Avoiding Surgical Complications

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Complications Explained
1) Some surgeons are not very good
2) Other factors may contribute to complications

Lessons from Cognitive Science and Aviation Safety

The phenomenal power of the human mind.
The human mind does not read every letter by itself, but the word as a whole.

Misperception
- Hard Wired
  - Perceptual information is highly filtered
    - 11,000,000 bits/second perceived
    - 40 bits/second consciously processed
  - Err towards familiar and expected

Heuristics
- Brain software
  - Shortcuts in reasoning
    - Availability heuristics
    - Likelihood = easily come to mind
  - Confirmation bias
    - Decision, then discount contradictory evidence
    - "Tunnel vision"

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So, you need to deliberately change view.

Laparoscopy Disadvantages

- Close-up vs. Wide angle

Laparoscopic/Robotic Surgery Disadvantages

- Loss of haptic "active" touch
  - Processed through visual cortex

- Cross-validation of perceptual information
  - Diminished

- Situation Awareness - Deliberate
  - Becomes more important

Situational Awareness

- Knowing where you’ve been...
- Knowing where you are...
- Anticipating where you might soon find yourself

Instinctive / Deliberate

- Instinctive
  - Experienced surgeon
    - Moves scope "Close and Wide" views

- Deliberate
  - "Where am I?"
Instinctive Thinking
Experience and Training Dependant
Patterns sought in long-term memory

Solutions: Experience
“5,000 Hours to be an expert”
- 2 hours/case
- 2 lsc cases/week = 200 hrs/year = 25 years
- 5 lsc cases/week = 500 hrs/year = 10 years

Instruments
- Know How They Work
- Argon Beam Coagulator
  - Fulguration - superficial
  - Argon flow - 6-8 L/min
  - Insoluble Gas

What is Safest Energy Source?
- Bipolar
- Monopolar
- Argon Beam
- Laser

John Denver

Shoe Tying
Made Simple
by John Denver

Kouros – 500BC (Getty Museum)
“Blink”
Medical Error: Solutions

- Systems Solutions - Hospital
  - Computers - medications, test results, etc

- Systems Solutions - Operating Room
  - Work load, proper instruments and maintenance
  - “Time Out” - check procedure and site
  - ?? During Surgery ??

Laparoscopy: Advantage

- Everyone Can See
  - Ask for Help
    - Assistant surgeon
    - Encourage involvement
    - Nurses
    - Eliminate hierarchy
    - Anesthesiologist
      - Additional expertise and experience

Good Collaboration Defined

- Nurses
  - “having their input respected”

- Doctors
  - “nurses who follow their instruction”

Liability Claims

- Claims with substantial harm to patients
  - 90% - a team member knew something wrong
  - Kept silent
  - Was ignored

  “Patients pay a high price for dysfunctional teamwork
  (Pronovost)

Precedent NASA: Why?

Crew Resource Management

- Crew encouraged to offer opinions
- Critique accepted non-defensively
- Conflicts resolved via reasoned argument and appropriate evidence
- Essential activities maintained - flying the plane!

Miracle on the Hudson

- “Sully”

Flight 1549 Teamwork

- Sullenberger
  - Took over flying the plane
  - Found place to land

- Co-pilot
  - Tried to relight the engines
  - Sent distress signal
  - Prepared plane for water landing

- Dail, Dent, Welsh - attendants
  - Prepared passengers for emergency landing
  - Helped with life vests
  - Opened doors
  - Helped passengers evacuate - 3 minutes
Operating Room = Cockpit

- Complex environment
- High stakes, high anxiety
- Emotional
- Hierarchical

Wrong-Site Surgery

- Colorado Malpractice Database, 2002-2008
- "Never-Events"
  - 107 wrong site procedures
  - 38 - Significant harm
  - 5 - Major harm
  - 1 death
- Attributed to lack of “time out” in 72% of cases

Wrong-Site Surgery

- Significant Harm - 38 patients
  - Spine - 5 wrong level
  - Vascular - 4 wrong site
  - Colon - 4 wrong part
  - Organ resection - 4 wrong organ
  - Orthopedic - 6 wrong side
- Gynecology - 2 wrong ovary
  - Ophthalmology - 2 wrong eye
  - Neurosurgery - 2 wrong side craniotomy
  - Urology - 2 wrong side ureter

WHO Surgical Safety Checklist

- Postoperative complication rates fell by 36%
- Mortality rates fell by 36%
- All hospital sites had a reduction in the rate of major postoperative complications

Preventing Harm

Team behaviors:
- Turn high performing individuals into a high-performing team
- Reduce the risk that errors will result in patient harm.

