

The clinico-pathological conference, based upon Giovanni Battista Morgagni's legacy, remains of fundamental importance even in the era of the vanishing autopsy

Fabio Zampieri¹ · Stefania Rizzo¹ · Gaetano Thiene¹ · Cristina Basso¹

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Abstract Walter Cannon and Richard Cabot inaugurated the clinico-pathological conference (CPC) at *Harvard Medical School* at the beginning of the twentieth century, but this approach to anatomico-clinical correlation was first introduced by Giovanni Battista Morgagni at the University of Padua in the eighteenth century. The CPC consists of the presentation of a clinical case, in which past and recent medical histories of the patient, with all relevant information about laboratory tests including biopsy results, therapy and, eventually in a fatal case, the autopsy, are discussed. This is done for an audience of trainees and all physicians involved in the care for the patient. The CPC is still in use in many academic hospitals, as a teaching tool not only for undergraduate and graduate medical trainees, but also for postgraduate continuous medical education, in spite of the progressively declining autopsy rate. CPCs represent the ideal occasion for fruitful discussion between the two “souls” of medicine, i.e., the clinical, with its focus on the patient, and the pathological, with its focus on understanding disease. To discontinue using them would be equal to denying that modern medicine originated in Morgagni's method.

Keywords Anatomico-clinical correlations · Autopsy · Clinico-pathological conferences · Pathological anatomy · Giovanni Battista Morgagni

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✉ Gaetano Thiene
gaetano.thiene@unipd.it

¹ Department of Cardiac, Thoracic and Vascular Sciences, University of Padua Medical School, Via A. Gabelli, 61, 35121 Padua, Italy

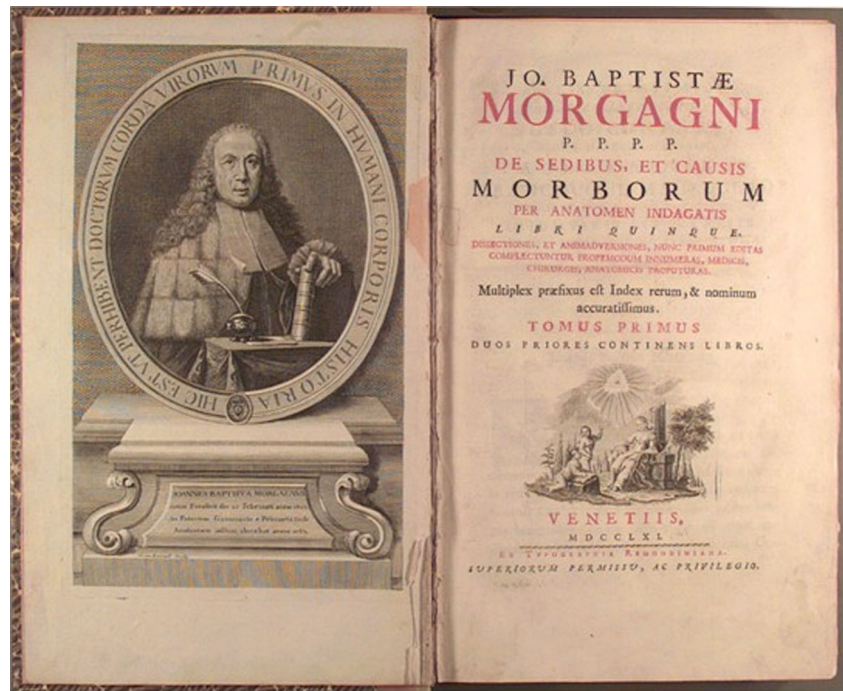
Morgagni and the anatomico-clinical correlation

The clinico-pathological conference (CPC), as we know it today, started at the beginning of the twentieth century. However, the method of anatomico-clinical correlation goes back to Giovanni Battista Morgagni (1682–1771), when he published his *De sedibus et causis morborum per anatomen indagatis* (seats and causes of diseases investigated by anatomy) [1] (Fig. 1). The opera contains clinical and autopsy reports of about 700 cases, grouped in five “books” (chapters) organized *a capite ad calcem* (from head to toe) [2]. Any chapter consists of a series of “anatomico-medical letters” (70 in total), each one dedicated to a symptom or sign, such as “suffocation” and “cough,” or a clinical entity, such as “epilepsy” and “arthritis,” explored in many single case reports [3]. Anatomico-clinical correlation for any disease is supported by an overview of several cases, which elaborates the most common and rare anatomical and clinical characteristics of the disease [4].

