At the present time, Behçet’s disease/syndrome and its treatment remains a complex and debatable problem for the medical practitioners. The pathologic process attending Behçet’s disease (BD) involves multiple systems and organs and, in most cases, requires prescribing several medications with various aims. Furthermore, its often recurrent character and unique natural course with a diminishing severity over time complicates decision-making on either/not prescribing certain medications. This review presents most evidenced-based data on BD and its modern treatment/management strategies over the two recent years.

Recommendations on treatment

In 2018, the European League against Rheumatism (EULAR) updated its recommendations on the BD patients’ management [1]. This decision is explained by the present urgency of EULAR’s 2008 recommendations’ being updated in the light of newly published papers on the BD patients’ management and medications used for its therapy. A lot of papers are specifically focused on the use of genetically-engineered biological medications for the BD treatment.

Based on the findings of new systemic reviews and expert opinions, 5 comprehensive principles and 10 recommendations were formulated. The general principles underline the importance of interdisciplinary approach, claim about the BD’s recurrent-remitting course; among the aims of BD treatment there are: a rapid inflammation’s suppression at the period of aggravation, reduced number of recurrences and prevention of organs’ permanent affliction [2]. It is pointed out that the treatment should be adjusted individually (customized) in terms of age, sex, type and severity of organic affliction, as well as patient’s preferences [3]. A harsher prognosis is associated with BD’s ophthalmological, vascular, neurological and gastric-intestinal manifestations. The last principle of BD patients’ management recommendations emphasizes the fact that disease’s manifestations may improve in most patients over time [1].

As to the specific recommendations, they were subdivided in terms of organic system and affliction ty-
For the mucocutaneous signs, the local treatment is preferable; however, if it is not efficacious, colchicine is to be prescribed. Furthermore, colchicine is a successful prophylactic tool for the mucocutaneous recurrences, such as erythema nodosum or genital ulcers. Immuno depressants, such as azathioprine (AZA), interferon alpha (IFN-α), cyclosporin A (CsA), tumor necrosis factor (TNF) inhibitor and apremilast, are recommended for the severe, long-healing, refractory, painful skin and mucomembranous lesions [2].

The patients with the BD-attended acute arthritis are to be treated with colchicine. The acute monoarthritis may be arrested by the intraarticular GC injections. In case of a recurrent or chronic arthritis, AZA, IFN-α may be prescribed [1].

Ocular involvement requires cooperation with ophthalmologists. The BD patients with inflammatory eye conditions, posterior segment’s involvement are recommended AZA, CsA, IFN-α or TNF inhibitors. The GCs may be systemically prescribed in combination with AZA or other immunosuppressants. With initial or repeated uveitis episodes, potentially associated with a vision loss, high glucocorticoid (GC), infliximab or IFN-α doses should be prescribed. In addition to the systemic treatment, the GC intravitreal injections may be used for treatment of aggravated unilateral uveitis [1]. Systemic immunosuppressant treatment is recommended for the patients with an isolated anterior uveitis and adverse prognostication factors – young age, male sex and early BD onset.

In case of acute thrombosis of deep veins attended by the BD, GCs and immunosuppressants, such as AZA, CsA and cyclophosphan (CP) are used [1]. The patients suffering from venous thrombosis refractory to treatment are prescribed TNF inhibitors. Anticoagulants may be recommended unless the hemorrhage risk is high or there is a potential pulmonary aneurism risk.

In order to treat the pulmonary arterial aneurism attended by the BD, high GC and CP doses are indicated, with TNF inhibitors in refractory cases. The patients with pulmonary hemorrhage and a high risk of hemorrhage are to be subject to arterial embolization rather than an open surgery. The patients with peripheral arterial or arterial aneurism should receive a conservative GC and CP treatment before the surgical intervention [1]. In case of life-threatening symptoms presented, surgery and arterial stenting is recommended. The pulmonary lobectomy may be performed in case of gigantic pulmonary arterial aneurism, while the peripheral big aneurisms should be resected, though only after immunosuppressive treatment and remission being achieved [4].

