

History of endocrinology in the world and in Poland

Historia endokrynologii na świecie i w Polsce

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Abstract

Endocrinology is a branch of medicine dealing with the functioning of endocrine glands. The main role of the endocrine glands is to control various functions and to adapt internal environment to changes in the external environment. Glands manage to do this by regulating the metabolism of target cells by hormones. One of the earliest connections with endocrinology is found in the Hippocratic humoral hypothesis dating about 400 years BC. The author of the first endocrinological observations was Aristotle, who noticed changes in behavior and appearance in castrated roosters. In the Middle Ages winners of battles ate their enemies organs, such as the heart, brain, or gonads, believing that they were a source of special power. However, the last two centuries were a time of intensive development of the research in this field. Certainly, we can now look to the future awaiting the next breakthroughs that will revolutionize today's perception of endocrinology.

Key words

endocrinology, history, hormones, world, Poland

Streszczenie

Endokrynologia jest działem medycyny zajmującym się funkcjonowaniem narządów wydzielania wewnętrznego, którymi są gruczoły. Ich główne zadanie to globalne i długotrwałe sterowanie różnymi funkcjami organizmu i dostosowywanie warunków środowiska wewnętrznego do stale zmieniającego się środowiska zewnętrznego. Spełniają one te funkcje poprzez regulację metabolizmu komórek docelowych za pomocą hormonów. Za jedno z pierwszych powiązań z endokrynologią uznaje się hipotezę humoralną Hippokratesa. Jest to czas datowany na około 400 r. p.n.e. Autorem pierwszych obserwacji z zakresu endokrynologii był Arystoteles, który zauważył zmianę zachowania i fizyczności u kogutów poddanych kastracji. W średniowieczu zwycięzcy bitew zjadali organy swoich wrogów, takie jak serce, mózg czy gonady, wierząc, że są one źródłem szczególnych mocy. Jednak ostatnie dwa stulecia to czas szczególnego rozwoju badań w zakresie tej nauki. Z całą pewnością możemy dziś patrzeć w przyszłość, oczekując kolejnych przełomów, które zrewolucjonizują dzisiejsze spostrzeżenie endokrynologii.

Słowa kluczowe

Endokrynologia, historia, hormony, świat, Polska

Sex hormones in the history of endocrinology

Even in ancient times the differences resulting from endocrine disorders have already been noted, where eunuchs (castrated men) were excluded from society, and meeting them on the street was a bad omen [1]. They were also excluded by Judaism [2]. Topic of eunuchism also appears several times in the Scriptures. It was not always a castrated man, but sometime it was determined by high-ranking official [2,3]. Eunuchs guarded harems over the centuries [2]. Over 3 000 years ago, for example, in Asia men were castrated to be able to serve aristocracy and religious institutions [4]. In some societies they performed very important functions and had an impact on many decisions [5]. They were eunuchs who often held position of the bailiffs, generals and diplomats [5].

The Baroque, however, was the era in which castrati were celebrated because of their angelic clean voices [5]. Three famous castrati singers Farinelli, Caffarelli and Senesino hypnotized with their voices were rewarded with a standing ovation for their performances [6]. However, the price of such a career was extremely high [6]. Depending on the age at which the surgery has been performed, the results were different [6]. Most often boys were castrated before the age of 10, which resulted in a lack of body hair, poor development of the penis and lack of sex drive [6]. It is estimated that in Italy alone about 4,000 boys a year underwent this procedure [7]. The era of castrati success in the music ended at the end of the eighteenth century, and the last of them was Alessandro Moreschi, who was sent into retirement by Pope Pius X in 1912 [6].

The history concerning the female gonads is not as widely described. In 1935, seven cases of women with menstrual irregularities, hirsutism and infertility were discussed [8]. Their ovaries were described as pearly white, hypertrophic and wedge like notches [8]. The co-occurrence of these symptoms was called polycystic ovary syndrome [8].

