

# THE DEVELOPMENT OF GYNECOLOGICAL LAPAROSCOPY

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## ABSTRACT

In this paper, we discuss the present situation of laparoscopy in gynecology. There is no doubt that hospital stay, postoperative pain and convalescence are less when it is possible to treat gynecologic disease via laparoscopy. However, for reaching the final conclusion about the other effects of this kind of surgery, e.g., adhesion formation after operation, pregnancy rate, etc., a series of prospective and randomized studies to compare laparoscopy with conventional surgery (laparotomy) are needed.

**Keywords:** Operative laparoscopy, Gynecology endoscopy.

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## HISTORY OF LAPAROSCOPY

The origins of endoscopy can be traced to the Greek school of Kos led by Hippocrates (460-375 B.C.), who described the use of rectal and primitive vaginal specula. The Babylonian Talmud (500 A.D.) describes the use of a siphonot, which was a lead tube that when inserted into the vagina, permitted the cervix to be visualized. This is the first account in history of an internal organ being directly visualized.

The father of modern endoscopy was Bozzini, whose first attempt at endoscopy was to observe the interior of the urethra with a simple tube and a candle. He recognized that one of the essential requirements for any form of endoscopy was the need for adequate illumination. All internal body cavities are completely dark and in order to be inspected, the structures require the transmission of adequate external illumination. Bozzini in 1860<sup>1</sup> responded to this need by developing a light reflector, which was a rather complex system by which light from a lamp was reflected down a tube into the vagina for illumination whilst the operator observed the cervix through a second channel. The first

truly practical endoscope was produced by Desmormeaux in Paris (1865).<sup>2</sup> The method of illumination used was a lamp that burned a mixture of alcohol and turpentine. The endoscopic sleeve was a plain hollow tube attached to the light source (Fig. 1). Desmormeaux used this apparatus mainly for examination of the urethra and bladder. This equipment may indeed have been a significant conceptual advance in its time, but that the technique was adopted says much for the fortitude of his patients who permitted an apparatus bellowing smoke and fumes to be inserted where man had been but never seen before. Pantaleoni in Ireland (1869) described using the endoscope of Desmormeaux to perform the first successful hysteroscopy when he demonstrated endometrial polyps to be the cause of postmenopausal bleeding.<sup>3</sup>

Edison invented the incandescent light in 1880, and in 1883, Newman first described a superior endoscope using this more convenient source of light. The light source was held in or near the patient and local burns subsequently followed. In 1943 Fourestier, Gladu and Vulmiere<sup>4</sup> overcame this problem by moving the light source some distance from the patient. They achieved this by transmitting light down a solid quartz rod. Such 'cold' light sources have subsequently been further improved by replacing the solid

rod with bundles of flexible quartz fibers and more recently with a liquid light cable containing alcohol. The first examination of the abdominal contents of a living animal was described by Dr. Georg Kelling to the German Biological and Medical Society in 1902.<sup>5</sup> He termed the examination "celioscopy". He appreciated that the view was dramatically improved when he created a pneumatoperitoneum by forcing air filtered through cotton wool into the cavity. Jacobeus of Stockholm first described the inspection of the peritoneal cavity in humans and he was the first to use the term "laparoscopy" in 1910.<sup>6</sup> Nordentoeft in 1912 improved laparoscopy by facilitating the insertion of the telescope with a Trocar system.<sup>7</sup>

Once the value of a pneumatoperitoneum became established, special needles were developed to minimize the risk of penetrating intra-abdominal structures. The first of these was invented by Goetze (1918),<sup>8</sup> and was improved by Janos Veress of Hungary.<sup>9</sup> We recently introduced a new generation of needles by using an objective instead of blunt part of the Veress.<sup>10</sup> This new instrument now has the name of "Optiveress".