During the gastrointestinal aggravations, the BD patients should receive GCs in combination with disease-modifying medications, such as 5-aminosalicylic acid (5-ASA) derivatives (mesalazine, sulfasalazine (SSZ)) or AZA [1]. In the severe and/or refractory cases, TNF inhibitors and/or thalidomide should be prescribed.

With acute parenchymatous CNS affliction attended by the BD, prescription of the high CS doses is necessary, followed by their gradual reduction, along with immunosuppressants; AZA being the drug of choice [1]. The monoclonal antibodies to tumor necrosis factor (TNF) α are used as fist-line medication in case of severe CNS affliction or for the refractory cases, while CsA should be avoided. The first episodes of cerebral venous sinus thrombosis (CVST) are to be managed by high GC doses via pulse therapy. The anticoagulants should be prescribed for a short term and taken cautiously, with extracranial vessel screening.

Tumor necrosis factor (TNF) inhibitors

Nowadays the TNF inhibitors are used by the BD patients in order to treat eye lesions and other more severe manifestations, such as neurological and vascular conditions, sometimes even for the resistant mucocutaneous signs. This approach is promoted by numerous cohort study findings, open-label trials and one controlled double-blind trial [5]. The persistence of clinical response to the TNF inhibitors suggests that they may be considered principal treatment for various BD manifestations. G. Emmi et al. (2018) [6] studied the clinical effectiveness and glucocorticoid-preserving effect of adalimumab compared with disease-modifying antirheumatic drugs (DMARDs) in a large retrospective BD cohort, whose main clinical manifestation was venous thrombosis. The researchers performed a retrospective analysis of 70 BD patients with venous complications, receiving adalimumab (with/out DMARDs) or DMARDs. After a medium period of 25-month observation, it was confirmed that adalimumab-based treatment resulted in a faster and more frequent clinical and instrumental improvement of venous thrombosis (p<0.0001) compared with only DMARDs. Furthermore, adalimumab treatment required lower GC doses (p<0.0001). These data prove a high effectiveness of adalimumab and TNF inhibitors for venous thrombosis and torpid BD treatment. No differences were found in the effectiveness and duration of treatment between the isolated DMARDs and adalimumab-based schemes, depending on anticoagulants. Concerning the latter, there were no differences in their effectiveness, reiterating the findings of earlier studies, which claimed immunosuppression to be the cornerstone, while anticoagulant therapy having a minor effect [7].

Infliximab was reported to have an excellent efficacy with refractory uveitis attended by the BD; it was approved for the treatment of this manifestation in Japan. The BRIGHT trial – prospective, large-scale, long-term post-marketing infliximab trial involving the Japanese patients – a long-term infliximab’s profile of safety and efficacy was tested in the real-life clinical conditions, with
BD patients who had uveoretinitis [8]. 650 patients with uveoretinitis were enrolled to start infliximab treatment from January 2007 to January 2010. Every six months the treatment was evaluated as to safety and efficacy. According to the physician’s general evaluation scale, after 24 months the response rate was 80.7%, with an average rate of eye aggravations greatly reduced during 6 months of infliximab treatment. The infusion reactions were observed in 11% patients, most of those curable. The authors made a conclusion that their findings testified to the fact that a 2-year infliximab treatment for a BD-attended refractory uveoretinitis was effective and well-tolerated. This conclusion enriched the evidence base of infliximab treatment for the BD.

