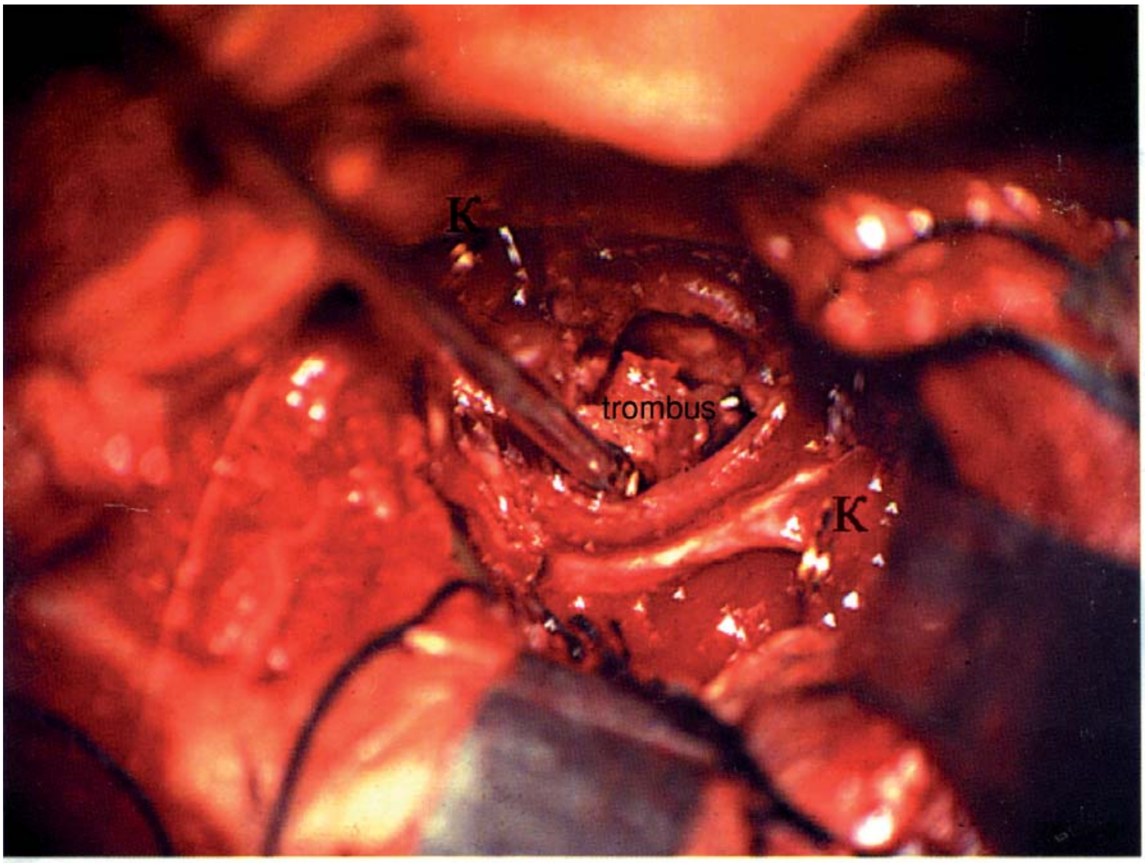
ISSN 0042-8817

MAGAZINE

QUESTIONS OF NEUROSURGERY

Of N.N. Burdenko



PMID: 16485825 (PubMed - indexed for MEDLINE)

MOSCOW MEDICINE

3

2005

EXPERIENCE IN USING A MOLECULAR RESONANCE COAGULATOR IN NEUROONCOLOGY

V.A. Cherekayev, A.Kh. Bekyashev, Yu. A. Filippov, A.I. Belov, D.A. Golbin

Abstract: The paper analyses the experience gained in using a molecular resonance coagulator in 145 patients with tumors of the base of the skull and brain.

The Vesalius NEUROsurgery N1 molecular resonance apparatus is an innovational bipolar device that is specially designed for neurosurgical application (operations on brain).

Due to the fact that the temperature at the site of a cut does not exceed 45-50°C, the apparatus has the minimum effect on tissues, nerves, nerve ending, and blood vessels, permitting a surgeon to make interventions into sophisticated anatomic formations.

The apparatus operates in the modes "cut" and "coagulation" that enable operations to be performed on particularly minor and fine structures.