### OPERATIVE LAPAROSCOPY

The first reported operative laparoscopic procedure was that performed by Fevers in 1933.<sup>11</sup> He was a general surgeon who performed an abdominal adhesiolysis. In 1937, Ruddock introduced a drill biopsy forceps with diathermy coagulation potential.<sup>12</sup> Perhaps the first gynecological operative laparoscopy was performed by Boesch in Switzerland in 1936.<sup>13</sup> Although an American surgeon, E.T. Anderson appeared to independently suggest that an electrical coagulation system could be used as a method of female sterilization,<sup>14</sup> Power and Barnes were the first to describe a series of sterilizations, performed in 1941, in which, using Ruddock's equipment, they fulgurated a 1 cm portion of the cornual section of each tube.<sup>15</sup> This technique became the most commonly used method of sterilization for the next 30 years. Using unipolar circuitry to coagulate tubes produced some burns, the cause of which was poorly understood at the time. These led to infection, peritonitis and deaths from bowel perforation. To avoid this complication, Frangenheim<sup>16</sup> in Germany and Rioux and Cloutier<sup>17</sup> in Canada introduced bipolar diathermy. These techniques were subsequently popularized as a method of tubal sterilization by Kleppinger and Corson. Kurt Semm adopted a different approach to the prevention of electrical burns. He developed a laparoscopic modification of his endocoagulator. With this system, electrical energy is used to heat the tip of the coagulator probe to a controlled temperature of 100°.

Raoul Palmer was largely responsible for the wider acceptance of laparoscopy in gynecological practice. By as

early as 1946, he had collected over 250 personal cases. Although originally introduced as a diagnostic tool, surprisingly, the wide dissemination of laparoscopy in North America in the early 70's was due to its application to perform female sterilization, a procedure that until then required laparotomy or colpotomy.<sup>18</sup>

Except in some pioneering centers, the use of laparoscopy as an access route for procedures other than tubal sterilization, biopsies, puncture and aspiration of ovarian cysts, and retrieval of foreign bodies, lagged. Prominent among these centers were Kiel in Germany and Vancouver in Canada. In 1979, Semm and co-workers reported oophorectomy, salpingectomy and adnexectomy. A ligation technique using a modified Roeder's loop was introduced by the Kiel group. In 1973, Gomel presented his initial experience with operative laparoscopy and demonstrated the value and safety of his approach for salpingo-ovariolysis, fimbrioplasty, salpingostomy and tubal pregnancy managed by segmental excision.<sup>18</sup>

By the end of the decade, the CO<sub>2</sub> laser was being used in Clermont-Ferrand, where a prominent endoscopic team was being established by Bruhat.<sup>18</sup> Thus, by the end of 1970, the principles of operative laparoscopy using electrical (unipolar and bipolar), thermal and laser energy, sharp and blunt dissection, ligation and suturing techniques already were established and the value and advantages of this approach for several gynecologic procedures recognized.

The technique for hysterectomy by laparoscopy was described in 1989.<sup>19</sup> In 1991, a group from France<sup>20</sup> performed 39 cases of laparoscopy lymphadenectomy. The Burch operation has been done via laparoscopy.<sup>21</sup> It was usually believed that oncology could not be discussed in the field of laparoscopy. However, recently this idea has been changed and it appears that gynecological malignancies are going to be treated via laparoscopy.

Microsurgical endoscopy is another new era in gynecologic laparoscopy. For example, microsurgical end-to-end anastomosis of the uterine tube has been reported while the complete technique was done through laparoscopy.<sup>22</sup>

### MICROSURGERY OR LAPAROSCOPY

It is a general belief that macrosurgical technique developed into microsurgical technique and then to laparoscopy. This means that laparoscopy is more advanced and complete than microsurgery. Gomel<sup>23</sup> does not believe this. He thinks that microsurgery changes the way of thinking about surgery and is really a new concept and philosophy in this field, and that laparoscopy is only a new access to the abdominal cavity. We do not agree with Gomel's idea that laparoscopy is only a new access to the abdominal cavity and not a new philosophy in surgery. Of

course, laparoscopy can not be a continuation of microsurgery. Microsurgery began in 1975, but the beginning of laparoscopy goes back to nearly two hundred years ago. These two kinds of thinking about surgery have progressed separately, crossed each other at one point and found shared view points: 1) non-touch technique, 2) operation under magnification, and 3) continuous irrigation. Laparoscopy also has additional benefits, like: 1) short hospital stay, 2) shorter convalescence, 3) less post-operative pain, and 4) small incisions (from the point of aesthetics).

