Resuscitation (2008) **79**, 189—192

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RESUSCITATION GREAT

Karel Wenckebach: The story behind the block

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Received 27 January 2008; received in revised form 27 March 2008; accepted 20 May 2008

KEYWORDS
Atrioventricular block;
Arrhythmia;
Dysrhythmia;
Cardiac;
Pause

Summary The first documentation of a human atrioventricular (AV) block dates back to 1873, when A.L. Galabin reported a 34-year-old patient using an apexcardiogram. This was followed the same year by Luciani, recording 2nd degree AV blocks while studying frogs. In 1899, Karel F. Wenckebach provided the cardiology field with the criteria of what he called ''Luciani periods'', what we now know as Wenckebach Periodicity or Mobitz I AV block. The classic electrocardiographic presentation of Mobitz I/Wenckebach periodicity is characterized by progressive prolongation of the PR interval on the electrocardiogram (EKG) on consecutive beats followed by a blocked P wave. This clinical entity is the first and most common of two types of 2nd degree AV block. This manuscript reviews the life of Karel F. Wenckebach and the events that led this great Dutch physician to make one of the most important contributions to the field of cardiology.

Introduction

In 1864, Karel F. Wenckebach (Figure 1), the son of an engineer and grandson of a Supreme Court justice, was born in The Hague, The Netherlands.[1] At the age of 10, he suffered the loss of his father and he and his family moved to Utrecht where he attended high school.[1]

In 1881, Wenckebach enrolled at the University of Utrecht Medical School. While there as a student, and prior to his graduation in 1888, Wenckebach published several articles about embryology. It is believed by some authors that Wenckebach's first love in medicine was the field of pathology[2]; however, Wenckebach suffered from color blindness, and this affliction would not let him appreciate the different color patterns of tissues. Instead, Wenckebach turned his interest to the developing field of cardiovascular recordings which he could easily read as they were in black and white.

Wenckebach worked as a physiologist with Theodor Wilhelm Engelmann (1843—1909), a professor in Utrecht who was performing research on muscle excitation and contraction as well as on cardiac physiology (myogenic theory of excitation and stimulus transduction).[3] Engelmann, who

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doi:10.1016/j.resuscitation.2008.05.015

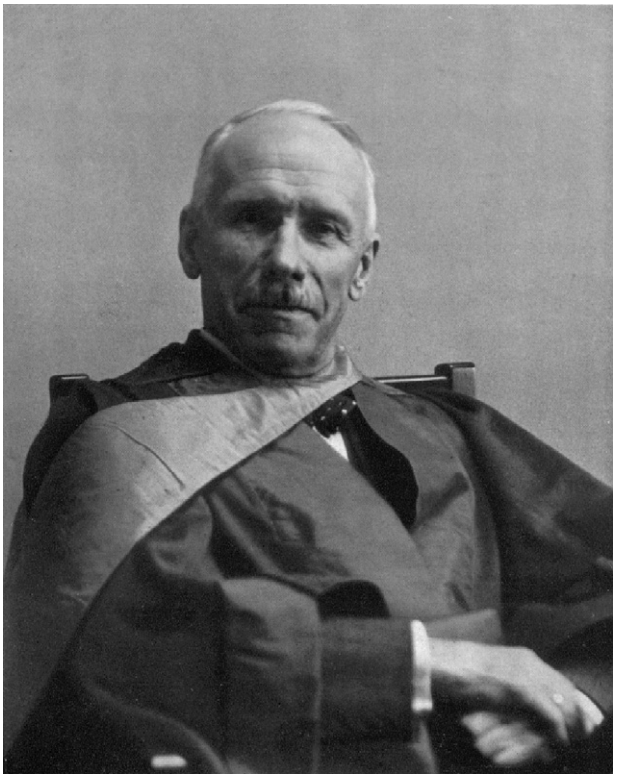

Figure 1 Karel F. Wenckebach.

believed that irregularities of the heart rhythm could be caused by conduction defects, would later become Wenckebach's mentor.[4,5] It was during this time that Wenckebach began to study cardiac rhythm disturbances while experimenting with frogs.

