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MONOCLONAL ANTIBODIES IN AUTOIMMUNE DISEASE TREATMENT: CURRENT TRENDS IN KAZAKHSTAN AND WORLDWIDE

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Abstract. Monoclonal antibodies are antibodies produced by a cloned cell that comes from a single precursor, or «clone» [1]. These antibodies are highly specific, allowing them to be used to treat a range of diseases. They can target specific molecules, such as viruses, tumor cells, or molecules involved in inflammation, unlike traditional therapies that target a broader range of cells and molecules.

Monoclonal antibodies (mAbs) have transformed modern medicine through their ability to target specific cells and molecules. Since their discovery in 1975, mAbs have been utilized across a broad range of therapeutic and diagnostic fields, demonstrating high specificity and efficacy [2]. These molecules have revolutionized the treatment of cancer, infectious diseases, autoimmune conditions, and other complex disorders, solidifying their role as indispensable tools in healthcare.

The rapid progress in biotechnology over recent decades has greatly enhanced the development and production of mAbs, leading to improved efficacy, safety, and accessibility of these biologics globally. However, despite global advancements, the application and development of monoclonal antibodies in Kazakhstan face significant challenges. These include the lack of local production infrastructure, limited accessibility of mAbs to patients, and underdeveloped scientific research and clinical trials in this field. Addressing these issues is critical to optimizing the use of mAbs for the benefit of the local population.

In this review we will explore recent trends and advancements in Mab therapy worldwide and in Kazakhstan

Key words: monoclonal antibody, therapy, autoimmune disease, application, development.

Introduction

Historical Background and Technological Milestones in Monoclonal Antibody Development

The discovery and development of monoclonal antibody (mAb) technology have had a profound impact on biotechnology and medicine. The foundation for mAb production was laid in 1975 when Georges Köhler and César Milstein developed a method to produce antibodies with uniform and predictable properties [2]. Their groundbreaking work demonstrated the ability to bind specific antibodies to target molecules, such as antigens, and it became the cornerstone for therapeutic applications.

The origins of monoclonal antibody research can be traced back to the 1950s. Henry Kunkel's pioneering work in 1951 revealed that myeloma cells could produce antibodies of a single type and specificity [3]. This discovery offered a critical understanding of antibody diversity and laid the groundwork for future advances in immunology and biotechnology.

In 1963, César Milstein began investigating the diversity of antibodies and the challenges in isolating monoclones from the multitude of antibodies produced by the human immune system. The inability to purify and produce monoclonal antibodies in large quantities presented a major hurdle in the field at the time [4].

In 1973, Dick Cotton, a member of César Milstein's research team, made a pivotal discovery by fusing two myeloma cells that produced immunoglobulins. The resulting hybridoma was capable of

producing antibodies derived from both parental types [4]. This finding demonstrated the feasibility of creating stable cell lines capable of producing monoclonal antibodies.

Building upon these insights, Köhler and Milstein developed the hybridoma technology in 1975, enabling the production of monoclonal antibodies that were specific to a given antigen and could be reproduced indefinitely. This breakthrough revolutionized both the study and therapeutic application of antibodies, paving the way for the development of highly targeted drugs.

Materials and methods of research

Implications for Biotechnology and Medicine

The introduction of monoclonal antibody technology ushered in a new era for medicine, providing researchers and clinicians with tools to diagnose and treat a wide array of diseases. From oncology to infectious diseases, mAbs have proven to be highly specific and effective, marking a significant advancement in personalized medicine.

Since the 1980s, MAbs have become essential tools in medical diagnostics and therapy. Initially, their applications were focused on developing therapeutic agents for cancer, autoimmune diseases, and infections. In 1986, the first monoclonal antibody drug used in cancer therapy was approved, followed by the approval of monoclonal antibodies targeting the human immunodeficiency virus (HIV) in 1997 [5].

By the year 2000, monoclonal antibodies had firmly established their role in the treatment of oncology, viral infections, and autoimmune disorders. Advances in genetic engineering and biotechnology have further enhanced these therapies, resulting in the development of monoclonal antibodies with improved properties such as greater stability, reduced immunogenicity, and enhanced binding affinity to specific cellular targets. This continued innovation has expanded the clinical applications of monoclonal antibodies, paving the way for new therapeutic strategies in various medical fields [6].