Microsurgery changes the physicians' method and idea about surgery and makes them more delicate and fine surgeons, persons who try not to traumatize the tissues. Modern laparoscopy is also similar. It is expected that a laparoscopist be a delicate surgeon. Unfortunately, the gynecology residency program in our country, like many parts of the world, is to train a macrosurgeon. We should realize that the branch of gynecology is different from general surgery. The gynecologist operates on the uterus, ovaries, and tubes; organs of reproduction. However, the general surgeon operates on the stomach, intestine, etc. Mistreatment of reproductive organs not only endangers the health of the patients, but has additional ill effects on the social status of a family as well as mental and physical health. We think that our gynecologic residency program should change and more focus should be put on training the gynecologist to become a microsurgeon rather than a macrosurgeon.

#### ADHESION FORMATION IN LAPAROSCOPY

It is usually believed that adhesion formation is less in laparoscopic operations in comparison with laparotomy. We studied this subject in humans.<sup>24</sup> Eight patients were operated on via laparotomy. In this group, 8 ovaries were treated by macrosurgical wedge resection using 3/0 chromic catgut. The other 8 ovaries were treated by the technique of ovarian cauterization. 10 other patients were operated on via laparoscopy. Ten ovaries were biopsied in multiple points and the other ten were treated by the technique of ovarian cauterization. The adhesion formation in 8 ovaries which were operated on by electrocautery via laparotomy was 1/8 while in the 10 ovaries which were operated on by the same technique via laparoscopy, it was 2/10, which was not statistically significant. All of these patients had polycystic ovaries (PCOS). Gomel<sup>23</sup> showed that surfaces of adhesion formation were numerically but not statistically greater in the horns of mice uteri in laparoscopic operation rather than laparotomy. In our study,<sup>24</sup> the rate of adhesion formation in 8 patients who had laparotomy was 1/8 in the group of cauterization, and 8/8 in the group of macrosurgical wedge resection, which was statistically different. These results suggest that the technique of operation on the site of

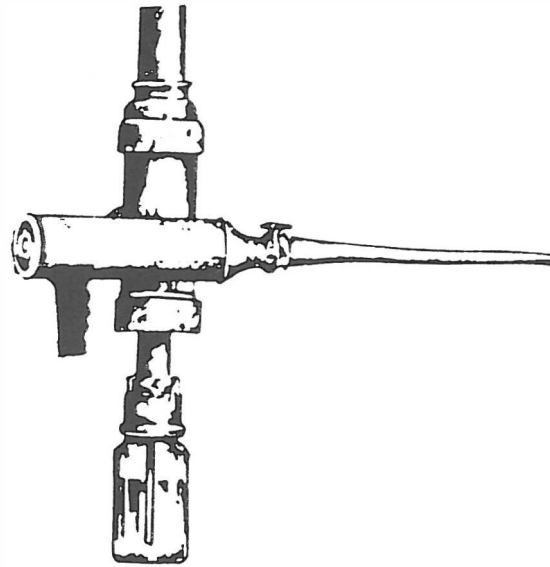


Fig. 1. A presumptive picture of an old laparoscopic apparatus.

pathology is more important than the technique of entry into the abdomen. If we were in a situation in which we had to choose between laparoscopic macrosurgery and laparotomy microsurgery, we would certainly prefer the latter. At the present time our criteria of judgement for continuation of operation is adherence to microsurgical techniques. This means that if we feel trauma to the tissues is somehow unacceptable or unavoidable, we prefer to change the technique from laparoscopy to laparotomy. The surgeon should not continue a macrosurgical technique only because it is performed via minimal access (laparoscopy).

#### LAPAROSCOPY, A "MINIMALLY INVASIVE SURGERY"

It is said that a laparoscopic operation is "minimally invasive surgery". However, some authors believe that hysterectomy is an invasive operation without considering the size of the incision. On the other hand, using the phrase "minimally invasive surgery" may cause a misunderstanding in the way that the surgeon thinks he is performing a minor operation. When the indication for performing surgery is not definitely clear for the surgeon, laparoscopists are more inclined to perform operation, because they believe that it is a "minimally invasive surgery". On the contrary, because of large incisions, the laparotomists are less inclined to perform such an operation.

Our idea about the phrase of "minimally invasive surgery" is that when we open the abdomen in many layers

and then perform hysterectomy, we are doing a more invasive surgery than performing hysterectomy via laparoscopy. So, we think that advanced operative laparoscopy is a "less invasive surgery", and not a "minimally invasive surgery".

