90 YEARS OF BUERGER'S DISEASE — WHAT HAS CHANGED?

STVRTINOVA V, AMBROZY E, STVRTINA S, LESNY P

90 ROKOV BUERGEROVEJ CHOROBY — ČO SA ZMENILO?

Abstract

Stvrtinova V, Ambrozy E, Stvrtina S, Lesny P:
90 Years of Buerger's Disease — What Has Changed?
Bratisl Lek Listy 1999; 100 (3): 123–128

Thromboangiitis obliterans or Winiwarter—Buerger's disease is a primary systemic vasculitis of an unknown etiology, which affects medium-sized arteries and veins mainly in the lower and upper extremities, causing multiple segmental arterial occlusions especially in young male smokers.
The aim of our study is to compare the knowledge on the etiology, epidemiology, clinical presentation, diagnostic and therapeutic possibilities in the time of Leo Buerger (90 years ago) and now.
Between 1994 and 1998, 26 patients (19 men and 7 women) were investigated with clinical suspicion for Winiwarter-Buerger's disease. Laboratory and arteriographic investigation revealed typical signs for this disease in 22 of them. To the most common clinical signs or symptoms belong smoking and the onset of the disease before the age of 50 years (in 95.5 %), intermittent claudication (in 72.7 %), rest pain and ischaemic ulcers or gangrenes in the fingers (in 68.2 %). In slightly more than half of the patients migrating superficial thrombophlebitis was present and similarly in one half of the patients Raynaud's phenomenon was found.
In conclusion — What has changed from the times of Leo Buerger? 1. Prevalence of TAO increased in women. 2. Older patients (more than 40 years old) are being diagnosed. 3. Upper-extremity involvement is more frequently present. 4. Diagnosis of TAO is being more proper, especially due to up-to-date diagnostic methods, like digital subtraction angiography. 5. The treatment is more effective, amputation number is decreased. And what has not changed? Similarly like Leo Buerger we do not know the precise etiology of the disease. Ceasation of smoking has still the most important therapeutic procedure. The clinical course of the disease is individual and in spite of the treatment is the clinical course unpredictable. ***(Tab. 5, Ref. 47.)***
Key words: thromboangiits obliterans, Winiwarter—Buerger's disease, clinical presentation, diagnostics.

2nd Clinic of Internal Medicine and Dpt of Pathology, Faculty of Medicine, Comenius University, Bratislava, and Dpt of Diagnostic Radiology, Slovak Institute of Cardiovascular Diseases, Bratislava
Address for correspondence: V. Stvrtinova, MD, PhD, 2nd Clinic of Internal Medicine, Faculty of Medicine, Mickiewiczova 13, SK-813 69 Bratislava, Slovakia.
Phone: +421.7.3590144, Fax: +421.7.3590785, Internet: vierastvrtinova @hotmail.com

Abstrakt

Štvrtinová V., Ambrózy E., Štvrtina S., Lesný P.:
90 rokov Buergerovej choroby — Čo sa zmenilo?
Bratisl. lek. Listy, 100, 1999, č. 3, s. 123–128

Thromboangiitis obliterans alebo Winiwarterova—Buergerova choroba je primárna systémová vaskulitída neznámej etiológie, ktorá zasahuje stredne veľké tepny a žily, prevažne na dolných a horných končatinách, pričom spôsobuje viacpočetné segmentové uzávery tepien, najmä u mladých mužov — fajčiarov.
Cieľom našej práce je porovnať poznatky o etiológii, výskyt, klinický obraz, diagnostiku a liečbu v čase opisu ochorenia Leom Buergerom (teda pred 90 rokmi) a v súčasnosti.
Od roku 1994 do roku 1998 sme vyšetrili 26 pacientov (19 mužov, 7 žien) s klinickým podozrením na Winiwarterovu—Buergerovu chorobu. Ďalšími laboratórnymi vyšetreniami a angiograficky sme diagnózu potvrdili u 22 pacientov. Medzi najčastejšie znaky ochorenia patrilo fajčenie a manifestácia ochorenia pred 50. rokom života (95,5 %), klaudikačné bolesti (72,7 %), pokojové bolesti v nohe alebo lýtku a ulcerácie a gangrény prstov (68,2 %). Povrchová migrujúca tromboflebitída sa vyskytovala u viac ako polovice pacientov, podobne Raynaudov syndróm bol prítomný u polovice pacientov.
Záverom — Čo sa zmenilo od čias Leo Buergera? 1. Výskyt ochorenia sa zvýšil u žien. 2. Stúpol výskyt ochorenia u ľudí starších ako 40 rokov. 3. Častejšie sa vyskytuje ochorenie aj na horných končatinách. 4. Zlepšila sa diagnostika ochorenia, najmä vďaka takým diagnostickým metódam, ako je digitálna subtrakčná angiografia 5. Zlepšili sa aj terapeutické možnosti, počet amputácií sa znížil. A čo sa nezmenilo? Rovnako ako Leo Buerger ani my dnes presne nevieme, prečo ochorenie vzniká. Rovnako aj dnes platí, že základným predpokladom úspešnosti liečby ochorenia je abstinencia fajčenia. Klinický priebeh ochorenia je individuálny a rozdielny u jednotlivých pacientov, klinický priebeh ochorenia je preto ťažko predvídateľný. *(Tab. 5, lit. 47.)*
Kľúčové slová: thromboangiitis obliterans, Winiwarterova—Buergerova choroba, klinický obraz, diagnostika.

