Annotation

on the dissertation work of Shamshiev Almas Sagyndykovich on the topic "Predicting and preventing the development of ischemic stroke at the PHC level in patients undergoing revascularization surgery on the carotid arteries ", submitted for the Doctor's degree (PhD) specialty 6D110200 - "Public health"

Relevance of the research topic

Stroke is the leading cause of disability and the second leading cause of death worldwide, the overall burden of stroke is increasing despite innovations in stroke treatment due to population growth, improved survival rates, and an aging population increases the prevalence of stroke (Virani S. S. et al., 2021). This poses challenges for healthcare professionals as the demand for treatment, rehabilitation and support services for stroke survivors increases (Global Burden of Disease Study, 2016).

Due to the chronic course, as well as the serious severity of this pathology, there is an obvious need to clarify the causes and outcomes of morbidity, as this has important implications for patients, moreover, it is important for issues such as health planning and management (Bewtra et al., 2013; Lamb, Christopher Andrew et al., 2019). The relevance of this problem is also determined by the fact that in Kazakhstan the incidence of strokes is high, amounting to 370 cases per 100,000 populations. Mortality and disability rates are also quite high. The mortality rate is 108 cases per 100,000 populations, which is 26 % of the total mortality rate. Stroke is the leading cause of disability, with a rate of 104.6 per 100,000 populations (Krishnamurthi R.V. et al., 2013). It is known that in Kazakhstan, more than 450 thousand people suffer a stroke every year, while up to 200 thousand cases end in death, and of the surviving patients, up to 80% remain disabled of varying severity (Zhusupova A. S. et al., 2013). Severe carotid artery stenosis is one of the most significant risk factors for ischemic stroke. Carotid artery stenosis is the etiological cause of approximately 15% of ischemic strokes, and approximately 1-3% of the population has moderate to high carotid artery stenosis (de Weerd M. et al., 2010). Treatment of carotid stenosis includes optimization of medical risk factors for stroke (for example, hypertension, hypercholesterolemia, diabetes, and tobacco use), antithrombotic drugs, and revascularization by carotid endarterectomy or carotid stenting.

Within the framework of the implementation of the goal of the Strategy 2050 and the Plan of the Nation "100 concrete steps", the Address of the President of the Republic of Kazakhstan "Third Modernization of Kazakhstan: global competitiveness", in accordance with the State Program for the Development of Healthcare of the Republic of Kazakhstan "Densaulyk" for 2016-2019 and the State Program for the Development of Healthcare of the Republic of Kazakhstan for 2020-2025, the gradual development of the healthcare system It is aimed at improving the quality of medical services, as well as their accessibility to all segments of the population. General coverage implies a broad understanding of the range of services required to maintain an appropriate level of well-being and health in the population, including those related to circulatory diseases, such as STEMI.

Purpose of the dissertation research

Objective: To substantiate predictive assessments of risk factors for ischemic stroke after revascularization operations and to develop preventive measures to prevent recurrent vascular events in patients at the primary health care level.

Research objectives

1. To evaluate short-and long-term outcomes in patients after carotid revascularization surgery, taking into account concomitant cardiovascular diseases, risk factors, and the frequency of postoperative complications.
2. To identify and evaluate risk factors for stroke after revascularization operations on the carotid arteries, as well as to develop predictive estimates of risk factors for ischemic stroke to optimize management and follow-up of patients.
3. To determine the role of primary health care specialists in accompanying patients after carotid artery revascularization, as well as to identify key barriers and factors affecting the implementation of preventive measures.
4. To evaluate the opinion of specialists in inter-level interaction on the management and prevention of complications in patients who have undergone revascularization operations on the carotid arteries.
5. To develop recommendations at the PHC level aimed at improving the effectiveness of medical care for people who have undergone carotid artery surgery and assess the impact of these interventions among the target group.

Research methods

The study covers a combination of qualitative and quantitative methods to comprehensively study the problem and achieve the goals set, which are divided into main tasks.

1. To evaluate short-and long-term outcomes in patients after revascularization operations on the carotid arteries, taking into account concomitant cardiovascular diseases, risk factors and the frequency of postoperative complications:

- Retrospective analysis of medical records: data from patients who underwent revascularization operations on the carotid arteries were analyzed to identify demographic, clinical and behavioral risk factors (age, gender, ethnic composition, arterial hypertension, diabetes mellitus, smoking, dyslipidemia, etc.). This allowed us to establish statistically significant relationships between risk factors and the degree of stenosis.

- Statistical analysis: logistic regression

- Instrumental methods: duplex vascular ultrasound (DUI), magnetic resonance angiography (MRA) or computed tomography (CT).

