Status and Prospects of Neurosurgical Care to the Population of Kyiv

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The article describes the regulatory framework of Kyiv on providing neurosurgical care; morbidity, disability and mortality of neurosurgical diseases, the level of staff training, health care at the hospital level, the outlook for the care for neurosurgical diseases system and vascular diseases in particular have been considered.

Keywords: neurosurgical care, morbidity, disability, mortality, regulatory framework, human resources, development prospects.

Preamble
Modern development of health care in most countries is characterized by a shift of priorities from cost savings to development and implementation of the most effective methods of resource allocation. Today all countries are interested in improving their health care systems in terms of empowerment to provide quality care to everybody who needs it.

This problem is still relevant both for countries that already provide effective medical care at the appropriate level, and for those where a lot of people still do not receive the necessary medical care that meets modern standards (Avksentyeva M.V., Omelyanovskyy V.V., 2010).

Studies conducted in different countries have disclosed a clear relationship between the organization and quality of care for patients with stroke and mortality and disability (Stahovskaya L.V. et al., 2009).

Despite advances in diagnosis and treatment of patients with cerebral vascular disease, ischemic and hemorrhagic stroke remains a major cause of death and disabilities among adults. At the same time, some surgical tactics and surgery technique issues are still open. However, improvement of surgical techniques for successful treatment of strokes is not enough. Examination and treatment of patients with stroke requires execution of corresponding algorithm of actions by physicians of different specialties. Timely hospitalization of a patient to a specialized hospital is necessary, as well as comprehensive instrumental examination, including use of X-ray (computer - CT) and magnetic resonance imaging (MRI), early start of resuscitation, mandatory involvement neurologists, emergency physicians, neurosurgeons, rehabilitators in diagnosing and treating (Zakaryavichus G. et al., 2002; Laputyn V.G., 2004; Krylov V.V. et al., 2007).

However, patients with suspected acute stroke (hemorrhagic, ischemic) are admitted to hospitals with different levels of capabilities, and neuro-visualization methods are used only in half cases. In some hospitals there are no conditions for intensive care. In big cities there is no advisory neurosurgical care; in neurosurgical departments neurosurgical activity is low. A similar pattern is characteristic not only for Ukraine but also for other states (Gusev E.I. and et al., 2003).

The purpose of the article is to examine activities of medical institutions of Kyiv providing neurosurgical care, and to develop ways to optimize these institutions to improve the provision of neurosurgical care to residents of Kyiv and to bring it to international standards.

Research object and methods
According to the order of the Main Department of Health (HUOZ) of Kyiv City State Administration of 05.07.2012 № 281, an audit of the following neurosurgical departments of Kyiv has been conducted: Kyiv City Clinical Hospital Ambulance (KMKL Emergency ambulance), Olexandrivs'ka City Clinical Hospital (OMKL), KMKL No. 1 and No. 17 in the period of 2007-2011, the audit results have been analyzed.

Results and Discussion
All neurosurgical departments of Kyiv worked under regulations approved by the Chief of Kyiv HUOZ, by orders of Chief Doctors of hospitals, regulations on neurosurgical departments, centres, job descriptions. The departments’ staff used clinical protocols of Ministry of Health of Ukraine and local protocols developed.

Neurosurgical service’s bed capacity
Neurosurgical Service of Kyiv (HUOZ system) consists of four neurosurgery departments: 3 departments are in KMKL Emergency ambulance (neuro-vascular for 50 beds, traumatic brain injury for 60 beds, spinal neuro-traumatic for 30 beds) and neurosurgical department in OMKL for 50 beds, as well as 10 neurosurgical beds within a neuro-center based on KMKL No. 1, neurosurgical beds in the department of poli-trauma of KMKL No. 17. Totally in all institutions of Kyiv HUOZ, 210 neurosurgical beds are operating (including 10 in OMKL under repairing).

During the period of 2007-2011 in departments of Kyiv neurosurgery 26467 patients were treated, including 8255 operated.

Staffing
In general, 73 neurosurgical doctors are working in neurosurgical departments in Kyiv, including 1 MD, 16 PhDs, all physicians are certified for proficiency.

There is understaffing of departments as for nursing and paramedical staff.

Work of the 1st neurosurgical department (traumatic brain injury)
KMKL Emergency Ambulance (2007-2011)
In the period of 2007-2011, the greatest number (2069) of patients has been treated in the 1st neurosurgical department (traumatic brain injury) of KMKL Emergency Ambulance, the second place belongs to neurosurgical department of OMKL (1764). The same trend is observed as for the number of operated patients (846 and 695 respectively). The largest range of operations has been carried out in the department of brain injury of KMKL Emergency Ambulance (941), in spinal (704) and neuro-vascular departments (655). The highest mortality during this period was registered in the neuro-vascular department of KMKL Emergency ambulance (12.6%), the lowest - in the spinal department (3.5%). The biggest number of operated patients died in the department of brain injury (97 people) and neuro-vascular department (74 people) of KMKL Emergency Ambulance.