### **RADICAL VERSUS CONSERVATIVE SURGEONS**

Successful performing of laparoscopy depends on two factors, instruments and experience. Production of instruments is a continuous process. We should be thankful to companies which produce these instruments. At the same time, we have to confess that this is also a line of business. Every company claims that its instruments and technology have better qualities and advantages. As stated by McDonough,<sup>25</sup> unfortunately, we do not have the same control on the production of the surgical instruments and technology as we do on food and drugs. Sometimes after using a particular instrument for so many years, we come to realize that that particular technology may have its own complications. We, like McDonough, believe that there should be an organization to supervise the quality control of these instruments and advisability of their use.

Some<sup>26</sup> believe that laparoscopy is like a wheel; it was invented to be modified in the process of time according to needs; the wheel of the bicycle, the wheel of the car, and that of airplanes. We first discovered the field of laparoscopy for tubal ligation and then for hysterectomy, pelvic lymphadenectomy, etc. The discoverers are the knowledgeable and brave surgeons who have revolutionized this field. Some make an example that these physicians are like a group of birds flying together. Suddenly one of the birds begins to test a new speed for flying higher. This bird is an exception and also a pioneer in its group. The surgeons who have contributed in finding new methods and expanding the knowledge of man are also exceptions and pioneers. However, they are also susceptible to unpredictable dangers. Smith, who introduced diethylstilbestrol (DES) for the first time for prevention of habitual abortion, at that time meant to help the patients. They did not really evaluate DES well, and they used it for the wrong reasons. Thus some believe that the car which needs a wheel also needs brakes.<sup>26</sup> Those brave radical surgeons are like a wheel, increasing the speed of medical progress. However, we need some conservative physicians to act like a brake. Sometimes, it is advisable to look at the subject from the point of view of these latter gynecologists.

At the present time, we can perform many advanced laparoscopic operations with abundant high-tech instruments. However, there is lack of solid articles presenting reliable statistics between operations which are performed via laparoscopy and laparotomy. This is the

time that we, as doctors who have tried very much for improving the techniques of laparoscopic operations, focus our attention extensively on comparative research. Only when the results of such prospective and randomized studies become clear can we judge more scientifically about these kinds of operations.

David Grimes in 1992 looked at the subject as a conservative doctor and compared all of the articles published about gynecologic diseases which were treated either by laparoscopy or laparotomy.<sup>27</sup> First, he specified the statistical value of the articles. Then he used a special classification (A, B, C, D and E). 'A' meant that the specific disease was preferred to be treated via laparoscopy and on the contrary, 'E' showed the preference of laparotomy. The other groups (B, C and D) were in between. Now let's discuss some of these diseases.

### **Polycystic Ovary Syndrome (PCOS)**

Since 1984, with the introduction of laparoscopic ovarian cauterization (L.O.C.) by Gjönnæss,<sup>28</sup> there has been a good change in the result of operation in these patients. We reported the rate of adhesion formation after LOC in 1991.<sup>29</sup> Our results showed that the rate of adhesions is much less than the macrosurgical ovarian wedge resection performed via laparotomy. The first report on the complications of LOC was also published by our group.<sup>30</sup> It has been shown that the rate of multiple pregnancy and abortion after LOC is like normal pregnancies.<sup>31</sup> Recently, Donesky has said that there is no ovarian hyperstimulation after LOC.<sup>31</sup> However, we have seen a mild case of ovarian hyperstimulation after this kind of operation (unpublished data). With regard to Grimes' study,<sup>27</sup> PCOS is in class 'B' (there is fair evidence that laparoscopy is better).

### **Ectopic Pregnancy**

Maruri in a study<sup>32</sup> calculated the annual expense of operating on all ectopic pregnancies via laparoscopy or laparotomy in the United States. \$138,920,000,00 was calculated to the benefit of the government if all operations were performed via laparoscopy. There is a prospective and randomized study to compare laparoscopic and laparotomy operation for ectopic pregnancy. On the whole, it seems that there is fair evidence that in cases of ectopic pregnancy, laparoscopy is better than laparotomy (class 'B').

### **End-to-End Tubal Anastomosis**

End-to-end anastomosis of the uterine tube has been done via laparoscopy.<sup>22</sup> However with regard to all of the studies on this subject, there is fair evidence that laparotomy is better than laparoscopy (class 'D'). Recently, the technique of end-to-end anastomosis of the tube via minilaparotomy was described. With this technique, we can minimize the disadvantage of large incisions.

