The Effects of Outpatient Management on Hospitalization for Ambulatory Care Sensitive Conditions Associated with Diabetes Mellitus

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Background: Ambulatory care sensitive conditions (ACSC) related to diabetes mellitus can potentially be prevented by good quality outpatient care. The purpose of this study was to evaluate which characteristics of ambulatory patients with diabetes were associated with ACSC hospitalizations.

Methods: Retrospective chart review of 65 adults with an ACSC diabetes-related hospitalization, and 130 controls with diabetes without ACSC hospitalizations. The primary outcome measure was the difference in hemoglobin A1c between groups.

Results: Patients with an ACSC hospitalization had poorer glucose control (mean A_{1c} 9.24 versus 7.68, $P < 0.001$), but there was no difference in blood pressure or lipid control.

Conclusions: Prevention of diabetes-related hospitalizations related more closely to glycemic control, rather than other important aspects of comprehensive care.

Key Words: ambulatory care sensitive condition (ACSC), diabetes mellitus, hospitalization, primary care populations, quality of care

The Agency for Healthcare Research and Quality (AHRQ) has defined certain hospital diagnoses related to diabetes mellitus, including uncontrolled diabetes and short-and long-term complications of diabetes, as ambulatory care sensitive conditions (ACSC).[1] These hospitalizations can potentially be prevented by good quality outpatient care. Gilmer et al[2] have determined that hemoglobin A_{1c} levels, hypertension, coronary heart disease, and depression are associated with increased overall healthcare costs, but it is not clear whether the costs were related to cardiovascular disease or preventable diabetes-related hospitalizations. Menzin et al[3] found a positive correlation between A_{1c} and inpatient admissions for short-term diabetes complications. To our knowledge, no published studies have examined whether patients with preventable hospitalizations for diabetes are less likely to receive comprehensive care or achieve goals of therapy.

The purpose of this study was to evaluate characteristics of patients with diabetes that are associated with hospitalizations for diabetes-related ACSC. The primary outcome was to determine whether there existed a difference in A_{1c} values for patients hospitalized for ACSC diabetes-related conditions versus those not hospitalized. We also compared demographic characteristics, drug therapy, and achievement of goals of therapy between these two groups.

Materials and Methods

Study Population

ACSC patients were defined as those patients aged 18 or older hospitalized from October 1, 1998 through September 30, 2003 for a diabetes-related ACSC at Tampa General Hospital, who had previously been seen in the hospital-based clinics for at least 12 months before the hospitalization. ACSC

Key Points

- Glucose control was the main factor in determining hospitalization for an ambulatory care sensitive condition related to diabetes.
- Blood pressure and lipid control were not associated with hospitalization for an ambulatory care-sensitive condition related to diabetes.
- Insulin use, but not oral hypoglycemic use, was related to hospitalization.
- Mean A_{1c} was >9.5 in 39% of the hospitalized patients, versus 17% of the controls.

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hospitalizations included patients with ICD-9-CM principal discharge diagnoses codes for uncontrolled diabetes, diabetes short-term complications (ketoacidosis, hyperosmolarity, coma) and diabetes long-term complications (renal, eye, neurologic, circulatory, or complications not otherwise specified) as defined by AHRQ.[1] The control group consisted of an age- and gender- matched group of patients also with diabetes mellitus but not hospitalized for ACSC related to diabetes mellitus during the study period. Controls were identified who had a principle or secondary ICD-9-CM diagnosis code of 250.00 to 250.99 for outpatient primary care visits. Pregnant patients were excluded from this study.

Data Collection

A sample size of 64 patients in each group was determined necessary to detect a difference in A_{1c} value of 0.5% between the two groups, alpha 0.05 and power of 80%. Using the date of admission to the hospital as the reference date, two age- and gender-matched controls were selected for each ACSC case. Data were abstracted by chart review using de-identified medical record numbers. The study was approved by the University of South Florida Institutional Review Board and given exempted status.

Study Variables and Data Analysis

Demographic data, laboratory results, and medication history were collected from the chart. The unpaired Student *t* test was used to compare continuous variables. The χ^2 test was used to compare frequencies between groups. A P value <0.05 was considered significant.

Results

Sixty-five patients with an ACSC hospitalization and 130 controls were identified. The ACSC hospitalizations included 33 (51%) long-term complications (9 renal complications, 8 neurologic complications, 5 circulatory complications, 11 other complications), 18 (28%) short-term complications, and 14 (22%) uncontrolled diabetes. Table 1 summarizes the principal demographic characteristics of the study population, showing no significant difference in ethnicity, smoking status, or mean blood pressure between the groups. ACSC patients were more likely to use insulin (60% versus 34%, $P < 0.001$) and were less likely to use angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (ACE-I/ARBs) (60% versus 77%, $P = 0.014$) or statins (28% versus 51%, $P = 0.001$,) but there was no difference in the use of sulfonylureas, metformin, or thiazolidinediones. Patients with an ACSC hospitalization were less likely to have had an A_{1c} in the previous 12 months (86% versus 98%, $P = 0.002$), although there was no significant difference in receiving a lipid panel (80% versus 85%, $P = 0.418$), a urine microalbumin test (65% versus 76%, $P = 0.09$), or performing home glucose monitoring (71% versus 58%, $P = 0.076$).