It should be noted that all neurosurgical department worked with overload, serving the population of Kyiv in urgent mode and 24 hours a day. However, equipping all neurosurgical departments requires quality improvement: purchasing new equipment (angiographs, two projection electronic converters, neurosurgical endoscopic racks, operating X-ray transparent tables, etc.). Not all departments of neurosurgery have possibility to conduct neuro-imaging 24 hours a day (MRI, CT, spiral CT (SCT)), ultrasound, especially during surgery.

After analyzing performance of neurosurgical care inpatient department there was observed that in OMKL, among all pathologies with which patients were hospitalized, cerebrovascular diseases take a leading position, and their share is increasing over the years. In 2007, it was 66.5%, in 2010 and 2011 it reached 82%.

Proportion of patients with traumatic brain injury in 2007 was 13.2%, in 2010 - 3.1%, in 2011 - 3.3%; with brain tumours - 6.2% in 2007 and 2.4 % - in 2011. The share of surgery (of the total number of patients treated with this nosology) at cerebrovascular diseases in 2007 was 40.1%, and in 2010 increased to 53.1%; with a traumatic brain injury in 2007 - 48.5 %, in 2011 - 55.2%; with tumours of the brain in 2007 - 64.4%, in 2011 - 65.1%. At that, postoperative mortality in 2007 was 10.3%, and in 2011 dropped to 9.8%.

Most patients were brought to the department by emergency ambulance: in 2007 - 56.6%, in 2010 - 74.8%, in 2011 - 61.3%.

The share of patients hospitalized within time <6 h since start of acute period in patients with cerebrovascular disease in 2007 was 27%, in 2010 - 29%, in 2011 - 31%. Within time <8 h about 41% was hospitalized in 2007 and 46% - in 2011.

Propotion of patients operated within time <6 h from the beginning of acute period in 2007 was 28%, in 2010 and 2011 it increased significantly - up to 62 and 83%, respectively. To the 1st neurosurgical department of KMKL ambulance mainly patients with traumatic brain injury arrived in a urgent manner: in 2007 - 2468 persons, in 2008 - 2311, in 2009 - 2238, in 2010 - 2361, in 2011 - 2069 patients. These were patients with brain concussion (42, 38.4, 43.7, 39.7 and 40%, respectively), brain contusion (18.9, 12.8, 18.7, 19.03, 20.28 %, respectively), intracranial hematomas (15.3, 14.46, 15.43, 14.67, 14.36% respectively), as well as the residual effects of recovering from traumatic brain injury and others. Almost all patients were examined in an urgent manner involving CT, spiral CT or MRI within the first 2 h after arrival and within the first 4 hours after onset. About 95% of patients in the early hours have been consulted by related experts. Around 80% of patients were operated within time <2 h, and appr. 20% more - within the first 6-10 hours. Postoperative lethanslness was 13.61, 14.98, 11.74, 10.39, 11.47% respectively. Causes of postoperative mortality were serious brain damage.

**Work of the IInd (neuro vascular) neurosurgical department of KMKL Emergency Ambulance (2007-2011)**

Planned hospitalization to the IInd neurosurgical department of KMKL Emergency Ambulance in 2007 made 355 persons, in 2008 - 545, in 2009 - 476, in 2010 - 590, in 2011 - 597. Among them there were patients with brain tumours, vertebrogenic disorders, dicsirculatory encephalopathy and other diseases. About 50% of these patients were operated (48.4, 46.7, 63, 41.3, 39.6% respectively by years). Postoperative mortality in this group of patients was 3.5, 2.02, 2.82, 2.5, 2.9% respectively.

During this period 1344, 1118, 1066, 1000, 981 patients by years respectively were hospitalised in urgent order. The vast majority of them are patients with brain stroke. So, the department accepted 556, 456, 364, 328 and 322 ischemic stroke patients, respectively by years. Absolute number of patients with hemorrhagic stroke was lower during this period: 251, 236, 270, 239, 247 persons respectively by years.

About 50% of these patients were operated (48.4, 46.7, 63, 41.3, 39.6% respectively by years). Postoperative mortality in this group of patients was 3.5, 2.02, 2.82, 2.5, 2.9% respectively.

Surgical activity in this period constituted 21.2-32.7%. Within time <2 h after admission there were operated 10, 6, 4, 3, 13%; <4 hours - 18, 12, 10, 7, and 20%; <6 h - 22, 16, 14, 12 and 12%, respectively by years.

