors potentially influencing the observed complication rates in our study, and their change over time, include the characteristics of the hospitals and physicians performing AF ablations; these issues may be worth further exploration. The observation that overall complication rates increased somewhat during the same time frame that the number of hospitals performing the procedure increased by >50% is consistent with the widely appreciated learning curve associated with AF ablation. Current data have shown that complication rates in individual laboratories fall as experience with the procedure accumulates.² Therefore, we may see complication rates of AF ablation in general practice decline in the future.

In our dataset, hospital procedural volume did not have a strong or consistent relationship with aggregate or individual complication risks, although an association between lower procedure volume and a higher risk of in-hospital death was observed. We believe this finding must be interpreted with particular caution because the number of observed deaths (25) was small, the volume of procedures in Medicare patients may not accurately reflect a center's (or physician's) overall procedure volume or experience, and MedPAR data do not permit ascertainment of causes of death, making the attribution of deaths as procedure-related tenuous. Although other complications were significantly more frequent in patients who died than in those who did not, it is worth noting that >70% of the deaths, did not report one of the other complications we investigated.

Our study must be interpreted within the context of several methodologic limitations. The most important of these pertains to our coding algorithm. By excluding a number of other diagnoses that might be associated with catheter ablation and the principal diagnosis of AF, we attempted to err on the side of "specificity" over "sensitivity" in our case finding. We believe the steep rise in procedure volume from 2001 to 2006 as well as the nature and frequency of observed complications support the validity of our approach. Nonetheless, some of the cases we identified may not have undergone true (i.e., left atrial or pulmonary vein isolation) AF ablations, and this could have undermined some of our results. The creation of billing codes specific for AF ablation would improve investigators' ability to use claims data to monitor utilization and outcomes of this procedure.

Our analysis is subject to the general limitations of research based on claims data, including a lack of clinical detail, the potential for miscoding of the diagnoses and procedures we used to define complications, and the limited time horizon of patient observation. In some cases, the discharge diagnoses we used to define complications may have been caused by some other procedure performed during the same hospitalization. In addition, some complications of AF ablation, such as pulmonary vein stenosis and esophageal fistula, usually are not clinically apparent until after hospital discharge and therefore would not be identified using our methods.

Our study was observational and retrospective. Thus, some of the observed findings could have been distorted by unmeasured confounders. Also, the lack of physician identifiers in our MedPAR data and the fact that many, if not most, AF ablations are performed in non-Medicare patients precluded us from fully examining the relationship between physician training and experience and complications. These issues clearly require additional study.

Prospective study designs involving a wider array of patients and practitioners than heretofore studied would better address both questions regarding procedural safety as raised by this report and important questions regarding the effectiveness of AF ablation in general practice. Results from such studies do not appear to be close at hand.

Conclusion

The use of catheter ablation to treat AF increased markedly in the Medicare population from 2001 to 2006. The overall rate of in-hospital complications also rose during this time frame, mainly due to an increase in vascular access complications, the majority of which were probably minor, and perforation/tamponade. The rates of other individual complications were largely consistent with previously published data on this procedure. Continued monitoring of procedural outcomes would be desirable as the use of AF ablation continues to expand.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Appendix

Appendix

ICD-9-CM diagnosis, procedure, and complication codes

ICD-9-CM Diagnosis Codes

Atrial fibrillation	427.31
Atrial flutter	427.32
Wolff-Parkinson-White syndrome	426.7
Nonparoxysmal AV nodal tachycardia	426.89
Paroxysmal supraventricular tachycardia	427.0
Paroxysmal ventricular tachycardia	427.1
Ventricular premature beats	427.69

ICD-9-CM Procedural Codes

Ablation procedure	37.34
Prior implantation of pacemaker	V45.01
Prior implantation of ICD	V45.02
Implantation of pacemaker in the same hospitalization	37.7x, 37.8x, 00.50, or 00.53
Implantation of ICD in the same hospitalization	37.94–37.98, 00.51, or 00.54
Open surgical ablation	37.33

Complications by ICD-9-CM Codes

1. Perforation/tamponade	37.0 (pericardiocentesis), 423.3 (tamponade), 423.0 (hemopericardium), or 423.9 (unspecified disease of pericardium, previously used for tamponade)
2. Pneumothorax	34.04 (chest tube), 511.8 (hemothorax), 512.0 (spontaneous tension pneumothorax), 512.1 (postoperative pneumothorax), or 512.8 (other spontaneous pneumothorax)

3. Stroke	997.00 (nervous system complication unspecified), 997.01 (CNS anoxia/hypoxia), or 997.02 (postoperative stroke)
4. Transient ischemic attack	435.9
5. In-hospital death	Discharge status expired
6. Vascular complication	
Hematoma/hemorrhage	998.11 or 998.12
Vascular complication requiring surgery (surgical repair)	39.31, 39.41, 39.49, 39.52, 39.53, 39.56, 39.57, 39.58, 39.59, 39.79
Accidental puncture	998.2

CNS = central nervous system; ICD = implantable cardioverter-defibrillator; ICD-9-CM = International Classification of Diseases, 9th Revision. Clinical Modification.

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Figure 1.

