# 1 History of Laparoscopy

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## Origins of Laparoscopy

Since antiquity, healthcare providers have striven to visually examine the internal anatomy of their patients. Indeed, rectal specula and natural light were in use in the era of Hippocrates of Cos (Rosin 1993). Ambient light or external light sources supplemented with diverse lenses or mirrors to examine the ears, nose, mouth, rectum, and vagina/uterus were used until the mid-nineteenth century. Among the first using artificial light was the *lichtleiter* or "light transmitter" invented by the German physician Philip Bozzini in 1804. The light source for the device was a wax candle, and its glow was reflected by a mirror into a speculum that Bozzini used for the examination of a variety of body orifices and the uterus (Figure 1.1). Unfortunately, Bozzini was ridiculed by the Vienna Medical Society and further development of laparoscopic endeavors were halted for 50 years (Rathert et al. 1974). In 1853, Antonin Desormeaux developed an "endoscope" with a lamp fueled by a mixture of turpentine and alcohol (Kaiser & Corman 2001). The light from the flame was concentrated and directed by a concave mirror to the area of interest and permitted evaluation of the cervix, uterus, and urinary bladder, although it lacked sufficient light for gastroscopy (Figure 1.2) (Rosin 1993; Lau et al. 1997). Burn injuries were common; however, Desormeaux received an award from the Royal Academy of Medicine in Paris and is considered the father of endoscopy. He went on to use his endoscope for diagnostic and therapeutic procedures in his practice at the Necker Hospital in Paris during the 1860s (Kaiser & Corman 2001).

The first endoscope with an internal light source was the invention of a German dentist, Julius Bruck, in 1867 (Figure 1.3) (Rosin 1993). The light source was an electrically heated platinum wire, which provided improved illumination but generated considerable heat. The potential for tissue burns induced by the instrument was reduced with the addition of a circulating water jacket. Maximilian Nitze, a German urologist, and his colleagues are generally credited with the development of the first rigid telescope in 1879, an instrument equipped with

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**Figure 1.1** Illustration of the *lichtleiter* of Philip Bozzini. The light from the candle is reflected by a mirror through an attached speculum (not shown) into the patient. Source: National Library of Medicine.

a series of lenses and a light source based on the design of Bruck that was ice-water cooled (Figure 1.4) (Nitze 1879). Following the invention of the incandescent bulb by Thomas A. Edison in 1880, it was incorporated into a telescope developed by the Glaswegian David Newman in 1883 (Dameword 1992). Further developments in lenses and miniaturization of incandescent light bulbs fostered additional advances so that endoscopy of the upper airway, lower urogenital tract, esophagus, stomach, and anorectum began to be conducted with some frequency. Although the thoracic and peritoneal cavities were yet to be examined, the equipment and methodology to do so was largely in place (Lau et al. 1997).

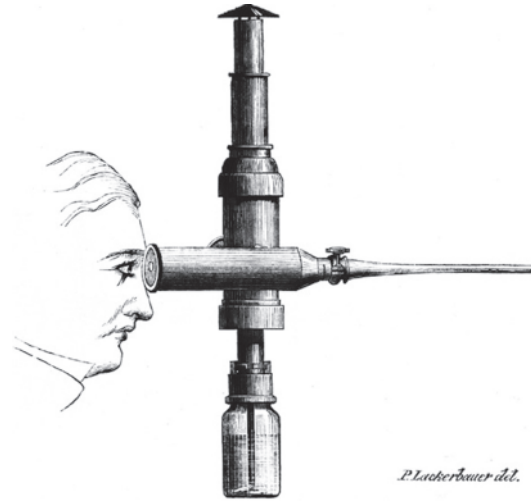


**Figure 1.2** Diagram of Antonin Desormeaux's endoscope of 1853. A lamp fueled by turpentine and alcohol provided the artificial light that was focused and directed through the speculum. Source: National Library of Medicine.

