1994, pag. 421-439.
4. Testut L.– Traité d'anatomie humaine. Angéiologie, livre IV, Ed.Gaston Doin, Paris, 1921, pag. 208-212, 222-226, 316-318.
5. Testut L.– Traité d'anatomie humaine. Angéiologie. Ed.Gaston Doin, Paris, 1924, pag. 604-606, 621, 710-711, 714-715.
6. Standring S. - Gray's Anatomy. The Anatomical Basis of Clinical Practice. Ed. Elsevier-Churchill Livingstone, Edinburg, 2005, pag. 1203; 1291; 1302; 1328; 1360-1363.
7. Kamina P. - Anatomie Clinique. Tome 3. Thorax. Abdomen. Ed. Maloine, Paris, 2007, pag. 147-148;159;272;275.
8. Moore L.K., Dalley F.A. - Anatomie médicale. Aspects fondamentaux et applications cliniques. Ed. De Boeck Université, Bruxelles, 2001, pag. 281;284;288;304; 306.
9. Barone R. – Anatomie comparée des mammifères domestiques. Tome 5. Angiologie. Ed. Vigot, Paris,1996, pag. 131-135.
10. Terminologia Anatomica. International Anatomical Terminology. Federative Committee on Anatomical Terminology. Thieme Verlag, Stuttgart, 1988, pag. 89.

ULTRASTRUCTURAL ORGANIZATION OF CORPUS CALLOSUM UNDER THE EFFECT OF NALBUFIN IN THE EXPERIMENT

***Mateshuk-Vatseba L. R., Zinko A. V.**

Department of General Anatomy, Danylo Halytskyy National Medical University of Lviv, Ukraine
*Corresponding author: lvatseba@gmail.com

Abstract

Background: Development of pharmacotherapy with the use of opiates and opioids requires elaboration of measures to prevent and offset the side effects and complications that they cause, especially for the brain sensitive to the drug therapy effects because of the nature of its structure and function.

Material and methods: The study was carried out on 24 mature white male rats aged 4.5 – 5.5 months and body weight 130-180 g. Nalbufin was intramuscularly injected to the experimental animals as follows: 1st week – 8mg/kg, 2nd week – 15 mg/kg, 3rd week – 20 mg/kg, 4th week – 25 mg/kg, 5th week – 30 mg/kg, 6th week – 35 mg/kg. The work was carried out using the method of electron microscopy. The study and photographing of the material was conducted with the aid of УЕМБ-100 К microscope at acceleration speed 75 kV and magnification on the microscope screen × 4000– 8000.

Results: The work presents data on ultrastructural organization of the corpus callosum of the white rat in the norm and in the dynamics of the long-term effect of opioid. Corpus callosum of the white rat is formed by myelinated and non-myelinated fibers. The first changes in the ultrastructure of corpus callosum are observed already after 2 weeks of injecting nalbufin to the experimental animals and continue to increase throughout the subsequent stages of the experiment. Principal manifestation of the neuropathy of the corpus callosum, in case of injection of nalbufin, during 6 weeks is degradation of axis cylinders of the nerve fibers, glial cells. Morphological changes characteristic of microangiopathy are taking place in parts of the hemomicrocirculatory bloodstream of corpus callosum.

Conclusions: Thus, continuous injection of nalbufin predetermines changes in ultrastructural organization of the corpus callosum. This work is the basis for further studies to be conducted by morphologists and neurologists with the objective of elaboration in the future of the new methods of diagnosing and prevention of brain pathology caused by prolonged use of opioids.

Key words: corpus callosum, ultrastructure, opioid, experiment.

Background

Opioids are widely used for anaesthetization in modern medical practice, especially in surgical and oncological clinics [4, 6, 9]. Development of pharmacotherapy with the use of narcotic materials requires elaboration of measures to prevent and offset the side effects and complications that they cause, especially for the brain sensitive to the drug therapy effects because of the nature of its structure and function [1, 2, 7]. However, many of these studies have the character of some separate observations and relevant general conclusions are not always well-founded [3, 8, 10]. There is a range of unresolved issues regarding the problem of structural rearrangement of the white matter of telencephalon in case of administering narcotic drugs. Analysis of present-day professional literature showed a particular interest of the researchers in the condition of the corpus callosum under the effect of exo- and endopathogenic factors [11]. This is why the objective of the study was to establish peculiarities of ultrastructural organization of corpus callosum and parts of its bloodstream under normal conditions and under the effect of nalbufin in the experiment.

