

A Comprehensive Program for Resident Training in Operative Laparoscopy

Andrew I. Brill, M.D., and Robert M. Rogers, Jr., M.D.

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A comprehensive program for resident training in operative laparoscopy is presented in outline as an educational template. We understand that placing such concepts into action can be formidable. Strategies for implementation critically depend on identifying available methodologies that can help actualize each educational component. Both conceptual and visual-motor objectives can be satisfied by collectively matching with explanatory text, instruction manuals, inanimate exercises and practice, animate porcine correlates, and companion videotapes (both in vitro and in vivo) as necessary.

Methods for validating the effectiveness of this program are in the process of development. Standardized neuropsychologic tools will be used to establish and monitor behavioral and psychometric benchmarks. Visiospatial benchmarks will be ascertained for motor processing using conventional in vitro exercises assessed by rate and efficiency. Ultimately, a properly oriented preceptor will assess benefits translated as improved surgical skills.

After this training cascade, most technical achievements are realized after performing enough cases through level III, which contains types of laparoscopic surgeries that are realistically available and can be

accomplished in most training institutions. Although some programs may provide the opportunity to experience the skill sets and procedures of levels IV and V, these levels are delineated for experienced and highly skilled laparoscopic surgeons and as content for fellowship programs for advanced laparoscopic surgery.

I. Level I

A. Pelvic findings and technical limits

1. Normal anatomy
2. No masses
3. Manipulation of pelvic viscera
4. No retroperitoneal dissection
5. No dissection of vascular tissue

B. Procedures and their indications

1. Diagnostic
2. Sterilization
 - a) Bipolar
 - b) Clips
 - c) Ring
3. Lysis of avascular adhesions

C. Anatomy

1. Abdominal wall
2. Major retroperitoneal vessels
3. Surface and viscera of pelvis

From the Department of Obstetrics and Gynecology, University of Illinois at Chicago, Chicago, Illinois (Dr. Brill); and the Women's Clinic, Ltd., Department of Obstetrics and Gynecology, Reading Hospital and Medical Center, Reading, Pennsylvania (Dr. Rogers).

Address reprint requests to Andrew I. Brill, M.D., Department of Obstetrics and Gynecology, University of Illinois at Chicago (M/C 808), 820 South Wood Street, Chicago, IL 60612; fax 312 996 4238.

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4. Surface and viscera of upper abdominal cavity
5. Nerves of upper and lower extremities
- D. Physiology
 1. Pneumoperitoneum
 2. Trendelenburg
- E. Biophysics
 1. Electrosurgery
- F. Ancillary instrumentation and technology
 1. Uterine elevators
 2. Scalpel blades
 3. Suture needles
 4. Veress needles
 5. Cannulas
 6. Laparoscopes
 7. Operative instruments
 - a) Probes
 - b) Graspers
 - c) Scissors
 - d) Irrigator-aspirator
 - e) Kleppinger bipolar forceps
 - f) Ring applicator
 - g) Clip applicator
 8. Insufflators
 9. Xenon light sources
 10. Light cables
 11. Two- and three-chip video cameras
 12. Video monitors
 13. Videotape recorder
 14. Printer
 15. Electrosurgical generators
- G. Skills
 1. Preparation: patient and operating room
 - a) Equipment floor plan
 - b) Room lighting
 - c) Stomach decompression
 - d) Anesthetic inhalants
 - e) Patient positioning of legs, arms, buttocks
 - f) Table height adjustments
 - g) Draping
 - h) Examination under anesthesia
 - i) Antiseptic preparation
 - j) Tenaculum to cervix
 - k) Uterine sounding
 - l) Setting intrauterine manipulator
 - m) Organizing cables and cords
 - n) Stance of surgeon
 - o) Central tenets of team approach
 2. Peritoneal access
 - a) Umbilical incisions
 - b) Abdominal wall elevation
 - c) Veress entry logistics
 - d) Assessing pneumoperitoneum
 - e) Intraperitoneal mapping with spinal needle
 - f) Cannula entry logistics, primary and secondary
 - g) Insertion and fixation of open Hasson cannula
 - h) Left upper quadrant Veress and cannula entry
 - i) Left lower intercostal Veress entry
 - j) Transfundal Veress entry
 - k) Cul-de-sac Veress entry
 3. Tissue evaluation, manipulation, and dissection
 - a) Macroergonomics
 - (1) Veress grips
 - (2) Cannula grips
 - (3) Laparoscope grips
 - (4) Video camera grips
 - (5) Probe grips
 - (6) Laparoscopic instrument grips
 - (7) Irrigator-aspirator grip
 - (8) Kleppinger grips
 - (9) Ring and clip applicator grips
 - (10) Abdominal incision closures
 - b) Microergonomics
 - (1) Mobilization of bowel
 - (2) Strategic regional and focused inspection
 - (3) Systematic irrigation-aspiration
 - (4) Focused grasping and lifting
 - (5) Posterior element as initiator
 - (6) Primacy of perpendicular approach
 - (7) Focused manipulation
 - (8) Tension-countertension maneuvers
 - (9) Uterine manipulation
 - (10) Blunt dissection
 - (11) Sharp dissection
 - (12) Positioning fallopian tube(s)
 - (13) Kleppinger-fallopian tube dynamics
 - (14) Physical and thermal
 - (15) Clip applications

