Operating Room Set Up and Instrumentation: Making the OR Work for You

Sarah L. Cohen, MD MPH
Brigham and Women’s Hospital

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Disclosures

- I have served as a consultant for Olympus Surgical
Objectives

Improve safety and efficiency in the OR by:

1. Optimal room set-up
2. Thoughtful instrument choices
3. Team-based approach
4. Surgeon preparation
“In all things success depends on previous preparation, and without such previous preparation there is sure to be failure.”

-Confucius
Troubleshooting

- Get to room early!
  - Ensure critical equipment present, working
  - Optimize set up for best surgeon ergonomics
  - Set up recording
  - Help position patient
Goldilocks

TOO LOW!

TOO HIGH!

JUST RIGHT
AUDIENCE RESPONSE:

After a long day in the operating room doing laparoscopic cases, what hurts the most?

A) Neck/Shoulders
B) Arms/Hands
C) Low Back
D) Legs/Feet
Optimal Table Height

- Goal = minimize strain fatigue
- Instrument handles at **elbow level** to minimize upper arm and shoulder work
- Adjust bed, utilize steps to attain desired height
An ergonomic study of the optimum operating table height for laparoscopic surgery

R. Berquer, W. D. Smith, S. Davis

Surg Endosc 2002

- 21 surgeons, 2 handed circle cutting task at varying instrument heights
- Measured surgeon discomfort, task difficulty
- EMG readings at deltoid, trapezius

![Graph](image)

Fig. 3. Graph depicting the subjective rating of musculoskeletal discomfort for 21 surgeons while accurately cutting through a quarter-circle curved line on a piece of paper using a standard disposable pistol-grip laparoscopic grasper and scissors in a trainer box. Data represent the mean ± SEM. * $p < 0.05$ by ANOVA and Neuman–Keuls post hoc testing.
Video Screens

One Monitor

Two Monitors
Recommendations

- Monitor straight ahead
- In line with the forearm— instrument motor axis
- Avoid axial rotation of the spine
- Positioned lower than eye level to avoid neck extension
  - Optimum angle is 15 degrees downward
## Monitor Positioning

**Table 1** Overview of ergonomic research on monitor positioning: effectiveness and efficiency aspects

<table>
<thead>
<tr>
<th>Author</th>
<th>N</th>
<th>Design</th>
<th>Methods</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Erfanian et al. [17]</td>
<td>108</td>
<td>Randomized controlled trial</td>
<td>Measurement of time to perform a laparoscopic appendectomy with a regular laparoscopic tower or in-line projection</td>
<td>Operating time was significantly shorter for the in-line projection (6 min; ( p = 0.013 ))</td>
</tr>
<tr>
<td>Hanna et al. [18]</td>
<td>10</td>
<td>Randomized controlled trial</td>
<td>Measurement of time and quality of intracorporeal knot tying in different monitor positions</td>
<td>Both knot quality ( (p &lt; 0.01) ) and execution times ( (p &lt; 0.01) ) were improved with the monitor straight in front of the operator at the level of the hands</td>
</tr>
<tr>
<td>Haveran et al. [19]</td>
<td>24</td>
<td>Randomized controlled trial</td>
<td>Measurement of time to perform a one-handed task in 3 different monitor positions (left, front, right) at eye height</td>
<td>Task time was significantly shorter with the monitor straight in front of the performer ( (p = 0.048) )</td>
</tr>
<tr>
<td>Matern et al. [20]</td>
<td>18</td>
<td>Randomized controlled trial</td>
<td>Measurement of task performance and muscle activity of a 2-handed task with a monitor frontal and sideways at eye level, and frontal at operating field level</td>
<td>Task performance was best with the monitor positioned in frontal position at operating field level. Muscle activity was minimal with the monitor in frontal position at eye level</td>
</tr>
<tr>
<td>Omar et al. [21]</td>
<td>20</td>
<td>Randomized controlled trial</td>
<td>Measurement of time and errors for one-handed and two-handed tasks with the display at eye and hand levels</td>
<td>For one- and two-handed tasks, time ( (p &lt; 0.001) ) and errors ( (p &lt; 0.001) ) scores were significantly better with the display at hand level</td>
</tr>
</tbody>
</table>
Surgeon stance

- Feet flat
  - Can use rubber pads to stand on, place one foot up on step
- Hips level
  - Avoid tilting/cocking or leaning
- Shoulders down and relaxed
- Arms by sides, elbows 90 degrees
- Spine straight ahead, facing monitor
- Neck neutral, not pushed forward
- Gaze slightly down
Another option... from Ethos™ Surgical
Patient Positioning

- Anti-skid devices
  - Pads, foam, bean bag
  - Prevent patient slipping during steep T-berg
  - Avoid shoulder braces or chest wall strapping
Patient Positioning

- Neurologically neutral low lithotomy
  - Yellow-fin stirrups

- Candy canes: little support, allow uncontrolled hip abduction & rotation

- Boot stirrups: adjustable, minimize pressure on lateral and posterior calf
Patient Positioning

- Tucking arms military style with padding
  - Sleighs, toboggans, sheet tuck
  - Provides unrestricted mobility for surgeon
    - Prevents surgeon from “sitting” on the patient’s arm
  - Prevents arm from being dislodged from arm board
  - Avoid ulnar nerve injury, protect hands
Optimal patient positioning

Neutral, padded positioning; Knee, umbilicus and contralateral shoulder in-line
Consider cost - limit disposable instruments
AUDIENCE RESPONSE:

What is your preferred energy source for laparoscopic surgery?

