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Editors

Practical Manual of Operative Laparoscopy and Hysteroscopy

Second Edition

Illustrated by Rod Powers and Josephine Taylor

With 200 figures in 269 parts

To: Dr. Camran



Springer

History of the Development of Gynecologic Endoscopic Surgery

Marian D. Damewood

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As early as 500 A.D. a "siphopherot" or tube made of lead and used to bring the internal female genitalia within range of the physician's eye was described (Fig. 1.1).¹ This ancient accomplishment resulted in visualization of the external cervical os through dilatation of the vagina. In the last two decades developments in the techniques of operative laparoscopy and operative hysteroscopy have had a major impact on the specialty of gynecologic surgery. At present, laparoscopy is the most frequently performed gynecologic procedure in the United States. The development of endoscopic surgery has been primarily stimulated by the worldwide need for permanent sterilization methods. Most importantly, improvements in the ability to achieve intraabdominal hemostasis primarily through the use of electrocoagulation, has made it possible to perform surgical procedures through the laparoscope.

Development of Laparoscopy

The first reported observation of the human peritoneal cavity with an optical instrument was by Jacobaeus in Scandinavia in 1910.² However, several developments predated this report. As early as 1805, Bozzani in Germany vi-

sualized the urethral orifice with candlelight and a simple tube. This led to Desormeaux's development, in 1843, of the first urethro-scope and cystoscope using mirrors to reflect light from a kerosene lamp.³ After this development Stein, in Germany (1874), developed a photo endoscope. Nitze, also from Germany, added a lens system to the endoscopic tube allowing magnification of the viewed area.⁴ The invention of the light bulb in the United States by Thomas Edison had a significant impact on the development of gynecologic endoscopy. Newman in Scotland developed a cystoscope using a small incandescent light bulb at the distal end (1883). Kelling from Germany (1902) first reported peritoneal endoscopy in dogs creating a pneumoperitoneum using a needle and a cystoscope designed by Nitze.⁵ Subsequently, Jacobaeus (1910) used a trocar and cannula to induce pneumoperitoneum in women, introducing a Nitze cystoscope through the same cannula to achieve pelviscopy, laparoscopy, or peritoneoscopy.²

Several refinements in the technique of peritoneoscopy preceded its application to gynecologic surgery. Orndoff from the United States developed a sharp pyramidal point on the laparoscopic trocar to facilitate puncture.⁶ An automatic trocar sheath valve was then intro-

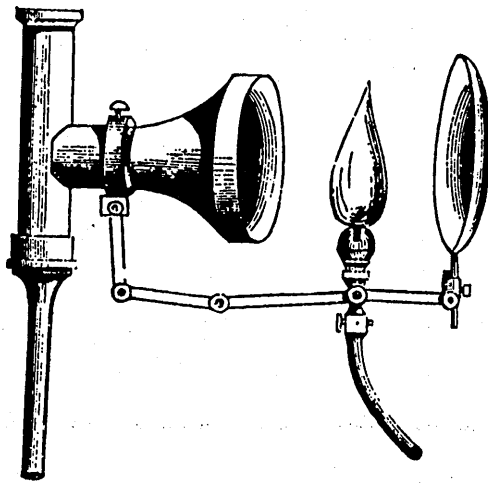


FIGURE 1.1. The "photoendoscope" or siphonoscope described in the Talmud.⁴

duced to prevent escape of air. Although the first pneumoperitoneum was created using air, Zollikoffer from Switzerland went on to use carbon dioxide (CO₂).⁷ A fore-oblique 45° lens system and the use of a second puncture for upper abdominal procedures were introduced by Kalk from Germany (1929).⁸ Biopsy instru-

mentation and cauterization of intraabdominal adhesions at laparoscopy was re-reported by Fervers from Germany (1933).⁹ This report was followed by the introduction of a single-puncture operating laparoscope by Ruddock in the United States in 1934,¹⁰ and followed almost immediately by Boesch's utilization of a 40° to 50° pelvic elevation during the procedure. In 1937 Hope (United States) used Ruddock's peritoneoscope to diagnose ectopic pregnancies.¹¹ In the United States, Anderson (1937) and Powers and Barnes (1941) performed endothermal coagulation of the fallopian tube for the purpose of sterilization.^{12,13} A laparoscopic uterine suspension was performed in 1942 by Donaldson and colleagues (United States).¹⁴ An alternative approach to peritoneoscopy, the culdoscope, was introduced by Decker in 1944 (Fig. 1.2).