While working on brain tissues, it is particularly important that there is no thermal injury, tissue charring, or sticking effect due to low working temperatures.

The possibility of concurrently making hemostasis and tissue dissection reduces the time of an operation and considerably decreases the extent of blood loss.

The clinical case given in this paper demonstrates the universality of the Vesalius NEUROsurgery N1 molecular resonance apparatus used in an infiltrative tumor of the bases of the skull.

One forceps operated in different modes may provide sparing coagulation of minor cortical arteries, reduce the volume of a tumor through its bloodless dissection, arrest bleeding from the hyperostosis (wax sticking effect), prepare nerves in the upper lid slit and cavernous sinus.

The Vesalius NEUROsurgery N1 molecular resonance surgical apparatus is recommended for neurosurgical care to perform brain operations requiring great caution in handling the tissues being operated on.

Electrosurgery is a branch of the surgery that uses a high frequency current (HFC) for the tissue dissection and coagulation. The first experiments using HFC electrosurgery on humans, were done at the end of the 19th Century, beginning of the 20th Century. Electrosurgery is based fundamental physical principle that thermal effect of the electric current appears is strongest where the cross section of the conductor is minimal. In 1899, Oudin described tissue disintegration with high frequency current produced by sparkle generator. Since 1970 HFC generators have obtained power levels which allowed them to be used as a tool for electrosurgery. Electrosurgery method is based on the tissue heating and disintegration using the action of HFC with temperatures above 100ºC. Haemostasis is also developed based on thermal exposure and includes as a matter of fact in bleeding surface cauterization and thermo coagulation of minor blood vessels. Usually electrosurgery apparatus works in the frequency of 0.5-2 MHz and with a power range from 300 to 700W.

During the improvement of electrosurgery apparatus, scientists determined that increasing of the frequency current would permit to increase the tissue heating velocity whilst at the same time reducing the action time and heating zone. A new method has been named as radiofrequency surgery. The apparatus for this technique works in a frequency of up to 4 MHz on the power to several thousand watts, however, this improvement was found unnecessary. Radiofrequency surgery did not completely abandon effect on the tissue at all, therefore the zone of the thermal death of the cells in the section remains, although is decreased.

A new period of electrosurgery arrived with currents making a molecular resonance in the tissue, when the high frequency oscillations of the cells membranes and cytoplasm lead to cell disintegration without heating.

Physics of this method can be explained by the following: generated energy is transmitted by quantum. The energy which is exactly equal to the intermolecular bonds' energy. Molecular resonance generator works on the unique patent combination of four frequencies in the range of 4 - 16 MHz, known as Cells Keeping Spectrum (CKS). Affecting on the bounds of the same energy, which they also have, generator's quantum creates a resonance of the molecular bounds. In this case the amplitude of the oscillations of separated molecules rises immediately leading to the breakdown of the cell membrane. At the macroscopic level this effect is realized as tissue cut. The destruction of intermolecular bounds occurs due to amplitude increase of their oscillations without bound energy changing.

The action described above ensures that the temperature at the zone of a cut does not exceed 45-50ºC reducing the zone of thermal necrosis to be formed and charring at the cut edges (see fig.1).

The application of mechanical force to cut the tissue is not required thus As a result of this the shift of individual layers of skin does not occur and healing occurs quickly after initial closing without the formation of even the smallest scar.

Cherekayev V.A. et al.