The largest is the proportion of patients who were operated within time <8 h after admission (30, 26, 22, 28, 20% respectively over the years) which does meet current requirements.

The volume of surgery included removal of epidural hematoma (in absolute terms over 5 years - 585 cases), subdural hematoma removal (177), removal of stroke hematoma (474), endarterectomy (83), redressment of internal carotid artery (32), clipping of saccular aneurysms (46), exclusion of arteriovenous malformations (44).

Postoperative mortality during this period was 20.7, 32.7, 28.5, 24.3, 22.5% respectively by years. The main causes of mortality were: destructive cerebral edema, recurrent acute cerebrovascular accident, myocardial infarction, severe brain injury, multiple organ failure.


Over this period 1284, 1098, 1087, 1151, 1089 patients were hospitalised to the third branch of KMKL Emergency Ambulance, including in urgent order - 769, 685, 720, 705, 636 patients respectively by years. 429, 333, 298, 408, 305 patients respectively were hospitalised with traumatic injuries of the spine (various departments); with a brain injury - 412, 378, 390, 379, 321 patients by years. In addition, the department received spinal patients with tumors of the spinal cord and spinal vascular lesions of the spinal cord, inflammation of the spinal cord, spinal canal stenosis.

Totally, in 2007-2011, based on the mentioned department, 670, 582, 541, 587, 630 patients were operated respectively by years. Postoperative mortality was 8.81, 8.76, 7.02, 4.94, and 4.0% respectively by years.

The main causes of postoperative mortality were: severe spinal cord contusion, rising swelling of the spinal cord, cardiovascular and pulmonary failure, aspiration syndrome, associated trauma.
The structure of the surgery included surgery in acute spinal vertebral injuries (13.4%), surgery in the subacute period of vertebral spinal injuries (17.95%), osteochondrosis (46.6%), surgery in closed traumatic brain injury (5.9%) and other surgeries (16.5%). Almost all patients who arrived in urgent order, were operated within 2-10 hours after arrival to the hospital.

Most patients were brought by Emergency Ambulance (99.5-99.7%).

Neurosurgical care for patients in KMKL No. 1

In the neurosurgical department of KMKL No. 1 during the above period, both urgent (113, 107, 91, 102, 104 by years respectively) and planned (309, 215, 181, 193, 224) care was provided.

The structure of pathologies with which patients were hospitalized in an urgent order, a large proportion were cerebral aneurism, hemorrhagic stroke (28.32, 26.17, 32.96, 31.38, 32.69% respectively by years), ischemic stroke (36.28, 35.51, 38.47, 37.25, 37.51% respectively by years). There was a small number of patients with transient ischemic attacks, chronic cerebrovascular insufficiency and dyscriculatory encephalopathy. These were mainly young adults (aged 20-40). Most patients came to the hospital within the first 2-6 hours (up to 30% - within the period 2-4 h) after the disease manifestation.<50% of patients were checked using MRI (CT, SCT).

Surgery activity was 33.63, 7.48, 12.09, 10.78, 4.8% respectively in 2007-2011. The following surgeries were completed: removal of intracerebral stroke hematomas (26.3, 87.5, 50, 9.9, 100, 60% respectively), ventriculotomy (5.26, 12, 5, 9.09, and 20%, respectively ) and a small amount of brain decompression, endarterectomy of the carotid arteries. After surgery mortality ranged from 4.42 to 0%.

Routinely, during this period there were hospitalized significantly more patients (309, 215, 181, 139, 224 persons by years respectively), mainly on neurocancer diseases, traumatic injuries and their consequences, degenerative diseases of the spine. Surgery activities each year was > 90%, postoperative mortality 1-0%.

It should be noted that within <2 h of onset, there were hospitalized > 50%, within <6 h - > 70% of patients. Within the first 4 h, > 90% patients were investigated using neuro-visualization methods. Over 80% of patients were operated in urgent order: acute intracerebral hematoma removed, epidural hematoma, subdural hematoma, ventriculotomy, cranioplasty, applying diagnostic burr holes.

Corporotomy with front spondylothesis at the cervical spine was also performed, occipitospondylothesis, transarticular stabilization, toracotomy and others.

Analysis of Kyiv neurosurgical departments' performance

Thus, after analyzing Kyiv neurosurgical departments’ performance, we note that within 5 years (2007-2011) Emergency Ambulance delivered up to 90% of patients in urgent order, appr. 95% of patients were hospitalised to all OMKL; to the Ist neurosurgical department of KMKL Emergency Ambulance - 95%; to the IIId department - 71% (including appr. 30% of patients hospitalized in a planned manner); to the IIIrd department – in an urgent order - appr. 58%; in a planned order – appr. 42% of patients. In urgent order, appr. 86% of patients were hospitalised to neurosurgical department of KMKL No.1 and appr. 95% - to KMKL No.17.