II. interná klinika Lekárskej fakulty Univerzity Komenského v Bratislave, Patologický ústav Lekárskej fakulty Univerzity Komenského v Bratislave a Oddelenie rádiodiagnostiky Slovenského ústavu srdcovocievnych chorôb v Bratislave
Adresa: Doc. MUDr. V. Štvrtinová, CSc., II. interná klinika LFUK, Mickiewiczova 13, 813 69 Bratislava.

Thromboangiitis obliterans or Winiwarter—Buerger's disease is a primary systemic vasculitis of an unknown etiology, which affects medium-sized arteries and veins mainly in the lower and upper extremities, causing multiple segmental arterial occlusions especially in young male smokers (Štvrtinová, 1998).

In 1879 Felix von Winiwarter described for the first time "a peculiar form of endarteritis and endophlebitis with gangrene of the feet" in an amputated leg of a 57 years old man. In the same year Leo Buerger was born in Vienna, who in 1908 (90 years ago) summarized the clinical observations and pathological findings and firstly used the term thromboangiitis obliterans (Haviar, 1947; Shionoya and Eastcott, 1992). Thus Leo Buerger described a special segmental obliterative vascular disease involving principally the medium-sized arteries and veins of the extremities (Horowitz, 1989). In spite of the fact that Leo Buerger was not the first who discovered this "new disease", in the clinical texts the name Buerger's disease is very commonly used (more commonly than the term thromboangiitis obliterans or Winiwarter—Buerger's disease).

In 1960 Wessler et al threw doubt on the true existence of Buerger's disease. Many authors then discussed the existence of this disease as a diagnostic category. But now, inspite some controversy about Buerger's disease, it becomes clear, that the clinical presentation of 2—5 % of patients with peripheral vascular diseases differs from that of other arterial diseases, atheromatous or non-atheromatous (Fiessinger, 1996).

Thromboangiitis obliterans (TAO) is quite a rare disease, but it begins in young people and often leads to disability and therefore presents a serious medical and social problem (Štvrtinová, 1996). The aim of our study is to compare the knowledge about the etiology, epidemiology, clinical presentation, diagnostic and therapeutic possibilities in the time of Leo Burger (90 years ago) and now.

Patients and methods

Between 1994 and 1998, 26 patients (19 men and 7 women) were investigated on the Angiological Department of the 2nd Internal Clinic of Medical Faculty Comenius University in Bratislava with clinical suspicion for Winiwarter—Buerger's disease. The clinical diagnosis was established when at least five from the following eight clinical signs or symptoms were present: 1) onset at the age of less than 50 years, 2) smoking, 3) intermittent claudication or rest pain in foot or hand, 4) superficial thrombophlebitis, 5) Raynaud's phenomenon, 6) ulcers or gangrenes of fingers, 7) involvement of upper extremities and 8) no evidence of diabetes mellitus, arterial hypertension, hypercholesterolaemia or hypercoagulability.

