

Pier Diego Siccardi (1880-1917) and the “Clinica del Lavoro” in the trench warfare

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SUMMARY

Background: *The year 2017 marks the centenary of the death of the Italian scientist Pier Diego Siccardi (1880-1917), one of Luigi Devoto’s assistants at the “Clinica del Lavoro” in Milan. Objectives:* To commemorate Siccardi and to describe the activities of the physicians of the “Clinica del Lavoro” during World War I. **Methods:** *A comprehensive analysis was conducted on scientific papers written by Pier Diego Siccardi and by other physicians belonging to the Clinica del Lavoro, in the period 1915-1918. Results:* During the Great War, the Clinica del Lavoro became a military hospital, even though it indirectly maintained a role in Occupational Health, assisting women who had started to work to replace the men sent to the front. Devoto and his assistants were drafted as Army doctors, but continued their research activities while at the front; focusing on the diseases that affected the soldiers, mainly infections. Bleeding fevers and jaundice were endemic among Italian troops, but their etiology was unknown. Pier Diego Siccardi identified this syndrome as an infection caused by a spirochete, and was the first one to isolate the infectious agent. Siccardi prematurely died of the same disease as a consequence of a laboratory accident, which provided further confirmation for his research. **Conclusions:** The heroic life of Siccardi and his tragic death testify the important activities of the scientists of the “Clinica del Lavoro” in the years of the Great War.

RIASSUNTO

«**Pier Diego Siccardi (1880-1917) e la Clinica del Lavoro in trincea**». **Introduzione:** Nel 2017 si ricorda il centenario della morte dello scienziato italiano Pier Diego Siccardi (1880-1917), uno degli assistenti di Luigi Devoto alla Clinica del Lavoro di Milano. **Obiettivi:** Commemorare la figura di Siccardi e descrivere le attività dei medici della Clinica del Lavoro durante la Prima Guerra Mondiale. **Metodi:** È stata condotta un’analisi approfondita degli articoli scientifici scritti da Pier Diego Siccardi e da altri medici che appartenevano alla Clinica del Lavoro, nel periodo 1915-1918. **Risultati:** Durante la Grande Guerra, la Clinica del Lavoro divenne un ospedale militare, anche se mantenne indirettamente una funzione di medicina del lavoro, assistendo le donne che avevano iniziato a lavorare per sostituire gli uomini chiamati alle armi. Devoto e i suoi assistenti furono arruolati come medici dell’esercito, ma continuarono le loro attività di ricerca al fronte, focalizzandosi sulle malattie, di cui i soldati soffrivano, soprattutto le infezioni. Le febbri emorragiche associate a ittero erano endemiche tra le truppe italiane, ma la loro eziologia non era riconosciuta. Pier Diego Siccardi identificò questa sindrome come un’infezione causata da una spirocheta e fu il primo ad identificarne l’agente patogeno. Siccardi morì prematuramente a causa di un incidente di laboratorio che confermò ulteriormente le sue ricerche. **Conclusioni:** La vita eroica di Siccardi e la sua tragica morte testimoniano le importanti attività degli scienziati della Clinica del lavoro negli anni della Grande Guerra.

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The year 2017 marks the centenary of the death of Pier Diego Siccardi (1880-1917), one of Luigi Devoto's (1864-1936) first assistants at the "Clinica del Lavoro" in Milan, the first institute in the world devoted to the study of occupational diseases, founded in 1902. Although the name of this Italian occupational physician is generally unknown and forgotten, his life and achievements are worth remembering. Siccardi's researches were pioneering not only in the field of occupational health, but also in the study of infectious diseases, focusing on leptospirosis, a disease from which Italian troops suffered during the Great War. The anniversary of Siccardi's premature death, consequence of a tragic laboratory accident, provides an opportunity to commemorate this young Italian scientist and to discuss the activities of the physicians of the "Clinica del Lavoro" during World War I.

THE "CLINICA DEL LAVORO" IN THE FRONTLINE

On 23 May 1915, Italy declared war on Austria-Hungary. The physicians and researchers of the "Clinica del Lavoro" were drafted as Army doctors. During the Great War, the Clinica became a military hospital, a place where wounded soldiers and their families could be taken care of (10). It indirectly maintained a role in Occupational Health, since during this period it assisted a large number of women who had just recently started to work to replace their men, husbands, fathers, and sons who had gone to fight in the World War (10). The Clinica edited a booklet aimed at helping soldiers and the civilian population on the home front coordinate the various forms of assistance and prevention (8). Actually, the Socialist Press harshly criticized the temporary transformation of the institute into a military hospital, because of the reduction of its specific research activity in the field of occupational diseases (4).