Material and methods

The study was carried out on 24 mature white male rats aged 4.5 – 5.5 months and body weight 130-180 g. Experimental animals were divided into 3 groups. The first group (5 rats) was used to study ultrastructure of corpus callosum of the white rats after 2 weeks of injecting nalbufin, the second group (5 rats) was used to identify changes in corpus callosum of the white rats on the ultramicroscopic level after 4 weeks of the experiment, and the third group (5 rats) was used to study restructuring of bloodstream and ultrastructure of corpus callosum of the white rats after 6 weeks of injecting nalbufin. 9 white rats to which saline solution was injected served as the control group.

Nalbufin was intramuscularly injected to the experimental animals as follows: 1st week – 8mg/kg, 2nd week – 15 mg/kg, 3rd week – 20 mg/kg, 4th week – 25 mg/kg, 5th week – 30 mg/kg, 6th week – 35 mg/kg [5].

The work was carried out using the method of electron microscopy. The animal was withdrawn from the experiment by way of overdosing intraperitoneal anesthesia using thiopental sodium (at the rate of 25 mg/kg). Sampling and standard preparation of the material for the electron microscopy were made immediately after death of the animal. Ultrathin sections were prepared with the aid of ultramicrotome with the help of glass knives. Strips of the sections of silver or mellow lemon color were selected for the study. Then the sections were contrasted first in a 2% solution uranyl acetate, and then in the solution of lead citrate. The study and photographing of the material was conducted with the aid of УЕМБ-100 К microscope at acceleration speed 75 kV and magnification on the microscope screen × 4000– 8000.

All animals were kept in the vivarium of Danylo Halytskyy National Medical University of Lviv, and the experiments were conducted in compliance with the provisions of the European Convention for the protection of vertebrate animals used for experimental and other scientific purposes (Strasbourg, 1986), European Council Directive 86/609/EEC (1986), the Law of Ukraine #3447-IV on the approximation of laws, regulations and administrative provisions of the member states regarding the protection of animals used for experimental and other scientific purposes (86/609/EEC), European Commission, Brussels (1986). Council Directive 86/609 / EEC (1986), the Law of Ukraine № 3447 – IV «On protection of animals from cruel treatment", general ethical principles of experiments on animals approved by the first National Congress of Ukraine on Bioethics (2001).

Results and discussion

Corpus callosum of the white rat is formed by the nerve fibers, that have the shape of the axis cylinders (fig. 1).

The axis cylinder consists of neuroplasm, containing longitudinally oriented neurofilaments and neurotubules, as well as mitochondria. The axis cylinder is covered axolemma. Neuroglia is formed predominantly by astrocytes, whose processes are long, straight, without branching, in transverse section they have a rounded or oval form, surrounding fascicles of nerve fibers, penetrate into them and accompany each nerve fiber. Astrocytes' processes end up on the vessels, basal membrane that separates the nerve tissue from the pia mater of the brain. Astrocytes' cytoplasm is filled with fascicles of filaments. The astrocyte nucleus is large, light colored, contains few ribosomes and elements of granular endoplasmic reticulum. All parts of hemomicrocirculatory bloodstream are located between the fascicles of the nerve fibers of the radiate crown. Arterioles' endotheliocytes in the transverse sections have an elongated form and occasionally protrude into the arteriole lumen. Plasmolemma forms micro-protrusions, cytoplasm a medium electron-optical density and contains a considerable number of organelles and micropinocytic vesicles, nuclei have an elongated form. Smooth myocytes form one layer. Venules have a relatively wide lumen of irregular form. Capillaries are of non-fenestrated type. Capillary endothelial cells form a continuous layer, located on the basal membrane.

