

Georg Kelling (1866–1945): the root of modern day minimal invasive surgery. A forgotten legend?

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Abstract On 23 September 1901, at the 73rd meeting of the Society of German Natural Scientists and Physicians in Hamburg, following his lecture “On the inspection of the gullet and the stomach with flexible instruments”, the surgeon and gastroenterologist Georg Kelling from Dresden performed a laparoscopy on a dog. He called this procedure coelioscopy. Kelling’s ingenious idea to connect his oral insufflation device with the Fiedler trocar and the Nitze cystoscope, led to the coelioscopy in 1901 and marked the hour of birth of laparoscopy. Until today, Georg Kelling has not experienced the appreciation he is entitled to. He is the forgotten pioneer of a method that today plays an important role in diagnostics and therapeutics. The present standard of endoscopy has confirmed the anticipations of Georg Kelling that he had hundred years ago. His name therefore deserves a fixed place in the history of medicine and especially in the history of endoscopy. Georg Kelling and his wife were killed during the heavy air raids on Dresden on 13 and 14 February 1945, but his vague footprints are still in the sands of medical history.

Keywords Coelioscopy · Laparoscopy · History of medicine · Kelling · Gastroscopy · Endoscopy

The education of Georg Kelling

Georg Kelling (Fig. 1) was born on 7 July 1866 in Dresden-Friedrichstadt as the eldest son of engineer Emil and Margarethe Kelling. After visiting elementary school, he attended the grammar school “Zum Heiligen Kreuze” and the “Vitzthum” grammar school in Dresden. Kelling left his hometown in 1885 with his matriculation certificate. His education was influenced by various changes of location during his years of study and his medical education. Kelling succeeded in contacting the leading physicians of his time again and again and thus perfecting his knowledge and skills [1].

He began his study of medicine on 21 April 1885 in Leipzig, at one of the oldest universities of Europe (founded in 1409). He was taught by notable scientists from the USA, such as the anatomist Charles S. Minot (1852–1914), the physiologist Henry P. Bowditch (1840–1938), the pioneer of pharmacology, John J. Abel (1857–1938), and the future pathologist William H. Welch (1850–1934) [3].

In the summer of 1887 the future medic Kelling served voluntarily in the grenadier regiment 101 in Dresden and continued his studies in the winter semester at the Friedrich Wilhelms University in Berlin (Humboldt University today) from 19 October 1887 until 7 March 1888. Here, Kelling was able to follow lectures by Du Bois-Reymond (physiology), Ewald (internal medicine), Olshausen (gynaecology), von Bergmann (surgery) and Virchow (pathology), among others. On 17 April 1888 Kelling enrolled again at the Medical Faculty of the University of Leipzig

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Fig. 1 Prof. Dr. med. Georg Kelling (1866–1945)

and attended lectures by, to name a few, Birch-Hirschfeld (pathology), Coccius (ophthalmology), Doederlein and Zweifel (gynaecology), Flechsig (psychiatry), and his future doctoral thesis supervisor Hoffmann (internal medicine) [3].

In June 1890 he passed the medical state examination and earned his doctorate on the issue “On the determination of the size of the stomach” on 15 July 1890. This led him to begin further education in the area of gastric and intestinal diseases [2].

The Berlin years

In the summer of 1891 he went to Berlin for 5 years to continue his education [1, 2]. Next to Kussmaul’s (1822–1902) hospital in Strasbourg, this was the “Mekka” of gastroenterology at the turn of the century in Germany. Kelling worked and received lectures from Professor Ismar Boas (1858–1938), Professor Carl Anton Ewald (1845–1915) at the internal ward of the Augusta Hospital and Professor Emil Du Bois-Reymond (1818–1896) at the Physiological Institute of the Charité.

Kelling’s teacher Boas had founded the first ambulatory for gastric and intestinal illnesses in Berlin’s Friedrichstrasse, against comprehensible opposition of the Berlin medical fraternity. An efficient ward for internal medicine was created by the foundation of the Augusta Hospital in the northwest of Berlin in 1869. Ewald headed this ward with great medical and scientific success from 1888 until 1915 [3].

Along with his practical training with Boas and Ewald, Kelling continued his theoretical education at the Physiological Institute of the Charité, which was founded in 1877 in Berlin’s Dorotheenstrasse. His first works originated from the experimental–physiological department under the supervision of Professor Dr. Johannes Gad (1842–1926) and from the chemical–physiological department under the supervision of the future nobel prize winner Professor Dr. Albrecht Kossel (1853–1927) [3].

The Dresden years

In 1896 Kelling set up his practice as a doctor for gastric and intestinal diseases. Next to establishing his practice, he dealt intensely with endoscopic questions at the town hospital in Dresden-Friedrichstadt as well as the Royal Veterinarian University of Dresden [3].