GOAL is to make teamwork the NORM in the Operating Room
Technique

- Operate
  - Mid pelvis
  - Avoid pelvic sidewalls
  - Uterus – if backstop necessary
  - Vessels, Bowel – know where they are
  - Energy sources
    - Direction – move lateral to medial

Instinctive: Fear/Stress

- Reaction / state of arousal
  - Tachycardia
  - Aggressive mood
  - Momentary Autism
    - Brain limits incoming information
    - Narrowing of attention
    - Vision restricted

Deliberate

Slow Down

Tamponade

Take a deep breath
Wait a few seconds to regain composure

Solutions: Training

- Practice, practice, practice
- Pelvic trainers
- Simulators

“5,000 Hours to be an expert”

Gyn Laparoscopy Simulator

- Simulate
  - Abnormal Anatomy
  - Major Vessel Injury
  - Ureteral Dissection
  - Bowel Injury
  - Bladder Injury
The Postoperative Promise

Postoperative Complications

Conclusions

- Understand:
  - Your brain is not hard-wired for surgery
  - Need to compensate for short-comings

Goals

- We all want patients to do well
- We all want to avoid complications
- It isn’t enough to be smart or have good hands.....
  - Need to understand cognitive limitations
  - Need to understand the benefits of teamwork

Learn

From the mistakes of others....

Thank You

The Robot

- “The Robot is an instrument looking for an indication. I can’t see where it is going to get any of my laparoscopic procedures done quicker, safer, or cheaper”
- “We should not need a million dollar robot to close a myomectomy site”
- “a classic example of marketing preceding science”
- “If only a fraction of the huge amount of money being poured into the purchase and maintenance of robotics had been directed towards promoting formal endoscopic teaching, we’d have probably done better, and our specialty would have benefited immensely”

The Robot

- “It behooves us to keep an open mind about robotics...it may provide us with tools about which we can only now imagine”
- “overlaying a 3D image with CT images (or MRI, PET) to show underlying anatomy”
- “robot will tell you ‘don’t cut that - it’s the ureter’”
- “visualization of wavelengths outside human perception to identify malignant disease, endometriosis, etc”
- “Remote surgery more accessible”

Questions
Marking the Ureters

Surgical Principles
- Traction/counter-traction
- Develop surgical planes
- Dissection
  - Tips away from vital organs and vessels

Morcellation
- Location
  - Anterior
  - Avoid bowel
  - Midline
    - Avoid iliac vessels
- Technique
  - PULL tissue into device
  - Do not move device
  - Observe cutting edge at all times

Decision Speed and Stress
- Stress increases response speed
  - Searching for source of threat
- Decisions made before all relevant information assimilated
- Speed traded for accuracy

What's Wrong With This Video?
Avoiding Laparoscopic Complications

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Resource

- Primer in Gyn Endoscopy
  - AAGL
    - Website - www.aagl.com
    - www.aagl.com/residents.asp

Dental Aptitude Test
1. Manual Dexterity (carving test) from a specified model
2. Survey of Natural Sciences, Biology and General Chemistry
3. Perceptual Ability

Predicting Academic Performance and Clinical Competency for International Dental Students: Seeking the Most Efficient and Effective Measures

Multiple regression analyses identified National Board Part II and dexterity measures as significant predictors of academic performance and clinical competency.

Surgical Technique
- Dissection
  - Identify vital structures
  - Sharp and blunt dissection
  - Develop tissue planes

- Tissue Handling
  - Atraumatic
  - Traction/counter-traction

Procedure Goals
- First, do no harm

Single officer patrol cars - Slow down
Fatality Rate For Aviation and Highway Travel

Surgical Complication Rate
- 1,303 Laparoscopies or Hysteroscopies/yr
- 1 Major vascular injury
- Average 1.0 hr/procedure

76/100,000 Operating Hours

“I learned that danger is relative and that inexperience can be a magnifying glass.”