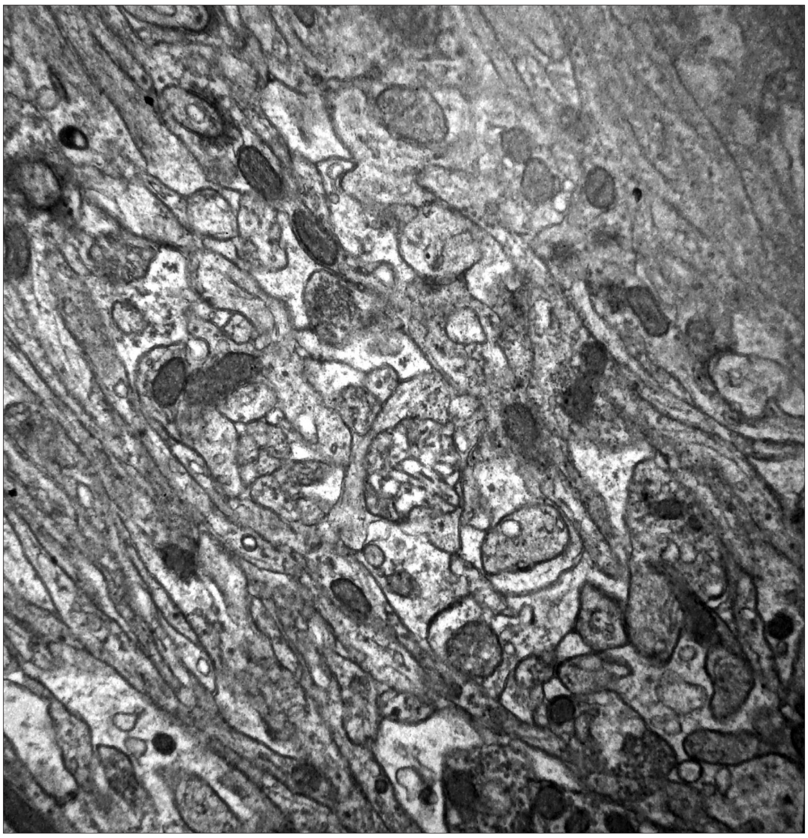

Fig. 1. Corpus callosum of the white rat. Electron diffraction pattern. Magnification: × 4000.

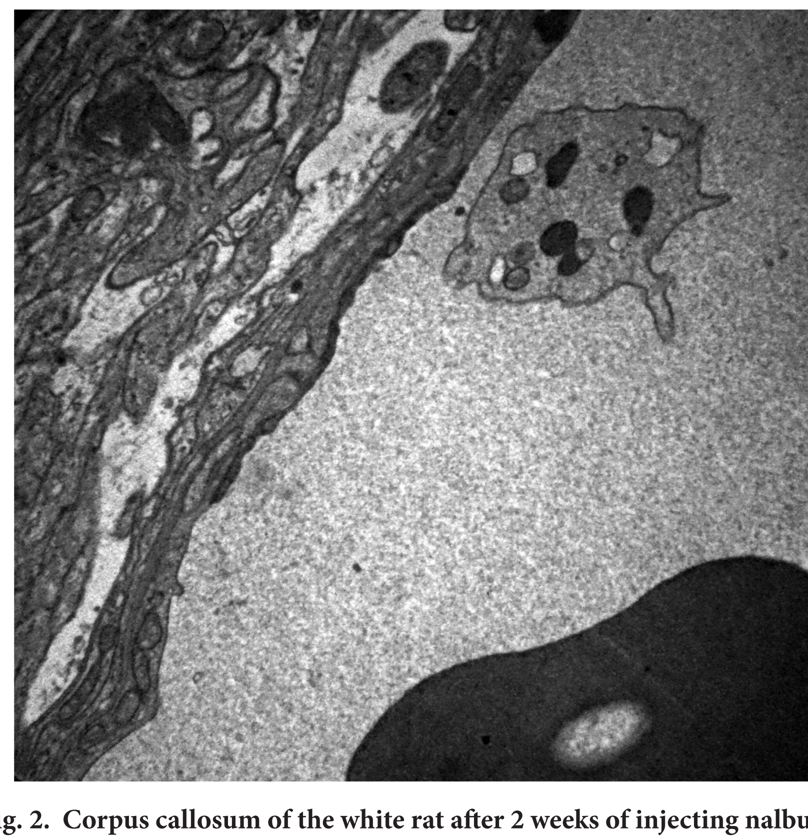

Fig. 2. Corpus callosum of the white rat after 2 weeks of injecting nalbufin. Electron diffraction pattern. Magnification: × 4000.

After 2 weeks of the experiment the nerve fibers do not yet have any signs of damage and their structure practically corresponds to that of the control group. However, the first signs of angiopathies appear in parts of corpus callosum hemomicrocirculatory bloodstream. Edema of endotheliocytes is observed in the capillaries, their lumens acquiring an irregular form. Electron-dense nuclei of endotheliocytes protrude into the capillaries' lumen, acquire an excessively elongated form. Fissures between the neighboring endotheliocytes are expanded. Plasmolemma forms occasional protrusions into the capillaries' lumen (fig. 2).