One of the most famous cases describes the condition which would later be named “Adams-Stokes syndrome,” after the Irish doctors Robert Adams and William Stokes, who first recognized this clinical entity in the nineteenth century (1846). Morgagni's clinico-pathological report (anatomico-medical letter LXIV) describes “a merchant of Padua, 74 year old [...] who fainted following an attack of dizziness. The following day he suffered an attack of epilepsy with frequent relapse [...] the pulse was vigorous, firm and rare. Death occurred [...] preceded by three or four attacks” [1].

Morgagni stated that pulse frequency was two thirds less than normal, that is 20–30 beats per minute. At autopsy, he observed that the “aorta was enlarged from the beginning of its curve and in its internal face, just above the valves, I saw few protrusions [...]. The dilation of the heart and the aorta did certainly not exist before the spirit of the patient was affected, because he was healthy. Therefore, I think that the cause of

Fig. 1 Frontispiece of *De sedibus et causis morborum per anatomen indagatis* (Venice, 1761) with a portrait of Giovanni Battista Morgagni



this dilation was most probably a disturbance of the nerves directed to the heart and that great artery” [1].

This nervous disturbance supposed by Morgagni seems an appropriate interpretation according to the knowledge at that time, since the complete description of the electrical conduction system would come centuries later, by Wilhem His in 1893 and Sunao Tawara in 1906, respectively [5, 6].

Another famous case in *De sedibus* is the anatomo-clinical description of liver cirrhosis. In the anatomo-medical letter XXXVIII, Morgagni reports the case of the Venetian patrician Gaspare Lombria, who died in 1722. Firstly, he examined the patient, proving the fluctuation of ascites with a clinical maneuver still in use today: “Placing the left hand on one side of the abdomen and beating the other side with the right hand, I could feel the water flowing from the right to the left side” [1]. At autopsy, Morgagni observed that “[...] the liver was firm, inside and outside composed of tubercles, that is of small glands, very clearly distinguishable” [1]. Morgagni interpreted the organic lesion as hypertrophy of liver glands with compression of small vessels, due to shrinking and hardening of the liver, leading to the accumulation of fluid in the peritoneal cavity.

The method of anatomo-clinical correlation was further developed by the Paris medical school at the beginning of nineteenth century [7]. Gaspard-Laurent Bayle and René Laennec, for instance, recognized the “tubercle” (cavity) in the lungs, which generates a typical sound during auscultation, and coined the term “tuberculosis” [8]. Noteworthy, the term liver “cirrhosis” was also introduced by Laennec. Such steps forward were possible thanks to the novel clinical

method of exploring the living human body, auscultation with the stethoscope invented by Laennec, and comparison with eventual autopsy findings.

Origin of CPC

Walter Cannon was the Director of the *Harvard Medical School Department of Physiology* from 1906 to 1942. When he was still a medical student, his roommate informed him about a new teaching method used by Christopher Langdell at the *Harvard Law School*. The method was based on the study of a single legal case through which general laws could be elaborated, called *Case system* [9]. Cannon proposed to apply this method to the teaching of medicine, because clinical and academic lessons were not enough to learn all practical and scientific aspects of medicine [10]. Through this method, moreover, the two complementary perspectives on medicine—the study of the theoretical basis of disease and the practice of curing—could be integrated [10].

According to Cannon medical cases, as documented in patient files in hospital or private doctor archives, could provide comprehensive information on the history of a patient, to be used for educating medical students because “diseases in text-books, like diseases in lectures, are abstractions; they are descriptions of averages or types with no body to give them reality” [10]. He proposed to present the cases in form of conferences, involving both young and expert physicians from different specialties, to stimulate questions and discussion, exactly the way CPCs are still conducted.

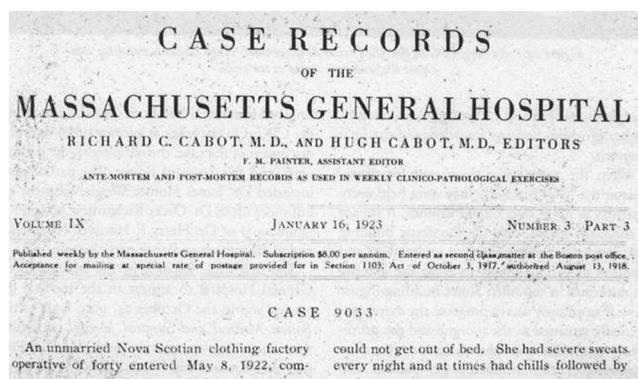


Fig. 2 Publication of a Richard Cabot “Case Record”