The first gynecologist to use laparoscopy clinically on a wide basis was Palmer in France (1947).¹⁵ He was also responsible for the introduction of the endouterine cannula for uterine manipulation and for the development of chromotubation. Further advancements in our ability to perform surgical procedures at laparoscopy occurred with the introduction of

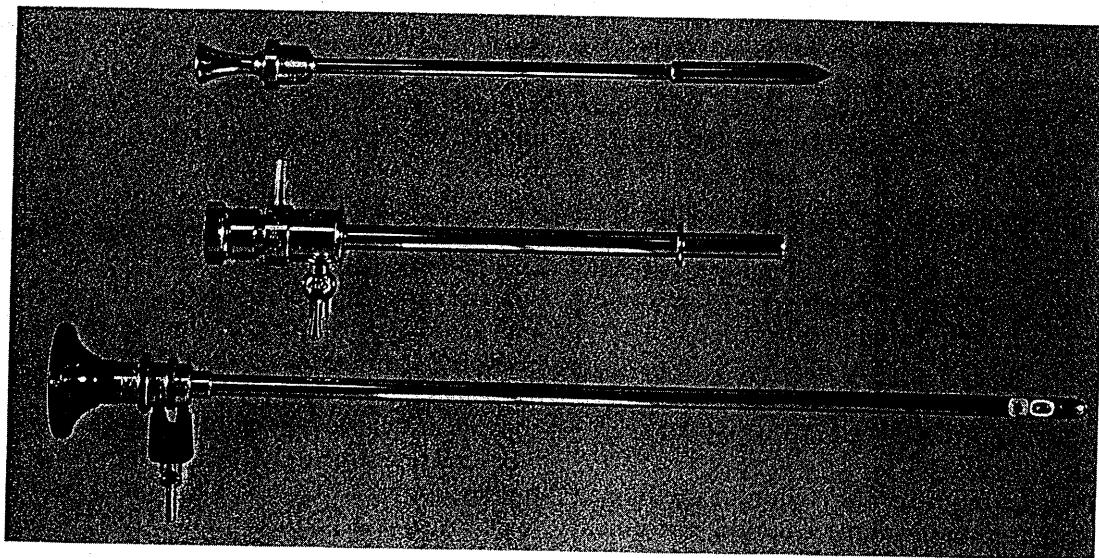


FIGURE 1.2. Decker culdoscope manufactured by American Cystoscope Makers, Inc. Note incandescent distal lamp and 90° viewing angle. From top to

bottom: pyramidal trocar, sheath with distal stop, and culdoscope. (Courtesy of Dr. Michael P. Steinkampf.)

I. Histo

TABLE I

In Bozzani Desorme

Stein Nitze

Edison Newman Boisseau

Kelling

Jacobaeu.

Orndoff

Zollikoff Korbsch Kalk

Fervers Ruddock

Boesch Anderson Powers & Decker Palmer

He Palmer Frangenh Semm

Stepoe Stepoe & Clarke Hulka Rioux Yoon

fiberoptics the early sign the scopes heim¹⁶ France tion for availabil tion was of pelvis

TABLE 1.1. Chronology of the development of laparoscopy.

Investigator	Date	Development
Bozzani	1805	Visualization of urethral orifice with candlelight and simple tube
Desormeaux	1843	Presentation of first urethroscope and cystoscope, using mirrors to reflect kerosene lamplight. First effective endoscope
Stein	1874	Development of photoendoscope
Nitze	1877	Addition of lens system to endoscopic tube, thus allowing magnification of area viewed
Edison	1880	Invention of incandescent lamp bulb
Newman	1883	Development of a cystoscope using a small incandescent light bulb at distal end
Boisseau de Rocher	1889	Separation of ocular part from introducing sheath and use of different telescopes through sheath
Kelling	1901	Creation of air pneumoperitoneum in dogs using a needle, followed by insertion of a Nitze cystoscope
Jacobaeus	1910	Creation of air pneumoperitoneum in humans using a trocar, followed by introduction of a Nitze cystoscope through the trocar. First recorded observation of a human peritoneal cavity with an optical instrument
Orndoff	1920	Development of sharp pyramidal point on the trocar to facilitate puncture and automatic trocar sheath valve to prevent escape of air (peritoneoscopy)
Zollikoffer	1924	Used carbon dioxide instead of air to create pneumoperitoneum
Korbsch	1927	First textbook with an atlas of laparoscopy
Kalk	1929	Developed fore-oblique (45°) lens system. Introduced second puncture for upper abdominal procedures
Fervers	1933	Cauterization of intraabdominal adhesions
Ruddock	1934	Developed single-puncture operating laparoscope. Published results of 900 peritoneoscopies. 100% diagnostic accuracy in 58 cases of ectopic pregnancy
Boesch	1935	Utilization of 40°-50° of pelvic elevation
Anderson	1937	Endothermic coagulation of fallopian tube as a method of sterilization
Powers & Barnes	1941	Sterilization by means of laparoscopy tubal cautery
Decker	1944	Introduction of culdoscopy
Palmer	1947	First gynecologist to use gynecologic laparoscopy clinically. Introduced the endouterine cannula for uterine manipulation and tubal patency testing
Hopkins & Kapany	1952	Introduction of fiberoptics to endoscopy
Palmer	1962	Utilization of electrocoagulation for tubal sterilization by laparoscopy
Frangenheim	1963	Used diathermy for tubal sterilization by laparoscopy
Semm	1963	Automatic insufflation of the pneumoperitoneum and complete pelviscopy instrumentation set
Stephoe	1967	First laparoscopy textbook in the English language
Stephoe & Edwards	1970	Recovery of oocyte with the laparoscope for in vitro fertilization
Clarke	1972	Introduction of instruments for tubal ligation by laparoscopy
Hulka	1972	Introduced clips for tubal sterilization by laparoscopy
Rioux	1973	Development of bipolar cautery for tubal sterilization by laparoscopy
Yoon	1974	Utilization of silastic rings for tubal sterilization by laparoscopy