After 4 weeks of injecting nalbufin edema was found in axis cylinders of the nerve fibers (fig. 3).

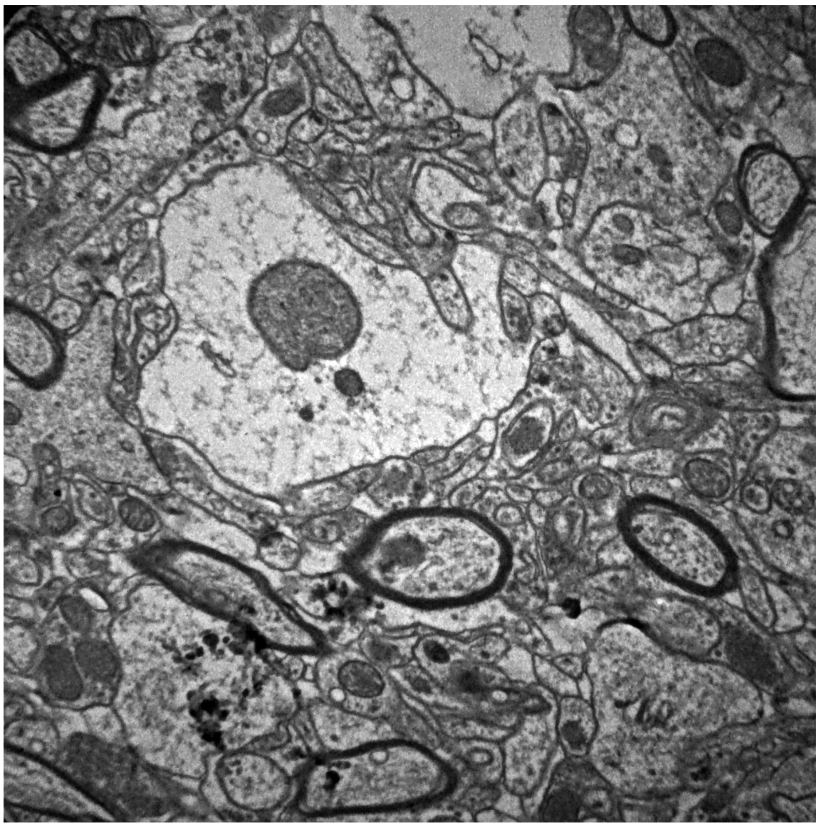

Fig. 3. Corpus callosum of the white rat after 4 weeks of injecting nalbufin. Electron diffraction pattern. Magnification: × 4000.

Axons' cytoplasm is of non-uniform electron-optical density, dark regions alternating with light regions, the number of organelles decreases. The size of glial cells located between fascicles of the nerve fibers increases. Cytoplasm of oligodendrocytes of the corpus callosum is lucid and swollen, nuclei hypertrophic, with dentate nucleolemma and contain structured chromatin. Nuclei contain 1-2 nucleoli of the reticular structure.

After 6 weeks of the experiment nonmyelinated nerve fibers are fragmented (fig. 4). Nerve fibers become of irregular form presented by oval fibers with protrusion and invaginations.

Corpus callosum glial cells are also affected (vacuolar degeneration of their cytoplasm, edema of mitochondria). Peryaxsonal edema, damaged axoplasm are noted to take place.

There have been noted a considerable number of ruined capillaries, luminal narrowing of the preserved capillaries. Nuclei of their endotheliocytes are excessively elongated, with condensed chromatin. Nucleolus is not found. Endotheliocytes' cytoplasm contains a smaller number of organelles, micropinocytic vesicles are often absent. Edematic mitochondria, some of them with degraded cristae, have been observed in endotheliocytes' cytoplasm. Plasmolemma forms protrusions into the lumen of microvessels. The basal membrane is thickened, has no clear boundaries. Pericytes are edematic, mitochondria in their cytoplasm often contains ruined cristae.