In Kazakhstan, as in many other countries, the use of monoclonal antibodies (mAbs) began to take shape in the 1990s [7]. By that time, mAbs had already established themselves as crucial therapeutic agents worldwide. However, their application in Kazakhstan faced several challenges, including high costs, limited access to advanced production technologies, and a shortage of specialized professionals in the field. Over the past few years, Kazakhstan has made concerted efforts to develop its biotechnology sector, with a focus on the production of monoclonal antibodies. These initiatives aim to increase the accessibility of mAb-based therapies for the population and reduce dependence on foreign manufacturers.

The current status of monoclonal antibody (mAb) therapy in Kazakhstan is an emerging area of research and clinical practice. While Kazakhstan has made strides in adopting innovative cancer treatments, the availability and implementation of mAb therapies remain limited compared to more developed nations. A review of the literature reveals that Kazakhstan is gradually incorporating mAb therapies into its healthcare system, particularly in oncology. In 2020, Biotherapy International established a partnership with Dr. Daniyar Dzhumataev, a prominent oncologist in Almaty, Kazakhstan, to expand access to innovative cancer treatments (Biotherapy International, 2025). This collaboration has enabled the introduction of advanced immunotherapy techniques, including mAb therapies, which were previously unavailable in the country. The affiliated clinic in Kazakhstan now offers treatments such as oncolytic viruses, the ATACK method, and personalized anti-tumor vaccines, all of which incorporate mAb technologies to varying degrees. Kazakhstan's progressive legislation has allowed for the implementation of cutting-edge immunotherapy techniques that are not yet approved in many European countries and the USA (Biotherapy International, 2025). This regulatory environment has created opportunities for the development and application of novel mAb therapies. However, the extent of mAb therapy adoption across the country's healthcare system remains unclear, with most advanced treatments concentrated in specialized clinics. The use of mAb therapies in Kazakhstan appears to be primarily

focused on oncology, with limited data available on their application in other therapeutic areas. This trend aligns with global patterns, where mAbs have shown significant promise in cancer treatment. However, the specific types of mAb therapies available and their efficacy in the Kazakhstani population require further investigation. One of the challenges facing mAb therapy adoption in Kazakhstan is the need for specialized facilities and trained personnel. The partner clinic of Biotherapy International in Kazakhstan boasts modern facilities with approximately 100 beds, equipped to provide comprehensive care. However, it is unclear how widespread such capabilities are across the country. The development of mAb therapies is a complex and time-consuming process, typically taking an average of 17 years from initial research to market launch. This lengthy development cycle may impact the availability of the latest mAb therapies in Kazakhstan, as the country works to build its research and development capabilities in this field. Despite these challenges, Kazakhstan's healthcare system is making efforts to integrate mAb therapies into standard treatment protocols. The collaboration between local oncologists and international experts, such as Professor Shimon Slavin of Biotherapy International, suggests a commitment to adopting best practices in mAb therapy [8]. The future of mAb therapy in Kazakhstan may be influenced by global trends in drug delivery methods. Research into alternative delivery routes for mAbs, such as intranasal and intramuscular injections, could potentially increase accessibility and reduce the need for specialized administration facilities [9]. These developments could be particularly beneficial for Kazakhstan as it seeks to expand mAb therapy access beyond major urban centers. In conclusion, while Kazakhstan has made initial steps in adopting mAb therapies, particularly in oncology, there is still significant room for growth and development in this field. The country's progressive regulatory environment and collaborations with international experts provide a foundation for further advancement. However, more research is needed to fully understand the current status of mAb therapy across different therapeutic areas and healthcare settings in Kazakhstan (Table 1.).