- (16) Band applications
- (17) Chromopertubation
- (18) Bipolar electrosurgical coaptive coagulation

H. Troubleshooting and creativity

- 1. Extremes of body habitus
- 2. Prior laparotomy
- 3. Uterine anteversion and retroversion
- 4. Large or malformed uterus
- 5. Cervical stenosis
- 6. Preperitoneal insufflation
- 7. Lens fogging
- 8. Adhesive disease
- 9. Carbonization and tissue sticking
- 10. Significant tubo-ovarian adhesions

I. Complications: recognition and management

- 1. Bleeding at tenaculum site
- 2. Uterine perforation and bleeding
- 3. Bleeding at cannula sites, superficial and deep
- 4. Traumatic injury to retroperitoneal vessels
- 5. Traumatic injury to bowel
- 6. Traumatic injury to bladder
- 7. Hemorrhage at traction and incision sites
- 8. Thermal injury to viscera
- 9. Sterilization failure

J. Medicolegal considerations

- 1. Informed consent doctrine
- 2. Preoperative counseling
- 3. Documentation
- 4. Postoperative care

II. Level II

A. Level IIA

- 1. Pelvic findings and technical limits
 - a) Vascular adhesions
 - b) Superficial peritoneal disease
 - c) No tissue masses
 - d) Sharp dissection in pelvis
 - e) No retroperitoneal dissection
 - f) No significant tissue removal
- 2. Procedures and their indications
 - a) Diagnostic with focal biopsy
 - b) Lysis of moderate adhesions
 - c) Biopsy and coagulation of superficial endometriosis

B. Level IIB

- 1. Pelvic findings and technical limits
 - a) Small mobile masses

- b) Sharp dissection and excision in pelvis
- c) Simple tissue removal
- d) No retroperitoneal dissection

2. Procedures and their indications

- a) Tubal sterilization: segmental resection, modified Pomeroy
- b) Salpingectomy
- c) Linear salpingostomy

C. Level IIC

1. Pelvic findings and technical limits

- a) Larger mobile masses
- b) Greater tissue removal

2. Procedures and their indications

- a) Ovarian cystectomy
- b) Pedunculated myomectomy
- c) Posterior culdotomy

D. Didactic content for levels IIA, IIB, and IIC

1. Anatomy

- a) Pelvic brim
- b) Pelvic sidewall
- c) Course of pelvic ureter
- d) Base of broad ligament
- e) Upper paravaginal anatomy
- f) Rectovaginal reflection

2. Ancillary instrumentation

- a) Injection-aspiration needles
- b) Monopolar operative instruments and electrodes
 - (1) Graspers
 - (2) Scissors
 - (3) Blade
 - (4) Spoon
 - (5) Ball tip
 - (6) Needle tip