In 24 patients conventional or digital subtraction angiography of the abdominal aorta, iliac arteries and of both lower limbs in whole extension was performed. In five patients the angiography of the upper limbs was performed bilateraly. Two patients refused angiography investigation. As arteriographic signs typical for the diagnosis of TAO we considered involvement of small and medium sized arteries, multiple segmental occlusive lesions, smooth vessel wall in non-affected arteries, abundant tortuous corkscrew or tree-root configurated collaterals, absence of arteriosclerotic lesions.

Biopsy of inflammed superficial vein was done only in one patient, we did not perform biopsy from an ischaemic ulcer or extremity because of the risk of worsened healing of the biopsy wound.

Results

From 26 patients with clinical suspicion for TAO further clinical, laboratory and arteriographic investigation revealed typical signs of this disease in 22 of them, in 2 patients arteriographic evidence of arterial emboli was found, in one 50 years old woman mixed connective tissue disease was diagnosed, and in one 48 years old man with history of migrating superficial thrombophlebitis, after right big toe amputation for gangrene, plantar ulcus and normal angiogram and no risk factors for atherosclerosis, severe neuropathy (mainly of ethyltoxic origin) was revealed. From the group of 22 patients with proved diagnosis of TAO were 17 men and 5 women (men to women ratio was 3.4:1). The mean age of the group was 42.4±10.5 years. The mean age of our patients at the time of the onset of the disease was 32.9±10.3 years — the youngest was 19 and the oldest 53 years old.

The clinical signs and symptoms in our 22 patients with TAO are listed in Table 1. To the most common signs or symptoms belong smoking and the onset of the disease before the age of 50 years (in 95.5 %), intermittent claudication (in 72.7 %), rest pain and ischaemic ulcers or gangrenes on the fingers (in 68.2 %). In slightly more than half of the patients migrating superficial thrombophlebitis was presents and similarly in half of the patients Raynaud's phenomenon was found. From 12 patients with migrating phlebitis in three of them veins of the forearm (alongside leg veins) were affected. Upper extremities were involved in one third of the patients. Superficial thrombophlebitis was the most common initiating sign of the disease, which led the patient visit a doctor (Table 2). Further initial signs of the disease were intermittent claudication (in four patients in feet and in two patients in calves) and finger gangrenes or necrosis (in the feet in 4 patients

Tab. 1. Clinical signs and symptoms of TAO in a group of 22 patients.

Signs, symptoms	Patient's No	%
Age of onset before 50 years	21	95.5
Age of onset before 40 years	17	77.3
Smoking	21	95.5
Claudications in feet or calves	16	72.7
Rest pain in extremities	15	68.2
Ischaemic finger ulcers or gangrenes	15	68.2
Migrating superficial thrombophlebitis	12	54.5
Raynaud's phenomenon	11	50.0
Upper extremities involvement (trombophlebitis, rest pain, finger gangrene)	7	31.8
Normal blood pressure values	22	100.0
Normal cholesterol and triglycerids	22	100.0
Normal blood sugar	22	100.0
Hypercoagulability	0	0

Tab. 2. First clinical sign of the disease in a group of 22 patients.

Clinical sign	Patient's No	%
Superficial thrombophlebitis	8	36.4
Claudicatio intermittens	6	27.3
Necrosis or gangrene of the finger	6	27.3
Raynaud's phenomenon	2	9.1

Tab. 3. Year of disease beginning in 22 patients with TAO.

Year of disease beginning	Number of patients
1998	2
1997	2 (1 woman)
1996	2
1995	2 (1 woman)
1994	3 (1 woman)
before 1994	11 (2 women)

Tab. 4. Buerger's original criteria for clinical diagnosis.

Onset: aged 20-40
Early phase:
Numbness, cold, indefinite pains, with associated blanching of forefoot
Absent ankle pulses
Later developments:
Erythromelalgia and trophic (tissue nutritional) changes
Dependent rubor of toes and forefoot
Blistering or ulceration near big toe nail most often
Cyanosis later around the above lesion
Pain now so severe that amputation is often sought before toe is necrotic

and in the hands in 2 patients). In 22 patients their disease has begun before the year 1994, in three patients in the year 1995, and in each of the further year two new patients with Winiwarter—Buerger's disease were diagnosed (Table 3).