The other open-label trial compared infliximab and adalimumab as the first biological agents in a major group of the BD-attended refractory uveitis patients [9]. Those patients were refractory to the regular therapy of non-biological agents. The data of 170 patients were analyzed (infliximab-treated — 103 patients, adalimumab-treated — 74 patients). After a 1-year therapy, all ophthalmological manifestations were found to be improved in all groups. Adalimumab demonstrated a better result in several parameters, such as vitritis (78.95 vs. 93.33%; p=0.04), better vision correction (0.67±0.34 vs. 0.81±0.26; p=0.001) and tolerance (84.95 vs. 95.24%; p=0.042). However, this trial was not placebo-controlled, complicating the decision-making.

C. Fabiani et al. (2019) [10] also compared the infliximab and adalimumab’s efficacy in the non-infectious intermediate uveitis, posterior uveitis and panuveitis by analyzing the retrospective data of 107 patients. 66 (61.7%) out of them received adalimumab and 41 (38.3%) — infliximab. Despite the reduction in the aggravated uveitis numbers during the first 12 months of treatment which was more significant in the adalimumab-receiving patients, this difference was not statistically significant. It may be attributed to the high GC doses, variability of eye afflictions in the adalimumab-receiving patients.

Another study compared infliximab and TNF α in the BD attended refractory uveitis patients [11]. The scientists performed a retrospective analysis of 20 patients receiving infliximab and 33 patients receiving TNF α. As a result, a roughly similar number of patients achieved remission in both groups (16 in the infliximab group (80%) and 28 in the TNF α group (85%)). Both groups had a similar improvement of mean vision acuity and all inflammatory parameters; their safety profiles being similar. Based on this study, there were no significant differences between infliximab and TNF α in the intraocular inflammation control, which may be important for the clinical practice, as the prices of those two therapy options are different.

One of the most recent and important studies by A. Katsuyama et al. (2019) [12] was aimed at the evaluation of a long-term effect and safety of the combined infliximab and CsA treatment of the BD attended refractory uveoretinitis. The study included a retrospective analysis of medical records for the patients with refractory uveoretinitis and BD who were unresponsive to the conservative treatment and received a combined infliximab and CsA treatment for 5.6±2.3. The rate of the ophthalmological aggravations significantly reduced after a 6-month period from 2.9 ± 1.6 to 0.6 ± 0.9 and 0.0 ± 0.0 by the end of observation (p=0.003). There were no significant side effects, apart from the urinary tract infections and progressive cataract. The authors made a conclusion that in cases of the BD attended refractory uveoretinitis a combined infliximab and CsA treatment is a promising option.

At the present time, there is no information as to the time of termination for those patients who are well-responding to the TNF inhibitor treatment or any other immunosuppressive therapy. In a range of studies the scientists were trying to suspend the treatment of patients with eye afflictions after 2-5 year successful treatment [13, 14]. Their preliminary conclusions point to a possible TNF inhibitor treatment’s suspension; however, this claim is to be confirmed by the high-quality evidence-based clinical trials.

Other therapies

**Ustekinumab**

Ustekinumab is a human monoclonal antibody, interleukin 12 and interleukin 23 antagonist. It is approved as a treatment for psoriasis, psoriatic arthritis and Crohn’s disease by the US government. A. Mirouse et al. (2018) reported their findings on ustekinumab’s use for the BD treatment in two separate studies, initially small, but then extended and involving more patients. In the first report [15], the authors evaluated ustekinumab’s efficacy and safety for the treatment of mouth cavity ulcers of the BD patients in the open-label clinical trial. They enrolled 14 patients, ¾ of whom were men with active mouth cavity ulcers, resistant to colchicine. The patients received subcutaneous 90 mg (11) or 45 mg (3) doses of ustekinumab at the beginning of trial, after 4 weeks and then every 12th week.

