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Operative Endoscopy Will Replace Almost All Open Procedures

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Despite being a relative newcomer to surgery, videolaparoscopy, also known as operative or therapeutic laparoscopy) has ignited a revolution in the surgical approach where it has been utilized for virtually every surgically addressed pathological entity.[1] Videolaparoscopic surgery has the predominant means of performing many common surgical procedures. Operative laparoscopy has largely prevailed over the open approach including more than 95% of cholecystectomies, 90% of fundoplications, 70% of ectopic pregnancies, and 50% of benign ovarian cysts. In addition, this minimally invasive approach has prevailed over more invasive open surgical resections in a diverse number of benign and malignant conditions. For example, gastric cancer can be treated with resection or intragastric surgery if diagnosed in its early stages. Videolaparoscopy affords the benefit of a less invasive and less morbid approach for early diagnosis of gastric cancer, ie, "stage the patient in an attempt to spare the patient." Similarly, patients with biliary tract and liver malignancies currently benefit from the use of staging laparoscopy for the identification of unresectable disease. Colon resection, cystectomy and bladder reconstruction, adrenalectomy, and treatment of pancreatic abnormalities are now all approached via operative laparoscopy. The use of laparoscopy for radical hysterectomy, prostatectomy, and pelvic and paraaortic lymphadenectomy is now prevalent.[1]

Morbid obesity, once considered a contraindication for laparoscopy, has now yielded to the clear advantages that laparoscopy presents. In one of the few randomized, controlled trials comparing open and laparoscopic approaches, patients undergoing gastric bypass laparoscopically had significantly fewer complications and a shorter length of stay than those patients who had open gastric bypass.[2] In my opinion, laparoscopic surgery should be the procedure of choice for pelvic and abdominal pathologies in obese and morbidly obese patients. In my experience, it is amazing how well these patients do when managed laparoscopically.

Has Darwinian natural selection lead to the evolution of surgery favoring the laparoscopic approach? Clear advantages of videolaparoscopic surgery over open surgery seem to drive an ongoing selection process following time-honored principals of surgery: identification of anatomy and exposure and use of proper surgical technique.

Laparoscopy offers better visualization and exposure, therefore, easier identification of anatomical relations. The superiority of laparoscopic surgery extends to several other parameters: reduced perioperative stress, diminished intraoperative and postoperative complications, fewer adhesion formations, lower cost, shorter convalescence period, and improved quality of life. The incisions provide better cosmesis. Surgeons are no longer crouching over while operating with their hands inside the thoracic, abdominal, and pelvic spaces; rather they are watching monitors and working in an enhanced and magnified operating field. More striking, as the surgeon benefits, is the patient's tremendous favorable results.

Open surgery, through a large incision, is associated with considerable tissue injury leading to a potentially harmful stress response. Cardiopulmonary and renal complications are reduced during laparoscopic surgery. Intraoperative complications are significantly lessened with laparoscopic surgery as this tool provides better visualization through significant magnification of the operative field and better illumination. Pneumoperitoneum provides a clearer view of the anatomy because intraoperative bleeding from microvessels is lessened due to increased intraabdominal pressure, minimizing the need for blood transfusion. Postoperatively, the smaller incisions of laparoscopic procedures decrease the rate of wound seromas, infections, hematomas, and ileus with less pain. With early ambulation, the risk of thromboembolic events is decreased.

The cost of hospitalization could be significantly reduced following laparoscopic surgery, as the hospital stay is markedly shorter. Pain is significantly lessened, and recovery is faster. Videolaparoscopic surgery enables rapid return to normal daily functions, and consequently, better quality of life. More importantly, laparoscopic surgery, when properly executed, is associated with better long-

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term results than is laparotomy as exemplified by less adhesion formation that translates to less pain, lower risk of bowel obstruction, as well as higher pregnancy rates for women of reproductive age.

In the future, operative laparoscopy will not be limited to abdominal, chest, skull, and endoluminal surgery. I believe that wherever there is a cavity in the body, or a cavity can be created, endoscopic surgery is indicated, and most probably, preferable.[5] Enhanced performance skills and novel instrumentations will lead us in further advancements in endoluminal surgery. This combined with endoscopy will enable the treatment of different diseases, such as gastrointestinal, genitourinary, or vascular disorders, limiting the need for incisions and providing access solely through the natural orifices of the body.

It is important to emphasize that operative laparoscopy remains technically challenging. The steep learning curve, demanding skill, availability of proper instrumentation, and experience of the surgeon all remain major limiting factors for operative laparoscopy. In turn, these limitations are precisely where the opportunities lie for innovative surgeons, engineers, and entrepreneurs to make their contributions. Novel technologies, such as tele-robotics, can enable surgeons to reach new frontiers. Surgical simulators will help pave the way for more efficient surgical training. Advancement in equipment should be directed toward the development and invention of safer, faster, and easier to use cost-effective devices. For example, we would benefit from flexible devices that provide superior imaging that at the same time allow tactile feedback. Such instruments would greatly improve the current limitations of maneuverability in some laparoendoscopic tasks and together with more sophisticated thermo-chemical, nanotechnology, and physical ablation devices may ultimately render surgery truly noninvasive. Such innovations would allow us to endoscopically address even the most emergent surgical conditions like acute hemorrhage.

The challenge remains not only in the instrumentation, but also the teaching methods for laparoscopic surgery to address the learning curve.[4] We are already using computer-based virtual reality simulators to aid the training process and proficiency of laparoscopic techniques. We certainly could benefit from borrowing simulation techniques from other fields such as aeronautics as well as combine advanced computer technologies, telecommunications, and virtual reality to introduce state-of-the-art laparoscopy teaching aids. Further, we need to improve how to measure surgical competency. Objective measures of surgical skill in laparoscopy are yet to be devised, and specific benchmarks for minimum surgical competency are still not set. Successful operative outcome correlates with a flattened learning curve, and we should precisely define the level of operative efficiency to be achieved by all newcomers to the field. Once the quality of surgical skill is defined, we will be able to ascertain the effectiveness of endoscopic surgery in respect to clinical outcome, patient satisfaction, and cost by performing multi-center, randomized trials. I strongly believe that the results of such studies will render many open surgeries obsolete.

Knowledge enhancement and its application is a time-dependent process that always leads to a change in existing paradigms and unthinkable innovations. At the beginning of the last millennium, a relatively unknown man by the name of Ibn al-Haytham, in the town of Basra, resolved the mystery of vision through simple empirical observations by determining that light originated outside the eye and reflected into it. His discovery of this visual dynamic led him to develop the "camera obscura," a device that transformed many aspects of today's knowledge and ultimately paved the road to tele- and robotic vision, enabling the invention and evolution of videolaparoscopic surgery almost 1000 years later. As video-assisted endoscopic surgery transformed operative laparoscopy from a "one man band" to an "orchestra," the technological revolution has begun and will continue to run to its final course of eliminating the need for open surgery.[1] In other words, almost all the surgeries (not only a small fraction like today) will be performed on images on TV screens! No more surgeon's hands in the body cavities! It is only a matter of TIME.

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