Discussion

In 1908 Leo Buerger for the first time used the term thromboangiitis obliterans and described more precisely the pathological and the clinical features of this disease as Felix von Winiwarter did several years before him. Leo Buerger was born in Vienna in 1879, but then the Buerger family moved to New York when Leo was quite young and so his general and medical educational background was American. First his leaning towards urology led to the development of the Brown—Buerger cystoscope (Shionoya and Eastcott, 1992). However, while still in junior appointments he became interested in vascular diseases, and in 1908, after 18 months of clinical and pathological research, he adressed the Association of American Physician in Washington, his subject being thromboangiitis obliterans (Buerger, 1908). The long and interesting text of this, the first detailed study of the disease, contained many valuable clinical observations (Table 4) and some less certain pathological findings, but his concluding paragraph — "I would suggest that the names *endarteritis obliterans* and *arteriosclerotic gangrene* be discarded in this connection and that we adopt the terms *obliterating thromboangiitis of the lower extremities* when we wish to speak of the disease under discussion" — led to a misunderstanding and confusion in the proper diagnosis of TAO for many years. The diagnosis of thromboangiitis obliterans became very popular in all patients with critical finger ischaemia and in many of them a wrong diagnosis was established. For that reason the true existence of Winiwarter—Buerger's disease was doubted (Wessler, 1960) and the lesions were attributed to atherosclerosis, embolism, or primary arterial thrombosis. A retrospective review of 205 case records of patients admitted to Mount Sinai Hospital (New York) between the years 1933—1963 revealed that the diagnosis of TAO was correct only in 33 patients, in 28 cases it was questionable and in 144 the diagnosis was incorrect (Herman, 1975). But then one by one many authors described more or less clear clinical, histological and angiographic signs enabling to distinguish TAO from other forms of peripheral arterial obliterative disease (Reiniš, 1952; McKussick, 1962; Wiliams, 1969; Puchmayer, 1984; Shionoya et al, 1988a; Lesný, 1995; Fiessinger, 1996; Štvrtinová et al, 1997).

Epidemiology

In the absence of specific diagnostic criteria, it is difficult to assess the prevalence or even incidence of TAO, but the disease has a worldwide distribution. The high incidence of Buerger's disease at the beginning of the century, immediately after Buerger's description of the disease was partially caused by incorrect diagnosis. After the Second World War a significant decline in the disease incidence was observed, especially in the USA and Europe, probably due tv better diagnostics and treatment possibilities, including antibiotic therapy, but also due to general decline in the number of smokers. Prevalence of TAO reportered by Lie (1989) in the year 1947 was 104 cases on 100 000 inhabitants, but only 13 cases in the year 1986. A higher incidence of the disease has been reported in Israel and Japan. The prevalence of TAO in Europe ranges from 0.5 to 2 % out of all peripheral arterial obliterative diseases (PAOD), while in Japan it reaches 20—30 % (Puchmayer, 1996). In Czechoslovakia the prevalence of TAO was estimated to 1 % from all PAOD (Puchmayer et al, 1986).

The age of the patients belongs to the classical diagnostic criteria described by Buerger. The first signs appear at the age of 20—40. But TAO can start also later in life. In the group of 112 patients with TAO twenty-nine percent of patients were more than 50 years old and 7 % were more than 60 years old when the disease was first diagnosed (Olin et al, 1990). In our group of 22 patients in five of them the disease starts at the age above 40 years and at an one patient in age more than 50.

TAO was formerly considered to be almost exclusively a disease of men, with women accounting for less than 1 % of affected patients. But today the spectrum of patients with TAO is changing, the disease is present also in women (Yorukoglu et al, 1993). The male-to-female ratio is decreasing to 3.4:1 on the contrary to the Buerger's original ratio of 99:1 (Leu, 1985). Olin et al (1990) reported 23 % of women in their group of patients (male-female ratio was 3:1), Dehaine—Bamberger et al (1993) had 12 women among 83 patients with TAO (14.5 %). In our group of 22 patients were 5 women (22.7 %), and male-to-female ratio was 3.4:1.

Etiology

The cause of Buerger's disease is not known, but inflammation is a typical pathological feature, especially in the acute phase of the disease. The main and only proved risk factor, known from Buerger's time, is smoking. But how cigarette smoking causes arterial occlusion is not yet known. However a predisposition is

necessary (the predisposition is more frequent in the yellow race). Less than 5 % of patients with probable TAO are nonsmokers. The role of passive smoking, cold climate, frostbite and trauma of the extremities has been suggested (Fiessinger, 1996). Excessive sympathetic tone was considered, too (Shionoya and Eastcott, 1992). Sex, age, race, and infection have all recieved attention as contributory factors (Williams, 1969). Many immunologic abnormalities were found, some authors consider the disease as an autoimmune disease responding to the antigen-antibody complex (Puchmayer, 1996). There are still many unknown factors concerning the etiology and further studies are necessary for a better understanding of the factors leading to disease exacerbation (Furukawa et al, 1994).