Female endocrine system interested researchers, mainly due to the ability to control fertility. Researchers have isolated hormones such as pregnandiol and estrone from the urine of pregnant mares [9]. At the end of the twenties of the twentieth century, Ludwig Haberlandt tried to create hormonal contraceptives, but the first pill was put into US market in 1957, thanks to Gregory Pincus, supported by "Planned Parenthood Federation" [10,11]. But it was in 1960 when Enovid, containing a progestin called norethindrone, has been registered by the FDA as a contraceptive drug [11].

Historical background of acromegaly

The first information about gigantism was provided as early as in the Bible when describing the Goliath [12]. Acromegaly was first described under the name prosopoectasia in 1864 by Andrea Verga [13]. In the autopsy he found a tumor moving the optic nerve, while not showing normal pituitary gland [13]. In 1877, Brigidi first described the microscopic picture of this tumor [12]. The term acromegaly was introduced in

1886 by Pierre Marie; he also was the author of the description of this disorder [14]. A year later, Oskar Minkowski observed the enlargement of the pituitary in all autopsies of patients with acromegaly [15]. In 1892, Roberto Massalongo linked the increased function of the pituitary gland with acromegaly [16]. In 1877, Henri Henrot noticed a tumor in the field of the pituitary gland also in a patient with gigantism [12]. Initially it was thought that it was a completely different disease entity from acromegaly [12]. However, in 1894, Christian F. Fritsche and Theodor Albrecht Edwin Klebs recognized that acromegaly is an acquired form of gigantism growing after the completion of the process of growing [12]. Sternberg also noticed many similarities between these two disorders [17]. Similar conclusions were made by subsequent researchers [12]. Finally, the reason for both disorders was found to be common at the beginning of the twentieth century [18].

Diabetes and its history

Many hundred years ago, diabetic patients were also distinguished. In Ayurvedic medicine it was called Madhumeha (sweet urine) [19]. This disease was also known by the Egyptians and the Greeks, and Greek physician Aretaeus of Cappadocia first described its symptoms, as well as introducing the concept of "Diabetes" [19]. Anatomic basis for researches on pancreas was the discovery of the pancreatic duct by Wirsung in 1642 [20]. Its physiological significance as secretory organ was described in 1671 by Regnier de Graaf. Clusters of insulin-producing cells were described German Paul Langerhans [21]. In 1890 Joseph von Mering and Oskar Minkowski proved that diabetes is a result of total pancreatectomy [20]. This created the basis for searching for insulin, the discovery was made in 1921-1922, and its discoverers, John James Macleod and Frederic Grant Banting, received the Nobel Prize [19]. This special honor was also awarded to the Frederick Sanger, who discovered the structure of the hormone in 1958 [19]. Insulin was synthesized by for the first time by Katsoyannis [22].

The history of endocrine surgery

Undoubtedly, the achievements of William Harvey and John Hunter, who were well-known anatomists, had significant effects on the development of endocrinology [23]. Hunter was the first one to transplant testicles to capons in 1786. However, he did not examine the impact of this process on hormones [24]. In the first half of the nineteenth century, Arnold Adolph Berthold also transplanted testicles to chickens, but this scientist carefully watched the effects of such action [24]. In 1849 he published the results of his experiment in which he castrated four roosters, two of them have undergone testicular transplant, and two were left without treatment [24]. Berthold described changes in the behavior of both pairs, thus became the author of the first experiment in the field of

endocrinology [24]. He postulated that the communication between cells, tissues and organs is essential for maintaining the physiological processes [23].

Another famous experiment in the field of endocrinology was a study conducted by Charles E. Brown-Séquard [25]. For 20 days he was giving himself a mixture of blood from the testicle's veins, semen and juice from animal testicles. Later he described the effects of the experiment, praising the increase of strength and endurance [25]. Although most of the described activities had a placebo effect, preparations produced on the model of his experiment sold very well [26].

The discovery of the first substances with hormonal activities and endocrine glands

In 1902 Bayliss and Starling described secretin as a substance produced by the intestine and released into the bloodstream to act endocrine [27,28]. In 1905, they were the first to use the term "hormone" [29]. Even in 1970, there were only three known gastrointestinal hormones: secretin, gastrin and cholecystokinin [30]. Today we know that the digestive system is controlled by many different substances and gastroenterological endocrinology is one of the most rapidly developing areas of endocrinology.