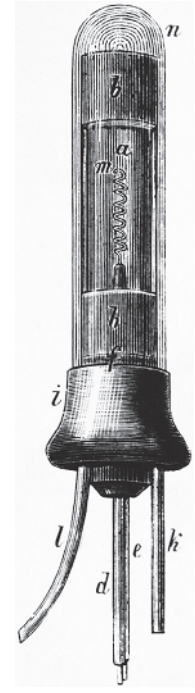



**Figure 1.3** Illustration of the internal light source invented by Julius Bruck in 1867. An electrically heated platinum wire created both light and heat. Excessive heat was managed by the addition of a water cooling jacket. Source: National Library of Medicine.




**Figure 1.4** A diagram of the rigid telescope invented by Maximilian Nitze in 1879. The original light source was based on the design of Bruck. Source: National Library of Medicine.

In 1901, the abdominal cavity of a pregnant woman was examined by Dimitri von Ott, who employed a speculum introduced into the abdominal cavity via a small colpotomy. External light was reflected into the speculum with a head mirror, a technique he called "ventroscopy" (Von Ott 1901). While his efforts presaged Natural Orifice Translumenal Endoscopic Surgery (NOTES®) procedures, it is not regarded as laparoscopy in the conventional sense by many medical historians. Priority for "true" laparoscopic examination of the abdomen is afforded the German surgeon Georg Kelling, who used a Nitze-style cystoscope to examine the peritoneal cavity of dogs in 1901. Kelling created pneumoperitoneum with filtered air and called the technique "koelioskopie" (Figure 1.5) (Kelling 1902; Rosin 1993). Although Kelling generally lost interest, he later reported the use of laparoscopic methods in a series of human patients. Hans Christian Jacobaeus, a Swedish surgeon, is credited with the first report of a relatively large series of "laparothorakoskopie" procedures in people, published in 1911 (Jacobaeus 1911). Jacobaeus used trocars but not abdominal insufflation; however, many of his patients had ascites, which afforded working space. Typical in medicine, progress tends to occur in parallel; an American surgeon, Bertram Bernheim, also reported on two laparoscopically managed patients in 1911 (Bernheim 1911). Evidently, enthusiasm for the concept of laparoscopy spread rapidly in the ensuing years; a 1925 literature review by Nadeau and Kampmeier documents extant methods in some detail and references no fewer than 42 publications (Nadeau & Kampmeier 1925). Milestones and personalities associated with the development of laparoscopy in humans and horses from the time of Kelling's work are illustrated in Figure 1.6.



**Figure 1.5** Georg Kelling, a German surgeon, is generally credited with the first "true" laparoscopy. He published on the use of a Nitze-style cystoscope and filtered air insufflation to examine the abdominal organs of dogs in 1901.

## Subsequent Developments

A number of technical improvements in endoscopy were realized in the early twentieth century. Laparoscopic examination of pelvic organs was improved by the adoption of Trendelenburg positioning, the subject of a report by the Danish surgeon Severin Nordentoft in 1912 (Nordentoft 1912). Advances in instrumentation included the invention of a needle to establish pneumoperitoneum (Korbsch 1921), the introduction of