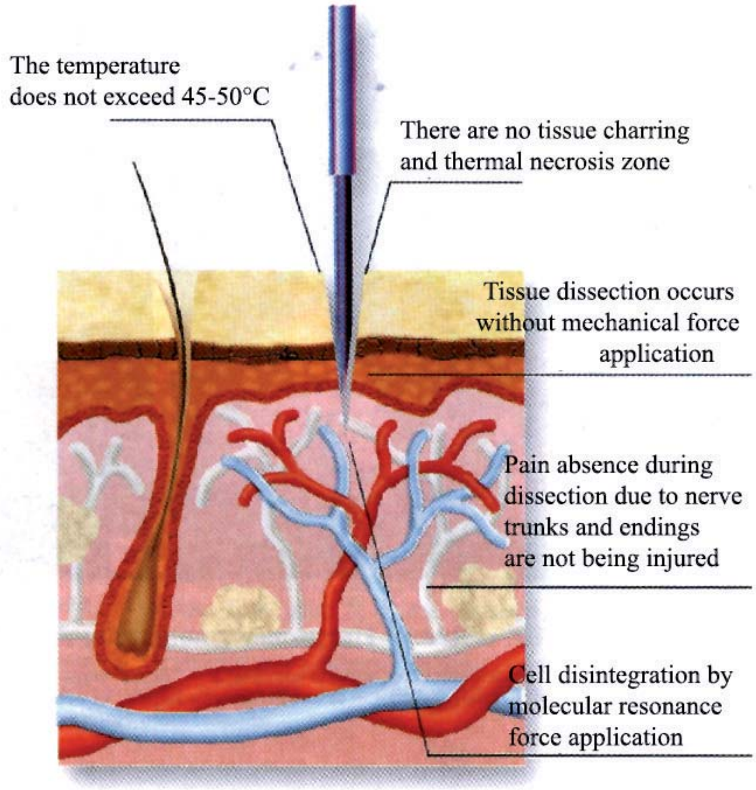


Fig. 1. The main advantages of the Molecular-Resonance surgery method (see article).

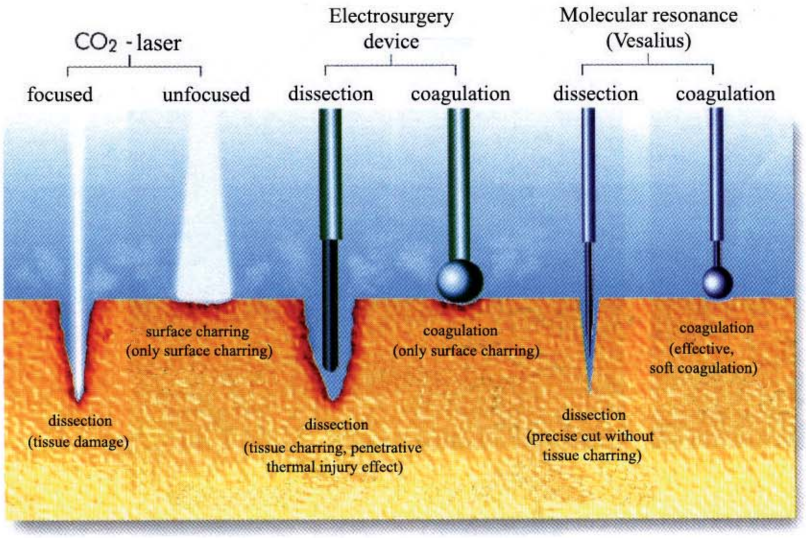


Fig. 2. The comparison of molecular resonance surgery method with the principal modern methods of energetic surgery.

