Hospitalization Costs, Resource Utilization, and Clinical Outcome in Patients Undergoing CABG Receiving Intensive versus Conservative Glucose Control

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Background

It is estimated that 50-90% of patients undergoing coronary artery bypass (CABG) develop hyperglycemia during the hospital course and this can be associated with longer hospital stay, greater perioperative morbidity and mortality.

The GLUCO-CABG trial reported that intensive control (IC) targeting a BG of 100-140 mg/dl in the ICU vs conservative control (CC) targeting BG of 141-180 mg/dl did not significantly reduce a composite of hospital complications including wound infection, pneumonia, acute respiratory or renal failure, major cardiovascular events, bacteremia and death (42% vs 52%, p=0.08) in hyperglycemic patients undergoing CABG surgery. The financial impact of this intervention, however, is unknown.

Study Aim

To determine differences in hospitalization costs and resource utilization among patients in the GLUCO-CABG trial treated with an insulin drip to keep BG levels 100-140 mg/dL vs 141-180 mg/dL.

Outcomes

Primary outcome: Difference in hospitalization costs between treatment groups.

Secondary outcomes: Difference in health care resource utilization: laboratory, pharmacy, radiology, consult service and ICU utilization.

Methods

Data identified for extraction and obtained from the electronic health record and coding departments at Emory University Hospital and Emory Midtown Hospital included:

- ICD-9, CPT, MS-DRG codes
- Resource utilization inventory
- Hospital charges
- Hospital costs = Hospital charges x cost-to-charge ratio

Cost-to-charge ratios were obtained from the 2011-2013 Medicare Hospital Cost Report by the Centers of Medicare and Medicaid Services and data available from the participating hospitals.

Results

The GLUCO-CABG trial included 302 ICU patients with and without DM that underwent CABG & were randomized to:
Intensive control (IC) BG 100-140 mg/dL OR conservative control (CC) BG 140-180 mg/dL

91% of patients were treated with a continuous insulin infusion guided via a computer-guided algorithm (Glucommander).

288 of 302 patients were included in this cost analysis (IC [n=144], CC [n=144]). 14 patients excluded due to unavailable financial data or admission to Grady Memorial Hospital.

Results

Patient Characteristics

All (288)	IC (n= 143)	CC (n= 145)	p value
Male/Female	99/44	105/40	0.39
Age (yrs)	65 ± 9	64 ± 10	0.86
BMI (kg/m^2)	31.3 ± 7.2	30.6 ± 7.2	0.55
Number with DM (%)	71 (50%)	72 (50%)	NS

All data presented as mean ±SD or median (IQR)

Glycemic Control

All (288)	IC (n= 143)	CC (n= 145)	p value
HbA1c (%)	6.8 ± 1.8	6.7 ± 1.7	0.62
Admission BG (mg/dL)	138 ± 58	144 ± 65	0.38
Randomization BG (mg/dL)	162 ± 21	168 ± 29	0.034
Pre-surgery BG (mg/dL)	132 ± 47	132 ± 45	0.95
BG in the ICU (mg/dL)	131 ± 14	152 ± 17	<0.001

Hospitalization Outcomes and Costs

	All (n= 288)	IC (n= 143)	CC (n= 145)	p value
Length hospital stay (days)	8.1 (2.5, 66.0)	7.9 (3.8, 44.0)	8.5 (2.5, 66.0)	0.17
Number of patients with complications†	135	60 (44%)	75 (56%)	0.10
Total Hospitalization Charges (USD)	103,502 (560.0 - 696789)	36,681 (17062, 190918)	106,685 (560.0, 696789)	0.036
Total Hospitalization Costs (USD)	40,884 (221.2, 275232)	39,366 (18128, 181942)	42,141 (221.2, 275232)	0.036

†Complications defined as mortality, sternal wound infection, pneumonia, bacteremia, respiratory failure, acute kidney injury, major cardiovascular events (AMI, arrhythmias, inotropes > 48 hours)

Resource Utilization (instances)

	All (288)	IC (143)	CC (145)	p value
Pharmacy	690 (117, 177,89)	640 (117, 177,89)	732 (141, 158,33)	0.13
Radiology	17 (7, 162)	15 (7, 137)	20 (8, 162)	0.002
Laboratory	234 (100, 1617)	213 (100, 1246)	246 (112, 1617)	0.014
Consultations	12 (1, 422)	9 (1, 218)	15 (1, 422)	0.013
ICU LOS (days)*	2 (1, 47)	2 (1, 26)	3 (1, 47)	0.007
Total Resource Utilization	1979 (1, 21694)	1920 (755, 21694)	2066 (1, 20544)	0.17

Resource Costs (USD)

	All (288)	IC (143)	CC (145)	p value
Pharmacy	3646 (742, 42410)	3243 (742, 31132)	4046 (929, 42410)	0.005
Radiology	832 (198, 10457)	777 (198, 8088)	941 (265, 10457)	0.008
Laboratory	5624 (2168, 46534)	5087 (2168, 31099)	6018 (2704, 46534)	0.005
Consultations	873 (44, 26476)	802 (44, 11859)	1011 (96, 26476)	0.016
ICU	3,314 (1503, 77880)	3,156 (1503, 43083)	4,509 (1503, 77880)	0.013
Total Resource Costs	15,036 (221, 199186)	14,060 (5272, 116913)	16,170 (221, 199186)	0.004

Intensive BG control resulted in a median cost savings of $2,699 (95% CI: $557-6,750); Resource data expressed as median (IQR)

Limitations

- Small number of subjects, n=288
- Cost of hypoglycemia treatment was not reported due to the inability to extract this charge data.

Summary

Intensive glucose control compared to conservative control in ICU patients that have undergone CABG procedures is associated with fewer complications and this in turn results in:

- Lower resource utilization
- Reduced hospitalization costs
- Median cost savings of $2,699 per patient

The lower hospitalization costs with intensive glycemic control is due to a reduction in hospital complications and lower healthcare resource utilization.

Conclusions

The results of this post-hoc cost analysis indicate that intensive glucose control (100-140 mg/dL) in the ICU resulted in lower hospitalization costs and less resource utilization compared to conservative glucose control (141-180 mg/dL) in CABG surgery patients.

Larger studies are necessary to confirm these findings.

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