100 Years of Thoracoscopy: Historical Notes

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Key Words

History of thoracoscopy · Jacobaeus · Medical thoracoscopy · Pleural effusion

Abstract

In the historical evolution of thoracoscopy, which was initiated exactly one century ago by Hans Christian Jacobaeus, two distinct periods can be identified: one between 1910 and 1955, characterised by its use for the lysis of pleural adhesions to obtain therapeutic pneumothorax in lung tuberculosis, and the subsequent period which has seen the development of diagnostic applications, principally due to pulmonologists and, after 1990, the start of an exclusively surgical thoracoscopy called video-assisted thoracoscopic surgery or VATS to perform video-assisted interventions.

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Introduction

Thoracoscopy celebrates its hundredth anniversary, with its beginning dating to 1910. In the 100 years of its use two distinct periods can be identified: that between 1910 and 1955, and the subsequent period. The first was mainly characterised by its use for the lysis of pleural adhesions to obtain therapeutic pneumothorax in lung tuberculosis. The second has seen the development of diag-

nostic applications, principally due to pulmonologists and, after 1990, the start of an exclusively surgical thoracoscopy to perform video-assisted interventions following the lead of laparoscopic surgery.

In this paper the principal stages of the history of thoracoscopy will be outlined, with particular reference to the technique performed by pulmonologists, defined today as medical thoracoscopy/pleuroscopy [1, 2], which has become an integral part of interventional pulmonology [3, 4].

The Precursors and the Pioneer

From a historical point of view it is important to remember the first experience of observation of the pleural cavity performed in Ireland by the urologist Francis Richard Cruise, at the suggestion of the internist Samuel Gordon. Cruise, one of the most famous endoscopists of the beginning of the 19th century, used a cystoscope, introduced through a pleurocutaneous fistula, to examine the pleural cavity of an 11-year-old girl suffering from chronic empyema. Gordon reported the description of this examination in the 1866 Dublin Quarterly Journal [5]. However, this experience was not followed by any further clinical application.

The real initiator of thoracoscopy was the Swedish internist Hans Christian Jacobaeus (1879–1937) (fig. 1), who,

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Fig. 1. Photographs of Jacobaeus at different ages (kindly provided by his daughter Kerstin Tamm).

aged 31, exactly a century ago, in 1910, published the first article describing its clinical application ‘Über die Möglichkeit die Zystoskopie bei Untersuchung seröser Höhlungen anzuwenden’ (on the possibility of using a cystoscope to examine the serous cavities) [6], dedicated to thoracoscopy and laparoscopy. In the part describing the exploration of the pleural cavity in 2 patients with pleurisy, Jacobaeus wrote: ‘In exudative pleurisy I carried out an insufflation (of air) and afterwards I examined the pleura. The two cases demonstrate that the method has vast potential’ [6].

He used a cystoscope with a 90° vision optic and an electric lamp at the tip, introduced into the cavity through a trocar, after insufflations of air to enable better exploration, under local anaesthesia. In fact he used a procedure very similar to what is today defined as medical thoracoscopy, which some years later was described by him in the following manner: ‘The patient is placed on his healthy side with a large, hard roll-pad under the chest as near the arm as possible, and a smaller pillow under his head. The reason for this posture is to get the pneumothorax half of the chest as convex as possible. It is also advisable to let the patient’s arm on the operated side lie upward and forward, so that the scapula is pulled upward and outward. The chest wall gets thinner, the interspaces are more easily felt, and the local anaesthetic can be given with more assurance if the thoracoscope can be introduced higher up on the chest wall without difficulty ... I first introduce the trocar for the thoracoscope after a careful local anaesthesia ... In introducing the thoracoscope rather far back

Fig. 2. Jacobaeus demonstrating the thoracoscopic approach (c. 1920).

near the spine, before the denser dorsal musculature begins, one gets the longitudinal direction of the lung at right angles to the thoracoscope’ [10] (fig. 2).

Hans Christian Jacobaeus was born in 1879 and he became world renowned as the initiator of thoracoscopy first described in the previously cited 1910 article. One year later Jacobaeus published a larger case series [7], describing, besides 45 laparoscopies, 35 thoracoscopies (12 on acute pleural effusion, 7 on chronic pleural effusion, 5 on empy-

Fig. 3. Detail picture of a tuberculous pleuritis in early stage. The pleura is hyperaemic. The ribs gleam weakly through; some grey-white soft prominent nodules are present, without doubt tuberculous nodules (from Jacobaeus [9], original description).