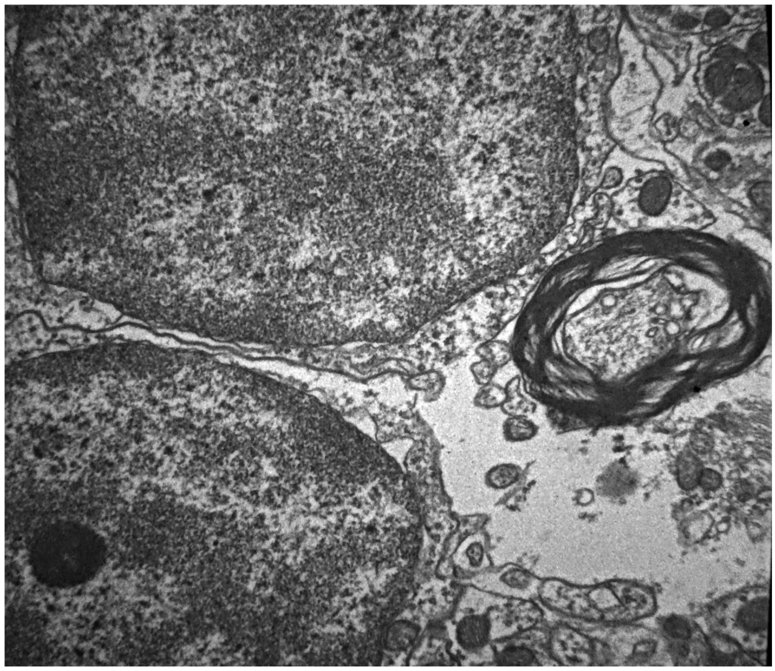

Fig. 4. Corpus callosum of the white rat after 6 weeks of injecting nalbufin. Electron diffraction pattern. Magnification: × 4000.

Conclusions

Corpus callosum of the white rat is formed by myelinated and nonmyelinated fibers.

The first signs of changes in the ultrastructure of corpus callosum are observed already after 2 weeks of injecting nalbufin to the experimental animals and continue to increase throughout the subsequent stages of the experiment.

Principal manifestations of neuropathy of the corpus callosum in case of injection of nalbufin during 6 weeks is degradation of axis cylinders of the nerve fibers, glial cells. Morphological changes characteristic of microangiopathy are taking place in parts of the hemomicrocirculatory bloodstream of corpus callosum.

This work is the basis for further studies to be conducted by morphologists and neurologists with the objective of elaboration in the future of the new methods of diagnosing and prevention of brain pathology caused by prolonged use of opioids.

References

1. Byelovitskiy O. V. Submicroscopic morphology of the brain in case of alcohol-morphine intoxication in the experiment / O.V. Byelovitskiy // Tavr. Med.-Biol. Herald. – 2010. – 13, # 1. – p.p. 13 – 16.
2. Lelevych S. V. Characteristic of neuromediator systems of some structures of the brain of rats in case of morphine abstinence. / S. V. Lelevych, V. V. Lelevych, E.M. Doroshenko // Problems of narcology. – 2009. – # 3. – p.p. 70 – 77.
3. Mamina O.O. Chemical-toxicological study of narcortic substances in the organs of poisoned rats / O.O. Mamina // Zaporizhzhya Medical Journal. – 2006. – # 6. – p.p. 140-142.
4. Obolenskiy S. V. Role and place of opioid analgetic nalbufin in the practice of out-patient anesthesiology / S. V. Obolenskiy // Out-patient surgery. In-patient replacing technologies. – 2007. – # 4. – p. 155.
5. Patent #76564 U Ukraine, MPK A 61 K 31/00 Method of modeling physical opioid dependence of rats / applicants: Onysko R.M., Paltov Ye. V., Fik V. B., Vilkhova I.B., Kryvko Yu. Ya., Yakymiv N. Ya., Fitkalo O.S.; patentee: Danylo Halytskyy National Medical University of Lviv. – #u201207124; application 12.06.2012; publ. on 10.01.2013, Bulletin #1.
6. Radomskiy V. T. Experience of application of nalbufin in radiation treatment of bone metastases / V.T. Radomskiy, N.M. Seregina, I. I.. Ostapenko // Ukrainian Medical Almanac. – 2014. – # 3. – p.p. 82 – 84.
7. Fisenko V. P. Neurochemical regularities of the action of opioid analgetics on the brain cortex / V. P. Fisenko // Bulletin of experimental biology and medicine. – 2001. – Vol. 132, # 7. – p.p. 4 – 12.