c) Toothed tissue graspers

d) Corkscrews

e) Endoscopic sacs

f) Endoloops

g) Fascial closure devices

h) Rectal and vaginal probes

i) Heaney needle holder

j) Small soft tissue retractors

3. Skills

a) Bowel preparation

b) Choosing and attaining accessory cannula sites

c) Tissue evaluation, manipulation, and dissection

- (1) Strategic inspection for signs of malignancy

- (2) Systematic peritoneal washings
 - (3) Systematic adhesiolysis
 - (4) Hydroinjection of retroperitoneum
 - (5) Hydrodissection
 - (6) Mechanical incision and excision
 - (7) Posterior blade initiated tissue incision
 - (a) Perpendicular insertion
 - (b) Elevation
 - (c) Rotation
 - (d) Transillumination
 - (e) Incision
 - (8) Monopolar techniques with a variety of electrodes
 - (a) Desiccation
 - (b) Coagulation
 - (c) Electrosection
 - (d) Vaporization
 - (e) Fulguration
 - (f) Fulgurative incision
 - (9) Linear and curvilinear monopolar electrosection
 - (10) Peritoneal relaxing incisions
 - (11) Bipolar electrosurgical techniques
 - (a) Coaptive desiccation
 - (b) Touch coagulation
 - (12) Hydrodissection for removal of intraluminal products of conception
 - (13) Endoloop as tissue ligature
 - (a) Logistics, engagement, cinching, and incision
 - (14) Mass reduction and extraction of tubal segment
 - (15) Ovarian fixation
 - (16) Ovarian cyst aspiration
 - (17) Diagnostic ovarian cystoscopy
 - (18) Tension-countertension dynamism of tissue peeling
 - (19) Bagging and extracting specimens
 - (20) Total directed peritoneal lavage
 - (21) Prophylactic hemostasis with vasopressin
 - (22) Corkscrew myoma fixation
 - (23) Anatomic recognition for posterior culdotomy
 - (24) Reshaping techniques for myoma removal
 - (25) Transporting and affixing adhesion barriers
 - (26) Widening abdominal wall, soft tissue, and fascia
 - (27) Direct abdominal fascial closure
 - (28) Transvaginal suturing of vaginal fornix
- d) Troubleshooting and creativity
- (1) No abdominal wall vessel landmarks
 - (2) Smoke evacuation
 - (3) Clot lysis and removal
 - (4) Bleeding epigastric vessels
 - (5) Cyst aspiration, size reduction
 - (6) Preventing leakage on cyst aspiration
 - (7) Dense dermoid
 - (8) Bleeding at ovarian hilum
 - (9) Nondependent and gaping ovarian defects
 - (10) Adhesion prevention
 - (11) Bagging large tissue mass
 - (12) Removing large tissue mass
 - (13) The stuck specimen
 - (14) Calcified myoma
 - (15) Maintaining pneumoperitoneum on vaginal incision
 - (16) Mass reshaping and morcellation
 - (17) Endometriosis near vagina, bladder, bowel, and ureter
 - (18) Significantly dissected ovarian fossa
 - (19) Peritoneal trophoblastic implantation
4. Complications: recognition and management
- a) Injury to superficial or inferior epigastric vessels
 - b) Abdominal wall vessel ligation and coagulation
 - c) Thermal injury to bladder or bowel
 - d) Active arterial hemorrhage
 - e) Lost vessel
 - f) Larger cannula sites
 - g) Direct fascial closure
 - h) Spillage of ovarian cyst contents, dermoid and mucinous
 - i) Myometrial bleeding
 - j) Pitressin-induced cardiovascular phenomena

III. Level III

- A. Pelvic findings and technical limits
 1. No distortion of retroperitoneum
 2. Dense vascular adhesions
 3. Advanced adhesiolysis
 4. Dissection and mobilization of pelvic ureter
 5. Securing large vascular pedicles
 6. Dissection and mobilization of retroperitoneum
 7. Laparoscopic suturing
- B. Procedures and other indications
 1. Lysis of dense adhesions
 2. Excision of peritoneal endometriosis
 3. Pelvic sidewall dissection
 4. Oophorectomy
 5. LAVH down to uterine vessels
 6. Supracervical hysterectomy
 7. Uterine morcellation
 8. LUNA
 9. Repair of incidental cystotomy
- C. Anatomy
 1. Three surgical layers of the pelvic sidewall
 2. Avascular retroperitoneal spaces
- D. Ancillary instrumentation
 1. Knot pushers
 2. Needle holders
 3. Suture needles and materials
- E. Skills
 1. Tissue manipulation and dissection
 - a) Restoration of tubo-ovarian anatomy
 - b) Entering and mobilizing retroperitoneum
 - c) Identification and isolation of pelvic ureter(s)
 - d) Mobilization of congenital bowel attachments
 - e) Tubo-uterine dissection and incision
 - f) Utero-ovarian dissection and incision
 - g) Retro-ovarian dissection
 - h) Skeletonization of ovarian vessels
 - i) Free suture-passing techniques
 - j) Extracorporeal tying
 - k) Intracorporeal tying
 - l) Bipolar coaptive desiccation of ovarian vessels
 - m) Broad ligament dissection
 - n) Skeletonization of lower uterine segment
 - o) Mobilization of vesicouterine plane