Fig. 4. Tuberculous pleuritis in somewhat advanced stage: the pleura is heavily inflamed and thickened. In the centre a white prominent nodule (fibrin). Nearby are numerous small tuberculous nodules (from Jacobaeus [9], original description).

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ema and 11 on pneumothorax). The pleural cavity was also described with a normal anatomy, as the course of the intercostal muscles, the intercostal vessels and nerves, the diaphragm with its tendinous centre. Moreover, he noticed the difficult exploration of mediastinal pleura.

He was a strong advocate of the method and published articles in German, English, French and Swedish. In 1915 [8], in a case of cavitory pulmonary tuberculosis, he performed a thoracoscopy under local anaesthesia with two separate entry ports, one for the optic and one for the cautery, in the fifth and third intercostal space, respectively. He saw a false adherence which joined the parenchyma to the diaphragm, and a true one located on the upper right lobe, the size of a little finger. He cauterized it, causing the instant collapse of the lung. The patient returned to his room on foot, and there were no immediate consequences. In subsequent years, his clinical studies of patients treated with thoracoscopic lysis of adhesions which prevented pneumothorax (later to be known as the Jacobaeus operation) became more numerous. They were published in international journals such as the British Medical Journal and the American Review of Tuberculosis. One article went into more depth: 'Die Thorakoskopie und ihre praktische Bedeutung' (thoracoscopy and its practical meaning), published in 1925 [9]. This comprehensive review details all of Jacobaeus' clinical work, and includes five drawings of some endoscopic aspects, four of which regarding tuberculosis (fig. 3, 4). More attention is paid to tuberculosis than to tumours, which comprise 30–40 cases, endoscopically distinguishable from tuberculosis by being characterized by lesions with nodule masses and/or pleural thickening. In cases with tumours, there is a clear prevalence of metastatic pleurisy, but five cases are also described with the non-specific term 'en-

dothelioma'. In his conclusions Jacobaeus stresses that thoracoscopy, preceded by careful examination of X-rays and preparatory pneumothorax, is fundamental in order to achieve accurate diagnosis of the nature and cause of any type of pleural tumour.

Jacobaeus also worked closely with the thoracic surgeon at his hospital, Einar Key, which enabled an appropriate and complete response to intrathoracic pathologies. In 1922, he published an article which gives an account of five cases of thoracoscopy prior to thoracotomy [10]. In these patients, Jacobaeus induced a pneumothorax and examined the pleural cavity, identifying the endothoracic tumour and providing useful information for the subsequent thoracotomy (therefore doing something similar to what today is defined as staging).

Jacobaeus was willing to collaborate with anyone who was interested in the area of the method he had created: for example, together with Unverricht, he improved the technical characteristics of the thoracoscope to make it more reliable and effective, very similar to recent equipment for medical thoracoscopy (fig. 5).

The Diffusion of the Method between 1920 and 1950: The Era of the Jacobaeus Operation

The period between the two World Wars can be defined as the period of the Jacobaeus operation because the lysis of pleural adhesions to create a pneumothorax as part of collapse therapy for tuberculosis rapidly became the most common application of thoracoscopy. Exclusive endoscopic rooms were created, nursing staff were trained, thorax models were made to allow doctors to learn the operation and case series with many patients

Fig. 5. Jacobaeus-Unverricht instruments for thoracoscopy (c. 1925; on the left) compared to the modern equipment, Boutin thoracoscope (on the right).

Color version available online

Fig. 6. Metastatic carcinomatous nodes on the visceral pleura. The figure shows the existence on the visceral layer of six nodes umbilicated, crater-shaped, whitish, elevated and jutting out bordered by a red radiant halo. They are metastatic nodes of a carcinoma original of the pancreas head (from Cova [14], original description). Colors refer to the online version only.