Table 1. Monoclonal antibodies – contribution of Kazakhstani scientists

Type of Mab	Illness	Results	Researchers
Infliximab (Remicade)	Non-specific ulcerative colitis	A study was conducted among patients of the regional hospital of Uralsk. A total of 216 people aged 18 to 74 years with varying degrees of UC activity were registered. The result of using Infliximab in severe forms of UC was a noticeable improvement in symptoms and the general condition of the patient already in the first week of its use. Also, 12-18 weeks after the first infusion, the patient showed healing of ulcers and erosions of the mucous membrane during an endoscopic examination [10].	F.K.Smailova et al [10].
Rituximab	Rheumatoid Arthritis with Raynaud's Syndrome	Rituximab was given to a patient in two 500 mg intravenous infusions 2 weeks apart and then was followed by injections of methotrexate 10 mg weekly for 2 months and prednisone 5 mg daily. As a result, the number of swollen joints were significantly decreased, the patient resumed physical activity and Das-28 score with ESR went down to nearly normal values. Also, the severity of pain was slightly reduced [11].	Raifa Ivanova, Maya Goremykina, Natalya Glushkova, Sandro Vento [11]
Golimumab	Ankylosing spondylitis and rheumatoid arthritis	Golimumab therapy was used for AS in addition to standard therapy, including physiotherapy and magnetic therapy. A positive trend was found in a group of patients, a decrease in back pain and an improvement in the general physical condition by the first year of taking the drug. No significant undesirable side effects were observed, some patients noted an escape effect in the first weeks of treatment. A group of patients with RA who also received golimumab showed a decrease in the activity of inflammatory processes with rheumatoid arthritis. An improvement in the psychoemotional state of patients was also noted against the background of successful treatment [12].	Madina D Murzabayeva [12].

Monoclonal antibodies (mAbs) have emerged as a pivotal therapeutic strategy in the management of autoimmune diseases, leveraging their ability to target specific immune pathways. Recent studies have highlighted the dual role of mAbs in both treating autoimmune conditions and inducing immune-related adverse events. For instance, elswhere reported cases of bullous pemphigoid (BP) in patients undergoing anti–PD-1/PD-L1 therapy, suggesting that mAbs can elicit complex immune responses that may involve both T-cell and B-cell mechanisms [13]. This underscores the necessity for early dermatological referral for accurate diagnosis and management of such adverse effects. The landscape of autoimmune therapy has been revolutionized by the advent of biological drugs and small molecule inhibitors that target inflammatory cytokines and immune cells. It was also emphasized the significant impact of inhibiting cytokines such as TNF, IL-6, IL-17, and IL-23 in diseases like rheumatoid arthritis and psoriasis [14]. Furthermore, B cell depletion therapies, particularly those utilizing anti-CD20 mAbs, have shown promise in treating neuroinflammatory diseases and systemic lupus erythematosus, illustrating the therapeutic potential of modulating B-cell activity in autoimmune disorders. Despite the successes of mAb therapy in human medicine, challenges remain in its application, particularly in veterinary contexts. Wang et al. explored the potential of mAbs in treating chronic conditions in small animals, such as cancer and arthritis [15]. While the therapeutic benefits observed in human medicine are encouraging, the limited availability of approved mAb products and safety concerns pose significant hurdles in veterinary applications. This highlights the need for ongoing research to optimize mAb therapies for diverse clinical settings. Moreover, the intersection of mAb therapy and infectious diseases has gained attention, particularly regarding COVID-19. Hughes et al. reported a case of severe COVID-19 pneumonia in a multiple sclerosis patient treated with the anti-CD20 mAb ocrelizumab [16]. This case illustrated the diagnostic challenges and potential risks associated with immunomodulatory treatments during the pandemic, emphasizing the need for careful management and consideration of de-risking strategies in patients receiving high-efficacy therapies. In conclusion, while mAbs represent a cornerstone in the treatment of autoimmune diseases, their application is multifaceted, involving both therapeutic benefits and potential adverse effects. Continued research is essential to refine these therapies, address safety concerns, and expand their use across both human and veterinary medicine.