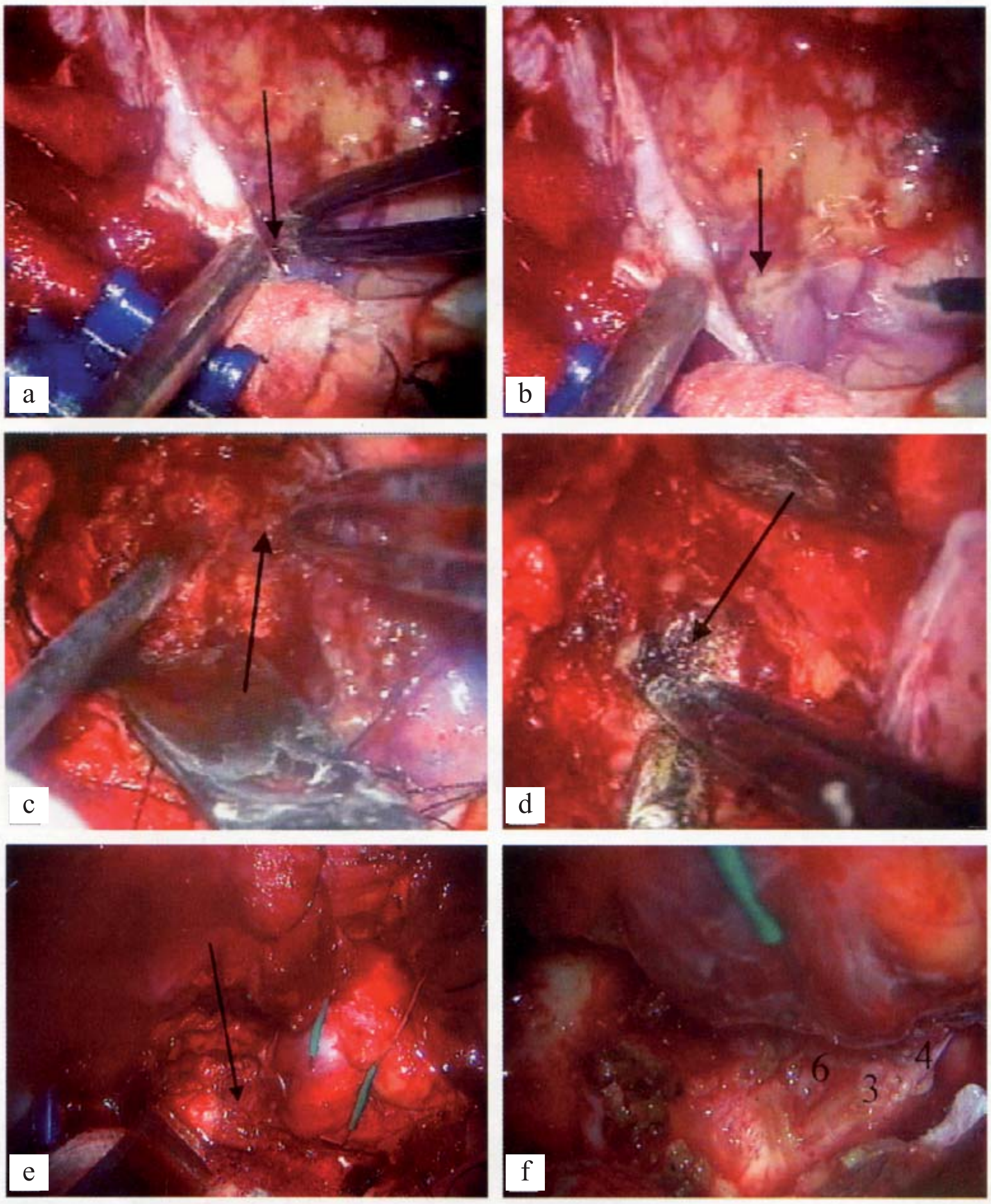


Fig. 5. Immages of the patient that was made during operation.

a, b- tumor separation from the cerebralcortex and vessels; c - "cutting" of the tumor; d - coagulation of hyperostosis; e - tumor, infiltrated cavernous sinus; f - the phase of dissection of III, IV, VI nerves in the upper lid slit and frontal parts of cavernous sinus.

Fig.3. Molecular resonance apparatus "Vesalius NEUROsurgery N1" (a) in its accessories, pedal (b) and bipolar forceps (c).

Advantages of the molecular-resonance surgery method:

1. Using molecular-resonance apparatus temperature at the zone of a cut does not exceed 45-50ºC, which leads to
   - absence of thermal injury effect, tissue charring, that almost exclude post-operated inflammation and reduce post-operation recovery period more than twice;
   - quite totally pain absence during the operation (nerve trunks and endings are not being injured) and the possibility to use only a local anaesthetics in the post-operation period.
   - the possibility to manipulate in the direct proximity of blood vessels, nerve trunks and nerve endings.
2. Tissue dissection occurs without the application mechanical force, which helps the wound to heal up by initial closing and without scar formation.
3. The possibility of concurrently making coagulation and tissue dissection minimises the extent of blood loss: operation is performed in almost "dry" wound.
4. The availability of specialized generators enables the operation to be performed on various tissues, using a vantages of molecular resonance method in several areas of medicine - neurosurgery, dermatology and plastic surgery, ENT- surgery, gynaecology, urology (also endoscopic).

The molecular resonance apparatus "Vesalius NEUROsurgery N1" is an evolutional bipolar device which is specifically designed for neurosurgical application (operation on the brain). Due to the fact that the temperature at the site of the cut does not exceed 45-50°C, the apparatus has the minimum effect on tissues, nerves, nerve ending, and blood vessels, permitting a surgeon to make interventions into sophisticated anatomic formations. The apparatus operates in the modes "cut" and "coagulation" that enables operations to be performed on particularly minor and delicate structures. While working on brain tissues, it is particularly important that there is no thermal injury, tissue charring, or sticking effect due to low working temperatures. The possibility of concurrently haemostasis and tissue dissection reduces the time of an operation and considerably decreases the extent of blood loss (Fig.2).