Table 1. Demographics[a]

Parameter	ACSC (n = 65)	Controls (n = 130)	*P*
Ethnicity (%)			
African American	30 (46%)	66 (51%)	0.54
White	24 (37%)	38 (29%)	0.28
Hispanic	7 (11%)	22 (17%)	0.26
Other/not documented	4 (6%)	4 (3%)	0.31
Smoking	23 (35%)	41 (32%)	0.59
Mean			
SBP (mm Hg)	140 ± 26	137 ± 19	0.35
DBP (mm Hg)	79 ± 17	76 ± 12	0.36
Mean BMI	32.3 ± 9	35.7 ± 9	0.017

[a]*ACSC, ambulatory care sensitive conditions; SBP, systolic blood pressure; DBP, diastolic blood pressure; BMI, body mass index.*

Patients with an ACSC hospitalization had poorer glycemic control (mean A_{1c} 9.24% versus 7.68%, $P < 0.001$), and were more likely to have microalbuminuria (48% versus 30%, $P = 0.049$), although there was no difference in mean serum creatinine (1.6 mg/dL versus 1.2 mg/dL, $P = 0.163$) or mean LDL (102 mg/dL versus 107 mg/dL, $P = 0.38$). The mean A_{1c} of those admitted with uncontrolled or short-term complications was 10.66; those admitted with long-term complications was 8.00. Patients admitted with an ACSC hospitalization were less likely to have achieved good glucose control (A_{1c} <7) (21% versus 42%, $P = 0.008$) and more likely to have documented poor glucose control before hospitalization (A_{1c} >9.5) (39% versus 17%, $P < 0.001$). However, there was no difference in achieving blood pressure or lipid goals between the two groups (Table 2).

Limitations

We used ICD-9 codes to identify patients with diabetes, so some patients may have been missed. We only analyzed hospitalizations from one institution; therefore patients admitted to other inpatient facilities were not identified. Our subjects were

Table 2. Goal attainment[a]

Parameter	ACSC group	Control group	*P*
A_{1C}			
<7.0%	12/56 (21%)	53/127 (42%)	0.008
>9.5%	22/56 (39%)	22/127 (17%)	0.001
BP			
<130/80 mm Hg	18/65 (28%)	34/130 (26%)	0.771
LDL			
<100 mg/dL	27/50 (54%)	49/109 (45%)	0.267

[a]*ACSC, ambulatory care sensitive conditions; BP, blood pressure; LDL, low density lipoprotein.*

low-income patients from two primary care clinics, and are not representative of all patients with diabetes.

Discussion

Although African-Americans and Hispanics have been found to have higher rates of hospitalization for uncontrolled diabetes and long-term diabetes complications than non-Hispanic whites,[4] both our study and a national study of US veterans did not find differences in racial characteristics in predicting preventable hospitalizations for diabetes,[5] suggesting that some of the disparity may rather be an issue of access to healthcare. Our findings were similar to those of Selby et al,[6] where the use of insulin, a serum creatinine of >1.3 mg/dL, an A_{1c} >10, and microalbuminuria/albuminuria were predictors of high short-term risk for complications requiring hospitalization. Our results suggest that the A_{1c} is the major predictor of preventable hospitalizations, given that half of our ACSC hospitalizations were for uncontrolled diabetes and short-term complications, and is consistent with the findings of Menzin et al,[3] where hospitalizations for short-term complications were doubled in patients with poor control. Likewise, our work extends the work of Moss et al[7] who also found that hospitalizations were related to A_{1c} levels, and supports the notion of prioritizing glucose control as a primary goal in the ambulatory management of patients with diabetes.

Conclusion

Our work suggests that the major emphasis to reduce preventable hospitalizations for diabetes should focus on improving glucose control. Although other measures of comprehensive care, such as blood pressure and lipid control are important in preventing other long-term complications, they are not associated with preventable hospitalizations for diabetes-related ACSC.

References

1. Agency for Healthcare Research and Quality. AHRQ Quality Indicators—Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions. Revision 4 (November 24, 2004). AHRQ Pub. No. 02-R0203. Available at: http://www.qualityindicators.ahrq.gov/archives/pqi/pqi_guide_rev4.pdf. Accessed June 27, 2007.
2. Gilmer TP, O'Connor PJ, Rush WA, et al. Predictors of health care costs in adults with diabetes. *Diabetes Care* 2005;28:59–64.
3. Menzin J, Langley-Hawthorne C, Friedman M, et al. Potential short-term economic benefits of improved glycemic control: a managed care perspective. *Diabetes Care* 2001;24:51–55.
4. Russo CA, Andrews RM, Coffey RM. *Racial and Ethnic Disparities in Potentially Preventable Hospitalizations, 2003. HCUP Statistical Brief #10.* Rockville, MD, Agency for Healthcare Research and Quality, 2006. Available at: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb10.pdf. Accessed June 27, 2007.
5. Helmer DA, Tseng CL, Brimacombe M, et al. Applying diabetes-related Prevention Quality Indicators to a national cohort of veterans with diabetes. *Diabetes Care* 2003;26:3017–3023.
6. Selby JV, Karter AJ, Akerson LM, et al. Developing a prediction rule from automated clinical databases to identify high-risk patients in a large population with diabetes. *Diabetes Care* 2001;24:1547–1555.
7. Moss SE, Klein R, Klein BE. Risk factors for hospitalization in people with diabetes. *Arch Intern Med* 1999;159:2053–2057.

"There's nothing better than discovering, to your own astonishment, what you're meant to do. It's like falling in love."

—Mike Nichols