The primary efficacy endpoint was the ratio of patients with a full clinical response, defined as an absence of ulcer in the mouth cavity after 12 weeks. At the 12th week, the endpoint was reached by 9 (69%) patients, 3 (21%) patients had a partial response; 2 (14%) did not manifest any response to the treatment. The mean number of ulcers in the mouth cavity reduced from 2 to 1 (p<0.0005) along with the BD’s activity (Beh et’s Syndrome Activity Score (BSAS), a patient reported outcome measure developed to assess the global disease activity in patients with Beh et’s syndrome (BS) with a scope of evaluation from 0 to 100) to 22.8±0.3 (p<0.01) from the initial level to 12th week. There improvements in the disease activity also enabled a more sparing use of prednisone. After a
median observation at 7-month point, 10 patients were still taking ustekinumab, while 4 had a relapse.

The second study [16] involved 30 patients, observed for no less than 24 weeks. The authors obtained the results which were similar to the previously described: the mean number of mouth ulcers reduced significantly at the 12th week of ustekinumab therapy against the initial level (0 vs. 2, p<0.0001). The endpoints were reached by 60 and 89% patients at the 12th and 24th week, respectively. The BSAS score was much lower at these time intervals compared to the initial level. After a median observation at 12-month point, 26 (86.6%) patients were still taking ustekinumab. During the treatment and observation, no severe side effects were revealed.

Based on these results, the researchers made a conclusion that ustekinumab is effective for the treatment of BD-caused mouth ulcers, which are resistant to colchicine [15, 16]. However, before these conclusions are ascertained, the ustekinumab’s advantage should be confirmed with placebo-controlled trials; still, these early data seem promising. Furthermore, there should be more data on ustekinumab’s effect on the non-oral manifestations of the BD ulcers before the decision is made as to the ustekinumab’s niche in the BD treatment.

**Secukinumab**

Secukinumab is the interleukin 17 inhibitor, approved for the treatment of psoriasis, psoriatic arthritis and ankylosing spondylitis (AS) in the US, was studied for its efficacy in the BD treatment. Taking into account some data pointing out a potential overlapping of pathogenic features between the seronegative spondyloarthropathy (SpA) and BD, this therapeutic agent may be useful for the BD treatment. In a small study [17], the authors were treating and evaluating retrospectively the outcomes of 5 patients with primarily mucocutaneous and articularatory BD manifestations, if the disease was colchicine, DMARD and at least one TNF inhibitor resistant. 4 BD patients (they also had their AS classification criteria) received a monthly secukinumab dose of 150 mg; one patient (he also had psoriatic arthritis classification criteria) received 300 mg. The authors determined the primary efficacy endpoint as the mouth ulcers reduced by over 50%; AS BASDAI score of no less than 4, ASDAS under 1.4, BD activity index (BDCAF) reduced by 50 % and over. The patient, who started taking secukinumab at a dose of 300 mg, reached the endpoint during 3 months and preserved the result during 9 months of observation. Out of 4 patients starting secukinumab at a monthly dose of 150 mg, 2 reached the endpoint by the 6th month; however, one patient had a relapse. These patients were transferred to a monthly dose of 300 mg, and reached the endpoint successfully after the dose raising.

This interesting study, though seemingly promising, lacks control group, and its small number of patients suggests further more evidence-based studies. Furthermore, these data remind us of the BD diagnostic difficulties, as all of these 5 patients corresponded to the diagnostic criteria of other conditions, potentially overlapping with the pathogenic mechanisms. According to the BD diagnostic criteria, the diagnostics requires eradication of all other potential diseases, though verbatim use of this recommendation would suggest the absence of BD in these patients. The overlapping pathogenic mechanisms may also potentially cause some unexpected conditions: as it was reported, the BD develops in those patients who received secukinumab to treat AS [18].