Cannon’s paper was supported, few months later, by an article written by Charles Eliot [11], President of Harvard University from 1869 to 1909, and was discussed during the meeting of the *Boston Society for Medical Improvement* on May 5, 1900. Richard Cabot, clinician at the *Massachusetts General Hospital* and professor at *Harvard Medical School*, was so enthusiastic about this proposal that he started using it in his teaching [12]. As of 1915, Cabot sent the texts of these conferences to physicians worldwide who asked for them, and in 1924, they started to be published in the *Boston Medical and Surgical Journal* under the heading *Cabot Case Records*. They continued to be regularly published when the journal changed its name to the current *New England Journal of Medicine*, later becoming *Weekly Clinico-Pathological Exercises* and presently *Case Records of the Massachusetts General Hospital* (Fig. 2).

Very significant are Cabot’s considerations on the birth of this method: “As soon as I began to have the opportunities of ward service at the Massachusetts General Hospital, [...] I was much impressed by the undesirable separation between the clinical men and the pathologists. One day I discovered in an old volume of bound records a case diagnosed as neurasthenia (nervous prostration), and [...] that an autopsy had been

performed. [...] I found that the patient had died of cancer of the pleura, but had had neurasthenic symptoms and vague intercostal pain, which had misled the clinicians. What especially impressed me was that the clinical diagnosis had never been changed, presumably because the clinicians were unaware of the postmortem results” [11, 13].

After Cabot, the protagonist of CPCs was Benjamin Castleman, Professor of Pathology at *Harvard Medical School* and Pathologist in Chief at the *Massachusetts General Hospital*, who edited the *Case Records of the New England Journal of Medicine* from 1951 to 1975 (in total about 2000). Interestingly, he was characterized as “a skilled clinical diagnostician as well as a superb pathologist” [14], which confirms that CPC is the ideal tool to merge these two basic approaches to medicine.

CPC: structure and significance

The CPC consists of the presentation of a clinical case, in which past and recent medical histories of the patient, comprising all relevant information about laboratory tests including biopsy results, therapy and, eventually in a fatal case, the autopsy, are discussed. This is done for an audience of trainees and all physicians involved in the care for the patient, together with surgeons and pathologists, and sometimes even geneticists and laboratory personnel. This approach is fundamental for clinical decision making, including therapy [15].

A CPC might elaborate the case of a deceased patient, as was usual at the beginning of the anatomico-clinical method, and report clinical and autopsy findings. From an educational point of view, this typology is probably the most effective for medical students, young physicians, and even those more experienced, because it reveals how complex even a single patient can be. Ultimately, the CPC reproduces the essential core of the scientific reasoning, focusing on the relationship between the particular and the universal, the unique

Fig. 3 **a** Entry of the Anatomical Theatre, at the Bo Palace of the University of Padua, with the motto: “Mors ubi gaudet succurrere vitae” (“Here death enjoys to help life”). **b** University of Padua Anatomical Theatre, viewed from the top: inaugurated in 1595, it is considered the oldest, still preserved, stable anatomical theatre of the world