Tumor necrosis factor alpha (TNF-α) has emerged as a critical mediator in inflammatory processes associated with arthritis, leading to the exploration of TNF inhibitors like adalimumab for therapeutic interventions. In a case study involving a 56-year-old female with grade 3 osteoarthritis of the left knee, intra-articular administration of 10 mg adalimumab resulted in significant pain relief and improved quality of life, despite no observable changes in ultrasound parameters [17]. This highlights the potential of adalimumab in managing pain associated with osteoarthritis, a condition traditionally viewed as degenerative rather than inflammatory. Furthermore, a separate case involving a 39-year-old female with migraine and ankylosing spondylitis demonstrated that adalimumab not only alleviated arthralgia but also led to a notable reduction in headache frequency and severity. The patient’s improvement was corroborated by changes in the Bath Ankylosing Spondylitis Disease Activity Index and the Headache Impact Test scores, suggesting that TNF blockade may extend beyond inflammatory arthritis to non-inflammatory pain conditions [18]. Collectively, these findings underscore the efficacy of adalimumab in reducing pain and enhancing quality of life in patients with various forms of arthritis, warranting further investigation into its broader applications in pain management.

Rituximab (RTX), a chimeric monoclonal antibody targeting the CD20 antigen on B cells, has emerged as a pivotal treatment for autoimmune conditions such as rheumatoid arthritis (RA) and pemphigus. Its efficacy in RA is well-documented, particularly in patients who exhibit inadequate responses to traditional disease-modifying antirheumatic drugs (DMARDs). A recent observational study highlighted that RTX treatment significantly reduced immunoglobulin levels in RA patients, leading to a high prevalence of hypogammaglobulinemia (HGG), with 84.4% of patients exhibiting low IgG levels post-therapy. This underscores the necessity for vigilant immunologic monitoring in patients receiving

RTX, as low immunoglobulin levels can predispose individuals to infections. Furthermore, the retrospective analysis conducted in Saudi Arabia corroborated the effectiveness of RTX in managing RA, demonstrating a significant reduction in prednisolone dosage among patients post-treatment [19]. This finding aligns with clinical guidelines advocating for RTX use in RA, emphasizing the importance of patient monitoring and the potential for tapering corticosteroids, which can mitigate long-term side effects associated with steroid use. In exploring retreatment practices, a study assessed the dosing frequency of RTX, proposing a reduced dose regimen that maintains efficacy while offering substantial cost savings. This approach not only addresses economic considerations but also minimizes the risk of adverse effects, particularly in the context of heightened infection risk during the COVID-19 pandemic. Collectively, these studies reinforce the role of RTX in targeting CD20-positive B cells in RA and potentially in pemphigus, while also highlighting the critical need for ongoing research into optimal dosing strategies and the management of associated immunological effects. Such insights are vital for clinicians and researchers aiming to enhance treatment protocols and patient outcomes in autoimmune diseases.

Tocilizumab, a humanized monoclonal antibody targeting interleukin-6 (IL-6) receptors, has emerged as a significant therapeutic option for patients with rheumatoid arthritis (RA). The pathophysiology of RA is characterized by an intricate interplay of various cell types and inflammatory mediators, with IL-6 playing a pivotal role in driving the inflammatory response. By inhibiting IL-6 activity, tocilizumab not only alleviates symptoms but also modifies the disease course, making it a cornerstone in the management of moderate to severe RA. Recent studies have demonstrated the efficacy of tocilizumab in improving clinical outcomes in RA patients. For instance, a Phase III study involving 622 patients showed that a significantly higher percentage of those treated with tocilizumab achieved a 70% improvement in the American College of Rheumatology criteria (ACR70) compared to placebo, underscoring its effectiveness in managing disease activity. Furthermore, real-world data from Taiwan indicated that tocilizumab is associated with a lower incidence of herpes zoster infections compared to tofacitinib, another RA treatment that indirectly inhibits IL-6 through Janus kinase pathways. This finding highlights the safety profile of tocilizumab in clinical practice. In addition to its clinical benefits, tocilizumab has been shown to positively impact vascular and myocardial function in RA patients. A study involving 80 patients revealed that those treated with tocilizumab exhibited significant improvements in endothelial glycocalyx thickness and myocardial work compared to those receiving prednisolone. Specifically, reductions in the perfused boundary region and pulse wave velocity were noted, indicating enhanced vascular health. These findings suggest that IL-6 inhibition not only addresses inflammatory symptoms but also contributes to cardiovascular health, which is often compromised in RA patients. The therapeutic implications of blocking IL-6 receptors extend beyond RA, as tocilizumab has shown promise in treating other inflammatory autoimmune diseases, including systemic-onset juvenile idiopathic arthritis and adult-onset Still's disease. The long-term safety and efficacy of tocilizumab have been well-documented, reinforcing its role as a vital treatment modality in rheumatology. Overall, the blockade of IL-6 receptors by tocilizumab represents a significant advancement in the management of RA, offering both symptomatic relief and potential disease modification. Researchers continue to explore its broader applications and long-term outcomes, solidifying its place in contemporary rheumatologic therapy.