Clinical presentation

Undoubtedly, Buerger's disease is an independent diagnostic category with a typical clinical picture clearly different from obliterating atherosclerosis (Table 5) or from other primary systemic vasculitis (Štvrtinová, 1995 a). Typical for TAO are peripheral arterial occlusions and inflammatory character of the disease (Shinoya et al, 1988 a). The disease usually extends from one vessel to several other in a centripetal pattern (Hirai and Shionoya, 1978), and episodes of worsening and remission are characteristic in the disease course. The reasons of the disease worsening and acute attack development are not known, but psychic stress or bad relationships in family or problems in work can play a role (Heidrich et al, 1988; Hofer-Mayer et al, 1995). Also a patient with severe ischaemia in Buerger's disease can be a subject of long remissions, what is probably due to more prompt collaterals formation in young people. On the other side, the lower the age of onset, the worse the prognosis (Shinoya and Eastcott, 1992).

Tab. 5. Differential diagnosis of Buerger's disease and obliterating atherosclerosis of the extremities.

Sign/Symptom	Buerger's disease atherosclerosis	Obliterating
Age of onset	less than 40 years	more than 40 years
Claudications in foot and pain in fingers	typical symptom	very rare
Involvement of upper limbs	typical symptom	extremely rare
Claudications in calves and thighs	rare, later in course	typical symptom
Migrating thrombophlebitis	typical symptom	very rare
Arterial occlusions distal to knee	typical sign	rare (without simultaneous proximal occlusions)
Arterial occlusions above knee	rare	typical sign
Smoking	typically present	common
Other risk factors (arterial hypertension, diabetes mellitus, hyperlipoproteinaemia)	absent	typically present

According to Heidrich and Riso (1988) the disease usually begins with distal claudications (in 32 %), migrating thrombophlebitis (in 24 %) or with rest pains (in 24 %). To the initial clinical signs of the disease in our group of 22 patients belonged superficial migrating thrombophlebitis (in 36 %), distal claudications (in 27 %) and finger gangrenes (in 27 %) (Table 2). Migrating superficial phlebitis is a typical and specific feature of TAO (Puchmayer, 1996). Rather than involving the main superficial venous trunk of an extremity, such as the saphenous vein, Buerger's disease has a predilection for the small veins of the foot or ankle. Migrating thrombophlebitis can also appear on the hand and forearm veins. Typical tender nodule "travels" along the vein and this typical feauture led to another term used in this connection — phlebitis saltans. In contrast, deep venous thrombosis is unusual and is suggestive of other diagnosis such as Behcet's disease.

Arterial occlusions are predominantly localized in foot and calf, but in one third of cases they can occur in femoropopliteal area. Therefore as clinical manifestation foot and finger claudications or pains are typical, and calf claudications are present only later in the course. Foot claudications and rest pains in the fingers are probably the most typical clinical symptoms of Winiwarter—Buerger's disease. The pain is much more intensive than in patients with PAOD caused by atherosclerosis (Gruss, 1988). The patients complain of exertion, of a feeling of tiredness, persistent cramp or burning pain involving the sole of the foot, but distal pulses are in this phase ususally palpable. Ankle blood pressure is in this early time often still normal. That is the reason why 70 % of patients have already critical limb ischaemia when the diagnosis is established (Olin et al, 1990). Ulcers and gangrene appearing early in the course of Buerger's disease are the main cause of digital gangrene in young males. Nerve involvement is typical, too, with sensory loss or a painful sensation, or both. Numbness and tingling of the extremities may be due to ischaemic neuropathy. Raynaud's phenomenon and hyperhidrosis are present mainly on the hands (Shinoya and Eastcott, 1992).