2. Identify and evaluate risk factors for stroke after revascularization operations on the carotid arteries, as well as develop predictive estimates of risk factors for ischemic stroke to optimize management and follow-up of patients:

- Retrospective follow-up: Follow-up of a group of patients undergoing carotid endarterectomy or carotid artery stenting to assess short-term (30 days) and long-term (up to 5 years) outcomes (stroke, myocardial infarction, death, restenosis). In our

study, we wanted to compare a cohort of patients who underwent CEA and stenting, as well as separated outcomes of surgical treatment. A total of 223 patients were included in the study, of which 179 underwent CEA and 44 underwent stenting.

- Statistical analysis: Using survival methods (log-rank analysis) to assess the impact of comorbidities, risk factors, and complications on outcomes.

3. Determine the role of primary health care specialists in accompanying patients after carotid artery revascularization, as well as identify key barriers and factors affecting the implementation of preventive measures:

- Development of predictive models: Using the methods of logistic regression, decision trees to develop models for predicting the risk of stroke based on the identified risk factors. This was a retrospective study with a five-year depth of coverage. A total of 223 people who underwent revascularization surgery were included in the study within a 5-year period.

4. To evaluate the opinion of specialists in inter-level interaction on the management and prevention of complications in patients who have undergone revascularization operations on the carotid arteries:

- Survey of primary health care professionals to assess their opinion on the quality and accessibility of medical care and rehabilitation. A total of 30 vascular surgeons who encounter patients after carotid artery surgery at the outpatient level participated in our survey. The median age of specialists was 31 (25-35) years, and the length of service was 7 (4.25-9.75) years

5. To develop recommendations at the PHC level aimed at improving the effectiveness of medical care for people who have undergone carotid artery surgery:

– Based on the results of quantitative and qualitative analysis, we developed clinical recommendations and algorithms for primary health care aimed at preventing stroke and restenosis, as well as optimizing the organization of medical care.

Object of study

Patients who underwent revascularization surgery on the carotid arteries.

Subject of study

Clinical and epidemiological characteristics, risk factors and organizational aspects of ischemic stroke prevention in patients after revascularization, with an emphasis on the role of primary health care in the management and observation of these patients.

Main points to be defended

1. Identification of statistically significant predictors and combinations of risk factors (hypertension, TIA, diabetes) associated with the development of stroke within 5 years after revascularization operations on the carotid arteries makes it possible to stratify patients according to the degree of risk and optimize the tactics of managing and monitoring these patients in primary health care: prepare personalized visit schedules, include in the "Patient's school " with repeated testing of knowledge and adherence to therapy.

2. Based on the opinions of primary care specialists, key organizational deficits were identified: a low level of integration of primary health care into the inter-level route of patients after revascularization operations, insufficient continuity between

the inpatient and outpatient stages, weak interprofessional communication, and limited resources for follow-up. There is a direct link between the experience of specialists and their activity in the implementation of preventive measures, which requires taking into account the personnel and motivational potential in the development of management decisions.

3. Analysis of the opinion of specialists-vascular surgeons involved at the level of polyclinic care revealed a number of problems in the organization of medical care and rehabilitation of patients after revascularization operations at the PHC level, including insufficient availability of psychological care, specialists in physical therapy, educational programs and diagnostic procedures, as well as insufficient patient commitment to rehabilitation activities. Optimizing care requires a comprehensive approach that includes expanding access to specialists, implementing educational programs, using a mobile application to monitor treatment and rehabilitation,as well as strengthening control over medication intake and implementing lifestyle recommendations.

Description of the main research results

A retrospective analysis showed that people from Central Asia dominated the cohort of hospitalized patients with suspected carotid artery disease in Kazakhstan (2017-2019). The main factors for the development of severe carotid stenosis were male gender, overweight, smoking, and hypercholesterolemia. Among Asians, male gender was shown to be a protective factor (OR=0.673 [95% CI: 0.524–0.881]), and among Slavs as a risk factor (OR=1.823 95% CI: [1.248–2.664]). According to BMI, overweight (OR = 1.719; 95%CI: 1.167–2.422) and obesity (OR=1.376; 95% CI: 1.078–2.016) were significant factors associated with the risk of stenosis (≥ 50%) only in the "other ethnic group". Smoking was identified as an increased risk factor among Slavs (OR=3,789; 95%CI: 2,174–5,618) at p=0.001. The presence of hypercholesterolemia was identified as a statistically associated risk factor among Slavs (OR=2,357; 95% CI: 1,793–4,547). These results require further research to develop a prevention strategy to address these risk factors in the target group.

In our work, we conducted a long-term follow-up of patients after undergoing surgery on the carotid arteries, which allowed us to track and identify some risk factors for stroke.