The first known documentation of a human atrioventricular (AV) block was made by Alfred Lewis Galabin in 1873. He reported on a 34-year-old patient using an apexcardiogram.[6] That same year, while working in Ludwig's laboratory, Luigi Luciani recorded a 2nd degree AV block for the first time while studying frogs.[6–9]

Twenty-six years later, Karel F. Wenckebach observed an abnormal group of beats with pauses, and noted the length between pauses was less then twice the interval between the preceding beats, and that the interval between atrial and ventricular contraction was shorter after a pause (Figure 2). Wenckebach paid homage to Luigi Luciani (1840—1919) by calling this beating group ''Luciani periods'',[5,10] what we now know as Wenckebach Periodicity or Mobitz I AV block. Figure 3 depicts Wenckebach's first mechanical recording on a smoked drum of 4:3 AV conduction, where the ''a—c'' interval gradually increases until the ''a'' wave is not followed by the expected ''c'' wave. This is the classic electrocardiographic presentation of Mobitz I/Wenckebach periodicity and is characterized by progressive prolongation of the PR interval on consecutive beats followed by a blocked P wave. This is the first and most common of two types of 2nd degree AV block. The actual mechanism of AV conduction was still unexplained at the time.[4]

In 1891, Wenckebach left Ultrecht because of economic issues and entered a private practice in Heerlen, but eventually returned in 1896.[1] Fascinated by pulsed cardiac irregularities, Wenckebach continued to study their physiology while also practicing clinical medicine. Between 1898 and 1915 he published many manuscripts on extrasystoles, conduction defects, allorhythmia and alternations.[7,11–14]

Clinically, the electrocardiogram today has been called the Rosetta Stone of dysrhythmias.[15] Nonetheless, before Willem Einthoven's first electrocardiogram, other mechanical devices such as Mackenzie's clinical polygraph were used for the identification of the different types of dysrhythmias. Wenckebach meticulously analyzed arterial pulse tracings and investigated other tracings, and in particular, the apex cardiogram.[4] To study the cardiac rhythm, emphasis was placed on the ''a'' wave, which indicated the contraction of the atrium and its relation to the ventricular systole in traces of venous pulses and the beat at the apex.[16] In 1899, Wenckebach reported on a patient with a recurrent irregular pulse, demonstrating repeated groupings of beats with pauses whose length was less than twice the interval between the preceding beats. He observed that the interval between the first two pulses after the pause was longer than the other pulse intervals and that after this phenomenon there were no extrasystoles.[5]

Wenckebach was unique as he was the first to show that those perturbations of the human heart constituted alterations of built-in properties in the myocardium and had the same nature as those he had observed in animal models.

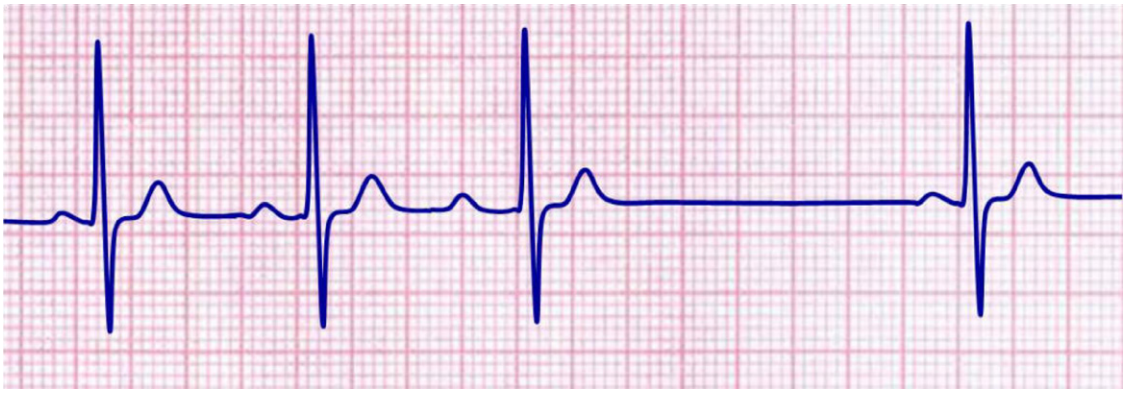

Figure 2 Electrocardiographic depiction of the Wenckebach periodicity (Mobitz I AV block).