- p) Uterine artery skeletonization
 - q) Coaptive desiccation of lower uterine segment vessels
 - r) Skeletonization and incision of uterosacral ligament
 - s) Anterior and posterior culdotomies
 2. Troubleshooting and creativity
 - a) Identification and surgical isolation of ureter(s)
 - b) Retro-ovarian fixation
 - c) Dense periovarian adhesions
 - d) Posterior and low lateral myomata
 - e) Mobilizing large uterus
 - f) Segmentally accessing large uterus
 - g) Vesicouterine fold after cesarean section
 - h) Using umbilical ligament for uterine artery isolation
- F. Complications: recognition and management
 1. Thermal and mechanical injury to ureter(s)
 2. Retroperitoneal bleeding
 3. Retracted or lost pelvic vessels
 4. Incidental cystotomy

IV. Level IV

- A. Pelvic findings and technical limits
 1. Partial cul-de-sac obliteration from endometriosis
 2. Advanced suturing
 3. Extensive and difficult retroperitoneal dissections
 4. Massive tissue morcellation
- B. Procedures and their indications
 1. Deep myomectomy
 2. Total laparoscopic hysterectomy
 3. Culdoplasty
 4. Burch urethropexy
 5. Paravaginal repair
 6. Vaginal reparative procedures
 7. Repairing bowel lacerations
- C. Anatomy
 1. Space of Retzius
 2. Uterine support
 3. Vaginal support
 4. Bladder support
 5. Rectal support
- D. Skills
 1. Tissue manipulation and dissection
 - a) Cannula sites: logistics for suturing instruments

- b) Inserting and removing curved needles
 - c) Suturing with curved needles
 - d) Continuous suturing techniques
 - e) Layered closure of myometrium
 - f) Suturing tissues of variable thickness and tenacity
 - g) Dissection of cardinal ligament complex
 - h) Circumferential dissection of vaginal fornices
 - i) Removal of uterine specimen(s)
 - j) Vaginal cuff closure and support
 - k) Fundamental value of medial umbilical ligament
 - l) Identification and entry into fundamental spaces
 - (1) Paravesical
 - (2) Pararectal
 - (3) Rectovaginal
 - m) Preperitoneal access to space of Retzius
 - n) Transperitoneal access to space of Retzius
 - o) Dissection cascade for space of Retzius
 - p) Transfixation to Cooper's ligament
 - q) Dissection and isolation of rectovaginal septum
- E. Troubleshooting and creativity
- 1. Multiple myomata
 - 2. Submucous myoma
 - 3. Adenomyoma
 - 4. Avoiding paravaginal ureter(s)
 - 5. Prior urethropexy
 - 6. Scarring in space of Retzius
 - 7. Atrophic uterosacral ligaments
 - 8. Avoiding ureteral entrapment
- F. Complications: recognition and management
- 1. Identification of bladder before and during mobilization
 - 2. Identification of ureters before complete culdotomy
 - 3. Prophylactic hemostasis during myometrial dissection
 - 4. Myometrial closure same as laparotomy alternative
 - 5. Identification of ureters before uterosacral fixation
 - 6. Identification of rectovaginal reflection and septum
 - 7. Layered closure of enterotomy
- V. Level V
- A. Pelvic findings and technical limits
- 1. Complete obliteration of cul-de-sac from endometriosis
 - 2. Extensive retroperitoneal dissection
 - 3. Reparative and microsuturing
- B. Procedures and their indications
- 1. Excision of cul-de-sac and paravaginal endometriosis
 - 2. Excision of ovarian remnant
 - 3. Pelvic lymph node dissection
 - 4. Presacral neurectomy
 - 5. Ureteral repair
 - 6. Tubal reanastomosis
 - 7. Excision and repair of bowel or bladder
 - 8. Cancer debulking
- C. Anatomy
- D. Skills
- E. Troubleshooting and creativity
- F. Complications: recognition and management