The apparatus was tested for sixth clinical department of N.N.Burdenko Neurosurgical Institute (NSI). Work of the apparatus "Vesalius NEUROsurgery N1" was tested on various modes ("cut" and "coagulation") and power regimes. The quality of tissue cutting by "cutting" forceps as well as various diameter range blood vessels coagulation was evaluated. The apparatus was used in neurosurgical operations on 145 patients ranging in age from 15 - 69 years old at sixth clinical department of N.N.Burdenko Neurosurgical Institute (NSI). Majority of patients have had tumours of the base of the skull (meningiomas of the wings of the main bone, olfactory memingiomas, craniofacial tumors, VII nerve neurinomas). The apparatus was also used for removing parasiggital meningiomas, the glial brain tumors.

The apparatus proves to be reliable and effective surgical instrument, allowing making precision neurosurgical operation. Particular attention should be paid to gentle impact of the apparatus on dissecting and coagulating tissue. The apparatus is easy to use - it has convenient control panel to set up a power quickly and precisely. The apparatus is provided with datasheet - in Russian - which contains exhaustive information about modes and full working instructions, settings and safety measures necessary for using this instrument. “Vesalius NEUROsurgery N1” has a modern design, suitable and functional control panel (Fig.3, a). During the testing period no issues with malfunctions, decrease of base bloc quality, connecting cables, foot pedal and bipolar electrodes have been identified. Work elements of the apparatus (bipolar electrodes, connecting cables) could be sterilized using standard protocols without additional treatment. One of the indisputable advantages is the absence of the scale on the tips of bipolar forceps during work

A clinical observation, indicated below, shows the possibilities of a molecular resonance coagulator in removing of infiltrative meningiomas of the wings of the main bone.

Molecular resonance surgery is a modern, high-performance surgical method to implement a wide spectrum of the operations in many fields of surgery where care and precision are required when handling the tissues. It differs favourably from traditional electrosurgery and laser surgery by the absence of thermal injury of the operating tissue, lower soreness, and minimal blood loss. Post-operated inflammation is excluded completely; post-operation recovery period is diminished essentially. Electrodes and other accessories of the apparatus “Vesalius NEUROsurgery N1” withstand sterilization and can be used repeatedly.

The Vesalius NEUROsurgery N1 molecular resonance surgical apparatus is recommended for neurosurgical care to perform brain operations requiring great caution in handling the tissues being operated on.

Patient 42 years old, case history N° 811/05, arrived in the institute with complaints on general weakness, protrusion of left eyeball, periodical speech disturbance. In 2002 she was operated in the hospital close to her residence. Meningiomas of the wings of the main bone of the left side was partially removed. Half a year ago left-side exophthalmoses appeared and began to increase. During the medical examination signs of the initial growth of the meningiomas of the wings of the main bone on the left side were recognized.

During the period of recovery in neurological status was noted that there was hyperpathia of the left side of her face, left-side exophthalmoses (2 mm) with oedema of eyelids.

During magnetic resonance imaging (MRI) of the brain infiltrative meningiomas of the wings of the main bone on the left side was recognized. (Fig.4, a).

During an operation it was revealed that there was bleeding and moderate thickness hyperostosis of the wing of the main bone. During resection occurs using boron treatment and nippers, bleeding was stopped by coagulation with “Vesalius NEUROsurgery N1” apparatus (Fig.5, g) (cutting mode was 50-60 W). The thickness of the hyperostosis projected in the upper lid slit reached 2 cm. The upper and the lower lid slit were opened after removing of hyperostosis. A big size infiltrative tumor of the bases of middle cranial fossa was revealed, expanding into the upper lid slit, cavernous sinus and anterior clinoid process. The brain membrane was cut. When the cystic cavity was opened it was revealed that there were gross alterations of temporal lobe. Upper lateral parts of the tumor were a bottom of the cystic cavity. We began with coagulation by “Vesalius NEUROsurgery N1” of the points of tumors attachment to the bases of middle cranial fossa. The tumor was compact, dense and moderately bleeding tumor. By reducing the volume of the tumor with ultrasound aspirator slowly also ultra lateral parts of the tumor were removed. The posterior region of the tumor has spread to the cerebellar tentorium. After removal the tumor from the cerebellar tentorium the basal region was reduced with ultrasound aspirator. The tumor was separated from cerebral cortex, as minor vessels extended from the tumor to internal capsule (Fig. 5, a ,b), from brain stem and branches of the middle cerebral artery (coagulation mode 25 W), coagulates followed by dissection of middle area of the tumor (Fig. 5, b) (coagulation in the cutting mode 50-60 W). Medial part has infiltrated the upper lid slit and has spread to cavernous sinus and anterior clinoid process. The tumor was separated from middle part of the cavernous sinus. Outer dural leaflet of the roof of cavernous sinus was infiltrated. Infiltration has spread to frontal lobe and upper lid slit (Fig. 4, d) and this part of the tumor was removed. Infiltrated surface area was coagulated. As volume of the tumor was reduced with ultrasound aspirator the part of the tumor situated on the anterior clinoid process was separated from cerebral cortex and excised. Electrodes were mounted on the levator muscle of upper eyelid, and lateral rectus muscle. Under the stimulation control infiltrative layer was diminished in the area of the upper lid slit and frontal parts of the cavernous sinus using coagulator “Vesalius NEUROsurgery N1” (coagulation mode 25-30 W) since oculomotor, trochlear and abducent nerves are responded (Fig. 5, e). Haemostasis and plastic

