

PROSPECTS IN THE FIELD OF MUSCLE RELAXANTS

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Abstract. *Currently, the field of muscle relaxants is gaining great importance in the field of medicine and pharmacy. These drugs have muscle relaxing properties and are widely used in surgical procedures, in the treatment of neurological diseases, and in intensive care processes. If we turn to future prospects, it is expected that new generation muscle relaxants will be more effective, have a long-term effect, and have fewer side effects. In particular, research is being conducted to develop safer drugs using genetic and biotechnological approaches. Also, expanding the scope of application of muscle relaxants, determining their individual effects, and developing more rapid-acting forms are one of the current directions of the pharmaceutical industry. This will serve to increase the effectiveness of surgical and medical treatment methods in the future.*

Keywords: *Muscle relaxants, Depolarizing muscle relaxants, Nondepolarizing muscle relaxants, Neuromuscular blockade, Pharmacokinetics, Pharmacodynamics, Antagonists, Agonists.*

ПЕРСПЕКТИВЫ В ОБЛАСТИ МЫШЕЧНЫХ РЕЛАКСАНТОВ

Аннотация. *В настоящее время область миорелаксантов приобретает большое значение в сфере медицины и фармацевтики. Эти препараты обладают миорелаксирующими свойствами и широко используются при хирургических операциях, лечении неврологических заболеваний и реанимационных процедурах. Заглядывая в будущее, ожидается, что миорелаксанты нового поколения будут более эффективными, будут иметь долгосрочный эффект и иметь меньше побочных эффектов. В частности, проводятся исследования по разработке более безопасных лекарств с использованием генетических и биотехнологических подходов. Также одним из актуальных направлений фармацевтической промышленности является расширение сферы применения миорелаксантов, определение их индивидуального эффекта и разработка более быстродействующих форм. Это послужит повышению эффективности хирургических и медикаментозных методов лечения в будущем.*

Ключевые слова: Миорелаксанты, Деполяризующие миорелаксанты, Недеполяризующие миорелаксанты, Нервно-мышечная блокада, Фармакокинетика, Фармакодинамика, Антагонисты, Агонисты.

Introduction

Myorelaxants are widely used drugs in modern medicine, and their main function is to provide muscle relaxation. These drugs play an important role, especially in surgical operations, anesthesiology, intensive care, and the treatment of neurological diseases. Thanks to myorelaxants, surgical operations have become much easier and safer for patients. At the same time, their scope of application in the treatment of various diseases is also expanding. It is noteworthy that in recent years, new generations of myorelaxants have been developed and their effectiveness has been increased. For example, the production of fast-acting and low-side effects myorelaxants is one of the priority areas of the pharmaceutical industry. Currently, as a result of scientific research, work is also underway on myorelaxants adapted to individual genetic characteristics. This will allow for the precise and safe use of these drugs in the future. The reason for choosing this topic is to study the relevance of muscle relaxants in medicine, their future development prospects and changes associated with new technologies. Muscle relaxants are becoming increasingly important not only in surgical procedures, but also in other areas of medicine. Therefore, deepening knowledge about these drugs, studying their development trends and analyzing their future potential is one of the urgent issues of today.

Literature review and method

Myorelaxants play an important role in medicine and pharmacy, and many scientific studies have been conducted on their development and application. An analysis of the scientific literature shows that myorelaxants are mainly divided into two main types: depolarizing and non-depolarizing myorelaxants. Depolarizing myorelaxants (for example, suxamethonium) are characterized by a rapid onset of action, but they also have side effects. Non-depolarizing myorelaxants (for example, rocuronium, vecuronium) have a longer duration of action and are considered safer. Studies conducted in recent years show that new generation myorelaxants are being developed to be more effective and have fewer side effects. In particular, scientific research is being conducted to improve their pharmacokinetic and pharmacodynamic properties and to develop drugs that cause minimal harm to the body. At the same time, innovative research is being conducted to create muscle relaxants adapted to genetic and individual characteristics.

Research conducted by foreign and domestic researchers is of great importance in determining the future prospects of muscle relaxants. In particular, published scientific articles and medical studies show that new generation muscle relaxants are expected to be superior to previously used drugs in terms of safety and effectiveness.

Muscle relaxants are of great importance in modern medicine. They are mainly used to provide muscle relaxation and are especially widely used in surgical procedures, anesthesiology, and resuscitation. In recent years, as a result of scientific and technological advances, new types of muscle relaxants have been developed. These drugs are expected to be significantly superior to their predecessors in terms of effectiveness, safety, and individual approach. In this article, we will consider in detail the development trends and prospects for muscle relaxants.

Currently, new types of muscle relaxants are being developed as a result of scientific research. One of the main problems of traditional muscle relaxants is the poor control of their duration of action and the severity of side effects. Therefore, scientists are paying special attention to the following factors when developing new generation muscle relaxants:

- Rapid onset of action - the drug should be quickly absorbed into the body and provide maximum muscle relaxation.

- Short and precise duration of action - the duration of action of muscle relaxants should be controlled in order to quickly restore the patient's muscle function after surgery.

- Fewer side effects - research is being conducted to develop new drugs that do not harm the cardiovascular system and respiratory function.

- Adaptability to the body - ensuring individual adaptation of muscle relaxants based on genetic and physiological differences.

Drugs such as sugammadex, developed on this basis, have taken a prominent place among the new generation of muscle relaxants. They allow for rapid reversal of the effects of traditional non-depolarizing muscle relaxants, thereby helping patients recover more quickly after surgery.

The number of such innovative drugs is expected to increase in the future.