8. Voronkov M. Administration of nalbuphine to heroin addicts. Feasibility and short-term effects / M. Voronkov, D. Ocheret, S. Bondarenko // Heroin Addict Relat Clin Probl. – 2008. – 10, # 1. – p.p. 19-24.
9. Maremmani I. Affective temperaments in heroin addiction / I. Maremmani, M. Pacini, D. Popovic. // J. Affect. Disord. – 2009. – Vol. 117, #3. – p.p. 186-192.
10. The relationship between total and regional corpus callosum atrophy,cognitive ampairment and fatigue in multiple sclerosis patients / O. Yaldizli, I.K. Penner, K Frontzek [et al.] // Mult. Scler. – 2014. – Vol. 20, № 3. – P. 356-364.
11. The structure of the corpus callosum in obsessive compulsive disorder / M. D. Paola, E. Luders, I.A. Rubino [et al.] // Eur. Psychiatry. – 2013. – Vol. 28, № 8. – P. 499 – 506.
12. Tract-based spatial statistics of diffusion tensor imaging in hereditary spastic paraplegia with thin corpus callosum reveals widespread white matter changes / K.K. Oguz, E. Sanverdi, A Has [et al.] // Diagn. Interv. Radiol. – 2013. – Vol. 19, № 3. – P. 181-186.

ASPECTE ANATOMO-CLINICE ÎN HIRUDOTERAPIE

***Turchin R., Guzun G., Suman S., Mazniuc V., Topor B. M.**

Catedra de anatomie topografică și chirurgie operatorie
Universitatea de Stat de Medicină și Farmacie „Nicolae Testemițanu”, Chișinău, Republica Moldova
*Corresponding author: raduturchin@mail.ru

Abstract

ANATOMO-CLINICAL ASPECTS IN HIRUDOTHERAPY

Background: According to the literature, the history of hirudotherapy includes several millenniums. With the development of science, researches in medicine have resulted in rapid and quite good treatment of acute diseases. In this way, in a short period of time a strong pharmaceutical industry, which proposes large amounts of synthetic drugs,has been developed. As a result, the share of natural remedies has considerably decreased, and the specialists of this field were essentially distressed. Today we observe that modern medicine rediscovers hirudotherapy. The leeches possess a mechanism that locks the system of hemostasis of the donor, represented by biologically active substances, secreted by the salivary glands. Due to these substances, hirudotherapy has many therapeutic effects. As mentioned before, hirudotherapy acts on the human body through general, local and bioenergetical effects.

Conclusions: First of all, zonality of curative effect is determined by regional adjusting of blood and lymphatic circulation. Therefore, the local action is the most important manifestation of hirudotherapy. The general action is based on the application of leeches in certain reflexogenic areas, arranged to the skin, and in regions of anastomoses between the deep and superficial venous system. In this context, the role of clinical anatomy is essential in determination of the points and areas where leeches are applied.

Key words: medical leech, hirudotherapy, hirudoreflexotherapy.

Conform literaturii de domeniu, istoricul hirudoterapiei numără câteva milenii.

O dată cu dezvoltarea științei, cercetările din domeniul medicinii s-au soldat cu succese destul de bune și rapide în tratamentul bolilor acute. În așa mod într-o scurtă perioadă de timp s-a dezvoltat o industrie farmaceutică puternică, care propune cantități impresionante de preparate medicamentoase sintetice, ca urmare, ponderea remediilor naturale a scăzut considerabil, iar specialiștii în acest domeniu au fost strâmtorați esențial [30].

Literatura de specialitate, la capitolul istoria tratamentului cu lipitori, indică diferite țări și diferite perioade: Egipt, Grecia, Mesopotamia, India cu 2000, 3000 și 3500 ani în urmă. Însă, cel mai vechi sistem medical de pe Terra, cunoscut în present, este medicina ayurvedică (din sanscrită *Ayurveda* – știința vieții) [1-3, 30].

Despre tratamentul cu lipitori au scris Hipocrate (2400 de ani în urmă), Galenus (1800 de ani în urmă), Avicenna (1000 de ani în urmă).

În Rusia lipitorile au fost practicate de cunoscuții medici N. I. Pirogov, M. I. Mudrov, G. A. Zaharin [16, 30].

Odată cu apariția unor concepte noi în medicină, despre lipitori a început să se vorbească tot mai puțin, ajungând chiar la interzicerea lor în fosta URSS [9].