**Tocilizumab**

In a small study by Y. Ding et al. (2018) [19], there was a retrospective analysis of clinical data from the patients with a severe and/or refractory vasculo-Behet’s syndrome, treated by tocilizumab during 2014-2018. The authors analyzed 7 patients (6 men and 1 woman) with an approximate age of 33 years. The multiple arterial affictions were registered in all patients, including the arterial aneurisms (in 5 patients), stenosis (in 4 patients) and occlusion (in 3 patients). 2 patients had a documented multiple venous thrombosis. The principal localizations of arterial affliction included subclavian (5/7), carotid (4/7), abdominal arteries (4/7), aortic arch (3/7), femoral (2/7) and coronary arteries (2/7). Before the first use of tocilizumab, all patients received a combination GC and immunosuppressive agent therapy. All patients reported an unsatisfactory clinical reaction with a progressing disease, and they were prescribed tocilizumab in a dose of 8 mg/kg every 4 weeks while maintaining the previous therapy. After 19 months of observations, all patients achieved an improvement of clinical symptoms and blood inflammation markers, no new arterial and venous affliction was reported. Some patients reduced the doses of other medications, including GCs.

This small and non-placebo-controlled study suggests that a combination of tocilizumab and immunosuppressants and GCs may have an important role in the treatment of active refractory form of vasculo-Behet’s syndrome. However, as with other new agents, in order to evaluate the efficacy and safety profile of tocilizumab, we need to hold lengthier and larger-scale studies.

**Interleukin 1 inhibitors**

Interleukin 1 inhibitors — anakinra, canakinumab, gevokizumab — constitute a promising therapeutic alternative for the BD treatment. At the present time, the evidence of this medication’s use is mostly based on the small isolated studies and a series of cases; and the real place of anti-interleukin 1 agents in the BD treatment is unclear. A. Bettiol et al. (2019) [20] made a systemic review of modern data on efficacy and safety of anti-interleukin 1 agents in the BD treatment. The use of anakinra and canakinumab was associated with a well-controlled mucous membranes and eye afflictions. Anakinra was
Another effective therapeutic agent with bone-articular manifestations. Gevokizumab was tested only for the BD eye manifestations; however, it showed controversial results.

Another randomized double placebo-controlled study analyzed the effectiveness of gevokizumab in 83 BD patients with a recent aggravation of uveitis; 40 patients received gevokizumab and 43 – placebo [21]. With the reduction of high GC doses, the patient was prescribed 60 mg gevokizumab or placebo every 4 weeks subcutaneously. As a result, it was established that gevokizumab did not influence the risk of eye membrane affliction aggravation. However, the data reveal that with gevokizumab treatment the vision acuity improved, the uveitis severity decreased, macular edema’s manifestation decreased; and this monoclonal antibody had a function of steroid-preserving agent. Gevokizumab is well-tolerated. Although the primary efficacy endpoint was not achieved with gevokizumab, the interleukin 1 pathway is not yet controlled in the BD-attended uveitis patients. This is a topical problem.

The data on anakinra and canakinumab’s use in pediatric practice as a first-line medication in the BD treatment were confirmed. The most frequent side effects were local or diffuse skin reactions and reactions at the injection site, especially with anakinra. Thus, the interleukin 1 pathway blocking may be an effective strategy in the BD treatment.

Interferon (IFN)

Lower extremity deep vein thrombosis (DVT) is a serious BD complication. The treatment strategy implies immunosuppressants; however, there are no predictors of relapse and the optimum choice of medications is unclear. In a prospective study [22], the first-line treatment strategy involved AZA and GCs. The IFN-α was used in those cases when AZA remained ineffective, and there was a severe eye affliction, requiring further treatment. 33 patients with lower extremity DVT were subject to a prospective observation during 40.7 ± 13.4 months. All in all, 29 patients received AZA, while 17 - IFN-α. The number of relapses was smaller, while the frequency of recanalization was higher with IFN-α, if compared against AZA (12 vs. 45 and 86 vs. 45%). The conclusion was that IFN-α seemed a highly promising medication preventing the lower extremity DVT’s relapses and providing a good recanalization.