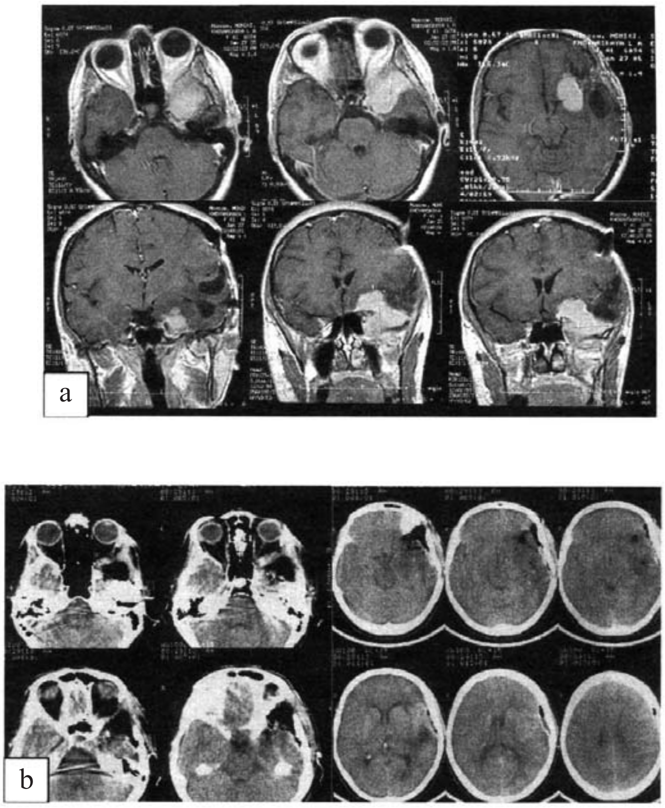


Fig.4. Magnetic resonance and computer imaging of the patient before (a) and after (b) operation.