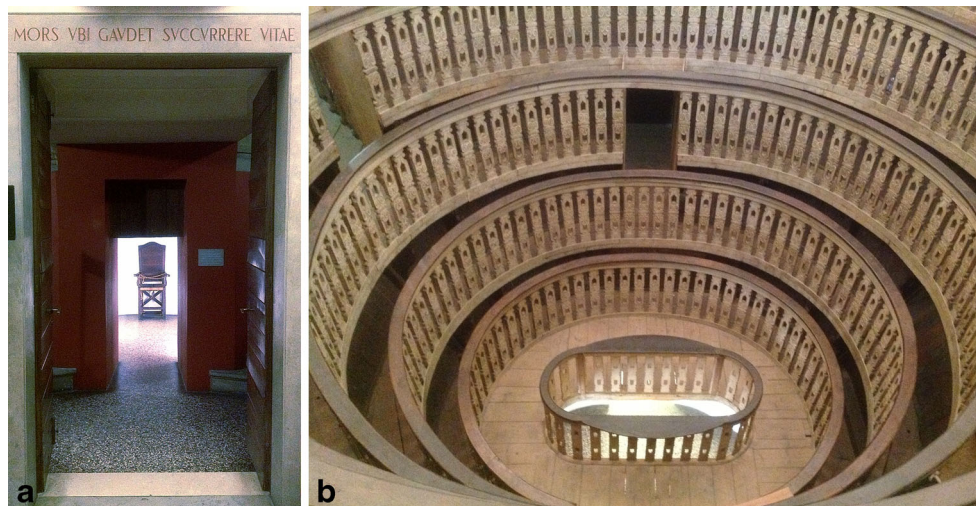


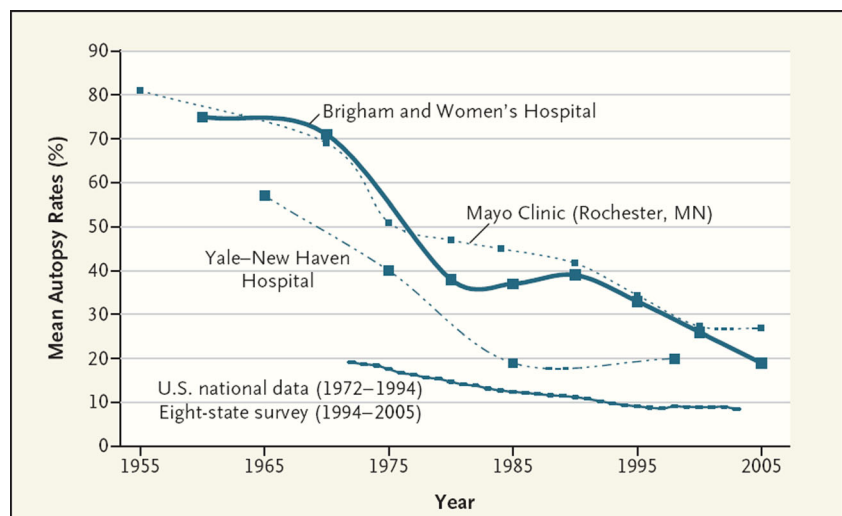
Table 1 Decline of autopsies in Europe and other countries from 1938 to 2003

Country	Initial autopsy rate (%) (period)	Subsequent autopsy rate (%) (period)
Australia	21 (1992–1993)	12 (2002–2003)
France	15.4 (1988)	3.7 (1997)
Hungary	100 (1938–1951)	68.9 (1990–1992)
Ireland	30.4 (1990)	18.4 (1999)
Jamaica	65.3 (1968)	39.3 (1997)
Sweden	81 (1984)	34 (1993)
UK	42.7 (1979)	15.3 (2001)
USA	26.7 (1967)	12.4 (1993)

From Burton and Underwood [21]

manifestation, and the laws of nature [16]. A CPC concludes with the so-called *epicrisis*, summarizing the explanation of symptoms and the final diagnosis of the disease which eventually caused the death of the patient as well as anatomical correlations. Understanding why a disease killed a patient provides insight fundamental for the progress of medical science and will also improve care for future patients, as it enhances clinical awareness and might hone diagnostic skills. In this sense, the motto inscribed at the entry of the oldest anatomical theatres “*hic locus est ubi mors gaudet succurrere vitae*” (this is the place where death enjoys helping life) has lost nothing of its validity (Fig. 3).

The main aims of the CPC are to stimulate discussion and, through discussion, familiarize the audience with diagnostic reasoning by the maieutic method (the Socratic approach: learning the truth through interaction between learner and instructor in which both contribute their experience). More than a correct final diagnosis, the essential outcome of the CPC is the process itself: clinical reasoning, maintenance of critical spirit, and cultivation of systematic doubt [15, 17].

Fig. 4 Decline of autopsies in USA from 1955 to 2005 (from Shojania et al. 2008) [20]

CPCs are considered a unique occasion for the integration of medical knowledge, which, otherwise, would remain fragmented into an increasing variety of (sub)specialties [16], with pathology as a key element in understanding disease mechanisms. CPCs provide an instrument for integrating knowledge and competencies of clinicians, in charge of diagnostic and therapeutic decision making, and pathologists, who will contribute morphological (and, nowadays, increasingly molecular) observations and mechanistic insight [13, 18]. In the dialogue of a CPC, the different but complementary perspectives of clinicians and pathologists will merge. This will fuse the *idiographic* perspective, the subjective reality of individuality, with the *nomothetic* perspective, the objective understanding of the particular through general mechanistic principles [19].

CPC and the decline of autopsies

The practice of autopsies has continuously declined in the second half of the twentieth century, which has had a negative influence on the clinico-pathological approach. At the beginning of twentieth century, the autopsy played a central role in medical research, education, and professional development, and autopsy rates of patients deceased in a hospital attained up to 80 %, while in the most recent decades, the rate has fallen to less than 20 % in a negative trend that continues until this day (Table 1, Fig. 4) [20–22].