Horsch (1988) found involvement of one lower limb in 26 % of patients, involvement of two lower limbs in 52 %, involvement of both lower and one upper limb in 7 %, of one upper and one lower limb in 7 % and involvement of both upper and lower limbs in 7 % of cases. Calf arteries are usually affected, stopping near at the popliteal or mid-thigh level, extension into the iliac part is uncommon. Involvement of the arteries of hand and forearm is a typical feature, too. Upper extremity arterial involvement, as demonstrated on an Allen test, was present in 63 % of patients (Olin et al, 1990). In our group of patients we found upper extremities involvement in one third of them. Though Leo Buerger's original description of the disease was limited to the extremities, TAO can affect also other arterial beds. Involvement of cerebral (Kessler, 1988; Dotti et al, 1995; Matchev et al, 1997), coronary (Ohno et al, 1985; Darcy and Virmani, 1989; Štvrtinová, 1995 b), renal (Gore and Burrows, 1958), pulmonal (Gore and Burrows, 1958) and visceral arteries (Shionoya et al, 1988 b; Broide et al, 1993; Schel-

long et al, 1994) was described in the literature. Multiple organ manifestations in thromboangiitis obliterans were reported, too (Haviar, 1947; Harten et al, 1996).

When we compare the clinical manifestation of TAO at the time of Leo Buerger and now, we can realize, that women are permanently more and more frequently affected, also the upper limb involvement is more common and more older patients are being diagnosed.

Diagnosis

The literature on TAO suffers from the lack of standard methods of establishing the diagnosis (Papa et al, 1996). From clinical diagnostic criteria the history of migrating thrombophlebitis, involvement of upper extremities, foot claudications, painful digital ulcers and gangrenes, the beginning of TAO before the age of 40 years and smoking belong to the most specific (Shionoya and Eastcott, 1992; Majewski et al, 1997). Measurement of toe systolic pressure and of transcutaneous oxygen pressure in the ischaemic area confirm the existence of critical ischaemia and may be of prognostic value.

The clinical suspicion for TAO can be supported by angiography (Hagen, 1988) even in the cases, were thrombophlebitis is not present and biopsy from ischaemic ulcer or critically ischaemic leg is not possible for the increased risk of the biopsy site worsened healing. Arteriographically, TAO can often be distinguished from atherosclerosis (Lesný, 1995; Majewksi et al, 1997). The arteriographic criteria used for the diagnosis of TAO are: 1) involvement of small and medium-sized vessels such as the digital arteries in the fingers and toes and the palmar, plantar, tibial, peroneal, radial and ulnar arteries; 2) segmental occlusive lesions with areas of diseased arteries interspersed between areas of normal-appearing arteries; 3) evidence of more severe disease distally; 4) evidence of collateralization around areas of occlusion (corkscrew collaterals); 5) proximal segments of the arterial tree with no evidence of atherosclerosis and no arteriographic evidence of arterial emboli (Olin et al, 1990; Suzuki et al, 1996).

Histologic investigation is nowadays only rarely used. Arterial biopsy of an acute lesion is usually contraindicated because of the risk of ischaemia worsening. The simultaneous inflammation of all layers of the vessel wall without necrosis, however helps to differentiate the lesions of TAO from most other forms of vasculitis, in which necrosis and destruction of the elastic lamina are often prominent (Štvrtinová, 1998).

None of the diagnostic criteria initially reported by Leo Buerger are absolutely specific for TAO. In the diagnosis of Buerger's disease, the exclusion of all other causes of PAOD (especially peripheral type of obliterating atherosclerosis, thromboembolic processes, diabetes mellitus, primary or secondary vasculitis, inherited disorders of blood coagulation) are needed.

Treatment

Ceasation of smoking is the most essential demand and represents an attempt of etiological treatment. But it is very difficult for patients with Buerger's disease to quit smoking (Olin et al, 1990). After ceasation of smoking, local treatment of cutaneous lesions is the second most important part of patient's management (Fiessinger, 1996). Besides the general procedures used in PAOD, the therapy of TAO must respect also some particulars, as e.g. antiinflammarory therapy (antibiotics, nonsteroidal anti-inflammatory drugs, corticoids) and some specific surgical procedured (Puchmayer, 1996). Though no form of medical treatment has been fully effective in patients with TAO, treatment of Buerger's disease should avoid premature, possibly unnecessary surgery (Shionoya, 1993). It seems that the number of amputations decreases in the last years.