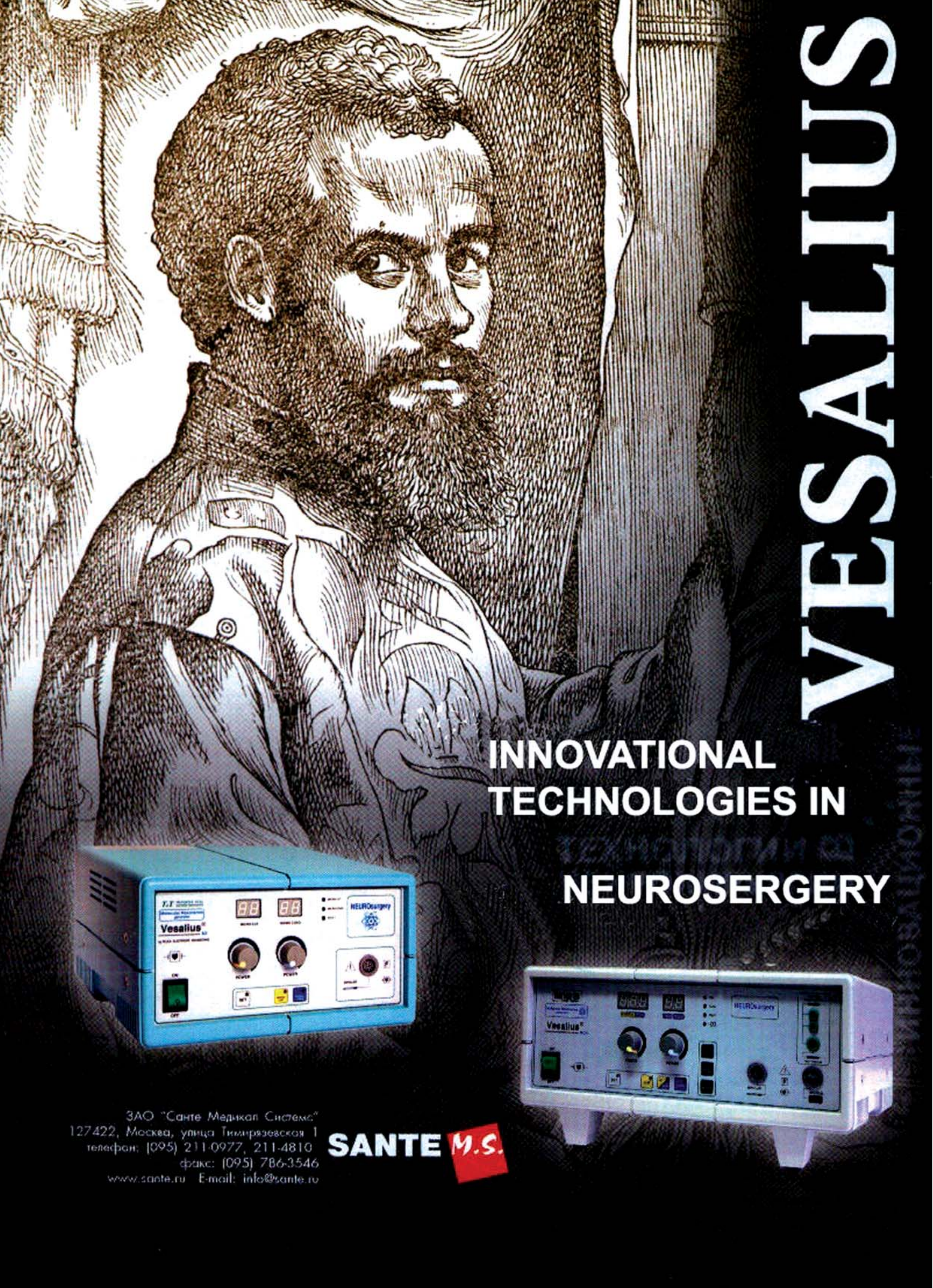
repair of defects in the dura mater with piece of periosteum were carried out. The stitches were made on the soft tissues. An active drain was organized under the piece of periosteum.

During the post-operated period the exophthalmos on the left side was regressed. At the time of the discharge from hospital the patient had ptosis of the left eyelid and moderate limit of movement – in all directions – of the left eyeball. Brain computer tomography (CT), using contrast dye, revealed liquid accumulation in the place where the tumor was removed (Fig. 4, b). Histology diagnosis was Meningotheliomatous meningiomas. Three weeks after the operation ptosis had regressed completely and left eyeball movement had totally recovered.

The clinical observation described above is demonstrated universality of the coagulator "Vesalius NEUROsurgery N1" in case of infiltrative tumor of the bases of the skull. Operating by the same coagulation forceps in different modes may provide sparing coagulation of minor cortical arteries, reduce the volume of the tumor through its bloodless dissection, arrest bleeding from the hyperostosis (wax sticking effect), and prepare nerves in the upper lid slit and cavernous sinus.

Translated by Evgeniya Sharova, 2008

This a translation of the original article "**EXPERIENCE IN USING A MOLECULAR RESONANCE COAGULATOR IN NEUROONCOLOGY**" from Magazine - Questions of Neurosurgery, issn 0042-8817, PMID:16485825 (PubMed - indexed for MEDLINE)


VESALIUS
INNOVATIONAL TECHNOLOGIES IN
NEUROSERGERY
Vesalius
NEUROsurgery
ЗАО "Санте Медикал Системс"
127422, Москва, улица Тимирязевская 1
телефон: (095) 211-0977, 211-4810
факс: (095) 786-3546
www.sante.ru E-mail: info@sante.ru
SANTE M.S.