SURGERY IN PRACTICE: understanding the parts and processes

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Objectives for today

- Define surgery
- Understand the types of conditions that are potentially treatable with a surgical procedure
- Understand how surgery fits into the overall treatment of a patient
- Understand the principles of caring for a patient having surgery
- Understand the concept of risk adjustment in predicting the results (outcomes of surgery)
- Understand the “imprecision” of surgery
Surgery: *defined*

- Operation - a medical procedure that
  - Violates natural boundaries
    - Skin
    - Orifice
- Tools – devices – manipulation
  - Under the control of a surgeon
- Performed for a specific therapeutic goal
  - Disordered clinical condition
- Planned sequence of steps and events
- Environment capable of supporting the patient
Surgery: scope

- Minor skin procedure
- Replacement of multiple abdominal organs
  - Liver/intestine and pancreas
  - Heart-lung

Personal perspective critical
Surgery: therapeutic goals

- Why do we do operations?
  - Remove abnormal tissues
  - Repair damaged structures
  - Repair disordered structures
  - Make a diagnosis
Why do we do operations?

- Remove abnormal tissues
  - Infections
    - Appendicix
    - gallbladder
  - Tumors
    - Benign
      - pheochromocytoma
    - Malignant
      - Lung/colon/breast/GI/pancreas/liver/brain…
  - Disease damaged organs
    - Inflammatory bowel disease
    - Prostate gland
    - Gallbladder
CT Abdomen
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Why do we do operations?

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    - Gallbladder
CT 12/2006
Duodenal Mucosa

Ligated Right Limb of ABF Graft

Bile Staining of the aortic graft

Duodenal Mucosa
Why do we do operations?

- Repair damaged structures
  - Trauma
    - Hemorrhage
    - Damaged organs
  - Bones and joints
  - Abdominal wall – hernia
  - Bowel
  - Heart valves
  - Blood vessels
  - Reconstruction of missing tissues
  - Replace vital organs - transplantation
Why do we do operations?

- Repair disordered functions: functional surgery
  - Urinary tract
  - Gastroesophageal reflux disease (GERD) - repair a valve
  - Gastric bypass
  - Ulcer disease – vagus nerve division
  - *Risky territory*
Why do we do operations?

- Make a diagnosis
  - *Exploratory*.....
- Rare event
  - Imaging
  - Image guided biopsy access
  - Laboratory improvements
Common features of operations

- Tissue injury
- Stress response
  - Local – within and surrounding the wound
  - Systemic – the whole body
    - Neurologic signalling
    - Hormone mediated
Common features of operations

- Control of bleeding
- Avoid injury to adjacent tissues
- Capable of healing
  - Skin
  - Tissue specific patterns of healing
    - Liver
- Scar

*Magnitude is highly variable*
Surgery: steps

Start here

Abnormal condition
Present for care

Operation

Anesthesia

Optimize pt for surgery
Evaluate pt as surgical candidate

Treatment plan

Evaluate H + PE, Labs, Imaging

Post-op care

Maybe Surgical?

Formulate Differential DX

Surgeon eval + Diagnostic tests
Preparing a patient or surgery

- Accurate preoperative diagnosis
- Formulate a preoperative plan
- Assess risk factors
- Optimize the patient’s condition for surgery
Operation: an integrated environment

- Careful execution
  - Think of your mother or father
- Expect the unexpected
- Optimize support
  - Intravenous fluids
  - Antibiotics
  - Ventilators
  - Blood products
  - Anesthesic techniques
MITIE MRI Research Operating Room
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Surgeon’s intraoperative databases

- Recall of history and physical findings
- Recall of data
- Intraoperative access to imaging
- Knowledge of anatomy and physiology
- Personal experience
- “Experience” of others
“Precision” in surgery

- A human art
  - Anatomical variation
  - Disease distortion
  - Human form variation – BMI, breast
  - Pregnancy

- Impact on models
- Impact on pre-operative planning
Evaluating the quality of an operation
Self-assessment of surgical outcomes

- M & M conferences
- Peer reviews
- Risk management
- Surgical logs?
- Self reported data bases
  - SAGES
  - ABPRS
  - Vascular surgery board
  - Pediatric surgery board
Outcomes as a measure of surgical quality

*Short term*
- Mortality
- Complications
- Recovery

*Long term*
- Recovery
- Success of operation
- QOL
IOM: Define and reward quality measures and performance

- Define means to measure quality
- Develop systems that foster quality care
- Reward quality care
- Improve the overall quality of care
Iezzoni’s algebra of effectiveness

PATIENT FACTORS
(risk adjustment)

+ 

EFFECTIVENESS OF CARE
(quality of processes)

+ 

RANDOM EVENTS
(statistical analysis)

= 

OUTCOME
Risk adjustment

- Use of specific parameters to define finite predictable results
- Define and test parameters
- Statistical analysis
- Development of predictive formulae
Elements in the National Surgical Quality Improvement Program Database