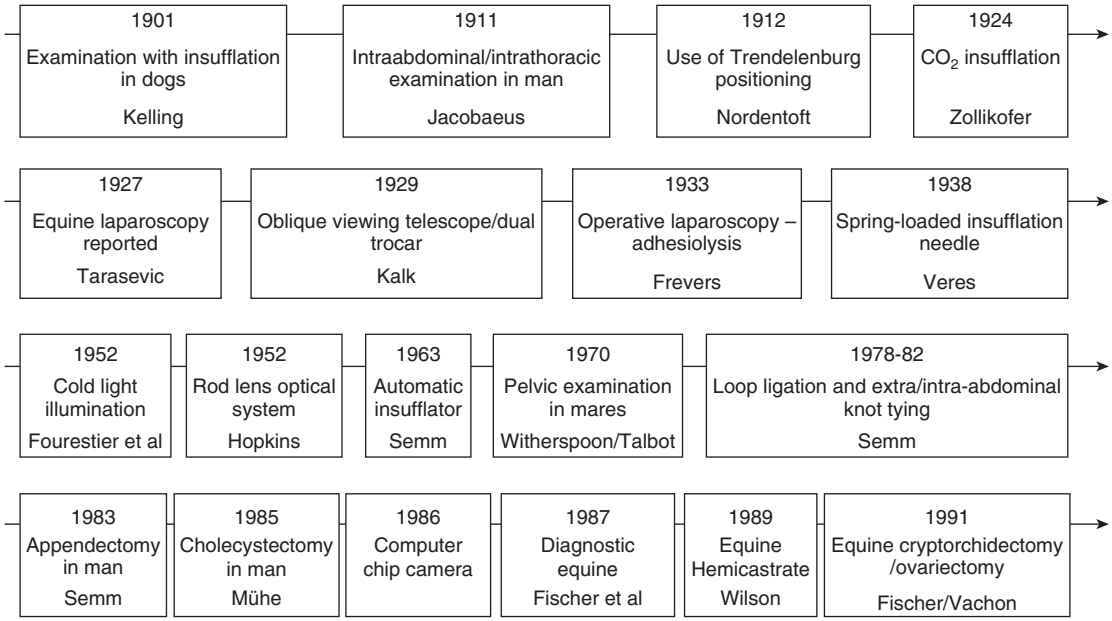



**Figure 1.6** Timeline of landmarks and personalities associated with selected developments in laparoscopic surgery in humans and horses from the time of Kelling's work in the early twentieth century.

insufflators (Goetze 1921), and optical improvements in telescopes (Unverricht 1923). The use of $CO_2$ as an insufflation gas was introduced by Zollikofer in 1924 (Zollikofer 1924), and the first operative laparoscopy is attributed to the German laparoscopist Carl Fervers, who conducted laparoscopic liver biopsies and lysed abdominal adhesions under direct observation (Gotz et al. 1993).

A number of individuals pioneered further technical and operative innovations in the discipline. Among them was the hepatologist Heinz Kalk, who introduced oblique-viewing telescopes and a variety of hand instruments and devised the use of a second operative (instrument) portal as early as 1929 (Kalk 1929). In the period between 1929 and 1959, Kalk published over 20 papers on laparoscopy, including a monograph on laparoscopic surgery with W. Bruhl in 1951 (Kalk & Bruhl 1951). Many consider Kalk, who commented « *this method really does not deserve the widespread opposition that still exists today, normally based on total ignorance…* » the father of modern laparoscopy (Figure 1.7). In 1938, Janos Veres, a Hungarian physician, improved on existing pneumoperitoneum needles by inventing one equipped with a spring-loaded obturator to reduce injuries to abdominal viscera when establishing pneumoperitoneum. The eponymous insufflation needle remains in use today (Veress 1938).



**Figure 1.7** Heinz Kalk, considered by some as the father of modern laparoscopy.

The introduction of cold light fiber optic illumination was revolutionary and the product of the efforts of French scientist Max Fourestier and his colleagues in 1952 (Fourestier et al. 1952). This advance both decreased the risks

of burns associated with previous methods of illumination and provided sufficient light to enhance the quality of endophotography. The contribution of Fourestier and his colleagues, combined with the development of a more robust and optically much improved rod lens system by the English physicist Harold Hopkins, opened new vistas in endoscopy and laparoscopy (Hopkins & Kapany 1954). In addition to virtually eliminating the pervasive risk of burns from previous light sources, there was now the capacity to enjoy a wider and more optically correct field of view. The work of Hopkins and his coworkers formed the basis for flexible fiber-optic endoscopes and modern rigid laparoscopes.