Apremilast

In the recent years, one of the most important news for the BD management was the approval of apremilast by the Food and Drug Administration (FDA) in the USA. Apremilast is an oral phosphodiesterase 4 (PDE4) inhibitor, modeling several inflammation pathways in order to treat the BD-related mouth ulcers. This decision relied on the results of the 3rd phase of the randomized placebo-controlled double-blind RELIEF trial of the apremilast’s efficacy and safety [23]. All the patients enrolled in this study were diagnosed with the BD-related active mouth ulcers; these patients also received at least one non-biological medication earlier. The primary efficacy endpoint was the reduction of the overall number of ulcers during 12 months. Among the other important outcomes, there were a diminished ulcerative pain in the mouth cavity, and complete healing of ulcers; complex disease activity scores, such as BDAF and BSAS, were also evaluated. The study was controlled by placebo for 12 weeks; however, the patients received medication up to 64 weeks. 207 patients were reported to achieve the primary efficacy endpoint: these results were statistically important for the mouth ulcers treatment with apremilast, rather than with placebo. The efficacy, observed at the 12th week, was retained by the 28th week. At the 28th week, 62% patients achieved the endpoint, concerned with the mouth ulcers being healed. The patients, randomized to receive placebo, started apremilast at the 12th week and demonstrated the advantages, similar to the ones, randomized into the apremilast from the beginning. The profile of side effects was the same for apremilast and placebo at the double-blind phase. The most frequent ones were diarrhea, nausea, headache and the upper respiratory tract infections, most adverse events were of small and medium degree of severity.

The described trial was continuing the previous 2nd phase trial of apremilast’s use for the BD-related mouth ulcers, with similar results being achieved [24]. In this study, 111 patients with BD and ulcerative afflictions of mouth cavity were receiving apremilast or placebo during 12 weeks, afterwards being transferred to apremilast. The primary efficacy endpoint was the diminished number of mouth ulcers by 12th week. The secondary efficacy endpoints included the extent of ulcerative tenderness, the number of genital ulcers, the general disease activity and life quality. It was concluded that apremilast was much more effective than placebo, and the group receiving apremilast did not have severe side effects.

These studies demonstrate that apremilast is an effective option for treatment of mouth ulcers, and may be as effective for treatment of other mucocutaneous manifestations, such as genital ulcers. However, other studies specific for these BD manifestations have not been performed yet. Another direction of further studies is apremilast’s safety and efficacy in combination with other immunodepressants, as many patients require a lengthy treatment, combined therapy for a better control of disease activity and achievement of remission.

Other BD treatment options

The efficacy of oral 5-aminosalicylic acid (5-ASA) was studied by H. Kinoshita et al. (2019) [25] with the BD intestinal manifestations. The authors studied the remission’s induction after 8 weeks, endoscopic results and no-
relapse survival after 52 weeks in 41 patients, receiving oral 5-aminosalicylic acid (5-ASA) treatment. At the 8th week, the clinical efficacy was registered in 28 patients, while the rates of response to treatment and remission were 61 and 57%, respectively. Most patients also had the endoscopic confirmation of response after 52 weeks, emphasizing in important role of oral 5-ASA in the BD patients with intestinal afflictions.

Another study evaluating the methotrexate (MTX)’s efficacy in the treatment of BD patients with refractory gastrointestinal manifestations, despite the 5-ASA, GC, AZA or TNF inhibitor treatment [26]. 10 patients were receiving MTX in order to treat the BD-related active refractory intestinal afflictions. 4 patients took MTX as a monotherapy, while 6 patients – as a combination with adalimumab. Among the indications of MTX treatment, there were: intolerance of thiopurine – 10%; TNF inhibitor’s insufficient efficacy - - 60%; GC dependence. The introduction was oral in 8 patients, subcutaneous or intramuscular – in 2 patients. The mean MTX for a refractory intestinal BD was 13.0 mg (7.5–20.0 mg); mean duration of the maintenance therapy was 7.9±5.0. This was the first study demonstrating efficacy and tolerance of MTX as a monotherapy and MTX’s combination with adalimumab in the BD patients. 3 patients (30%) responded to MTX after 3 months and 4 patients (50%) – after 6 months, achieving remission with no GCs. Furthermore, C-reactive protein (CRP) rate reduced significantly after 6 months in comparison with the initial one. Based on this study, it may be concluded that MTX may be an effective therapeutic agent for the treatment of BD-related refractory gastrointestinal manifestations. However, in order to confirm this assumption, further larger-scale studies are required.

