“Using Statistical Run Charts to Improve Clinical Practice”

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Improving Clinical Practice with Continuous Quality Improvement Programs.

Introduce 3 terms
- Quality Control
- Continuous Quality Improvement
- Quality Indicators
Quality control is defined as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problems are solved.
Continuous Quality Improvement

• An approach to quality improvement in which past trials of change are used as the basis of future trials and something is always being tested for its effects on improvement.

www.mywhatever.com/cifwriter/content/66/4620.html

• Simply put, it is the concept that there is always room for improvement.

Continuous Quality Improvement

Are Perfusion Technology and Perfusionists Ready for Quality Reporting Employing Six-Sigma Performance Measurement?

Jeffrey B Riley, MHPe, CCT. JECT. 2003;35:168-171
Continuous Quality Improvement

D - Define
M - Measure
A - Analyze
I - Improve
C - Control

Rath and Strong’s Six Sigma Pocket Guide. AON Consulting; 2002.
Continuous Quality Improvement

Control – modify protocols

Define – what do we want to improve

Improve – identify causes & implement solutions

Measure – perfusion quality indicators

Analyse – retrieve the data
Quality Indicators

• Quality Indicators (QIs) are measures of health care quality that make use of readily available hospital inpatient administrative data.
IQIP ACUTE CARE INDICATORS

Inpatient Acute Care Indicators

*AC Indicator 1a: Device-Associated Infections in Intensive Care Units*

The following measures are available for the APICU, CCU, MICU, MSICU, and SICU:
- Central line-associated bloodstream infections
- Ventilator-associated pneumonia
- Symptomatic indwelling urinary catheter-associated UTIs

*AC Indicator 1b: Device Use in Intensive Care Units*

The following measures are available for the APICU, CCU, MICU, MSICU, and SICU:
- Central line use
- Ventilator use
- Indwelling urinary catheter use

*AC Indicator 2a: Surgical Site Infections*

Measures for surgical site infections by procedure classified by NNIS Risk Index, as well as the overall rates are available for:
- Chest incision only CABG patients
- Chest and donor site incision CABG patients
- Other cardiac surgery patients
Aim

• To assess the value of the introduction of our quality control (QC) and continuous quality improvement (CQI) programs into our clinical perfusion practice.
Method

- 980 consecutive cases.
- Three periods are reported,
  - prior, group 1, n=364
  - with the QC report, group 2, n=253
  - following CQI program group 3, n=363
Method

• Defined 7 quality indicators
  – minimum haemoglobin (g/dl)
  – minimum and maximum pCO₂ (mmHg)
  – minimum pO₂ (mmHg)
  – time cardiac index < 1.6 L/min/m² (min)
  – mean arterial pressure (MAP) < 40 mmHg (min)
  – venous saturation < 60% (min)
  – arterial outlet blood temperature of > 37.5°C (min)
Method

• Quality indicators
  – minimum haemogoblin (g/dl)
    • < 7 g/dl
  – minimum and maximum pCO$_2$ (mmHg)
    • < 35mmHg or > 45 mmHg
  – minimum pO$_2$ (mmHg)
    • <100 mmHg
Method

• Quality indicators (timed)
  – cardiac index
    • < 1.6 L/min/m² (min)
  – mean arterial pressure
    • < 40 mmHg (min)
  – venous saturation
    • < 60% (min)
  – arterial outlet blood temperature of
    • > 37.5°C (min)
Method

• Cardiac Data Management System
  – integrates data from the heart lung machine data management system with intra-operative physiological and biochemical data and clinical data systems.
Data Transfer

Heart-lung machine computer

Hospital network

Server computer

Access Processing Database

Research Database on SQL Server
Method

- **Quality Control Reporting**: process produces a QC report, which incorporates clinical and QI data
  - n=253, “Group 2”
In the event of a QI parameter detection a QC report is generated,
In the event of a QI parameter detection a QC report is generated.

Flow/Pressure:

Arterial Pressure Values (mmHg): (min)

Arterial Pressure < 40 mmHg (>5 min): Yes

- <30: 1
- <40: 8
- <50: 18
- <60: 23
- <70: 17
- >70: 3
In the event of a QI parameter detection a QC report is generated,
Method

• Continuous Quality Improvement:
To close the loop and improve our process introduced regular team meetings specifically to assess practices and introduce change.

n=363, “Group 3”
Continuous Quality Improvement

Control – modify protocols

Improve – identify causes & implement solutions
Team meeting

Define – what do we want to improve
Compliance with practice guidelines

Measure – perfusion quality indicators

QC Reporting

Analyse – retrieve the data
Method

• **Statistical Process Control Theory**
  – Control charts for interpretation of data
  – non parametric tests (Kruskal-Wallis)
Method

- Statistical Process Control Theory
  - Control charts for interpretation of data
  - non-parametric tests (Kruskal-Wallis)
Method

Figure 1. Arterial PCO$_2$ during CPB.
Results
Protocol

• CO$_2$ management between pCO$_2$ of 35 and 45 mmHg
Protocol

• Aim to keep Cl > 1.6 l/min/m$^2$
Cardiac Index < 1.6 L/min/M²

UCL = 16.6
CEN = 6.6

UCL = 8.8
CEN = 3.79

UCL = 8.7
CEN = 3.8

LCL = -3.5
LCL = -1.2
LCL = -1.1
Protocol

- Aim to keep MAP > 40 mmHg
Protocol

• Aim to keep venous saturation >60%
Venous Saturation < 60%

UCL = 12.1

CEN = 4.8

LCL = 2.4

UCL = 4.4

CEN = 1.9

LCL = 0.6

UCL = 5.9

CEN = 2.1

LCL = 1.8
Mean Arterial Pressure < 40 mmHg

UCL = 36.4

LCL = -28.4

CEN = 6.4
CEN = 4.0
CEN = 4.4

UCL = 30.2

UCL = 17.9

LCL = -18.0

LCL = -9.3

Time (mins) vs. Date
Protocol

- Maximum arterial outlet temperature 37.5°C
Arterial Outlet Temperature > 37.5°C

UCL=16.8
LCL=4.2
CEN=7.2

UCL=13.7
LCL=-0.9
CEN=1.7

UCL=8.3
LCL=-2.5
CEN=1.7

Date

Time (mins)
Conclusion

• Introduction of QC and CQI programs in improved adherence to institutional perfusion practice.
The Future

• Better perfusion management will result in improved clinical outcomes for the cardiac surgical patients whose care we are charged with.
• Better protocols for our perfusion practice.
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