CONTRIBUTING FACTORS TO SERIOUS ADVERSE OUTCOMES

D Bacon MD MA[1], R Skomra CRNA MS[1], CA Walawander MA[2], and P Knight MD PhD[3].

[1]VA Western New York Health Care System, Buffalo, NY; [2]Pharmaceutical Outcomes Research, Inc., Buffalo, NY; [3]SUNY at Buffalo, Buffalo, NY.

ABSTRACT

CONTRIBUTING FACTORS TO SERIOUS ADVERSE OUTCOMES

D Bacon MD MA[1], R Skomra CRNA MS[1], CA Walawander MA[2], and P Knight MD PhD[3].

[1]VA Western New York Health Care System, Buffalo, NY; [2]Pharmaceutical Outcomes Research, Inc., Buffalo, NY; [3]SUNY at Buffalo, Buffalo, NY.

Introduction: JCAHO is an accrediting body for hospitals in the United States. As part of the accreditation process, the JCAHO is initiating a new program called ORYX. The goal of the program is to integrate routinely collected performance measures into the accreditation process. ORYX PLUS is a voluntary accelerated option to the ORYX initiative being undertaken by the Joint Commission and is currently being offered to hospitals. The goal of this program is to support standardization of outcomes measurement across hospitals for comparative purposes. Risk adjustment models will be provided by the JCAHO to insure comparability of data collected by different hospitals and different performance measurement systems. Two perioperative performance measures identified in ORYX PLUS were evaluated.

Methods: Data was collected on 4003 cases during the time period 1/1/ 97 to 8/31/98. The numerator of the first performance measure were patients who developed any one of the following adverse outcomes: a central nervous system injury, a peripheral neurological deficit, an acute myocardial infarction complication or had a cardiac arrest within two post procedure days of procedures involving anesthesia administration. The numerator of the second performance measure was intrahospital mortality of patients within two post procedure days of procedures involving anesthesia administration. For our purposes, all surgical procedures involving anesthesia were included in the denominator for both measures. Morbidity and mortality rates were reported on a quarterly basis. Univariate tests were performed using the chi-square test and wilcoxon rank sum test. Statistical significance was defined $p < 0.05$.

Results: The overall morbidity rate was 0.85% and ranged from 0.15% to 1.92% over 7 calendar year quarters. The overall mortality rate was 0.52% and ranged from 0.32% to 0.85% over 7 calendar year quarters. Patients with a serious adverse outcome were more likely to have a greater number of pre-existing co-morbidities (mean(sd) 3.2 (2.1) vs. 4.3 (2.2), $p<0.001$). Other statistically significant factors associated with these events included ASA class (3, 4, or 5), administration of nitrates preoperatively, invasive monitoring, general anesthesia, blood transfusions, and longer anesthesia duration Patients with serious morbidity were more likely to have an unplanned ICU admission, ($p < 0.001$).

Discussion: The mortality and serious morbidity rates were small with small variability from quarter to quarter. A risk-adjusted benchmark for these serious events is important. The routine monitoring of these rates will insure the quality of an anesthesia service stays in statistical control. Ongoing evaluation of contributing factors to the events will also help in refining anesthesia guidelines. However, a significant decrease in these rates is unlikely in this elderly patient population with multiple pre-existing co-morbidities without significant advancements in surgical interventions or life-saving treatment modalities.

INTRODUCTION

JCAHO

(Joint Commission on Accreditation of Health care Organizations): an accrediting body for health care organizations in the United States.

ORYX:

(a kind of gazelle or a small, soft antelope of Africa and Asia with large, lustrous eyes) a new program initiated by the JCAHO with goals to:

- monitor performance measurement data on a continuous basis
- identify areas of improvement
- verify effectiveness of paradigm shifts
- evaluate comparative data across organizations
- integrate routinely collected performance measurement data into the accreditation process

Hospitals are currently mandated to submit 2 performance measures every quarter to the JCAHO through a performance measurement system reviewed as acceptable by the JCAHO.

ORYX Plus:

An extension of ORYX which is intended to benchmark data across institutions and make data publicly available. Risk models are applied to hospital data and risk-adjusted data is submitted to the ORYX database based on predefined definitions and models. Participation is optional.

PORP (Perioperative Outcomes Research Program[SM]):

This unique continuous quality improvement and benchmarking service for the perioperative setting has met the initial criteria for inclusion in the future accreditation process and is included on the Joint Commission's list of acceptable systems. Perioperative Outcomes Research Program[SM] is committed to meeting future criteria established by JCAHO. The following six measures have been accepted by the Joint Commission for accreditation purposes in connection with the ORYX initiative:

- Mortality
- Unplanned return to operating room
- Post surgical recovery duration
- Significant perioperative morbidities
- Unplanned inpatient admission after outpatient surgery
- Post operative nausea/vomiting

The program is run by Pharmaceutical Outcomes Research, Inc., Buffalo, NY (1-800-248-4244).

VA Western New York Health Care System:

Anesthesia group dedicated to evaluating, documenting, and improving the process and quality of care of it's surgical patients.

Objective:

Two perioperative measures identified in the ORYX PLUS initiative were evaluated in a Veteran's health care system in Western New York using PORP.

METHODS

Population:

Data was collected on all 4003 surgical cases from 1/1/97 to 8/31/98. Rates were calculated quarterly.

Clinical Outcome Measures:

$$\text{Mortality Rate} = \frac{\text{Intrahospital Mortality within two post procedural days}}{\text{All surgical procedures involving anesthesia}}$$

$$\text{Morbidity Rate} = \frac{\text{Patients developing within two post procedural days a central nervous system injury, a peripheral neurological deficit, an acute mycardial infarction, or had a cardiac arrest}}{\text{All surgical procedures involving anesthesia}}$$

Standardized Rate:
Standardized rates were computed by dividing the observed event rate by the risk adjusted event rate. A value > 1 indicates more events occurred than expected; < 1 indicates less events occurred than expected.