Among the greatest innovators in the development of modern laparoscopy was the German engineer and surgeon Kurt Semm. Indeed, his contributions are largely responsible for the current trend for minimally invasive surgery (Spaner & Warnock 1997). The development of the automatic insufflator, the morcellator, a variety of hand instruments, the ligating loop, and techniques for extracorporeal knot tying and intracorporeal suturing are all attributable to Dr Semm. Additional contributions include advancing surgical techniques for tumor staging, adhesiolysis, and applications for bipolar electrocautery. He also invented a laparoscopic training device, the "pelvitrainer." Semm published extensively and a number of his gynecologic procedures appear in a surgical atlas on "pelvicoscopy" in a number of languages (Semm 1992). With this staggering list of accomplishments, it is not surprising that Semm earned his share of habitual detractors (Litynski 1996a). Indeed, though his principal professional interest was gynecologic surgery, he conducted the first laparoscopic appendectomy in 1980 (Semm 1989), and the presentation of his work was met with such opposition that it was not published until three years later (Vilardell 2006).

## Rapid Growth of Human Laparoscopy

Despite important developments in electrocautery equipment and other advances, the growth of laparoscopy in general surgery was tentative through the 1960s and 1970s. In September of 1985, Erich Mühe, in a private hospital in Böblingen Germany, conducted the first laparoscopic cholecystectomy using a "galloscope" of his own design (Litynski 1996b; Lau et al. 1997). Mühe's lack of enthusiasm for publication resulted in limited awareness of this accomplishment, and the first laparoscopic cholecystectomy is often attributed to Phillipe Mouret, a general surgeon from Lyon, France, in 1987 (Nagy et al. 1992; Gotz et al. 1993; Spaner & Warnock 1997). The laparoscopic cholecystectomy was an important advance; it was rapidly adopted by a number of centers in several countries, and very soon after, laparoscopic surgery became the subject of avid study the world over. The surprisingly rapid recovery of patients undergoing laparoscopic cholecystectomy and other innovative, minimally invasive biliary tract procedures, combined with the development of computer chip television cameras in 1986, set the stage for the subsequent explosive growth of the discipline in human surgery (Berci 1994). In the next few years, a wealth of procedures in diverse body systems was developed, and it is now difficult to enumerate the laparoscopic operations that are routinely conducted in human hospitals everywhere. The list continues to grow as technological advances such as capacitance monitored bipolar cautery, imaging systems, and robotics have gained widespread acceptance.

## Evolution of Equine Laparoscopy

In many respects, the history of the origins and progress in diagnostic and surgical laparoscopy among equine veterinarians has paralleled that of human medicine. While equine laparoscopy may have been attempted previously, the earliest published account dates to 1927 (Tarasevic 1927). As in man, the first reports pertain to the examination of the reproductive organs. Witherspoon and Talbot reported on the use of laparoscopic examination to supplement other methods for the study of the ovulation pattern of mares in 1970 (Witherspoon & Talbot 1970). Laparoscopy was also used for diagnostic and therapeutic purposes in the reproductive tract of mares by

Heinze and his colleagues in the early 1970s (Heinze et al. 1972; Heinze 1975). Subsequent reports of equine laparoscopy were rather sporadic until the mid-1980s, although Witherspoon et al. contributed a chapter on equine laparoscopy to a seminal text on veterinary laparoscopy in 1980 (Figure 1.8) (Witherspoon et al. 1980). The rapid development of laparoscopic instrumentation subsequent to the introduction of cholecystectomy allowed equine surgeons, who were already familiar with triangulation techniques used in arthroscopy, to quickly advance operative laparoscopy in the horse. Laparoscopic instrumentation designed specifically for the horse became available in the early 1990s.

Rapid growth in equine laparoscopy can probably be traced to Ted Fischer's work on diagnostic and surgical laparoscopy in the late 1980s and early 1990s. He and his colleagues' opening publication documented the utility of laparoscopy in the diagnosis of abdominal disease (Fischer et al. 1986). Wilson described the use of standing laparoscopy as an aid in the management of the equine hemicastrate (Wilson 1989) and Fischer and Vachon followed with a report on equine cryptorchidectomy using laparoscopic techniques (Fischer & Vachon 1992). Techniques for laparoscopic cryptorchidectomy were developed and refined by Fischer's group and by a number of other early adopters (Davis 1997; Hendrickson & Wilson 1997; Fischer & Vachon 1998). Concomitantly, techniques for ovariectomy using a variety of laparoscopic approaches and techniques were also described (Palmer 1993; Ragle & Schneider 1995; Bouré et al. 1997; Rodgerson et al. 2001),