Charles A. Lindbergh

Trocar Removal
- Also under direct vision
- Release pneumo-peritoneum
- Re-inspect trocar sites
- Inspect umbilical port
- On way out

Marking the Ureters = Deliberate
Avoiding Vascular Injury

- Adequate skin incision
- Stay in midline
  - Thin
  - 45 degrees - hollow of Sacrum
- Obese
  - 90 degrees - umbilicus shifts below bifurcation
- Table horizontal - no Trendelenberg
- Pressure at insertion
  - ? Higher (> 15mm) is better?

Inferior Epigastric Bleeding

- Foley
- Bipolar
- Suture
- Closure Device
  - Grise/Carter/Exit

Which is Safest?

- Bipolar
- Monopolar
- Yag/KTP laser
- ABC

Alternative Approaches

- Open Laparoscopy – Hasson
  - Does NOT eliminate risks
  - Visceral injuries
    - 0.08% closed vs. 0.05% open
  - Lowers risk of vascular injuries
    - 0.07% closed vs. 0% open
- LUQ approach

Technique

- Bleeding
  - Isolate vessels
  - Tamponade
  - Dissect away from ureter
  - Apply energy to isolated vessel

Avoiding Tissue Spread

- Strategies
  - “Cutting” current (low voltage)
  - Compress tissue - less volume
  - Pulse energy to allow tissue cooling
  - Irrigate to cool tissue

> 200 lbs
Trocar Insertion

- Safety shield - NOT!
- Adequate skin incision
- Index finger to stop penetration
- Secondary trocars
  - Direct vision - tip in view

Patient Selection

- Adhesions to Anterior Abdominal Wall
- Previous Incision
  - 27% Pfannenstiel
  - 55% midline below umbilicus
  - 67% midline above umbilicus
- Hx - Pelvic/Abdominal Infection
  - Abscess, Ruptured Appendix

Brill, Ob/Gyn, 1995

LUQ

Adhesions Unlikely
- LUQ
- Midclavicular line to ant axillary line
- Below 10th rib

NG Tube

Veress, 1st trocar

Brill, Ob/Gyn, 1995
Laparoscopic Surgery

- **Advantages**
  - Illumination
  - Magnification

- **Disadvantages**
  - Close vs. wide view
  - Need to Deliberately Change View

Avoiding Laparoscopic Complications: Lessons from Cognitive Science

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- Intersection of cognitive science and laparoscopic surgery.
- Clear that the human brain has limitations that can be overcome with training, but also with technology.
Trocar Insertion

- Vascular Injury – 47
  - Common Iliacs
    - R = 16
    - L = 5
  - Aorta = 6
  - Vena Cava = 5

Soderstrom, JAAGL, 1997

Retroperitoneal Hematoma

Management
- Do NOT open peritoneum
- Do NOT grasp veins
- Tamponade
- Vascular surgeon
- Midline incision
  - Continue tamponade

Laparoscopy Simulator

- Simulate
  - Abnormal Anatomy
  - Major Vessel Injury
  - Ureteral Dissection
  - Bowel Injury
  - Bladder Injury

Effective Decision Making

- Must Balance
  - Deliberate thinking
    - Conscious processing
    - Weighting pros and cons
    - Learning and repetition based
  - Instinctive thinking
    - Subconscious processing
    - “Intuition”
    - Improves with experience
    - => 5,000 hours to be “expert”

Accident Chain

- Any one action may have manageable results
- A series of events may result in untoward consequences
- The pilot is the last link in the safety chain

“Weather, Pilot Inexperience Factors in JFK Jr. Crash”
July 16, 1999

Jeppson Flight Instructor Refresher Course
Crew Resource Management
- Flight deck crew are encouraged to offer opinions...so as to promote trust, effective working and decision making.
- Critique is accepted objectively and non-defensively.
- Essential activities are maintained while collecting information. (Flying the plane!!)
- Conflicts of opinion are clearly stated, assessed and resolved via reasoned argument and appropriate evidence.
- The effects of stress and fatigue on performance are recognized.

Sterile Cockpit Rule (1981)
- No non-essential conversation or activity during certain crucial times:
  - Pushback to takeoff
  - Plane is taxiing
  - Altitude of 10,000 feet or less
- Flight attendants do not contact anyone in the cockpit.

Deliberate Thinking for Surgeons
- Learn anatomy
- Learn proper techniques
- Be familiar with instruments
- Understand energy sources
- Know how to manage complications and emergencies

Yerkes-Dodson Law
- I am Concerned!
- I am Uncomfortable!
- This is a Safety Issue!

Never hesitate to CUS but only when appropriate!