A) Monopolar
B) Advanced bipolar (Ligasure, Enseal, PK)
C) Ultrasonic (Harmonic, Thunderbeat, Sonocision)
D) Laser
Energy Sources

- Monopolar
- Advanced bipolar
- Ultrasonic
- Laser

ALL devices carry potential for electrosurgical injury, know your device and it’s limitations!
Monopolar

- Scissor, dissector, L-hook, paddle

- Cutting mode
  - Low voltage, less thermal spread

- Coagulation mode
  - Higher voltage, more fulguration

- Simple and cheap, easy to use
- Smoke, thermal spread, hot tips

- Be aware of coupling injury, insulation failure
- MUST HAVE GROUNDING PAD
Advanced Bipolar Devices

- Limit stray current effect seen with monopolar
- Lower voltage, less thermal spread
- Electrosurgical generators with feedback control

- Still at risk for insulation failure, injury
- Fewer options for tissue effect (seals and divides)
Advanced Bipolar Devices

LigaSure™ (Covidien)
- Seals vessels up to 7mm
- Minimal sticking/charring
- 2mm thermal spread
- Variety of tips, device options
  - LigaSure Advance™ has monopolar tip
Advanced Bipolar Devices

- **Gyrus PlasmaKinetic (Olympus)**
  - Pulsed bipolar energy, allows intermittent cooling
  - Limited thermal spread/sticking
  - Seals 5-6mm vessels, 3mm thermal spread
  - Limited comparative data, but may have more variable sealing results

- **EnSeal® (Ethicon)**
  - Compression and bipolar
  - Seals vessels up to 7mm
  - 1mm thermal spread
  - Longest vessel seal time
Ultrasonic Devices

- Convert ultrasonic energy into mechanical energy, heats proteins, separates tissue
- Versatile dissection, less smoke
- 1mm thermal spread
- Only seals vessels up to 5mm
- **Surgeon dependent** – be aware of tissue tension

Harmonic® (Ethicon)
Thunderbeat – includes bipolar option (Olympus)
Sonocision- cordless (Covidien)
Laser

- Precise application of energy, control of target depth
- Very limited thermal spread
- Laser mediums: CO2, argon, KTP, NdYAG
- Limited by equipment cost, training
Limited adequately powered comparative studies
Many industry sponsored
Hard to compare in vivo, ex vivo
Advanced bipolar can seal larger vessels have higher seal burst pressures
Ultrasonic and monopolar with best dissection
BUT.... Which energy device is best?!?

None are without risk

All can cause thermal or electrosurgical injury
Uterine manipulators

- **Your second most important assistant**

- Choice of manipulator depends on nature and complexity of case

- Main difference between manipulators is the degree of ante- and retro-version
RUMI® (Cooper)

- Excellent retro/ante version
- Optional pneumooccluder balloon
- Rigid cup delineates fornices
- More difficult to assemble
- Limited with nullip/small pelvic outlet
- Partially reusable

V-Care® (ConMed)

- Good uterine mobility
- Built in pneumooccluder
- Very easy to insert
- Option without cup
- Fully disposable
Suture Options/Assist Devices

- Laparoscopic needle drivers
  - Non-barbed Suture
  - Barbed Suture

- Automated suturing devices
  - Endostitch™ (Covidien)

- Lapra Ty® (Ethicon)
The intangible yet invaluable aspects...
AUDIENCE RESPONSE:

Do you have a dedicated OR team for your procedures?
A) Yes – core group of staff
B) No – different people depending on the day
Teamwork: Learn from aviation, crew resource management

- Highly functioning team is key to patient safety
  
  - Decrease wrong site surgery, surgical site infection
  
- Efficiency
  
  - Specific to certain procedures, techniques
    - ie robotics
Team Approach

- What to do if you don’t have a team?
  - Seek out interested nurses, staff
  - Provide training, inservices
  - Discuss with administration – hard to argue with safety, efficiency data

- How to optimize your team?
Team Approach

- Simulation

- Enhance communication
  - Update preference cards, alert to specific case needs
  - Time outs/debriefs
  - Safety checklists
AUDIENCE RESPONSE:

What, if any, personal preparation do you do before a case?

A) None. Does coffee count?
B) Review the patient history
C) Discuss the case with colleagues
D) Review videos
E) Mental imagery exercise
Surgeon Preparation

Borrowed from the world of sports psychology

Olympians Use Imagery as Mental Training

By CHRISTOPHER CLAREY    FEB. 22, 2014
Surgeon Preparation

- Mental imagery: “the symbolic rehearsal of a physical activity in the absence of any gross muscular movements”

- Produces cognitive blueprints for movement patterns

- Mental rehearsal of these blueprints allows movements to become automatic

Surgeon Preparation

- 66 residents with limited experience in cystoscopy
- Imagery group had <20 minute guided session to envision the procedure
- Control group read textbook chapter
- Surgery assessment scores 15.9% higher in imagery group
Surgeon Preparation

Also from the sports world:

- Record your cases, review your performance

Make use of your colleagues

- Brainstorm about difficult/unique cases
- Never hesitate to ask for help

*Surgery is a team sport!*
Final Tips

- Get to the room early
- Set things up the same way every time
- Be aware of your stance
- Know all equipment better than anyone
  - Reps available if needed
- Know where supplies are kept
Final Tips

- Optimize your team
- Update preference cards
- Record cases often
- Consider mental imagery exercises
- Observe other high-performing surgeons
References

- Sari V, Nieboer TE, Vierhout ME, Stegeman DF, Kluivers KB. The operation room as a hostile environment for surgeons: physical complaints during and after laparoscopy. Minim Invasive Ther Allied Technol. 2010 Apr;19(2):105-9
- Law and Lyons. Comparative Studies of Energy Sources in Gynecologic Laparoscopy. JMIG 2013