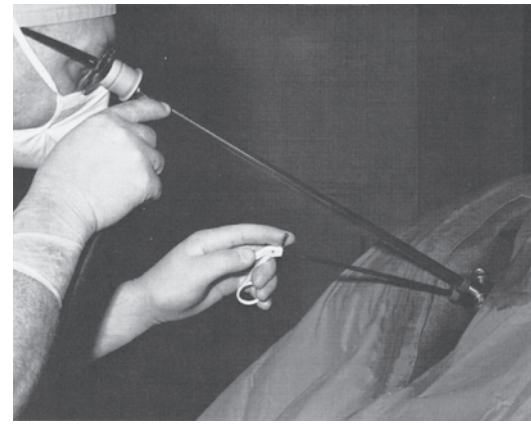


**Figure 1.8** Laparoscopic surgery in mares, ca. 1970. Reproduced with permission from Williams and Wilkins.

**Table 1.1** Selected advances in equine laparoscopy (1995–2010).

| Year | Author(s) | Technique |
|---|---|---|
| 1986 | Fischer | Diagnostic laparoscopy |
| 1995 | Edwards et al. | Urinary bladder repair |
| 1995, 1996 | Fischer et al., Klohnen & Wilson | Inguinal herniorrhaphy |
| 1997, 1998 | Bleyaert et al.; Bouré et al. | Adhesiolysis |
| 1999 | Fischer | Umbilical remnant resection |
| 2000 | Ragle | Cystic calculus removal |
| 2000 | Trostle | Colopexy |
| 2000 | Trumble et al. | Testicular artery ligation |
| 2001 | Marïen et al. | Closure of the nephrosplenic space |
| 2003 | Keoughan et al. | Hand-assisted nephrectomy |
| 2004 | Sutter and Hardy | Mesenteric rent repair |
| 2004 | Delling et al.; Janicek et al. | Hand-assisted ovariohysterectomy |
| 2008 | Bracamonte and Bouré | Serial full-thickness intestinal biopsies |
| 2008 | Ortved et al. | Hand-assisted splenectomy |
| 2009 | Caron and Mehler | Mesh incisional hernioplasty |
| 2010 | Brink et al. | Mesometrial imbrication |

in addition to case reports of other laparoscopic procedures as well as a pair of elegant descriptions of the laparoscopic anatomy of the horse (Galuppo et al. 1995, 1996). The state of the art of equine laparoscopy was compiled in the first textbook on the subject, edited by Fischer in 2000 (Fischer 2000). The list of indications and procedures in the discipline accelerated thereafter (Table 1.1). The growth in enthusiasm for equine laparoscopy parallels that in humans and in other domestic animals in the twenty-first century; Medline accessions using the search terms "equine" and "laparoscopy" for the period of 2000–2010 are more than double those of the previous decade. Further advances are to be anticipated as the veterinary community creates and adopts technical and intellectual progress.

## Bibliography


Berci, G. (1994) History of endoscopic surgery. In: *Endoscopic Surgery* (ed. F.L. Greene & J.L. Ponsky), pp. 1–5. Saunders, Philadelphia, PA.

Bernheim, B.M. (1911) Organoscopy: cystoscopy of the abdominal cavity. *Annals of Surgery*, 53, 764–767.

Bleyaert, H.F., Brown, M.P., Bonenclark, G., et al. (1997) Laparoscopic adhesiolysis in a horse. *Veterinary Surgery*, 26, 492–496.

Bouré, L., Marcoux, M., & Laverty, S. (1997) Paralumbar fossa laparoscopic ovariectomy in horses with use of endoloop ligatures. *Veterinary Surgery*, 26, 478–483.

Bouré, L., Marcoux, M., Lavoie, J.P., et al. (1998) Use of laparoscopic equipment to divide abdominal adhesions in a filly. *Journal of the American Veterinary Medical Association*, 212, 845–847.