Flow diagram showing selection of study participants from Medicare Provider Analysis and Review (MedPAR) files for fiscal years 2001–2006 and main exclusion criteria. AF = atrial fibrillation; ICD = implantable cardioverter-defibrillator; RFA = radiofrequency ablation.

Table 1

Trends in utilization of pulmonary vein isolation

Year	No. of hospitals	Total no. of procedures performed
2001	100	315
2002	123	436
2003	138	662
2004	156	1,132
2005	163	1,545
2006	162	1,975

Table 2

Baseline characteristics by percent of population

	No complications (N = 5,516)	Any complication (N = 549)	P value
Female gender	42.5	46.6	.07
Race			.67
White	95.3	94.9	
Nonwhite	4.7	5.1	
Age category (years)			
<65	8.7	8.4	.87
65–69	35.3	35.5	.92
70–74	27.8	31.5	.07
75–79	16.6	15.8	.72
80–84	8.0	7.8	.93
≥85	3.5	0.9	<.01
Obesity	3.6	1.6	.01
Chronic obstructive pulmonary disease	13.7	15.8	.17
Smoking			
Current	2.2	1.3	.21
Past	5.9	6.2	.78
Diabetes mellitus			
Type 1	0.5	0.5	.76
Type 2	12.6	10.4	.15
Chronic renal failure	0.4	0.5	.51
Prior dialysis	0.5	0.2	.36
Prior stroke	4.1	4.0	1
Hypertension	51.8	52.5	.79
Unstable angina	0.2	0.7	.05
Abdominal aortic aneurysm	0.5	0.4	1
Cardiomyopathy	5.9	5.8	1
Heart failure	15.0	14.0	.61
Chronic liver disease	0.3	0.7	.15
Peripheral vascular disease	0.9	1.5	.16
Hyperlipidemia	28.3	23.0	<.01
Coronary artery disease	23.4	18.6	.01
Prior myocardial infarction	5.0	2.9	.03
Prior percutaneous coronary intervention	5.4	3.8	.13
Prior coronary artery bypass grafting	7.6	6.0	.20
Prior valve surgery	2.1	1.8	.87

Table 3

Rates of complications by year (%)

Complication	2001	2002	2003	2004	2005	2006	Total
Any complication	6.7	8.5	7.9	8.2	9.4	10.1	9.1
In-hospital death	0.3	0.9	0.6	0.4	0.5	0.2	0.4
Stroke	0.3	0.2	0.3	0.4	0.6	0.3	0.4
Transient ischemic attack	0.3	0.5	0.3	0.3	0.1	0.1	0.2
Perforation/tamponade	1.3	2.3	3.3	3.2	3.6	3.2	3.1
Pneumothorax	0.3	0.2	0.2	0.5	0.5	0.3	0.4
Any vascular complication*	5.4	5.5	4.1	4.5	5.8	6.9	5.7
Hemorrhage/hematoma	4.4	3.9	3.5	3.8	4.7	6.3	4.8
Surgical vascular repair	0.3	0.9	0.0	0.2	0.2	0.6	0.4
Accidental puncture	1.6	1.4	0.6	0.8	1.4	0.5	0.9

* Subcategories of vascular complication are not mutually exclusive.

Table 4

Rates of complications by volume quartile (%)

Complication	Quartile 1 (>104 cases) N = 1,565	Quartile 2 (50–103 cases) N = 1,466	Quartile 3 (25–49 cases) N = 1,521	Quartile 4 (12–24 cases) N = 1,513
Any complication	8.7	9.2	8.9	9.4
In-hospital death	0.1	0.3	0.7*	0.6*
Stroke	0.3	0.3	0.4	0.4
Transient ischemic attack	0.1	0.1	0.3	0.3
Perforation/tamponade	2.8	3.4	3.5	2.8
Pneumothorax	0.1	0.3	0.3	0.8*
Any vascular complication	6.0	5.5	5.1	6.2
Hemorrhage/hematoma	5.1	5.0	4.2	4.9
Surgical vascular repair	0.3	0.4	0.3	0.5
Accidental puncture	0.9	0.5	0.9	1.4

* $P < .05$ vs quartile 1.

Table 5

Hierarchical logistic regression analysis of patient characteristics and their relationship to the occurrence of any complication (admissions from all years included)

Variable	OR (95% CI)	P value
Gender		
Female	REF	
Male	0.85 (0.71–1.02)	.08
Race		
White	REF	
Nonwhite	1.16 (0.77–1.77)	.47
Age category (years)		
<65	REF	
65–69	1.09 (0.77–1.55)	.63
70–74	1.24 (0.87–1.77)	.23
75–79	1.04 (0.70–1.53)	.86
80–84	1.04 (0.66–1.63)	.88
≥85	0.25 (0.10–0.66)	.005
Hospital volume		
Quartile 1 (highest)	REF	
Quartile 2	1.06 (0.64–1.78)	.81
Quartile 3	1.09 (0.66–1.79)	.74
Quartile 4	1.13 (0.69–1.83)	.63
Obesity	0.44 (0.22–0.87)	.02
Chronic obstructive pulmonary disease	1.28 (0.99–1.64)	.06
Unstable angina	4.28 (1.30–14.2)	.02
Hyperlipidemia	0.78 (0.62–0.96)	.02

CI = confidence interval; COPD = chronic obstructive pulmonary disease; OR = odds ratio; REF = reference.