Although Devoto and his assistants were called up and sent to the front, they continued their scientific research. More specifically, Devoto studied renal and heart diseases among soldiers and, together with Domenico Cesa Bianchi (1879-1956) and Luigi Preti (1881-1941), investigated influenza pandemic (Spanish Flu), malaria and malnutrition. Felice Pe-

russia (1885-1959), who had established the first radiological cabinet at the Clinica, studied the application of radiology at the front (10). The clinical features and treatment of various infectious diseases in the trenches were described; inter alia, Luigi Preti studied typhoid fever, Carlo Vallardi (1884-1962) amoebic dysentery, and Marino Tempini colitis (10).

From July to November 1916, 700 Italian soldiers suffered from bleeding fevers and jaundice of benign evolution. Army physicians were not aware of the etiology of these conditions and initially attributed them to scurvy or rheumatic peliosis. The signs and symptoms were actually the clinical manifestation of leptospirosis (also known as Weil's disease), a zoonosis caused by a *spirochete* bacteria of the genus *Leptospira*. This disease is characterized by severe jaundice, kidney failure, and bleeding. Humans become infected through contact with water, food, or soil contaminated with urine of infected animals, generally rodents. The disease occurs especially in workers involved in outdoor activities, such as veterinarians, slaughterhouse workers, farmers, sewer maintenance workers, waste disposal workers, and people who work on crumbling buildings (14). It was also known as "Field Fever", since the sodden conditions of trench warfare facilitated infection (13). In 1886, the German physician Adolf Weil (1848-1916) first described a disease that resembled the condition known as "infectious jaundice", suffered by Napoleon's army during the Egyptian campaign (12). Outbreaks of infectious jaundice occurred among troops in several battlefields, such as in the War of the Austrian Succession (1742-1745), in the American Secession War (1862-1863), and in the Franco-Prussian War (1870-1871) (12). In 1907, Arthur Marston Stimson (1876-1953) observed spirochetes in a kidney tissue section of a patient who suffered from yellow fever. In Japan, where the disease was common among coal miners, Ryokichi Inada (1874-1950) and Yutaka Ido (1881-1919) managed to reproduce acute leptospirosis in animals after injecting guinea pigs with the blood of Weil's disease patients, thus identifying the infectious agent (1). The Japanese group published the results of their research in 1916; the following year, they demonstrated that rats were the carriers of this spirochete, named *Spirochaeta icterohaemorrhagiae* (1).

In Italy, Domenico Cesa Bianchi and Carlo Moreschi (1876-1921) from the Clinica del Lavoro, were the first scientists to investigate the origins of the bleeding fevers (10). Afterwards, the head of the Italian Army Medical Services decided to put in charge of the investigation another assistant of Luigi Devoto, the young scientist Pier Diego Siccardi (3).

SICCARDI: LIFE AND WORKS

Pier Diego Siccardi was born in Ancona on 23 August 1880. He belonged to an aristocratic family of Northern Italy and his mother was related to the Italian Minister of Finances Quintino Sella (1827-1884) (5). Siccardi started his medical studies at the University of Bologna and then graduated in Padua in 1904, where he worked as research assistant at the Institute of Internal Medicine directed by Achille De Giovanni (1838-1916) between 1904 and 1910 and at the Institute of Physiology, directed by Aristide Stefani (1836-1925) between 1910 and 1913 (3, 5). The cultural environment of those years influenced the young Siccardi, who became a great friend of the Italian artist Umberto Boccioni (1882-1916) (2). His initial medical studies were on the pathogenesis and medical treatment of ancylostomiasis (16-21); he reported his results on the topic at the first International Conference on Occupational Diseases (Milan, June 1906) and at the first Italian Conference on Occupational Diseases (Palermo, October 1907) (17, 19). During these events, Siccardi met Devoto, who soon came to admire the works of the young researcher. The U.S. physician Bailey K. Ashford (1873-1934), a pioneer in the treatment campaign against hookworm, also appreciated his works. In particular, he stated: "The work of Siccardi is especially valuable, as he fearlessly cut into old and worn-out theories and false deduction with the knife of a surgeon brilliantly refuting doctrines no longer tenable in the modern conception of uncinariasis and basing his views largely upon his own personal and laborious work. These theses are essentially those of clinical research in which the laboratory contributes its important part" (9).