In conclusion — **What has changed from the times of Leo Buerger?** 1. Prevalence of TAO increased in women. 2. More older patients (more than 40 years old) are being diagnosed. 3. Upper-extremity involvement is more commonly present. 4. Diagnosis of TAO is being more proper, especially due to up-to-date diagnostic methods, like digital subtraction angiography. 5. The treatment is more efficient, amputation number has decreased. **And what has not changed?** 1. Similarly like Leo Buerger we do not know the precise etiology of the disease. 2. Ceasing of smoking is still the most important therapeutic procedure. 3. The clinical course of the disease is individual, in spite of the treatment the clinical course still stays unpredictable.

References

Broide E., Scapa E., Peer A. et al: Buerger's disease presenting as acute small bowel ischaemia. Gastroenterology, 104, 1994, 4, 1192—1195.

Buerger L.: Thromboangiitis obliterans: a study of the vascular lesions leading to presenile spontaneous gangrene. Amer. J. Med. Sci., 136, 19O8, 567—580.

Darcy T.P., Virmani R.: Coronary vasculitis. 237—275. In: Virmani R., Forman M.B. (Eds.): Nonatherosclerotic ischaemic heart disease. New York, Raven Press 1989.

Dehaine-Bamberger N., Amar T., Touboul C. et al: Buerger disease, clinical and prognostic aspects. 83 cases. Presse-Med., 5, 1993, 22, 945—948.

Dotti M.T., De-Stefano N., Vecchione V. et al: Cerebral thromboangiitis obliterans: clinical and MRI findings in a case (letter). Europ. Neurol., 35, 1995, 246—248.

Fiessinger J.N.: Buerger's disease or thromboangiitis obliterans. 2143—2147. In: Tooke J.E., Lowe G.D.O. (Eds.): A Textbook of Vascular Medicine. London—Sydney—Auckland, Arnold 1996.

Furukawa K., Yao Y., Ishimaru S.: Buerger's disease. Nippon Rinsho, 52, 1994, 8, 2143—2147.

Gore I., Burrows S.: Reconsideration of the pathogenesis of Buerger's disease. Amer. J. Clin. Pathol., 29, 1958, 319—330.

Gruss J.D.: Konservative Therapie (PGE_1) der Endangiitis obliterans. 128—131. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Hagen B.: Angiographische Charakteristika bei Endangiitis obliterans. 84—92. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Harten P., Muller-Huelsbeck S., Regensburger D., Loeffler H.: Multiple organ manifestations in thromboangiitis obliterans (Buerger's disease). A case report. Angiology, 47, 1996, 4, 419—425.

Haviar V.: Prípad generalizovanej morbus Winiwarter—Buerger. Bratisl. lek. Listy, 27, 1947, 57—60.

Herman B.E.: Buerger's syndrome. Angiology, 26, 1975, 713—716.

Heidrich H., Hollatz F., Potthoff R.: Thromboangiitis obliterans und psychodynamische Befunde. 59—62. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Heidrich H., Riso J.: Klinik der Thromboangiitis obliterans. 40—41. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Hirai M., Shionoya S.: Intermittent claudication in the foot and Buerger's disease. Brit. J. Plast. Surg., 65, 1978, 210—216.

Hofer-Mayer T., Adler R.H., Minder C. et al: Clinical Speculation: Is Specificity Back? This Tima Thromboangiits Obliterans. Psychosom. Med., 57, 1995, 2, 195—201.

Horowitz S.A.: Case records of the Massachusetts general hospital. Case 16. New Engl. J. Med., 320, 1989, 16, 1068—1076.

Horsch A.K.: Klinik der Thromboangiitis obliterans. 45—47. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Kessler Ch.: Organmanifestation der Endangiitis obliterans aus neurologischer Sicht. 109—114. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988.

Lesný P.: Význam angiografie v diagnostike vaskulitíd. Bratisl. Lek. Listy, 96, 1995, 10, 550—555.

Leu H.J.: Thromboangiitis obliterans Buerger. Pathologisch-anatomische Analysen von 53 Fällen. Schweiz. med. Wschr., 115, 1985, 1080—1086.

Lie J.T.: The rise and fall and resurgence of thrombangiitis obliterans (Buerger's disease). Acta Pathol. Jap., 39, 1989, 3, 153—158.

Majewski W., Marszalek A., Staniszewiski R. et al: Clinical and morphological aspects of Buerger's disease. Intern. Angio, 16, 1997, 1, 239—244.