In the summer of 1898 he visited the well-known surgeon Johannes von Mikulicz-Radecki at the Royal Surgical Hospital in Breslau and had the opportunity to study abdominal surgery and to operate with him. He thankfully noted in his essay “Studies on the surgery of the stomach” in 1900:

“Thanks to the goodness of Professor Dr. von Mikulicz, I was lucky to be introduced to abdominal surgery through the hands of the master”.

In retrospect, this work visit was highly beneficial to his later experimental, endoscopic and surgical work and established his reputation as a gastroenterologist.

Kelling joined the “Society for Nature History and Medicine in Dresden” in 1894 and was confronted with the research of Fiedler, Schramm-Vogelsang, Nitze, and Oberlaender [4–6].

The internist Alfred Fiedler (1835–1921) was scientifically active in various fields of internal medicine. Fiedler constructed an improved trocar for body cavity invasion, which was later, named after him. He performed punctures of the abdominal cavity, the pleura and the pericardium with this instrument. The Fiedler trocar was also used by Kelling for his animal experiments and constituted an integral part of his insufflation device.

The gynaecologist Justus Schramm-Vogelsang (1837–1901) also made a significant contribution to the endoscopy scene in Dresden. He dealt with diaphanoscopy, which was developed further by the dentist Julius Bruck (1840–1902) from Breslau. With this technique he was able to visualize the female pelvis.

During his short stay in Dresden from 1876–1878, Max Nitze (1848–1906) dealt with the various examinations on the lighting and exploration of body cavities. He was convinced that the light source must be intracorporeal; therefore it must be attached to the tip of the instrument

examining the cavity. He was also convinced that the pictures, which were too small at that time, had to be enlarged by an optical system and be fed to the human eye. On 2 October 1877, Nitze successfully demonstrated the first urethroscope and cystoscope on a corpse.

The further development of the Dresden endoscopy in the second half of the 19th century was also influenced by Felix Martin Oberlaender (1851–1915). Like Nitze, he, also had worked on a ward for dermal and venereal diseases at the town hospital of Dresden-Friedrichstadt since 1876 and dealt with the gonorrhoeic illnesses of the urethra. Due to his amicable connection to Nitze, he could very closely follow the construction and usage of Nitze's instruments and use this knowledge for his scientific work. He reported a "Nitze-Leiter lighting procedure of inner body cavities" [3].

In his dissertation in 1890, Kelling focused on the sizing of the stomach using percussion. He concluded that this method for determination of the size and volume of the stomach seemed suitable only to a little extent and suggested to determine the volume of the stomach by oral gas insufflation. He specified the appropriate device but stated not having performed any examinations himself [2]. Based on his doctorate, Kelling later dealt with the anatomy and physiology of the stomach [7] between 1890 and 1900 and gained experience with the oral air insufflation.

From oral to abdominal insufflation

In his contribution "The tamponade of the abdominal cavity with air in order to control life-threatening bleeding", 1901, Kelling took a critical look at the methods of hemostasis known at that time, which were obviously insufficient. He advocated achieving an intraabdominal vascular compression (air tamponade) by pushing from 50–80 mmHg by an abdominal air insufflation (Fig. 2) [8].

On 23 September 1901, Kelling held a memorable lecture at the 73rd meeting of Society of German Natural Scientists and Physicians in Hamburg (Fig. 3) entitled "On the inspection of the gullet and the stomach with flexible instruments". As a conclusion after the discussion of the esophagoscopy and the gastroscopy, he exemplified the principle of his new method, the coelioscopy, based on the principle of abdominal instead of oral insufflation, utilizing the Fiedler trocar for insufflation and the Nitze cystoscope for visualization, and elaborated thus [9, 16, 17]:

"I am concluding, dear Sirs, with the request that endoscopic methods for the intestinal tract may find more use than it has been the case until now, as they are actually qualified to substitute the laparotomy in many cases".

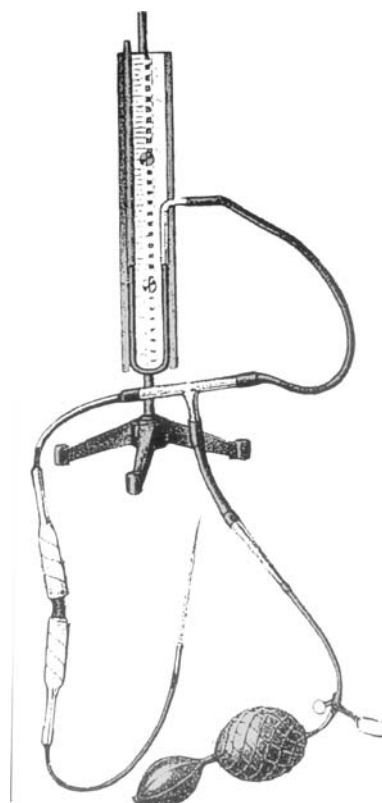


Fig. 2 Apparatus for abdominal air insufflation



Fig. 3 The "Konzerthaus Hamburg", Conference place of the 73rd meeting of the Society of German Natural Scientists and Physicians ("Gesellschaft Deutscher Naturforscher und Ärzte") from 22 to 28 September 1901 in Hamburg