fiberoptics in 1952 by Hopkins and Kapany. In the early 1960s Harold Hopkins went on to design the rod lens system used in most endoscopes today. Almost concurrently, Frangenheim¹⁶ in Germany (1963) and Palmer in France continued to develop electrocoagulation for tubal sterilization by laparoscopy. The availability of intraabdominal electrocoagulation was a major impetus to the development of pelviscopy, since this type of surgery would

not be possible without the ability to achieve intraperitoneal hemostasis. Additional advancements in pelviscopic techniques and instrumentation have been attributed to Kurt Semm of Germany. In 1963, he introduced the use of an automatic insufflator to maintain pneumoperitoneum.¹⁷ Semm is also credited with the introduction of a complete pelviscopy instrumentation set, which has since been updated and modified.

In the 1970s laparoscopy was increasingly used for intraabdominal surgery. Steptoe and Edwards recovered the first oocyte for in vitro fertilization in 1970 using the laparoscope.¹⁸ Until the introduction of transvaginal ultrasound oocyte retrieval in the late 1980s, laparoscopy had formed an integral part of the in vitro fertilization procedure. Laparoscopic tubal sterilization using clips was introduced by Hulka and colleagues in 1972.¹⁹ Rioux (1973) from Canada developed bipolar cautery for laparoscopic tubal sterilization. Yoon of the United States (1974) laparoscopically applied silastic rings, also for tubal sterilization. The chronology of the development of operative laparoscopy is summarized in Table 1.1.

Concurrent with the development in the technology of laparoscopy, a significant body of information was developed. The first textbook with an atlas of laparoscopy was published by Korbsh from Germany in 1927. Rudock in the United States in the late 1930s published results of 900 laparoscopies.²⁰ Specific reference in this publication was given to the diagnostic accuracy of laparoscopy with respect to ectopic pregnancy. Two years later Beling, also from the United States, published a review that listed indications for laparoscopy with specific reference to endometriosis, chronic pelvic inflammatory disease, and the diagnosis of ectopic pregnancy. Palmer in 1947 published results of his case series of 250 procedures. The late 1950s and early 1960s saw the introduction of multiple textbooks of gynecologic laparoscopy. A German textbook was published in 1959 by Frangenheim, followed by Thoyer-Rozat²¹ with a French version, and Albano and Cittadini²² with an Italian text on gynecologic endoscopy. The first textbook of laparoscopy published in the English language was by Steptoe from the United Kingdom, in 1967.²³ Cohen and Fear from the United States presented the first American publication of gynecologic laparoscopy, followed by the first American textbook of gynecologic laparoscopy in 1970.²⁴ Additional large case reports concerning outpatient laparoscopic procedures were reported by Wheelless from the United States in 1970.²⁵

Standards for laparoscopic surgery have been set and followed in the United States. In 1972 Phillips founded the American Association of Gynecologic Laparoscopists (AAGL), and during the same year Hulka coordinated the first annual report of Complications Committee of the AAGL.

The impact of diagnostic and operative laparoscopy on gynecologic practice has been significant. Laparoscopy has allowed the gynecologist to establish the diagnosis in a large number of clinical situations and has reduced greatly the need for laparotomy. Additional advances stimulated the laparoscopic treatment of endometriosis, pelvic adhesions, tubal disease, ectopic pregnancies, and ovarian cysts. A significant reduction in cost, postoperative morbidity, and recuperation with respect to laparotomy has also been documented.