Color version available online

Fig. 7. Plaque of acute pleuritis. The figure shows a zone of the pleura reddened, velvet-like, non refracting surrounded by vessels dilated and vanishing in a radiating way in the healthy pleura. The surrounding thin whitish veil of fibrin is a consequence of a 'parvicellular' infiltration and partly of a thin veil of fibrin that renders opacous the surrounding pleura (from Cova [14], original description). Colors refer to the online version only.

were published, like those of Gullbring (442 patients) [11] and Maurer (1,200 patients) [12]. In addition, a number of books on the method were published: the most significant were those by Unverricht [13], Cova [14], the first colour atlas with beautiful drawings (fig. 6, 7), and in particular Mistal [15], a complete manual of 400 pages.

In contrast, the diagnostic applications of the technique were really limited in that period with isolated reports, like occasional cases of metastatic tumours or endothelioma (which today is defined as mesothelioma) [16].

Color version available online

Fig. 8. Lung appearance in spontaneous pneumothorax (from Sattler [17]).

Another application, which became important in subsequent years, was described by Anton Sattler in Vienna: the pneumothorax. Sattler [17] illustrated some thoracoscopic aspects of the disease (fig. 8), like the bullae rupture, and to explain the passage of air into the pleural cavity in cases of absence of rupture, proposed a mechanism very similar to what is defined today as pleural porosity.

Post-Second World War Decline and Subsequent Renaissance

In the 1950s, with the advent of anti-tuberculous chemotherapy, surgical collapse therapy was abandoned. Thoracoscopy also declined, except in continental Europe, where various centres developed it for the diagnosis of many pleuropulmonary diseases under the leadership of pulmonologists like Brandt in Germany, Sattler in Austria, Swieringa in Holland, Alcozer in Italy and Boutin in France, to mention the most important.

Two meetings were of fundamental importance for the rebirth of thoracoscopy: in 1980 Boutin organized the first International Symposium on Thoracoscopy in Marseille [18] and in 1987 Loddenkemper organized the second Thoracoscopy Symposium in Berlin [19]. They allowed pulmonologists interested in this technique to meet and to find centres where the method could be learned. Thoracoscopy was applied in all aspects of pleural disease, such as diagnosis of pleural effusions and pneumothorax, staging of mesothelioma or lung cancer and therapy, mainly to obtain an effective pleurodesis without complications. Two books represented the pinnacle in the period of the rebirth of thoracoscopy: the

Atlas of Diagnostic Thoracoscopy published by Brandt, Loddenkemper and Mai [20], and the *Practical Thoracoscopy* published in 1991 by Boutin, in collaboration with Viallat and Aelony [21], both characterised by an excellent synthesis of technical knowledge and application of a method which gradually became an integral part of endoscopy performed by pulmonologists.

Surgical Thoracoscopy

In the early 1990s, following the applications for laparoscopic cholecystectomy, an exclusively thoracoscopy surgical was developed to make minimally invasive interventions like stapler pulmonary biopsy, removal of pulmonary nodules, resection of bullae and blebs in pneumothorax, removal of mediastinal cysts and tumours, and even lobectomy and pneumonectomy. With reference to the use of videotechnology a new terminology was coined surgical videothoracoscopy and video-assisted thoracic surgery or VATS, this last definition being the most used word today to indicate thoracoscopy performed by surgeons [22].

Medical Thoracoscopy Today and Tomorrow

The current role of medical thoracoscopy can be said to be established, being defined in reviews [23], guidelines [3], manuals [24, 25] and also in textbooks of pleural diseases [26, 27]. Its application is accepted in particular for the diagnosis of pleural effusion and for pleurodesis of malignant effusion, whereas its use is not undisputed in spontaneous pneumothorax [28] and in more interventional applications such as pleural space infection, forceps lung biopsy and sympathectomy [29]. Certainly, some recent multicentre studies have strongly contributed to its recognition for pleurodesis in malignant effusion [30] and pneumothorax [31].

Medical thoracoscopy can further progress with a wider adoption of the more interventional procedures and the improvement of equipment. The latter field includes minithoracoscopy [32], the most relevant indications of which are small pleural effusions, semirigid thoracoscopy [33], with the advantage of a flexible tip but the inconvenience of the small size of biopsy samples, and fluorescence thoracoscopy, used for a better detection of pleural malignancies in early stage [34] and to identify the sites of air leakage in patients with primary spontaneous pneumothorax [35].

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