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UROLOGY BOARD REVIEW MANUAL

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Laparoscopy in Urology: Physiologic Considerations

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Table of Contents

Introduction	2
Equipment Used for Insufflation	3
Physiologic Changes During Laparoscopy.	5
Anesthetic Considerations.	10
Intraoperative Complications of Laparoscopy.	13
Postoperative Considerations	16
Case Discussions.	17
Conclusion	19
References	19

Cover Illustration by Paul Schiffmacher

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Laparoscopy in Urology: Physiologic Considerations

Vincent G. Bird, MD, and Howard N. Winfield, MD

INTRODUCTION

The application of modern laparoscopic principles to urologic surgery has resulted in significant patient benefits, including decreased postoperative pain, reduced length of hospitalization, and shortened recovery times. The evolving technologies that accompany laparoscopy and its application have also afforded the laparoscopic surgeon excellent visualization, magnification, and surgical instrumentation that allow the performance of increasingly complex surgical procedures with a degree of safety and efficacy equal to that of similar open surgical interventions.

Laparoscopic surgery is performed in a different environment from that of open surgery. This unique environment results in differences in which the anesthetized patient responds to the physiologic stress of surgery. Urologists performing transurethral surgery are already familiar with the concept of performing procedures in a surgical environment different from that of open surgery. As is the case with transurethral surgery, both the laparoscopic surgeon and anesthesiologist must have a complete understanding of the differences between open and laparoscopic surgery in order to ensure that all patients undergoing laparoscopic interventions will be able to tolerate the procedure, and that patients are not being exposed to undue risk that may result from factors specifically related to the nature of laparoscopic surgery.

The laparoscopic technique is predicated on the mechanical creation of pneumoperitoneum, which has important physiologic implications. A proper and thorough understanding of the physiology of laparoscopic anesthesia and surgery is becoming even more relevant in that laparoscopic procedures are now not only offered to young, healthy adult patients. Many pediatric and elderly patients with a variety of medical conditions may now also benefit from laparoscopic procedures. This review focuses on the physiologic sequelae of the pneumoperitoneum induced in laparoscopy. Studies relating to laparoscopy alluded to in this article were performed

with CO₂ insufflation of the peritoneal cavity unless it is specifically stated that the conditions are otherwise.

HISTORY OF LAPAROSCOPY

The use of minimally invasive techniques for the diagnosis and treatment of a variety of medical conditions extends back to ancient times. Archaeological evidence reveals that the Greeks and Romans inserted instruments into the human body in a variety of manners in attempts to visualize internal anatomy and pathology.¹ The Arabian physician Albukasim (936–1013) was the first known to have used illumination (light from a candle reflected from a mirror) to view the interior of the vagina.¹ However, the evolution of modern endoscopy/laparoscopy truly began approximately 200 years ago when Bozzini constructed his “Lichtleiter,” which was the first crude cystoscope.² The quality of endoscopy slowly progressed as improved light sources became available. Bladder endoscopy was readily embraced because the bladder could easily be filled with fluid that also acted as a coolant for the distally located light source. Soon after its invention, the principles of the electric light bulb were quickly adapted to endoscopy by Maximilian Nitze, thus further improving the quality of endoscopy.¹

Peritoneal endoscopy would prove more formidable than cystoscopy. In 1902, Ott performed “ventroscopy” by passing a speculum through a small colpotomy, illuminating the abdominal cavity with incandescent light reflected from a head mirror.³ However this viewing was quite limited as the abdomen was not expanded. A few years later, both Kelling⁴ in Germany and Jacobaeus⁵ in Sweden described endoscopic abdominal inspection with the use of pneumoperitoneum. The use of insufflation greatly enhanced endoscopic surveillance of the abdominal cavity. The safety of these procedures was then improved by the use of proximal light sources, which prevented the dangers of burns and other electrical faults associated with intraabdominal light sources.

During most of the twentieth century, mainly in Europe, laparoscopy was widely used as a diagnostic tool. Many European endoscopists continued to make improvements upon the procedure. Notably, in Germany,