Matchev S., Petrov V., Batchvarova V. et al: Transcranial Doppler velocities in patients with thromboangiitis obliterans. Angiology, 48, 1997, 6, 535—544.

McKussick V.A.: The Buerger's syndrome in the United States. Arteriographic observations with special reference to involvement of the upper extremities and the differentation from atherosclerosis and embolism. Bull. Hopk. Hosp., 110, 1962, 145—148.

Ohno H., Matsuda Y., Takashiba K. et al: Acute myocardial infarction in Buerger's disease. Amer. J. Cardiol., 57, 1986, 3, 690—691.

Olin J.W., Young J.R., Graor R.A. et al: The changing clinical spectrum of thromboangiitis obliterans (Buerger's disease). Circulation, 82, 1990, Suppl. IV, 3—8.

Papa M.Z., Rabi I., Adar R.: A point scoring system for the clinical diagnosis of Buerger's disease. Europ. J. Vasc. Endovasc. Surg., 11, 1996, 3, 335—339.

Puchmayer V.: Thromboangoitis a atherosclerosis obliterans: Rozdíly v lokalizaci a kuřáckych zvyklostech. Čas. Lék. čes., 123, 1984, 43, 1312—1317.

Puchmayer V., Pokorný J., Krčílek A.: Buergerova choroba a obliterující ateroskleróza. Dve rozdílná onemocnění. Čas. Lék. čes., 125, 1986, 43, 1313—1316.

Puchmayer V.: Klinická diagnostika, některé zvláštnosti a terapie Buergerovy choroby. Bratisl. Lek. Listy, 97, 1996, 4, 224—229.

Reiniš Z.: Diferenciální diagnostika obliterující arteriosklerózy a thrombangoitidy. Prakt. Lék., 32, 1952, 23, 523—526.

Schellong S.M., Bernhards J., Ensslen F. et al: Intestinal type of thromboangiitis obliterans (Buerger's disease). J. Intern. Med., 235, 1994, 69—73

Shionoya S., Ohta T., Hishikimi N.: Definition der Endangiitis aus klinischer Sicht. 8—10. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988 a.

Shionoya S., Ohta T., Hishikimi N.: Organmanifestation des Morbus v. Winiwarter—Buerger. 107—109. In: Heidrich H. (Ed.): Thromboangiitis obliterans. Morbus Winiwarter—Buerger. Stuttgart—New York, Georg Thieme Verlag 1988 b.

Shionoya S., Eastcott H.H.G.: Buerger's disease. 153—173. In: Eastcott H.H.G. (Ed.): Arterial Surgery. Madrid—Melbourne—New York—Tokyo, Churchill Livingstone 1992.

Shionoya S.: Buerger's disease: diagnosis and management. Cardiovasc. Surg., 1, 1993, 3, 207—214.

Suzuki S., Yamada I., Himeno Y.: Angiographic findings in Buerger disease. Int. J. Cardiol., 54, 1996, Suppl., 189—195.

Štvrtinová V.: Systémové primárne idiopatické vaskulitídy (veľkých a stredných ciev). Rheumatologia, 9, 1995 a, 1, 119—128.

Štvrtinová V.: Vaskulitídy koronárnych artérií. Bratisl. Lek. Listy, 96, 1995 b, 10, 544—551

Štvrtinová V.: Obliterujúca tromboangiitída — diagnostika a liečba. Lek. Obzor, 45, 1996, 3, 87—89.

Štvrtinová V., Lesný P., Ambrózy E. et al: Thromboangiitis obliterans — the role of angiography in the diagnosis. Intern. Angio, 16, 1997, Suppl. 1, 66 (abstract).

Štvrtinová V.: Primárne systémové vaskulitídy. Bratislava, Slovak Academic Press 1998, 208 pp.

Wessler, S., Ming S.C., Gurewich V. Freiman D.G.: A critical evaluation of thromboangiitis obliterans: The case against Buerger's disease. New Engl. J. Med., 262, 1960, 1149—1160.

Williams G.: Recent views on Buerger's disease. J. Clin. Path., 22, 1969, 5, 573—578.

Yorukoglu Y., Ilgit E., Zengin A. et al: Yucel E.: Thromboangiitis obliterans (Buerger's disease) in women (a reevaluation). Angiology, 44, 1993, 7, 527—533.

Received January 12, 1999