### Salpingo-ovariolysis

The studies showed that the pregnancy rate after salpingo-ovariolysis<sup>23</sup> was the same whether it was performed via laparoscopy or laparotomy (class 'C'). However, some surgeons prefer laparoscopy because it is performed via a small incision and has a shorter period of convalescence.

### Myomectomy

There are many articles which discuss myomectomy in infertile patients.<sup>33</sup> Unfortunately, there is no prospective and well-controlled study to show the effects of myomectomy on fertility. Fine suturing is difficult to perform via laparoscopy. After laparoscopy myomectomy, we are obliged to use medium-size sutures that are not good from the point of adhesion formation. So, at the present time we prefer laparotomy microsurgery for performing myomectomy instead of laparoscopy myomectomy. We use 6/0 Vicryl sutures on the surface of the uterus after laparotomy myomectomy. In second look laparoscopy, mild and moderate adhesions were found on the incisional line and adnexa (unpublished data). There are articles which show that barrier materials are useful to decrease adhesion formation after myomectomy.<sup>34</sup>

### Laparoscopic Hysterectomy

There are few articles to compare laparoscopic hysterectomy with laparotomy hysterectomy. In a very well designed study,<sup>35</sup> it was shown that the time of operation and decrease in hemoglobin and hematocrit is more in laparoscopic hysterectomy than vaginal hysterectomy. The other comparisons were the same between the two methods. We performed laparoscopic hysterectomy in 20 cases. The patients had good conditions after operation and left the hospital sooner. There were no complications among them. On the whole, we believe that laparoscopic hysterectomy should be a substitute for abdominal hysterectomy and not for vaginal hysterectomy.

### Endometriosis

David Grimes' study<sup>27</sup> showed that endometriosis was in class 'C' (there is no evidence indicating that laparoscopy is better than laparotomy). However, an article on a randomized and prospective study published after Grimes' article showed that the choice of class 'B' was better than class 'C' in patients with endometriosis.<sup>36</sup>

## SOME CONCERNS ABOUT TEACHING LAPAROSCOPY

Pitkin<sup>37</sup> and Gomel<sup>23</sup> have shown concern about teaching laparoscopy in very short courses. It is not advisable to give students the feeling that every gynecologic endoscopy

(operative hysteroscopy, laser laparoscopy, resectoscopy, ...) can be taught in a very short period of time. We agree and believe short course teaching is not good for the safety of the patients. In a one-month course in our Endoscopy Center, we always tell our students that they shouldn't think this is the end of laparoscopy; in reality this is just the beginning and the end of it goes as far as the end of their life. Our other concern is that at the present time, buying laparoscopy instruments is like having a license to perform all gynecologic endoscopic operations. The best solution is the addition of gynecologic endoscopy to residency programs. However, until that time, it is the responsibility of the Iranian Council of Medicine to make special rules and supervise performing operations in order to prevent post-operative complications. For example, we suggest that laparoscopy surgeons be classified as novice, intermediate, and advanced surgeons and proceeding from one level to the next should require special documentations.

Doctors with low levels of skill in endoscopy usually learn laparoscopy by observing a laparoscopy trained surgeon, watching video films or participating in medical congresses. This may give the trainees the misconception that such operations are very simple and can be performed by any physician. We should realize that some advanced operations which are easily performed by experienced surgeons can not be done by unexperienced physicians. Every surgeon should know his limitations in performing operations. This is advisable for the safety of the patients.

In summary, laparoscopy is an ongoing and progressive operation. Modern laparoscopy trains a microsurgeon. After some years the laparoscopist finds himself a physician who tries not to traumatize the tissues and to perform delicate surgery. At the present time we can handle many operations via laparoscopy which conventionally are performed by laparotomy (laparoscopic hysterectomy, Burch operation, pelvic lymphadenectomy, and even Wertheim's hysterectomy). But the question is which technique is to the benefit of the patient. In order to answer this question, we need prospective, randomized and well-designed studies. Loving laparoscopy should not cause us to be prejudicious physicians who insist on an idea; we should never forget that, "Something which seems to be true today, may prove to be false in the future".

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