Fig. 1 presents a summarized analysis of the BD patient management depending on the afflicted target-organs. It includes only the recently approved medications.

Conclusions

In the recent 2 years, the BD treatment is experiencing major success: the EULAR recommendations were approved, the first medication – apremilast - was approved specifically for the BD treatment, and the data on the promising new therapeutic agents were presented and are likely to be added to the BD treatment regimen. We also found out more about other medications, such as TNF inhibitors; a lot of patients were taking them during long periods of time, the data of long-term observations confirming their important contribution to the BD treatment. Nevertheless, the lack of placebo-controlled and randomized trials remains a problem. Furthermore, the studies of medication’s efficacy within the framework of real clinical practice and studies of therapeutic agent’s cessation are required in order to secure a response for the rare BD manifestations, such as neurological and vascular complications.

Fig. 1. Behçet’s disease management

Note. 5-ASA - 5-aminosalicylic acid, GI – gastrointestinal, IFN-α – interferon α, TNF - tumor necrosis factor, PA – pulmonary artery, PerA - peripheral arteries, CNS – central nervous system.
The treatment is customized for every patient, is derived from the type and severity of organic affliction, age and sex of patients, duration of the disease. The patients who have only been afflicted at the level of mucous membrane and joints may be treated with topical medication and colchicine. Unless the latter are ineffective, immunosuppressive or immune-modulating agents, such as azathioprine, IFN-α, apremilast or TNF inhibitors, should be added. The patients, whose eyes, vessels, central nervous system or gastrointestinal tract are afflicted, immunodepressants, such as azathioprine, should be used as a first-line medication. The biological agents, such as IFN-α or TNF inhibitors, are used by the patients who are resistant to the immunosuppressive therapy. Cyclophospham is usually the first choice for the initial treatment of life-threatening arterial vessel aneurisms. Glucocorticoids may be recommended for the fast suppression of damage with all the afflictions.

Conflicts of interests. Authors declare the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

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Терапевтичні можливості й сучасні підходи до лікування хвороби Бехчета

Головач І.Ю., Егудіна Є.Д.

1 Клінічна лікарня «Феофания» Державного управління справами, м. Київ, Україна
2 Клініка сучасної ревматології, м. Київ, Україна

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Головач І.Ю., Егудіна Є.Д.

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2 Клініка сучасної ревматології, м. Київ, Україна

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Вол’, сустави, позвоночник, ISSN 2224-1507 (print), ISSN 2307-1133 (online)

Vol. 10, No. 1, 2020

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Information about authors

I.Yu. Golovach, MD, PhD in medicine, professor, Head of the Center of rheumatology, Clinical Hospital “Fedynnya” of the Agency of State Affairs, Kyiv, Ukraine, e-mail: golovachirina@gmail.com; phone +380506542188; ORCID iD: https://orcid.org/0000-0001-8702-5638

Ye.D. Yehudina, MD, PhD, professor, Head of the Educational Center, Clinic of Modern Rheumatology, Kyiv, Ukraine; ORCID iD: https://orcid.org/0000-0002-6930-354X

I.Yu. Golovach, MD, PhD in medicine, professor, Head of the Center of rheumatology, Clinical Hospital “Feofaniya” of the Agency of State Affairs, Kyiv, Ukraine, е-mail: golovachirina@gmail.com; phone +380506542188; ORCID iD: https://orcid.org/0000-0001-8702-5638

Received 08.01.2020
Revised 21.01.2020
Accepted 03.02.2020