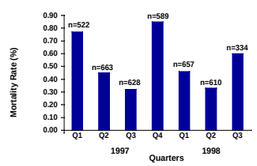
Statistics:

Evaluation of factors possibly associated with mortality and serious morbidity rates was performed using the chi-square test and wilcoxon rank sum test. Statistical significance was defined as $p < 0.05$.

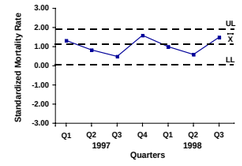
Risk adjusted mortality and serious morbidity rates were calculated by incorporating the factors found in the univariate analysis into a multivariable logistic regression model.

RESULTS

Unadjusted Mortality Rate



Standardized Mortality Rates

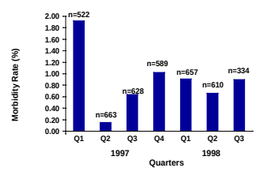


Factors included in the risk adjustment model were: ASA Class, blood component transfusion, and anesthetic duration

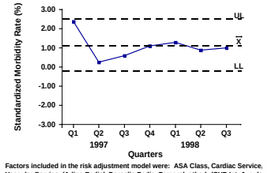
Factors Associated with Mortality

Factor	Time Period = 1/1/97 - 8/31/98			
	# of cases w/ Factor	w/o Factor %	w/ Factor %	p-value
ASA Class = 3,4,5	2676	0.08	0.75	0.006
Emergency Case	233	0.40	2.58	< 0.001
Anesthesia Duration	mean(sd)	162 (114)	248 (154)	0.0047
Antidysrhythmics	133	0.47	2.26	0.031
Inotropes	54	0.46	5.56	0.003
Vasopressor	21	0.45	14.29	< 0.001
PA Catheter	296	0.40	2.03	0.003
TEE	61	0.48	3.28	0.040
Neuromuscular Blocker	2127	0.27	0.75	0.034
Midazolam	3283	1.11	0.40	0.039
Colloid	439	0.25	2.73	< 0.001
Propofol	2057	0.82	0.24	0.011
SSP Units	56	0.46	5.36	0.003
PRBC (Homologous) Units	155	0.36	4.52	< 0.001
FPP (Homologous) Unit	77	0.38	7.79	< 0.001
Blood Product	250	0.32	3.60	< 0.001

Unadjusted Morbidity Rate



Standardized Morbidity Rates



Factors included in the risk adjustment model were: ASA Class, Cardiac Service, Vascular Service, (A-line Radial, Dorsalis-Pedis, Femoral, other), (CVP-Int. Jugula Femoral Subclavian Antecubital, other), (PA Catheter), (Cardiopulmonary Bypass (SVO2), General Anesthetic Procedure, blood product, and anesthetic duration

Factors Associated with Morbidity

Factor	Time Period = 1/1/97 - 8/31/98			
		Incidence of adverse event		
	# of cases w/ Factor	w/o Factor %	w/ Factor %	p-value
ASA Class 3,4,5	2676	0.23	1.16	0.002
Cardiac Service	363	0.60	3.31	< 0.001
Urological Service	617	0.97	0.16	0.043
Vascular Service	543	0.72	1.66	0.040
Anesthesia Duration	mean(sd)	162 (114)	268 (133)	< 0.001
Nitrates	558	0.67	1.97	0.005
CVP-Int. Jugular, Femoral Subclavian Antecubital,Other	263	0.67	4.18	< 0.001
A-Line Radial, Dorsalis,Pedis, Other	669	0.30	3.59	< 0.001
PA Catheter	296	0.54	4.73	< 0.001
Cardiopulmonary Bypass	118	0.77	3.39	0.017
SVO2	45	0.78	6.67	0.006
MAC	756	1.02	0.13	0.017
General Anesthesia	2732	0.39	1.06	0.032
Sufentenil	189	0.73	3.17	0.005
Neuromuscular Blocker	2127	0.37	1.27	0.002
Rocuronium	504	0.69	1.98	0.007
Vecuronium	61	0.76	6.56	0.002
Glycopyrrolate	748	0.71	1.47	0.040
Isoflurane	952	0.62	1.58	0.005
Colloid	439	0.62	2.73	< 0.001
Etomidate	839	0.54	2.03	< 0.001
Propofol	2057	1.23	0.49	0.010
Neostigmine	759	0.71	1.45	0.045
SSP Units	56	0.79	5.36	0.011
PRBC (Homologous) Units	155	0.73	3.87	0.002
PRBC (Autologous) Units	13	0.80	15.38	0.005
FFP (Homologous) Units	77	0.79	3.90	0.027
Blood Product	250	0.64	4.00	< 0.001
Unplanned ICU admit	27	0.75	14.81	< 0.001

CONCLUSIONS

- The morbidity and mortality rates were small with small variability from quarter to quarter. A significant decrease in these rates is unlikely in this elderly patient population with multiple pre-existing co-morbidities without significant advancements in surgical intervention or life-saving treatment modalities. However, it is important for these measures to continue to be monitored for any increase in these rates.
- Continually benchmarking these events not only across time within an institution but also across institutions is important because it allows an institution to use statistical quality control methods to identify what is random variation or when an intervention is necessary and allows an institution comparison to national standard.
- Risk adjusting clinical outcome measures is important as it is an attempt to compensate for differences in outcomes that are affected by patient or procedure characteristics or severity.