Results and its discussion

Monoclonal antibody (mAb) therapy has emerged as a pivotal treatment strategy for various autoimmune diseases, leveraging the specificity of mAbs to target distinct molecular epitopes. One of the primary advantages of mAbs is their high specificity for targeted antigens, which minimizes off-target effects and preserves the patient’s microbiome. This specificity is particularly beneficial in the context of infectious diseases, where mAbs can be developed to target specific pathogens without adversely affecting non-target microbial species. The in vitro selection of human antibody fragment

libraries using techniques such as phage and yeast display facilitates the rapid isolation of mAbs against infectious agents, providing a robust platform for therapeutic development. This approach allows for the generation of a diverse repertoire of antibodies, enhancing the likelihood of identifying candidates with optimal binding characteristics. In the realm of autoimmune disorders, mAbs targeting specific immune pathways have shown promise in conditions like neuromyelitis optica spectrum disorder (NMOSD). The presence of aquaporin-4 immunoglobulin G antibodies (AQP4-IgG) in NMOSD underscores the potential for mAb therapies to modulate immune responses effectively. However, the complexity of NMOSD pathology presents challenges in developing effective mAb treatments, as existing therapies are often only partially effective. This highlights a limitation of mAb therapy: while they can be highly effective, their efficacy may be constrained by the multifaceted nature of certain diseases. In oncology, mAbs have revolutionized treatment paradigms, particularly through the use of immune checkpoint inhibitors. For instance, camrelizumab, a humanized mAb targeting PD-1, exemplifies the potential of mAbs in treating advanced solid tumors. The ability to measure mAb concentrations in patients allows for personalized dosage adjustments, enhancing treatment efficacy and minimizing adverse effects. Nonetheless, quantifying mAbs in complex biological matrices remains a challenge, necessitating the development of precise and reliable analytical methods to ensure accurate dosing and monitoring. Despite their advantages, mAbs also face limitations related to their size and tissue penetration capabilities. Traditional mAbs are relatively large, which can restrict their ability to penetrate solid tumors effectively. This limitation has led to the exploration of alternative formats, such as nanobodies—small, single-domain antibodies derived from camelids. Nanobodies exhibit superior tissue penetration and stability, making them attractive candidates for cancer imaging and therapy. However, the transition from mAbs to nanobodies requires further research to fully understand their clinical implications and potential applications. Moreover, the safety profile of mAb therapies, while generally favorable, is not without concerns. Adverse events can occur, particularly in the context of combination therapies where mAbs are used alongside other treatments. The potential for immune-related adverse effects necessitates careful monitoring and management strategies to mitigate risks. This underscores the importance of ongoing research to optimize mAb therapies and enhance patient safety. In conclusion, mAb therapy presents a compelling option for treating a variety of diseases, characterized by high specificity and the potential for personalized treatment approaches. However, challenges related to disease complexity, tissue penetration, and safety must be addressed to fully realize their therapeutic potential. Continued advancements in mAb technology, including the development of novel formats like nanobodies, may offer solutions to some of these limitations, paving the way for more effective and safer therapeutic strategies in the future. Researchers are encouraged to explore these avenues to enhance the efficacy and applicability of mAb therapies across diverse clinical contexts. Monoclonal antibody (mAb) therapy has emerged as a cornerstone in the treatment of various diseases, particularly cancer and autoimmune disorders. The advantages and limitations of mAb therapy are critical considerations for researchers aiming to optimize therapeutic strategies. This literature review synthesizes findings from recent studies to elucidate these aspects. One of the primary advantages of mAb therapy is its ability to specifically target diseased cells while sparing healthy tissues. This specificity is particularly evident in cancer treatments, where mAbs can inhibit tumor-associated antigens or modulate immune checkpoints to enhance T cell responses against tumors. For instance, recent studies have demonstrated that bispecific constructs, known as tribodies, can effectively activate lymphocytes and induce stronger tumor cell lysis compared to traditional monoclonal antibodies. This highlights the potential of mAbs to improve therapeutic outcomes by overcoming resistance mechanisms that often limit the efficacy of monotherapies. Furthermore, the structural and functional characteristics of mAbs can pose challenges in specific therapeutic contexts. The large size and complex structure of traditional mAbs can limit their ability to penetrate tissues effectively, particularly in solid tumors. This has led to the exploration of alternative strategies, such as small-molecule monodomain antibodies, which offer advantages in terms