Development of Hysteroscopy

Attempts at visualization of the uterine cavity preceded the development of peritoneoscopy. As early as 1000 A.D., Abulkasim used a mirror to reflect light into the vaginal vault. Desormeaux (1853) in France inspected the interior of the uterus with an early endoscope and reported the first "satisfactory" hysteroscopy. In addition, he identified polyps in the uterus of a postmenopausal patient experiencing vaginal bleeding.²⁶ Aubinais in 1864²⁷ inspected the uterine cavity with the naked eye and Pantakami²⁸ from Ireland used a cystoscope (Fig. 1.3) initially designed by Desormeaux to identify uterine polyps (1868). Clado (1898) in France described several models of hysteroscopic instrumentation and published material on the technique of hysteroscopy (Fig. 1.4).²⁹ This accomplishment was followed by the publication of a treatise on hysteroscopy, with specific reference to contact hysteroscopy (Fig. 1.3), by David in 1908.³⁰

Further refinements in hysteroscopy were directed at the development of effective distending media and clear visualization of the uterine cavity. Rubin in 1925 combined the cystoscope with CO₂ insufflation of the uterine cavity.³¹ In

FIGURE 1.3. Toni (1868).²⁹ Provided light for produced with hysteroscopy. *Ir Diagnostic and Chicago: Year B*

1928 Gauss understand the this case was of a transparent the endoscop

FIGURE 1.4. technique of (Reproduced in Fig. 1.3.)

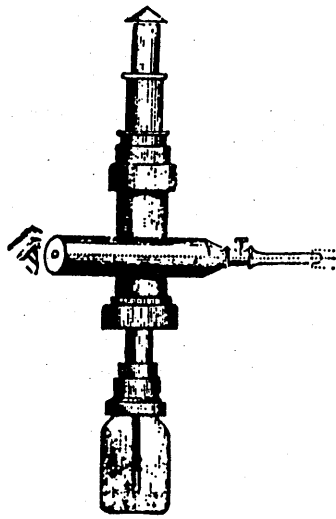


FIGURE 1.3. The first hysteroscope used by Pantaleoni (1868).²⁹ The alcohol lamp at the bottom provided light for the tapered metal hysteroscope. (Reproduced with permission from Barbot J. History of hysteroscopy. In: Baggish MS, Burbot J, Valle RF, eds. *Diagnostic and Operative Hysteroscopy: A Text and Atlas*, Chicago: Year Book Medical Publishers; 1989.)

within the uterine cavity was presented by Silander in 1962.³³ Edstrom and Fernstrom in 1970 introduced high molecular weight dextran as a distension medium.³⁴ Lindemann in 1970 used CO₂ for uterine distension.³⁵ These developments increased the clinical utility of hysteroscopy. Developments in hysteroscopy are summarized in Table 1.2.

Since the lens systems of earlier hysteroscopes were inferior, inadequate light and image transmission occurred frequently. At present, most hysteroscopes consist of a lens system surrounded by glass fibers carrying light into the uterine cavity. However, Vulmiere in 1952 used a rigid one-piece mineral glass guide, which when properly treated could not only illuminate but also magnify the image when in direct contact with the object. In 1963 an optical trocar in an italic sheath was used and perfected in 1973 when Barbot introduced it for clinical use in France.²⁹ In 1979 Baggish reported the first experience with this instrument in the United States.²⁹ Contact hysteroscopy optics were combined with the principles of modern panoramic hysteroscopy into a single instrument, the microcolpohysteroscope, introduced by Hamou in 1980.³⁶ As recently as 1987 Baggish introduced a focusing panoramic hysteroscope with a four-channel operating sheath particularly useful for laser procedures.²⁹

1928 Gauss used water to flush blood and distend the uterine cavity.³² The water source in this case was held 50 cm above the patient. Use of a transparent rubber balloon mounted on the endoscope that was subsequently inflated