For centuries, there have been speculations regarding adrenal disorders. Until, in 1855 Thomas Addison published a monograph "On the Constitutional and Local Effects of Disease of the suprarenal Capsules" in which he explained the mechanisms of adrenal insufficiency [31]. This disease still bears his name. The turn of the 20th century was a time of Cybulski and Szymonowicz's studies, who, in 1894, delivering intravenously extract from the adrenal medulla, reported significant hypertension and bradycardia [32]. They postulated that this was a substance produced in the adrenal gland and secreted into the blood [32]. In 1899, John Abel, and Jokichi Takamine in 1901, isolated the adrenaline from the adrenal glands, and in 1904 Stolz made the first chemical synthesis of the hormone [33]. In the twenties of the last century intensive research on the adrenal glands was still carried out [23]. In that period, the first adrenalectomy and hypophysectomy were performed [23]. It was also a period in which most of the steroid hormones were discovered [23]. Steroid ring construction was discovered simultaneously in London and in Munich [34]. Cortisone was discovered in 1948 and steroids quickly started to be used for the treatment of Addison's disease, rheumatic and inflammatory diseases [35]. Then they have found use in the treatment of allergic, immunological, dermatologic, ophthalmic or respiratory and digestive tract diseases [35]. The first half of the twentieth century was a time of intensive studies on Cushing's syndrome [36]. At the end of World War II, the conclusion was made that it was caused by adrenal disease, and in 1950 Julius Bauer noted that it can also be caused by the dysfunction of the pituitary gland [37].

The year 1954 was the time when Vincent du Vigneaud described the structure of oxytocin, and a year later he syn-

thesized it [38]. He is also the author of the first synthesis of vasopressin [38], while Guillemin and Schally identified and characterized most of the major neurohormones of the hypothalamus in 1977 [39].

The history of the first descriptions of the thyroid disease dates back to 1000-1110, when Avicenna and AlJuraj described the connection between thyroid diseases and exophthalmos [40]. Until the nineteenth century, knowledge about the disease of this organ was negligible. It was known only that (1) some component of food, mainly marine origin prevents goiter (2), that goiter has something in common with cretinism (3) and the structure of the thyroid was known [41]. In the years 1802-1840 four scientists from different countries (Flajani from Italy, Parry from England, Graves from Ireland and Basdow from Germany) independently described the symptoms of thyroiditis, today called Graves' disease [42]. Each of them described tachycardia and an enlargement of the thyroid gland and the three of them also described the exophthalmos [42]. In 1811 iodine was discovered, as well as its inhibitory effect on goiter [41]. At the beginning of the nineteenth century, the only available treatment of goiter was thyroidectomy, but after some time treatment included also subcutaneous injections of extracts from sheep's thyroid as a treatment for postoperative hypothyroidism and myxedema [41]. In 1912 a Japanese surgeon Hakeru Hashimoto described four cases of chronic thyroiditis with lymphocytic infiltration, fibrosis and the loss of parenchyma [43]. Thyroxine, a hormone produced by the thyroid gland was first isolated from bovine thyroid glands in the early twentieth century, and its synthesis was made ten years later [41]. Triiodothyronine was discovered in the 50s, and peripheral conversion of T4 to T3 was established in 1970 [41]. Mid-21st century was the time of the introduction of radioiodine treatment, as well as antithyroid agents [41].

The forties of the 20th century was a time of significant development of medicine, which also contributed to the development of endocrinology. At this time, scientists were interested, among other things, in radioisotopes or electron microscopy [23]. One of the undeniable breakthroughs was the appearance of radioimmunoassay methods for determining the concentration of substances, developed by Rosalyn Yalow, and still used today in the hormonal analysis [44].

Currently, research in the field of endocrinology is conducted on the borderline with other areas of medicine. For example, many studies investigating the vitamin D as prohormone having a great importance for maintaining the health are made [45].