This was a retrospective study with a five-year depth of coverage. A total of 223 people who underwent revascularization surgery were included in the study. Within 5 years, 28 people had a stroke. We applied logistic regression to examine the associations of risk factors with the five-year risk of stroke in patients. Statistically significant risk factors for the development of ischemic stroke within 5 years after carotid revascularization were: arterial hypertension (p=0.038), diabetes mellitus (p<0.001), and a history of TIA (p=0.030).

To study the influence of factors in combination, we used the "Decision Tree" method (Construction method: EXHAUSTIVE CHAID, which allows you to use variables in nodes of several levels). According to the results of this method, in the presence of diabetes, there is a 27.6% risk of stroke within 5 years after carotid artery surgery, and in the combination of diabetes and hypertension, the risk is 71%.

However, if the patient has diabetes but does not have hypertension, while if the patient takes statins, the risk is 27.3%.

The logistic regression procedure and the Decision Tree method used for data analysis showed acceptable results, but both methods showed low sensitivity (89% and 99%, respectively) with high specificity (57% and 18%, respectively).

The study of the comprehensive assessment of the involvement of primary health care professionals in the prevention of ischemic stroke in patients undergoing carotid revascularization interventions covered key aspects: the role of primary health care in post-stroke prevention, participation in patient monitoring, knowledge of risk factors, preventive measures, barriers to work and educational needs.

The high recognition of the role of PHC was emphasized by the PHC staff. More than 85% of doctors and almost 100% of nurses consider the participation of primary health care to be critical for the prevention of recurrent stroke. This indicates a formed professional understanding of the importance of the outpatient link in the patient's inter-level route.

About 30% of respondents identified actual participation in the observation of this group of patients: doctors: ~28% participate regularly, ~39% — sporadically; nurses: ~35% participate (146 out of 420), while a third-only occasionally. This indicates incomplete integration of primary health care into the patient's postoperative route.

In the course of the study, priority risk factors were identified. Both doctors and nurses most often indicated: arterial hypertension, dyslipidemia, diabetes mellitus, smoking.

The pilotschool for patients undergoing revascularization surgery has shown high efficiency in the short term. Most patients reported a significant improvement in their quality of life during the first three months after completing the program. All patients (100%) implemented the recommendations they received in their daily lives. The most common changes were blood pressure monitoring and taking recommended medications. More than 73% of participants at all stages of observation noted the usefulness of information, ease of presentation of material and interesting classes. Although most quality-of-life measures improved in the first months, by month 12 there was a gradual decline on the SF-36 scale, especially in aspects such as life activity, social functioning, and pain intensity. To maintain a long-term positive effect, it is recommended to conduct repeated training activities 6 and 12 months after the end of the program.

The scientific novelty of the study is determined by the following provisions:

1. For the first time in Kazakhstan, a multi-factor analysis of the risk of developing carotid artery stenosis was conducted, where key behavioral and metabolic risk factors were reliably identified: hypercholesterolemia, smoking, obesity, with an emphasis on a personalized approach adapted to the patient's behavioral context.

2. Statistically significant predictors of the development of ischemic stroke within 5 years after carotid revascularization were identified: arterial hypertension, a history of TIA and diabetes mellitus, with the calculation of the odds ratio (OR) and confidence interval levels, which made it possible to create a prognostic risk assessment model at the PHC level.

3. Based on the opinions of PHC specialists, recommendations were developed and proposed aimed at preventing ischemic stroke and carotid artery restenosis in individuals after revascularization operations and optimizing the organization of medical care for patients; a comprehensive module of the educational program for the "Patient's School"was developed and tested.

Practical significance of the work

1. The prognostic model of stroke occurrence after revascularization operations obtained in the course of this work, which takes into account the presence of hypertension, TIA, and diabetes mellitus in patients, can be used as a scientific basis for making managerial decisions to optimize the organization of patient care.

2. The results of a survey of PHC specialists on the organization of medical care for patients and the developed algorithm for patient routing after carotid artery surgery are recommended for use by local public health authorities and other specialized health organizations responsible for methodological guidance and analysis of the incidence of STEMI to improve policy and management in the organization of medical care for patients with STEMI.

3. A comprehensive module of the educational program for the "Patient's School" was developed and tested, including blocks on lifestyle changes, increasing treatment adherence, a digital component - a mobile application for self-monitoring blood pressure, reminders about taking medications, registering well-being and transmitting data to the district doctor.

Personal contribution of a doctoral student

– Formulation of the scientific problem and setting the aim of the study, reflecting the existing lack of scientific data in Kazakhstan regarding the role of PHC in the management of patients after carotid revascularization.

– Development of an original research design that includes both quantitative and qualitative methods, as well as the definition of inclusion and exclusion criteria, sample construction and organizition of data collection in a retrospective cohort.