At the 47th Convention of the German Society for Surgery in 1923, Kelling reiterated the topic "endoscopy". In his lecture "On the coelioscopy and gastroscopy", he reported the advantages of this new method [10, 17]:

"...mainly for economic reasons, since the great price rise necessitates one to spare the patients days in care,

Fig. 4 Johannes von Mikulicz-Radecki-Georg Kelling Medal



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den

**VON MIKULICZ-
KELLING-PREIS**

*Sie ehrt damit den Pionier laparoskopischer
Eingriffe, dessen bahnbrechende Forschungen den
Weg zur minimal invasiven Chirurgie freimachten.*

München, den 2. Oktober 1993

der Generalsekretär

W. Harzel
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der Präsident

M. Trede
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MICHAEL TREDE

Fig. 5 Document of the German Society for Surgery and the Surgical Society for Endoscopy

...dressing, medication and, in particular, possibly avoidable operations, such as exploratory laparotomy...”

Priority conflict in past and present

As many scientists before him, Kelling had to face unpleasant priority claims in the years 1910, 1921 and 1932. This, however, did not compromise his creative power [11, 12].

In 1964, the internist Egmont Wildhirt described Kelling’s priority as follows [13]:

“It was his conception to fill the abdominal cavity with air and thus creating a new visual field in order to be able to inspect the organs”... Kelling must therefore be credited as the actual inventor of laparoscopy, even after his pioneer work fell into oblivion”.

The little information available on Georg Kelling and his work led to incomplete or false information even to the present day. However, it was reported that he performed laparoscopic operations on 45 patients and described pathological findings such as tuberculosis and tumors [14].

The concept of laparoscopy by Georg Kelling

The life and scientific work of Georg Kelling has not been properly catalogued in detail until today. In the past, few authors attempted to give a brief insight into some of his work. The two reviews published by Hatzinger et al. [16–18] describing the work of Kelling highlighted his collection of instruments as an important contribution to modern urology.

It is undisputable that his concept was far ahead of the state of knowledge at that time. With the distance of one century and under consideration of the significance of endoscopy today, Kelling’s endoscopic work must be evaluated as follows [3]:

1. Contrary to the spirit of that age, Kelling favoured endoscopic methods over the exploratory laparotomy (1898).
2. Kelling was the first to assort and describe a complete basic instrument for laparoscopy including insufflation needle (Fiedler trocar), insufflation device (Poltzer air pump), optics trocar, and optics (Nitze cystoscope) (1901) [16–18].
3. The first indications and contraindications for laparoscopy/coeloscopy were formulated by Kelling (1901).

4. Kelling recommended practicing endoscopic methods on corpses, obviously foreseeing the problems of young doctors' education (1901).
5. Kelling, almost visionarily, predicted the ambulant laparoscopic surgery (1901).
6. Far ahead of his time, Kelling recognized the economic benefit of endoscopic operations (1923).

Bitter end in Dresden and late recognition

Kelling was 73 years old during the outbreak of World War II. One year later, on 13 May 1940, his first wife, Hedwig Kelling, died of a heart attack. On 4th March 1941 Georg Kelling married Johanna Sommer (1896–1945), a close family friend. The war raging in western and eastern Europe reached Dresden in February 1945. On 13 and 14 February English and American bombers attacked the defenceless city, overcrowded with refugees, and razed Dresden to the ground. Georg Kelling and his wife Johanna probably died in this inferno. Descendants report that Kelling's son Rudolf, who lived in Leipzig, visited Dresden a few days after the destruction of the city only to find the house in the Christianstrasse no. 30 completely destroyed. No remains of Georg Kelling and his wife or family documents were found.

Kelling's substantial bibliography proves the versatile scientific work of the surgeon and gastroenterologist from Dresden. His work is reflected in several examination and operation methods, which were named after him but are no longer common today or are simply out-dated by development [3]. Kelling's work received a late, but very valuable honour by the steering committee of the German Society for Surgery in 1992 [15]. Under the name "Johannes von Mikulicz-Radecki-Georg-Kelling Grant Prize for Endoscopic Surgery", the German Society for Surgery annually allocates a prize for special scientific and practical solutions in the field of endoscopic surgery.

The document bears the emblems of the German Society for Surgery and the Surgical Society for Endoscopy. The silver medal displays the pictures of Johannes von Mikulicz-Radecki and Georg Kelling (Fig. 4). The first prize was awarded to the Kiel gynaecologist Kurt Semm in 1994 (Fig. 5).

In appreciation of Kelling's merits, the "Association of Gynaecologists in Oschatz" organized a "Georg Kelling Convention" supported by the Collm Clinic Oschatz on 22 September 2001.

On 23 September 2001 they also published a book "Georg Kelling and the Saxon roots of laparoscopy—100 years of laparoscopy" on the occasion of the 100th birthday of laparoscopy.

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