In 1913 Siccardi moved to Milan, where he started to work as Devoto's assistant and head of

the laboratory of occupational pathophysiology at the "Clinica del Lavoro". During that period, he mainly conducted studies on lead poisoning and occupational respiratory diseases, including tuberculosis (22-26, 30). In 1915, Siccardi was called to the front as medical officer of the Fourth Army (6). Initially, he conducted studies related to military medicine, e.g. emphysema-edema of the face from grenade blasts (27). As mentioned earlier, the head of the Army Medical Services left him in charge of investigating the origin of the bleeding fevers that the Italian troops were experiencing (3). In August 1916, Siccardi established a bacteriological laboratory in Montebelluna, only a few kilometres from the frontline (5), where he initially postulated a scurvy-related syndrome (28). The breakthrough he needed was the hospitalization, on 11 April 1917, of F. Amadio, a 20 years old soldier. He was in a general good state of nutrition and blood pressure, but had severe pain in all muscles, joints and bones, particularly in the limbs. The patient had fever, pale skin without jaundice, and a hemorrhagic rash; nothing was found in blood, urine and stool analysis, except for slightly increased platelets counts (31). Siccardi decided to inoculate a blood sample of the soldier in a guinea pig. During the following weeks, the patient's health conditions were characterized by intermittent fever, subcutaneous hemorrhage, increased pain in the limbs and urinary urobilinogen. The disease eventually subsided and the patient was released from hospital on 24 May (31). The guinea pig, inoculated with the blood of the patient, died 5 days after the injection, suffering from fever, asthenia and progressive deterioration of internal organs. The autopsy of the animal revealed cutaneous haemorrhage and jaundice, and microscopy of blood, urine, kidney, and liver samples showed a *spirochete* with bent extremities. Specific coloration confirmed the presence of the *spirochete* previously discovered by Inada and Ito (31). Siccardi thus demonstrated that the bleeding fevers that affected the Italian troops were caused by *Spirochaeta icterohaemorrhagiae*, first described by the Japanese researchers' studies on coal miners (29, 31). Infections by spirochete were concurrently found in many European battlefields, including the English and Belgian armies (33, 34). Siccardi's paper on these findings was appreciated

by the Italian scientific community, who gave a greater importance to his studies. In the meantime, the defeat of Caporetto forced the young researcher to move his laboratory to Parma. In a letter dated 24 October 1917, Siccardi asked Devoto if he had read the positive reviews of his work; it was their last correspondence. On 24 November 1917, Siccardi accidentally injured himself with a small piece of glass contaminated with biological material (kidney) from a guinea pig infected by *spirochete*. A week later, the young scientist showed the symptoms of Weil's disease, and eventually died prematurely on 12 December at the age of 37 (6, 7, 11).

CONCLUSIONS

Siccardi's death provided additional confirmation to the studies on leptospirosis. In detail, the spirochete, isolated in a patient with mild symptoms, was demonstrated to cause a rapid death in a guinea pig and in another human subject, accidentally inoculated with a biological sample from the animal (7). Its virulence was confirmed to increase in the passages from humans to animals and from animals to humans (7). For these reasons, Siccardi played an important role in the studies on leptospirosis, not only with his research but also, sadly, with his own death.

His studies testify the important activities of the scientists of the "Clinica del Lavoro" in the years of the Great War. Together with Siccardi, other Italian occupational physicians and scientists contributed to the development of medicine in that period, such as Cesa Bianchi, Moreschi, Perussia, Preti, Tempini, Vallardi (10). Commemorating Siccardi, Luigi Devoto stated: "The Clinica del Lavoro, the assistants, the friends of the Clinica, the students and myself lost not only a major representative of the School, a distinguished teacher, a valuable scholar and a researcher, appreciated in Italy and abroad, but also the forerunner of our School" (11). At the end of the Great War, Devoto established the "Siccardi Foundation" to commemorate the great Italian scientist. Each year, the Foundation provided an award of 2.000 Italian lire (about €4.000 in today's money) to a young graduate in medicine for one-year of practice as a physician at the "Clinica del Lavoro" (10).

Siccardi was a brilliant scientist and probably would have become one of the most important researchers of the Clinica. Luigi Devoto did not hide his predilection for the young researcher, and Siccardi constantly returned the affection with which he was welcomed in Milan. In his private correspondence, the young scientist was proud to show his successes to his Professor. Curiously, his tragic end calls to mind the premature death of another Devoto's assistant, Carlo Moreschi, who died in 1921 of smallpox, contracted while examining some passengers from a Russian ship in Messina (Sicily) (15). As well as Moreschi, Siccardi risked his own life during outbreaks of infectious diseases, and tragically died in his prime while conducting hazardous experiments. For this reason, his heroic figure should serve as an example for all scientists. One hundred years after Siccardi's death, there is still much to be learned about his short life and his scientific activity. The "Clinica del Lavoro", the scientific community, and occupational physicians should be proud of the figure of Pier Diego Siccardi, whose death reminds us of the sacrifice of a generation of young Italian men on the World War I Centenary.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED

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