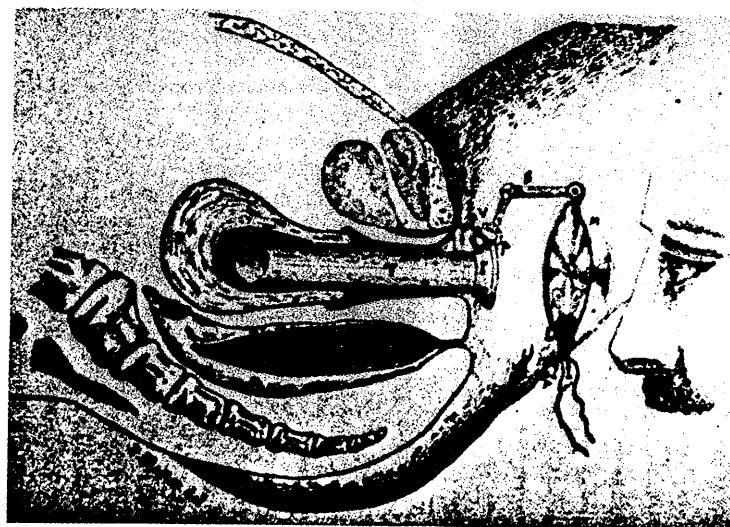


FIGURE 1.4. The hysteroscopic technique of Clado (1898).²⁹ (Reproduced with permission as in Fig. 1.3.)

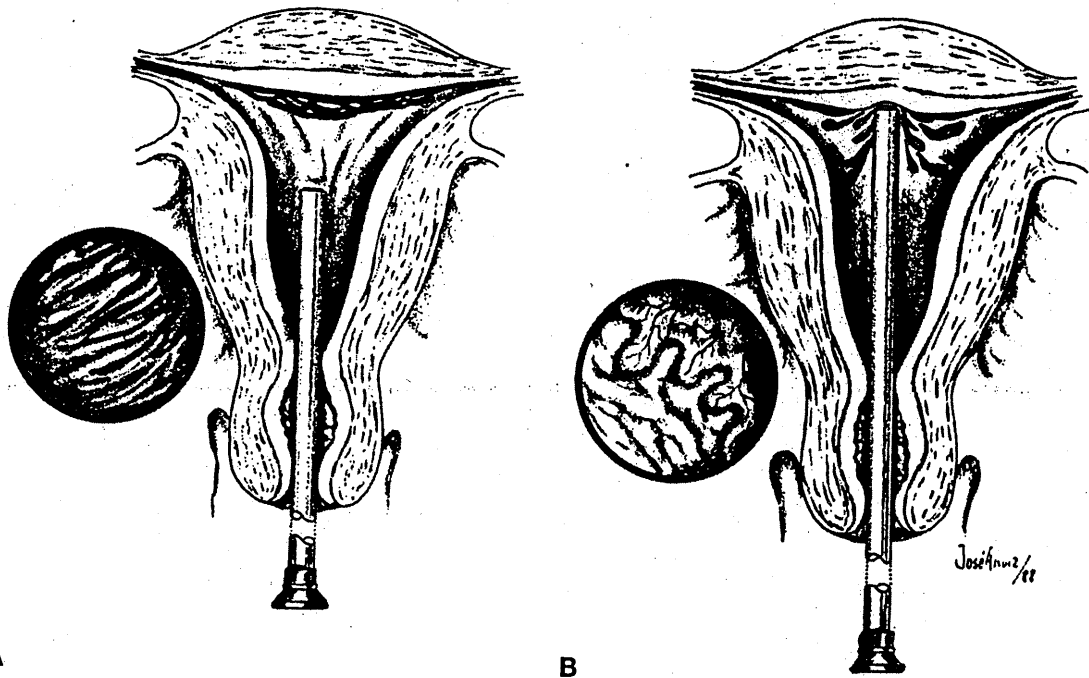


FIGURE 1.5. Early contact hysteroscope (1907).^{29,30} A: Before contact. B: After contact. (Reproduced with permission as in Figure 1.3.)

TABLE 1.2. Chronology of the development of hysteroscopy.

Investigator	Date (A.D.)	Development
Abulkasim	1000	Utilization of mirror to reflect light into vaginal vault
Desormeaux	1853	Inspection of interior of uterus with early endoscope, first "satisfactory" endoscope
Aubinais	1864	Inspection of uterine cavity with the naked eye
Pantaleoni	1868	Used cystoscope designed by Desormeaux to identify uterine polyps
Clado	1898	Described several models of hysteroscopic instruments
David	1907	Treatise on hysteroscopy, with specific reference to contact hysteroscopy
Ruben	1925	Combination of a cystoscope with CO ₂ insufflation of the uterine cavity
Gauss	1928	Use of water to flush blood and distend uterine cavity. Water source held 50 cm above the patient
Silander	1962	Use of a transparent rubber balloon mounted on the endoscope inflated within the uterine cavity
Edstrom & Fernstrom	1970	Introduction of high molecular weight dextran as a distention medium
Lindemann	1970	Use of CO ₂ for uterine distension
Hamou	1980	Introduction of the microcolpohysteroscope
Baggish	1987	Invention of a focusing panoramic hysteroscope and a four-channel operating sheath particularly advantageous for the Nd:YAG laser

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