One of the younger branches of the science of hormones is also psychoneuroendocrinology. The researchers were looking for the connections between biochemical disturbances and mental diseases [46]. Studies were carried out on the basis of which it was suspected that endocrinopathies may result in the development of mental disorders [46]. There have also been the reports of cases of depression or schizophrenia, the causes of which were thought to be in endocrine disorders [46].

History of endocrinology in Poland

The origins of endocrinology in Poland were mainly in the form of the transfer of skills to recognize the symptoms of endocrine disorders, or their symptomatic treatment [47].

The early fifties of the 20th century was a period in which methylthiouracil, cortisol, as well as bilateral adrenalectomy were introduced for the treatment [47]. Then, also the method for the determination of concentrations of adrenal hormones was also developed at that time [48]. These achievements were the results of work of steroid hormones laboratory, under the leadership of Professor Barbara Migdalska and the adrenal team of Doctor Anna Kasperlik-Zaluska [47]. Another breakthrough was the diagnosis and effective treatment of the patient with Conn's syndrome in 1956 [47]. An important achievement was the introduction of the determination of concentrations of peptide hormones using radioimmunoassay methods by Professor Wojciech Jeske [48].

In 1955, Professor Walenty Hartwig created the Study of Physicians Improvement at the Medical Academy in Warsaw, which was converted into the Medical Center of Postgraduate Education (CMKP) in 1970 [47]. The main task of this institution was to provide post-graduate training for medical personnel in the field of diseases of the endocrine glands [48].

In 195 the first isotope laboratory was opened, headed by Oskar Chomicki, W. Czech, Professor W. Gąsiorowski and Tadeusz Górowski, which allowed the use of radioiodine in the diagnosis and treatment of thyroid diseases [47].

Endocrinology in Poland owes a lot to Professor Tadeusz Pawlikowski, considered to be its creator [49]. He was the founder of Poland's first Clinic of Endocrinology, opened on the 4 May 1966, as part of the Department of Endocrinology, Medical University of Lodz [50]. On 15 March 1975 the Clinic of Endocrinology was transformed into the Institute of Endocrinology, and its creator was also professor Pawlikowski [50]. For many years he was also Editor in Chief of the journal "Endokrynologia Polska" (Polish Journal of Endocrinology) He was the author of numerous books and a member of numerous scientific societies, both national and international [49].

The Clinic of Endocrinology in Lodz is a place where many innovative methods of diagnosing and treating of the following diseases were developed: diabetes insipidus (Helvetica

Med. Acta 1969), exophthalmos malignant in Graves' disease (Acta Endocrinol 1989), recognition functional hyperprolactinemia (Acta Endocrinol 1978), the treatment of Cushing's disease (Endokrynol Pol 1982) and acromegaly (J Endocrinol Invest 1997). The Clinic also developed the methods of diagnosing and treating adrenal tumors and Nelson syndrome (Year Book of Endocrinology and Year Book of Internal Medicine 1997) [47].

Tadeusz Górowski was the author of the first textbook of thyreology, and Professor Walenty Hartwig was the author of the first Polish textbook of clinical endocrinology.

1977 was the year in which the Central Consultation Endocrinology Clinic in Lodz was established. It was headed by Professor Stefan Zgliczyński [47].

Another important figure in the history of Polish endocrinology was Professor Michał Karasek, an endocrinologist and morphologist, whose main interests included the pineal gland, melatonin, andrology and submicroscopic morphology [51]. He was the author of over 422 scientific papers, among others, in the field of endocrinology, which appeared in journals with very high Impact Factor [51]. He was on the lists of most frequently cited Polish authors in the field of biomedical sciences [51]. At the same time he was chairman of the section of Experimental Endocrinology and Neuroendocrinology of the Polish Society of Endocrinology [51]. In 2009 he was Head of the Department of Neuroendocrinology, in Clinic of Endocrinology, Medical University of Lodz [52].

Summary

Endocrinology is a branch of medicine which origins can be traced to the ancient times. For centuries, many of its faces have been discovered, which allowed us to possess the knowledge we have today. However, the last two centuries were a time of the rapid development of the research in this field. Certainly, we can now look to the future awaiting the next breakthroughs that will revolutionize today's perception of endocrinology.

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