Autopsies might be discouraged by clinicians for fear of “missed diagnoses” and tend to be regarded as a waste of time by busy pathologists. Autopsies have even come to be considered unnecessary, with the availability of sophisticated imaging and laboratory tests that made pre-mortem diagnoses more reliable. Furthermore, autopsies are rarely reimbursed by health insurance providers and are no longer considered as a key element of quality control for clinical care in the process

of hospital accreditation [14]. Finally, once consent of relatives became mandatory, as it is nowadays in most countries, cultural, emotional, and religious considerations emerged as important obstacles. However, studies suggest that beyond relatives' refusal, unwillingness of clinicians to seek consent has contributed greatly to the steep decline in the hospital autopsy rate [21]. Postmortem imaging, such as magnetic resonance or computed tomography, is gaining in popularity, as it avoids any kind of intervention on the cadaver and also respects religious and cultural concerns. However, these imaging approaches will never be able to replace anatomic dissection, because essential detailed information might not be obtained and histology is often necessary to ascertain the final diagnosis [21].

One of the most important concerns regarding autopsy practice has been retention of organs and the archiving of tissue specimens, which is generally considered an integral part of the autopsy protocol. In the UK, following a much publicized and politically contested practice of organ retention at Adler Hey Children's Hospital in Liverpool, the "Human Tissue Act" in 2004 introduced a more complex approach to consent [22]. This has led to an incremental decline of the autopsy in this country, along with similar bioethical legislation in other countries.

Following the decline in autopsy practice, CPCs have also lost some of their former lustre, but giving up on CPCs entails a high risk. First of all, when clinical observation and reasoning are no longer confronted with pathological findings, the result might be excessive confidence of clinicians on diagnostic tools and overestimation of clinical performance. Of note, it has been suggested that Harvard Medical School alumni, who have benefited from this method of teaching, might have better diagnostic skills than US physicians educated elsewhere [23]. Also, for pathologists, the CPCs remain an essential exercise, as confrontation with clinical findings will help them correctly interpret complex anatomical findings in their clinical context. CPCs remain irreplaceable moments of learning; they foster professional collaboration and exchange of interdisciplinary knowledge, the need of which has only increased in our era of super-specialization. Pathologists have to be proactive in defending the value of autopsy practice, but a growing workload and the greater economic interest of surgical pathology practice often seem to weigh heavier.

Jesse Edwards, formerly pathologist at the Mayo Clinic, Rochester, Minnesota, wrote in 1991: "At this point in the history of medicine, the leaders in the field of diagnostic aids have come from a class of people familiar with the autopsy and development of these tests and many others has been supported by anatomic observations made by pathologists and clinicians working together at the autopsy. Now, persons in the diagnostic fields are being educated and trained in a period not only of declining incidence of autopsy, but, worse than that, absence of the clinician from the few autopsies that are being performed. Unless that trend reverses itself, it is my prediction that the day will come when current and future teachers will miss the fundamental

instruction on which the practice of medicine has been built. To overcome the deficiency, there will need to be a return to the autopsy with a promise for future developments in the field of diagnostic testing" [24].

More than two centuries ago, Giovanni Battista Morgagni, ahead of his time, was well aware of the fundamental role of the autopsy to educate and refine diagnostic skills: "[...] physicians who have done or seen many autopsies have learned at least to mistrust their diagnosis; the others who don't confront themselves with the often discouraging findings of autopsies, live in the clouds of an uncontrollable illusion" [25].

Conclusions

In continuing to practice the clinico-pathological method, pathologists recognize that only the integration of "understanding disease" with "intention to cure" will further the cause of medicine. This remains true in the twenty-first century, with pathology no longer limited to cells, tissues, and organs but also addressing the molecules and genes involved. In this regard, the intuitive reflection of Rudolph Virchow, revolutionary and well ahead of his time, is noteworthy: "Any anatomic modification is material, but is any material modification anatomic? Why not molecular? Can a profound molecular modification occur in the setting of an apparently normal structure? These modifications belong more to physiology than to anatomy, they are functional-dynamic [...]. Many phenomena are merely functional in nature and when you try to explain them mechanistically, on the basis of subtle molecular changes, the method of investigation will never be morphological" [26].

The CPC exemplifies that in order to understand and cure disease, it is mandatory to integrate the "eye" of the pathologist with the "hand" of the clinician, in a continuous effort to correlate all aspects compounding pathological phenomena. As a consequence, correlating autopsy findings with clinical data remains of fundamental importance in teaching students, post-graduate trainees, and practitioners alike: "Good doctors never stop learning, and well-chosen, carefully prepared CPCs remain a powerful and dynamic teaching tool" [27]. To discontinue using them would be equal to denying that modern medicine originated in Morgagni's epistemological revolution.

Conflict of interest We declare that we have no conflict of interest.

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