Risk Factors Affecting Outcomes in Patients Undergoing Hypothermic Circulatory Arrest During Aortic Surgeries

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Background:

Hypothermic Circulatory Arrest (HCA) is a cardiopulmonary perfusion management technique used in heart surgery involving the aortic arch. It is used as a preventative measure for adverse neurological outcomes associated with these high risk surgeries in which blood circulation to the body and brain must be stopped.

Patients are cooled on the cardiopulmonary bypass circuit to a targeted temperature, usually between 15°C and 18°C, blood is exsanguinated into a reservoir, and circulation is halted to allow for surgical repair of the ascending aorta and the aortic arch.

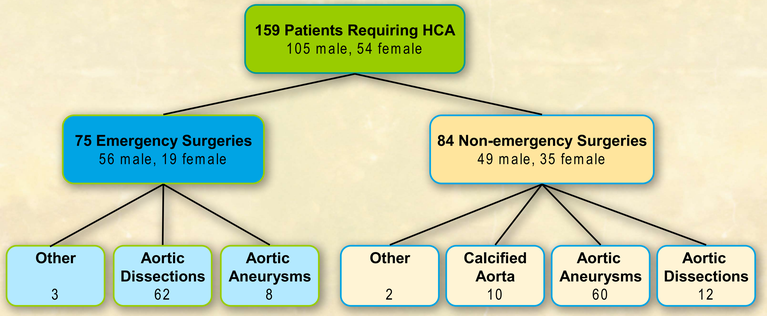
Objectives:

To evaluate surgical outcomes of mortality and perioperative complications in patients who underwent HCA during aortic surgery to evaluate pre- and intraoperative risk factors.

Methods:

- Patient charts were retrospectively reviewed from the Lehigh Valley Health Network Inpatient Electronic Medical Record and Department of Perfusion database from 2000-2010
- 159 patients with aortic pathologies requiring HCA
  - Patients were broken down according to surgery type and pathology
- Adverse outcomes evaluated included:
  - 30-day mortality
  - Cerebrovascular Accident (CVA)
  - Renal Failure
  - Ventilator-Dependent Respiratory Failure (VDRF)

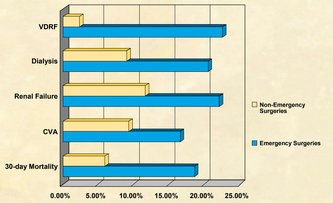
Results:



Linear Regression Analysis of Preoperative and Intraoperative Risk Factors

Independent Variable	Odds Ratio	5% Confidence Level: Lower	95% Confidence Level: Upper	Coefficient	Standard Error	Wald Statistic	P value
Constant	0.00408	0.000119	0.14	-5.502	1.804	9.298	0.002
Age, yrs	0.985	0.944	1.028	-0.015	0.0215	0.487	0.485
Sex	3.098	1.011	9.493	1.131	0.571	3.919	0.048
COPD	0.917	0.188	4.468	-0.087	0.808	0.0116	0.914
CAD	0.429	0.121	1.517	-0.847	0.645	1.726	0.189
Diabetes	4.174	1.079	16.153	1.429	0.69	4.284	0.038
HTN	0.604	0.176	2.066	-0.505	0.628	0.646	0.421
Prior Renal Failure	0.757	0.138	4.158	-0.278	0.869	0.103	0.749
Prior OHS	1.218	0.29	5.116	0.198	0.732	0.0728	0.787
CPB time, min	1.02	1.01	1.031	0.0202	0.00546	13.691	<0.001
Cross-clamp time	0.989	0.98	0.999	-0.0107	0.00494	4.715	0.03

Adverse Outcomes: Comparison of Surgery Types



Outcome	Non-emergency Surgery	Emergency Surgery	Overall
30-day mortality	5.95%	18.67%	11.95%
CVA	9.33%	16.67%	12.77%
Renal Failure	11.69%	22.22%	16.43%
Dialysis	9.09%	20.63%	14.29%
VDRF	2.38%	22.67%	11.95%

**Patients with preexisting CVA, and renal failure were excluded from the respective statistics.

Conclusions:

- Major aortic surgical operations requiring HCA have become safer in the past decade.
- Elective, non-emergent operations have very reasonable mortality and morbidity rates.
- Risk factors including emergency surgery, female sex, Diabetes Mellitus, and duration of cardiopulmonary bypass significantly affect the likelihood of death