Surgical activity in neurosurgical departments of all hospitals was stable: in OMKL it was appr. 42%, in the Ist department of KMKL Emergency Ambulance - 48%, in the IIId department – appr. 28% in urgent order and 48% - in planned order, and in the IIIrd department surgical activity was 48%, in KMKL No.1 - 13.8% in urgent order and appr. 80% - in planned order, in KMKL No.17 – appr. 20% in urgent order.

Postoperative mortality in OMKL during 5 years averaged 11%, in the Ist neurosurgical department of KMKL Emergency Ambulance - 12%, in the IIId department - 26%, in the IIIrd - 6.2%, in KMKL No.1 - 1.8%, in KMKL No.17 - 10%.

It should be noted that in 2007-2011, patients with cerebrovascular disease mainly came to OMKL (594, 789, 848, 930, 1454 people respectively by years), to the IIId department of KMKL Emergency Ambulance (828, 723, 676, 574; 581 by years respectively) and to KMKL No. 1 (113, 107, 91, 102, 104 respectively by years).

Number of patients with stroke who received surgical or conservative treatment in OMKL is 2 times higher than in KMKL Emergency Ambulance. Due to the presence of angiographic machine, CT, MRI, spiral CT, apparatus for ultrasonic Doppler, working around the clock, in OMKL the number of operated patients with stroke is the greatest exactly in this hospital, where thrombolytic therapy was also introduced.

Given the current demands to create neuro-vascular centres with multi-functional teams for providing emergency medical assistance (within the "therapeutic window") with a neurologist, neurosurgeon, cardiologist, anaesthesiologist, functionalists, such centres can be created in two hospitals (OMKL, KMKL Emergency Ambulance) provided equipping them with comprehensive neuro-imaging equipment, including angiograph (with continuous operation). That is, these centres should be established according to the availability of required equipment in these hospitals working around the clock, of intensive care departments, neurology and neurosurgery departments.

In addition, in Kiev there must be an authority defining categories of patients requiring treatment in these facilities, the mentioned hospitalizations and the results of treatment should be started to be monitored.

There should be established departments at these centres for early rehabilitation, as well as city rehabilitation departments (centres), as well as patients’ neurosurgical clinical examination system in Kiev.

According to the order of the Ministry of Health of Ukraine of 03.08.2012 № 602 "On approval and implementation of medical and technical documents on standardization of medical care for ischemic stroke", three vascular centres are planned to be established in Kyiv. These centres will be established according to the availability of required operating equipment in certain hospitals, as well as intensive care units, neurological and neurosurgical units. To ensure full communication between the vascular centres of Kyiv (for communication and their readiness for normal work), for providing urgent x-ray-endovascular care for patients, special vehicles (reanimobiles) will be allocated, as well as on the basis of one of the centres, a monitoring service will be arranged.

The monitoring service is to ensure the coordination of care for not only cerebral but also cardiac thrombolysis, x-ray-vascular neurosurgery. The monitoring service should also fix issues of logistics in each case (with constant monitoring of the traffic situation in the city), monitor readiness of vascular centres to perform their functions, as well as transfer of patients if any technical malfunctions, etc. The monitoring service should make a preliminary analysis of the clinical situation according to complex algorithms followed by warning vascular centres' personnel.

The monitoring service of cardiovascular centres should be directly connected to the monitoring service of Emergency Ambulance station for cooperation in providing emergency medical care to patients with acute cerebrovascular and cardiovascular diseases.

Conclusions
1. Neurosurgical departments have enough capacities for the city to meet the needs of providing a highly urgent and planned neurosurgical care.
2. Equipment of all neurosurgical departments in Kyiv needs qualitative improvement, tools need to be replaced, new equipment need to be purchased (angiographs, two projection electrical transformers, neurosurgical endoscopic racks, surgery X-ray transparent tables).
3. There is a need to create neuro-vascular centres (departments) with multidisciplinary teams providing emergency neurosurgical care to residents of Kyiv, to create a monitoring service to coordinate vascular centres with a view of implementing of thrombolytic therapy in all the centres.

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Literature:

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Summary. The article contains a description of the regulatory framework in Kyiv city concerning the provision of neurosurgical care. Morbidity, disability and mortality of neurosurgical diseases, staff training level, rendering of medical care at the hospital stage, the perspectives for development of the system of medical care in neurosurgical diseases and vascular disease in particular are reviewed.
Key words: neurosurgical care, morbidity, disability, mortality, regulatory framework, human resources, development perspectives.

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