of size, stability, and ease of synthesis. These alternatives may provide new avenues for enhancing the therapeutic index of antibody-based therapies.

Conclusion

In conclusion, while mAb therapy offers significant advantages in targeting diseases with high specificity and achieving clinical efficacy, it also presents notable limitations, including resistance mechanisms, high costs, and potential adverse effects. Researchers must navigate these complexities to optimize mAb therapies for various clinical applications. The ongoing development of novel constructs, such as bispecific antibodies and small-molecule alternatives, may help address some of these limitations and improve therapeutic outcomes for patients. As the field continues to evolve, a comprehensive understanding of the advantages and limitations of mAb therapy will be essential for advancing research and clinical practice.

One of the primary advantages of mAb therapy is its ability to deplete B cells and plasma cells effectively, thereby mitigating the pathogenesis of autoimmune conditions. For instance, mAbs targeting CD20, such as rituximab and ocrelizumab, utilize mechanisms like complement-dependent cytotoxicity (CDC) and antibody-dependent cellular cytotoxicity (ADCC) to achieve rapid and sustained B-cell depletion. This targeted approach minimizes off-target effects, which is a significant advantage over broader immunosuppressive therapies. However, the limitations of mAb therapy must also be acknowledged. While the specificity of mAbs reduces cross-reactivity, the potential for adverse effects remains a concern. For example, in the treatment of multiple sclerosis, different anti-CD20 mAbs exhibit varying efficacy and side effects based on their mechanisms of action, which can complicate treatment decisions. Additionally, the cost associated with mAb therapies can be prohibitive, particularly for patients requiring long-term treatment, which poses a significant barrier to access and adherence. In the context of myasthenia gravis, recent advancements have highlighted the potential of mAb therapies to target disease-specific mechanisms. Complement inhibition and neonatal Fc receptor (FcRn) inhibition represent novel strategies that may enhance the efficacy of existing treatments. These therapies offer exciting possibilities; however, they also introduce challenges related to their cost and the need for ongoing clinical evaluation to establish their long-term benefits and safety profiles. Moreover, the interplay between autoimmune diseases, such as rheumatoid arthritis (RA) and autoimmune diseases of the thyroid gland (AITD), underscores the complexity of mAb therapy. The shared pathological pathways necessitate a comprehensive understanding of how mAb treatments for one condition may influence the other. For instance, while biological treatments for RA may help regulate anti-thyroid antibodies, TNF-alpha inhibitors can adversely affect thyroid function, potentially increasing the incidence of subacute thyroiditis. This interrelationship highlights the need for routine screening and a multidisciplinary approach to patient care. In summary, while mAb therapy offers significant advantages in targeting autoimmune diseases, including specificity and rapid efficacy, its limitations, such as cost and potential adverse effects, warrant careful consideration. Ongoing research is essential to optimize these therapies and address the challenges they present in clinical practice.

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АУТОИММУНДЫ АУРУЛАРДЫ ЕМДЕУДЕГІ МОНОКЛОНАЛДЫ АНТИДЕНЕЛЕР: ҚАЗАҚСТАНДАҒЫ ЖӘНЕ ӘЛЕМДЕГІ ҚАЗІРГІ ТЕНДЕНЦИЯЛАР

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Аңдатпа. Моноклоналды антиденелер – бір прекурсордан немесе «клоннан» келетін клондалған жасуша шығаратын антиденелер [1]. Бұл антиденелер өте спецификалық болып табылады, бұл оларды бірқатар ауруларды емдеу үшін қолдануға мүмкіндік береді. Олар жасушалар мен молекулалардың кең ауқымына бағытталған дәстүрлі терапиядан айырмашылығы, вирустар, ісік жасушалары немесе қабынуға қатысатын молекулалар сияқты нақты молекулаларды нысанаға алады.