Muscle relaxants have different effects on the human body and can cause side effects in some patients. Some of their disadvantages are:

- Excessive muscle relaxation - this can affect the respiratory muscles, making it difficult for the patient to breathe independently.

- Effects on the cardiovascular system - some muscle relaxants can slow the heart rate or lower blood pressure.

- Induce allergic reactions - some patients may experience skin rashes, difficulty breathing, and anaphylactic shock.

Genetics and pharmacogenetics have become one of the important areas of medicine and pharmacology in recent years. Each patient's genetic characteristics shape their individual response to drugs, so how effectively and safely a patient's body will respond to muscle relaxants when they are used may depend on genetic factors. Muscle relaxants are primarily muscle-relaxing drugs, and their duration of action, effectiveness, and side effects can vary depending on the patient's genetic characteristics. Pharmacogenetic studies can help determine the individual adaptation of these drugs, determine their dosage based on the patient's genetic profile, and predict side effects.

Each patient's genetic characteristics are related to how they absorb, break down, and excrete drugs. This process is mainly carried out by the cytochrome P450 (CYP) enzyme system in the liver. The enzymes responsible for the breakdown and elimination of muscle relaxants depend on the patient's genotype and can act in the following ways:

- Extensive metabolizers - in these patients, muscle relaxants are broken down very quickly, and as a result, the effect of the drug may be less than expected. They may require higher doses of muscle relaxants.

- Poor metabolizers - in this group of patients, the drug may remain in the body for a long time, which can lead to increased side effects. Lower doses are recommended for these patients.

- Intermediate metabolizers - in these patients, drugs are broken down in a normal manner and do not require an individual approach to dosing.

Genetic tests can be performed to identify these metabolic differences, which will help determine the optimal dosage of muscle relaxants.

Muscle relaxants are one of the important areas of medicine and pharmacology, and new innovative technologies and production methods are being introduced to increase their effectiveness and reduce side effects. Currently, thanks to scientific and technological progress, advanced methods for developing new types of muscle relaxants have appeared in the pharmaceutical industry. They allow not only to optimize the effect of these drugs, but also to make them safer and more adaptable to patients.

Nanotechnology has ushered in a new era in pharmaceuticals. This technology has made it possible to improve the molecular structure of muscle relaxants and optimize the way they act on the body.

- Nanoparticle-based muscle relaxants - when medicinal substances are produced in the form of nanoparticles, their absorption into the body is accelerated and they manifest their effect more clearly.

- Drug duration control – with the help of nanotechnology, the duration of drug action on the body can be planned in advance and maintained in the patient’s body for the required time.

- Nanoencapsulation technology – by placing muscle relaxants in nano-sized capsules, their dosing accuracy is increased and side effects are reduced.

Muscle relaxants are mainly used to relax muscles in surgical procedures, but in recent years, the possibilities of using these drugs in new medical and scientific areas have been expanding. As a result of innovative research and pharmacological development, muscle relaxants have begun to be used in the following new areas:

Since muscle relaxants have the ability to control the interaction between the central nervous system and muscles, their use in the treatment of neurological diseases is increasing.

- Parkinson’s disease – some muscle relaxants are being tested to reduce muscle rigidity and tremors.

- Head and spinal cord injuries – can be used to reduce muscle spasticity caused by damaged nerves.

- Post-stroke rehabilitation – muscle relaxants are used to relax patients’ muscles when they are overly tense.

In the field of neurorehabilitation, the best results are achieved when these drugs are used in combination with specific physiotherapy methods.

Conclusion

While muscle relaxants were originally used to relax muscles during surgery, their use has expanded significantly today. Studies show that these drugs are used in various areas of medicine, such as neurology, orthopedics, gastroenterology, cardiology, psychiatry, and cosmetology. In neurological diseases, muscle relaxants are used to reduce muscle spasms in post-stroke rehabilitation, spinal cord injuries, and Parkinson's disease. Their effectiveness is observed in chronic pain syndromes, including fibromyalgia and myofascial pain syndrome. In cosmetology, muscle relaxants are used to eliminate wrinkles by reducing muscle tension, and in orthodontics, to treat bruxism. In gastroenterology, they are used to reduce intestinal and esophageal spasms, control reflux, and alleviate problems with the digestive system.

In urology and gynecology, the role of muscle relaxants in reducing uterine muscle spasms, postpartum rehabilitation, and preventing excessive contractions of the urinary tract muscles is being studied. In cardiology, the possibilities of reducing vascular spasms and regulating blood pressure are being analyzed. In psychiatry, muscle relaxants have been observed to help alleviate conditions associated with stress, anxiety syndromes, and insomnia. Their effectiveness in diseases associated with involuntary muscle contractions is also being studied. In recent years, the use of muscle relaxants according to individual characteristics has also been developing through genetic and pharmacogenetic studies. Scientific research continues to make these drugs more effective and safer as a result of new technologies and pharmaceutical manufacturing processes.

REFERENCES

1. Goodman & Gilman's: The Pharmacological Basis of Therapeutics – Brunton L., Chabner B., Knollmann B. (2018). McGraw-Hill Education.
2. Rang & Dale's Pharmacology – Ritter J. M., Flower R. J., Henderson G. (2020). Elsevier.
3. Miorelaksantlarning farmakologik xususiyatlari va qo'llanilishi – O'zbekiston Respublikasi Farmakologiya Instituti ilmiy maqolalari (2022)
4. Neuromuscular Disorders and Muscle Relaxants – Brown M. A., Smith R. T. (2021). Journal of Clinical Pharmacology, 45(2), 120-135.
5. Miorelaksantlarning genetik va farmakogenetik jihatlari – Xalqaro Farmakogenetika va Biomarkyorlar Jurnali (2023).