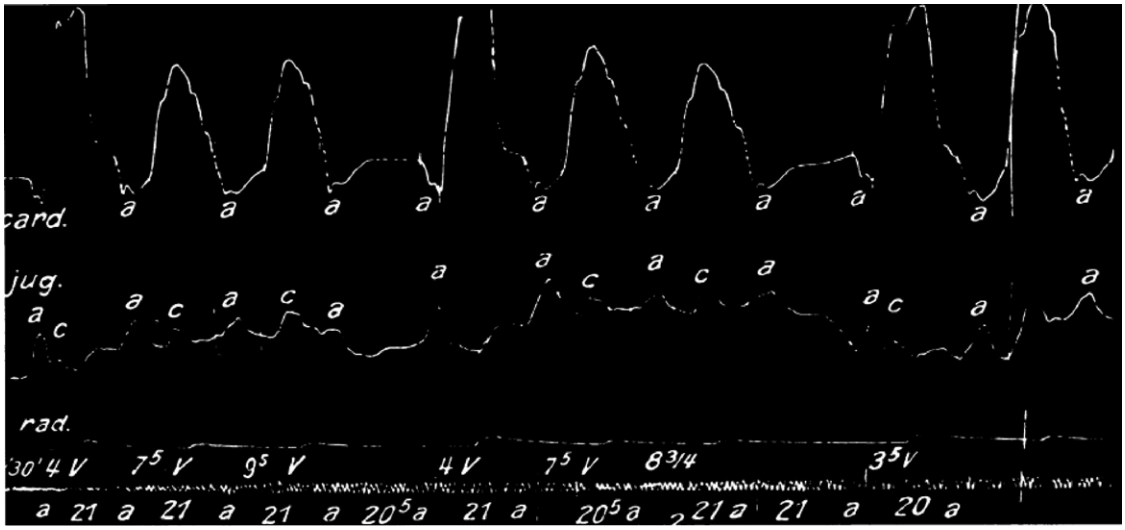

Figure 3 Wenckebach's mechanical recording on a smoked drum of 4:3 atrioventricular conduction. *Note that the ac interval gradually increases until the ''a'' wave is not followed by the expected ''c'' wave.

Continuing his great interest in the human heart, he introduced the use of quinine as an anti-arrhythmic drug in 1914. He administered 1 g of this drug to a patient with atrial fibrillation.[17,7] Moreover, he identified and defined quinine's effects as having a ''*quieting influence on the heart, quite apart from whether there is auricular fibrillation or not*''.[4]

Wenckebach published his first, and most noted, work ''Die Arhythmie als Ausdruck Bestimmter Funktionsstdrungen des Herzens.''[11,18] This publication garnered him international fame and recognition for his work in documenting dysrhythmias.

In 1930, he received the degree of LL.D. from the University of Edinburgh.[11] He received many honors during his life and is still widely recognized for his numerous outstanding contributions to cardiology and physiology, but also because of his great modesty. At the age of 65, Wenckebach retired from his chair in Vienna and went to the Dutch East Indies to study the heart failure associated with beriberi, which after his arrival he found hard to study given the fact that fatal cases were no longer common.[4] He then headed to Singapore and continued to perform examinations on heart specimens. A very eloquent teacher, Wenckebach has been quoted as saying ''In medical science there are vast realms of which I have no special knowledge.''

Conclusions

Karel F. Wenckebach provided the cardiology field with the criteria of what we now know as Wenckebach periodicity or Mobitz I AV block. Today, this well known dysrhythmia named after him, is part of the great history of cardiology and represents a very common phenomenon that continues to be studied by the many physicians that share Wenckebach's interest for the physiology of the human heart.

Conflict of interest

None to declare.

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