Brink, P., Schumacher, J., & Schumacher, J. (2010) Elevating the uterus (uteropexy) of five mares by laparoscopically imbricating the mesometrium. *Equine Veterinary Journal*, 42, 675–679.

Bracamonte, J.L., Bouré, L., Geor, R.J., et al. (2008) Evaluation of a laparoscopic technique for collection of serial full-thickness small intestinal biopsy specimens in standing sedated horses. *American Journal of Veterinary Research*, 69, 431–439.

Caron, J.P. & Mehler, S.J. (2009) Laparoscopic mesh incisional hernioplasty in five horses. *Veterinary Surgery*, 38, 318–325.

Dameword, M.D. (1992) History of the development of gynecologic endoscopic surgery. In: *Practical Manual of Operative Laparoscopy and Hysteroscopy* (ed. R. Azziz & A.A. Murphy), pp. 7–14. Springer-Verlag, New York.

Davis, E.W. (1997) Laparoscopic cryptorchidectomy in standing horses. *Veterinary Surgery*, 26, 326–331.

Delling, U., Howard, R.D., Pleasant, R.S., et al. (2004) Hand-assisted laparoscopic ovariohysterectomy in the mare. *Veterinary Surgery*, 33, 487–494.

Edwards, R.B., Ducharme, N.G., & Hackett, R.P. (1995) Laparoscopic repair of a bladder rupture in a foal. *Veterinary Surgery*, 24, 60–63.

Fischer, A.T. (1999) Laparoscopically assisted resection of umbilical structures in foals. *Journal of the American Veterinary Medical Association*, 214, 1813–1816.

Fischer, A.T. (2000) *Equine Diagnostic and Surgical Laparoscopy*. W.B. Saunders, Philadelphia, PA.

Fischer, A.T. & Vachon, A.M. (1992) Laparoscopic cryptorchidectomy in horses. *Journal of the American Veterinary Medical Association*, 200, 1705–1708.

Fischer, A.T. & Vachon, A.M. (1998) Laparoscopic intra-abdominal ligation and removal of cryptorchid testes in horses. *Equine Veterinary Journal*, 30, 105–108.

Fischer, A.T., Lloyd, K.C., Carlson, G.P., et al. (1986) Diagnostic laparoscopy in the horse. *Journal of the American Veterinary Medical Association*, 189, 289–292.

Fischer, A.T., Vachon, A.M., & Klein, S.R. (1995) Laparoscopic inguinal herniorrhaphy in two stallions. *Journal of the American Veterinary Medical Association*, 207, 1599–1601.

Fourestier, M., Gladu, A., & Vulmière, J. (1952) Perfectionnements á l'endoscopie médicale; realization bronchoscopique. *Presse Médicale*, 60, 1292–1294.

Galuppo, L.D., Snyder, J.R., & Pascoe, J.R. (1995) Laparoscopic anatomy of the equine abdomen. *American Journal of Veterinary Research*, 56, 518–531.

Galuppo, L.D., Snyder, J.R., Pascoe, J.R., et al. (1996) Laparoscopic anatomy of the abdomen in dorsally recumbent horses. *American Journal of Veterinary Research*, 57, 923–931.

Goetze, O. (1921) Die neues verfabren der gasfullung fur das pneumoperitoneum. *Munchener Medizinische Wochenschrift*, 51, 233–234.

Gotz, F., Pier, A., Schippers, E., et al. (1993) The history of laparoscopy. In: *Color Atlas of Laparoscopic Surgery* (ed. F. Gotz, A. Pier, E. Schippers, et al.), pp. 3–5. Georg Thieme Verlag, New York.

Heinze, H. (1975) Pelviscopy in the mare. *Journal of Reproduction & Fertility*, 23, 319–321.

Heinze, H., Klug, E., & von Lepel, J.D.F. (1972) Optische darstellun der inneren geschlechtsorgane bei equiden zur diagnostik und therapie. *Deutsche Tierarztliche Wochenschrift*, 79, 49–51.