Моноклоналды антиденелер (мАд) нақты жасушалар мен молекулаларды нысанаға алу қабілеті арқылы заманауи медицинаны өзгертті. 1975 жылы ашылғаннан бері мАд жоғары ерекшелік пен тиімділікті көрсете отырып, терапевтік және диагностикалық өрістердің кең ауқымында қолданылды [2]. Бұл молекулалар онкологиялық ауруларды, жұқпалы ауруларды, аутоиммундық жағдайларды және басқа да күрделі ауруларды емдеуде революция жасап, олардың денсаулық сақтаудағы таптырмас құрал ретіндегі рөлін нығайтты.

Соңғы онжылдықтардағы биотехнологиядағы жылдам прогресс мАд-нің дамуы мен өндірісін айтарлықтай жақсартты, бұл бүкіл әлемде осы биологиялық заттардың тиімділігін, қауіпсіздігін және қолжетімділігін арттыруға әкелді. Дегенмен, жаһандық жетістіктерге қарамастан, Қазақстанда моноклоналды антиденелерді қолдану және дамыту айтарлықтай қиындықтарға тап болды. Оларға жергілікті өндірістік инфрақұрылымның жоқтығы, пациенттерге мАд қолжетімділігінің шектеулілігі, осы саладағы ғылыми зерттеулер мен клиникалық сынақтардың дамымағандығы жатады. Осы мәселелерді шешу жергілікті халықтың игілігі үшін мАд пайдалануды оңтайландыру үшін өте маңызды.

Бұл шолуда біз әлемде және Қазақстанда мАд терапиясының соңғы тенденциялары мен жетістіктерін қарастырдық.

Түйін сөздер: моноклоналды антидене, терапия, аутоиммунды ауру, аппликация, дамыту.

МОНОКЛОНАЛЬНЫЕ АНТИТЕЛА В ЛЕЧЕНИИ АУТОИММУННЫХ ЗАБОЛЕВАНИЙ: СОВРЕМЕННЫЕ ТЕНДЕНЦИИ В КАЗАХСТАНЕ И МИРЕ

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Аннотация. Моноклональные антитела — это антитела, вырабатываемые клонированной клеткой, которая происходит от одного предшественника, или «клона» [1]. Эти антитела высокоспецифичны, что позволяет использовать их для лечения ряда заболеваний. Они могут воздействовать на определенные молекулы, такие как вирусы, опухолевые клетки или молекулы, участвующие в воспалении, в отличие от традиционных методов лечения, которые воздействуют на более широкий спектр клеток и молекул.

Моноклональные антитела (мАт) изменили современную медицину благодаря своей способности воздействовать на определенные клетки и молекулы. С момента своего открытия в 1975 году моноклональные антитела использовались в широком спектре терапевтических и диагностических областей, демонстрируя высокую специфичность и эффективность [2]. Эти молекулы произвели революцию в лечении рака, инфекционных

заболеваний, аутоиммунных состояний и других сложных расстройств, укрепив их роль незаменимых инструментов в здравоохранении.

Быстрый прогресс в области биотехнологии за последние десятилетия значительно улучшил разработку и производство моноклональных антител, что привело к повышению эффективности, безопасности и доступности этих биологических препаратов во всем мире. Однако, несмотря на мировые достижения, применение и разработка моноклональных антител в Казахстане сталкиваются со значительными проблемами. К ним относятся отсутствие местной производственной инфраструктуры, ограниченная доступность моноклональных антител для пациентов и недостаточно развитые научные исследования и клинические испытания в этой области. Решение этих проблем имеет решающее значение для оптимизации использования моноклональных антител на благо местного населения.

В этом обзоре мы рассмотрим последние тенденции и достижения в терапии моноклональными антителами во всем мире и в Казахстане.

Ключевые слова: моноклональные антитела, терапия, аутоиммунное заболевание, применение, разработка.