Preoperative data
  10 Demographic variables
  30 Clinical variables
  12 Laboratory variables
Intraoperative data
  15 Clinical variables
Postoperative data
  10 Laboratory variables
  30-Day postoperative mortality
  21 Categories of 30-day postoperative morbidity
  Length of hospital stay
### Most Predictive Preoperative Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum albumin, g/dL</td>
<td>1.0</td>
</tr>
<tr>
<td>ASA class</td>
<td>2.0</td>
</tr>
<tr>
<td>Disseminated cancer</td>
<td>3.0</td>
</tr>
<tr>
<td>Emergency operation</td>
<td>5.0</td>
</tr>
<tr>
<td>Age</td>
<td>4.7</td>
</tr>
<tr>
<td>BUN &gt;40mg/dL (&gt;14.3 mmol/L)</td>
<td>7.5</td>
</tr>
<tr>
<td>Do not resuscitate</td>
<td>8.3</td>
</tr>
<tr>
<td>Complexity score</td>
<td>12.0</td>
</tr>
<tr>
<td>AST &gt;40 U/L</td>
<td>14.3</td>
</tr>
<tr>
<td>Weight loss &gt;10%</td>
<td>10.2</td>
</tr>
<tr>
<td>Functional Status</td>
<td>10.2</td>
</tr>
<tr>
<td>White blood cell count &gt;11.0x10³/µL</td>
<td>12.7</td>
</tr>
</tbody>
</table>
Probability \( P(\text{Death}) = \) \( \frac{e^{-1.72}}{1 + e^{-1.72}} \)

\( f(X) = -7.89 - (0.62 \times \text{albumin}) + (0.65 \times \text{ASA class}) + (0.01 \times \text{BUN}) + (1.03 \times \text{disseminated cancer}) + (1.01 \times \text{ascites}) + (0.03 \times \text{age}) + (0.56 \times \text{emergency}) \)
Patient #1
Emergency right hemicolecotony for bleeding AVM

- Albumin = 2.0 (3 SD below mean)
- ASA = 4 (threat to life)
- BUN = 102 (8 SD above mean)
- Disseminated Cancer = 0 (no)
- Ascites = 1 (yes)
- Age = 74
- Emergency = 1 (yes)

\[ F(x) = 7.89 - 1.24 + 2.60 + 1.02 + 0.00 + 1.01 + 2.22 + 0.56 = -1.72 \]

\[ P(\text{Death}) = \frac{e^{-1.72}}{1 + e^{-1.72}} = \frac{0.1791}{1 + 0.1791} = 15\% \]
Patient #2
Elective right hemicolectomy for cancer

- Albumin = 3.8 (average)
- ASA = 1 (healthy)
- BUN = 17 (average)
- Disseminated Cancer = 0 (no)
- Ascites = 0 (no)
- Age = 60 (average)
- Emergency = 0 (no)

\[ F(x) = 7.89 - 2.36 + 0.65 + 0.17 + 0.00 + 0.00 + 1.80 + 0.00 = -7.63 \]

\[ P(\text{Death}) = \frac{e^{-7.63}}{1 + e^{-7.63}} = 0.0005 = 0.05\% \]
## General surgery mortality

<table>
<thead>
<tr>
<th>Vol</th>
<th># events</th>
<th>Event rate</th>
<th># Exp events</th>
<th>Exp event rate</th>
<th>O/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1435</td>
<td>.98</td>
<td>23.9</td>
<td>1.67</td>
<td>.58*</td>
</tr>
<tr>
<td>2</td>
<td>1034</td>
<td>3.0</td>
<td>18.6</td>
<td>1.81</td>
<td>1.66*</td>
</tr>
<tr>
<td>3</td>
<td>829</td>
<td>.6</td>
<td>9.75</td>
<td>1.18</td>
<td>.51</td>
</tr>
<tr>
<td>4</td>
<td>911</td>
<td>.91</td>
<td>11.6</td>
<td>1.32</td>
<td>.62</td>
</tr>
<tr>
<td>MD</td>
<td>484</td>
<td>6.2</td>
<td>23.4</td>
<td>4.84</td>
<td>1.28</td>
</tr>
</tbody>
</table>
Effect of risk adjustment on outcomes

Non-risk adjusted rate

3 - 0.6/100

4 - 0.9/100

1 - 0.98/100

2 - 3.0/100

MD - 6.2/100
Effect of risk adjustment on outcomes

<table>
<thead>
<tr>
<th>Non-risk adjusted rate</th>
<th>Risk adjusted O/E</th>
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</thead>
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<tr>
<td>3 - .6/100</td>
<td>**1 - .58</td>
</tr>
<tr>
<td>4 - .9/100</td>
<td>3 - .51</td>
</tr>
<tr>
<td>1 - .98/100</td>
<td>4 - .62</td>
</tr>
<tr>
<td>2 - 3.0/100</td>
<td>MD - 1.28</td>
</tr>
<tr>
<td>MD - 6.2/100</td>
<td>**2 - 1.66</td>
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Effect of risk adjustment on outcomes

**Non-risk adjusted rate**

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<td>6.2/100</td>
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**Risk adjusted O/E**

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<td><strong>1</strong></td>
<td>-.58</td>
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<td>MD</td>
<td>1.28</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>1.66</td>
</tr>
<tr>
<td>Pre-op Risk Factors</td>
<td>UMD (%)</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5 or more</td>
<td>24</td>
</tr>
</tbody>
</table>
## Preop comorbidities

<table>
<thead>
<tr>
<th>Condition</th>
<th>UMD (%)</th>
<th>NSQIP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>29</td>
<td>11</td>
</tr>
<tr>
<td>ETOH</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>COPD</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Dep function</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>CHF</td>
<td>6</td>
<td>1</td>
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<tr>
<td>ARF</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>CRF</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Steroid use</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>HTN</td>
<td>41</td>
<td>33</td>
</tr>
<tr>
<td>MI</td>
<td>2.6</td>
<td>.7</td>
</tr>
<tr>
<td>Sepsis</td>
<td>13</td>
<td>4</td>
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Patient Factors +
Effectiveness of Care +
Random Variation =
Outcome

Reliable Clinical Database
Valid Analytic Models
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