Hendrickson, D.A. & Wilson, D.G. (1997) Laparoscopic cryptorchid castration in standing horses. *Veterinary Surgery*, 26, 335–339.

Hopkins, H.H. & Kapany, N.S. (1954) A flexible fibrescope, using static scanning. *Nature*, 173, 39–41.

Jacobaeus, H.C. (1911) Kurze ubersicht meine erfahrungen mit der laparothorakoskopie. *Munchener Medizinische Wochenschrift*, 58, 2017–2019.

Janicek, J.C., Rodgerson, D.H., & Boone, B.L. (2004) Use of a hand-assisted laparoscopic technique for removal of a uterine leiomyoma in a standing mare. *Journal of the American Veterinary Medical Association*, 225, 911–914.

Kaiser, A.M. & Corman, M.L. (2001) History of laparoscopy. *Surgical Oncology Clinics of North America*, 10, 483–492.

Kalk, H. (1929) Erfahrungen mit der laparoskopie (Zugleich mit beschreibung eines neuen instrumentes). *Zeitschrift fur Klinische Medizin*, 111, 303–348.

Kalk, H. & Bruhl, W. (1951) *Leifaden der laparoskopie und gastroskopie*. Theime, Stuttgart, Germany.

Kelling, G. (1902) Uber oesophagokopie, gastroskopie und kolioskopie. *Munchener Medizinische Wochenschrift*, 49, 21–24.

Keoughan, C.G., Rodgerson, D.W., & Brown, M.P. (2003) Hand-assisted laparoscopic left nephrectomy in standing horses. *Veterinary Surgery*, 32, 206–212.

Klohnen, A. & Wilson, D.G. (1996) Laparoscopic repair of scrotal hernia in two foals. *Veterinary Surgery*, 25, 414–416.

Korbsch, R. (1921) Die laparoskopie nach jakobaeus. *Berliner Klinische Wochenschrift*, 38, 696–698.

Lau, W.Y., Leow, S.K., & Li, A.K.C. (1997) History of endoscopic and laparoscopic surgery. *World Journal of Surgery*, 21, 444–453.

Litynski, G.S. (1996a) *Highlights in the History of Laparoscopy*. 138–144. Barbara Bernert Verlag, Frankfurt, Germany.

Litynski, G.S. (1996b) *Highlights in the History of Laparoscopy*. 157–192. Barbara Bernert Verlag, Frankfurt, Germany.

Marïen, T., Adriaenssen, A., Hoeck, F.V., et al. (2001) Laparoscopic closure of the renosplenic space in standing horses. *Veterinary Surgery*, 30, 559–563.

Nadeau, O.E. & Kampmeier, O.F. (1925) Endoscopy of the abdomen; abdominoscopy: a preliminary study, including a summary of the literature and a description of the technique. *Surgery Gynecology and Obstetrics*, 41, 259–271.

Nagy, A.C., Poulin, E.C., Girotti, M.J., et al. (1992) History of laparoscopic surgery. *Canadian Journal of Surgery*, 35, 271–273.

Nitze, M. (1879) Beobachtung und untersuchungsmethode fur hanohre, harnblase und rectum. *Wiener Medizinische Wochenschrift*, 29, 649–652.

Nordentoft, S. (1912) Uber endoskopie geschlossener kavitaten mittels meines trokar-endoskopes. *Verhandlungen der Deutschen Gesellschaft Gynakologie*, 41, 78–81.

Ortved, K.F., Witte, S., Fleming, K., et al. (2008) Laparoscopic assisted splenectomy in a horse with splenomegaly. *Equine Veterinary Education*, 20, 357–361.

Palmer, S.E. (1993) Standing laparoscopic laser technique for ovariectomy in five mares. *Journal of the American Veterinary Medical Association*, 203, 297–283.

Ragle, C.A. (2000) Dorsally recumbent urinary endoscopic surgery. *The Veterinary Clinics of North America*. *Equine Practice*, 16, 343–350.

Ragle, C.A. & Schneider, R.K. (1995) Ventral abdominal approach for laparoscopic ovariectomy in horses. *Veterinary Surgery*, 24, 492–497.

Rathert, P., Lutzeyer, W., & Goddwin, W.E. (1974) Philipp Bozzini (1773–1809) and the lichtleiter. *Urology*, 3, 113–118.

Rodgerson, D.H., Belknap, J.K., & Wilson, D.A. (2001) Laparoscopic ovariectomy using sequential electrocoagulation and sharp transection of the equine mesovarium. *Veterinary Surgery*, 30, 572–579.

Rosin, D. (1993) History. In: *Minimal Access Medicine and Surgery. Principles and Techniques* (ed. R.D. Rosin), pp. 1–9. Radcliffe Medical Press, Oxford, UK.

Schambourg, M.M. & Marcoux, M. (2006) Laparoscopic intestinal exploration and full-thickness intestinal biopsy in standing horses: a pilot study. *Veterinary Surgery*, 35, 689–696.

Semm, K. (1989) History. In: *Operative Gynecologic Endoscopy* (ed. J.S. Sanfillipo & R.L. Levine), 3–17. Radcliffe Medical Press, New York, USA.

Semm, K. (1992) *Pelviscopy: Operative Guidelines*. UFK, Kiel, DE.

Spaner, S.J. & Warnock, G.L. (1997) A brief history of endoscopy, laparoscopy and laparoscopic surgery. *Journal of Laparoendoscopic & Advanced Surgical Techniques*, 7, 369–372.

Sutter, W.W. & Hardy, J. (2004) Laparoscopic repair of a small intestinal mesenteric rent in a broodmare. *Veterinary Surgery*, 33, 92–95.

Tarasevic, A. (1927) Die operation zur besichtigung der körperhöhlen des pferdes mit beleuchtungsapparaten. *Jahresbericht Veterinärmedizin*, 47, 485.

Trostle, S. (2000) Gastrointestinal endoscopic surgery. *Veterinary Clinics of North America. Equine Practice*, 20, 329–341.

Trostle, S., White, N.A., Donaldson, L., et al. (1998) Laparoscopic colopexy in horses. *Veterinary Surgery*, 27, 56–63.

Trumble, T.N., Ingle-Fehr, J., & Hendrickson, D.A. (2000) Laparoscopic intra-abdominal ligation of the testicular artery following castration in a horse. *Journal of the American Veterinary Medical Association*, 216, 1596–1598.

Unverricht, W. (1923) Die thorakoskopie und laparoskopie. *Berliner Klinische Wochenschrift*, 2, 502–503.

Veress, J. (1938) Neues instrument zur ausfuhrung von brustoder bachpunktionen und pneumothoraxbehundlung. *Deutsche Medizinische Wochenschrift*, 64, 1480–1481.

Vilardell, F. (2006) *Digestive Endoscopy in the Second Millenium. From Lichtleiter to Echoendoscopy*, 261–291. Georg Thieme Verlag, Stuttgart, DE.

Von Ott, D.O. (1901) Ventroscopic illumination of the abdominal cavity in pregnancy. *Zhurnal Akrestierstova I Zhenskikh Boloznei*, 15, 7–8.

Wilson, D.G. (1989) Laparoscopy as an Aid in the Surgical Management of the Equine Hemicastrate. *Annual Meeting of the American Association of Equine Practitioners*, 35, 347–353.

Witherspoon, D.M., Kraemer, D.C., & Seager, S.W. (1980) Laparoscopy in the horse. In: *Animal Laparoscopy* (ed. R.M. Harrison & D.E. Wildt), pp. 157–167. Williams & Wilkins, Baltimore, MD.

Witherspoon, D.M. & Talbot, R.B. (1970) Nocturnal ovulation in the equine animal. *The Veterinary Record*, 87, 302–304.

Zollikofer, R. (1924) Zur laparoskopie. *Schweizerische Medizinische Wochenschrift*, 54, 264–265.