– Independent collection, processing, and analysis of clinical and epidemiological data, including stratification by degree of stenosis, comorbidities, and behavioral factors.

– Development of a predictive model of the risk of ischemic stroke based on multivariate analysis, which allowed us to propose a stratified approach to monitoring patients at the PHC level.

– Assessment of the opinions and experience of primary care physicians and vascular surgeons on routing, continuity, and accessibility of medical care, based on author's questionnaires.

– Development and testing of the educational module "Patient Schools", which includes not only full – time training, but also a digital component-a mobile application for self-monitoring and interaction with a doctor.

– Authorship in scientific publicationsях, including articles in journals indexed in Scopus.

Conclusions

1. Short-term and long-term outcomes after carotid endarterectomy (CEA) and

stenting were not statistically different. Differences related to preoperative diagnosis: duplex scanning was more often used before CEA (74.3% vs. 47.7%, p=0.007), angiography — before stenting (97.7% vs. 74.3%, p=0.005). Severe stenosis (>70%) was more common in the CEA group (67.7% vs. 46.5%, p=0.006), moderate (50-70%) — in the stenting group (46.5% vs. 16.5%). These differences indicate the need to standardize diagnostic protocols and create interdisciplinary commissions to select the optimal treatment method, as well as determine the tactics of patient management in the postoperative period.

2. Prognostic models of stroke risk showed that hypertension (OR=1,519; 95%CI: 1,023–5,258), TIA (OR=1,579; 95%CI: 1,045–7,387**)**, and diabetes (OR=2,120; 95%CI: 1,390–6,234**)** were statistically significant predictors of stroke risk within 5 years after revascularization surgeries. If you have diabetes, there is a 27.6% risk of stroke within 5 years after carotid artery surgery, and if you have diabetes and hypertension, the risk is 71%. However, if the patient has diabetes but does not have hypertension, and the patient takes statins, the risk is 27.3%. When determining the prognostic model of stroke risk, it is important to pay attention to the combination of diseases in patients who have undergone revascularization operations on the carotid arteries and the organization of medical care at the PHC level.

3. The results of a survey of PHC doctors and nurses confirmed the high importance of their participation in the system of secondary prevention of ischemic stroke: over 85% of respondents recognized the critical role of PHC in the patient's inter-level route. At the same time, only a third of specialists participate in regular follow-up of patients after revascularization operations on the carotid arteries, which indicates insufficient integration of outpatient care into the postoperative management stage. Most often, respondents identified arterial hypertension, dyslipidemia, and diabetes mellitus as key risk factors, and also focused on behavioral and drug-related aspects of prevention. Weak inter-level coordination and low patient adherence are identified as barriers to effective follow-up. Statistically significant correlations were found between work experience and involvement in postoperative follow-up, as well as between the perception of the importance of primary health care and the breadth of preventive measures used. This demonstrates the importance of experience and professional motivation in implementing preventive strategies at the PHC level.

4. The survey of vascular surgeons also revealed key problems at the PHC level in preventing recurrent stroke in patients after revascularization operations on the carotid arteries: limited access to specialized specialists (rehabilitation specialists, psychologists, physical therapy specialists), low patient adherence to risk factor control, and insufficient availability of diagnostic and educational resources. In response to the identified barriers, a patient routing algorithm has been developed that provides for a phased follow-up, distribution of responsibility between levels of the healthcare system, and strengthening the role of PHC in interdisciplinary interaction.

5. The organization of a pilot program for patients undergoing revascularization surgeries has shown high efficiency in the short term. Most patients reported a significant improvement in their quality of life during the first three months after completing the program. All patients (100%) implemented the recommendations they received in their daily lives. The most common changes were blood pressure

monitoring and taking recommended medications. More than 73% of participants at all stages of observation noted the usefulness of information, ease of presentation of material and interesting classes. Although most quality-of-life measures improved in the first months, by month 12 there was a gradual decline on the SF-36 scale, especially in aspects such as life activity, social functioning, and pain intensity.

The main results of the dissertation research were presented at the following conferences:

1. III Congress of the Kazakhstan Society of Vascular Surgeons "Modern approaches to angiology and vascular Surgery", April 11-14, 2018-Semey, Kazakhstan
2. International scientific and practical conference of students and young scientists "Apsatar Readings:" The Future of medicine. Challenges and Solutions", April 24, 2019-Almaty, Kazakhstan
3. The IX Annual International Scientific-Practical Conference “Medicine Pressing Questions” May 6-8, Baku, Azerbaijan

Publications

5 works were published on the topic of the dissertation, including 4 articles in journals recommended by the Committee for Control in the field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 1 article in the journal, indexed by the Scopus: Family Medicine and Primary Care Review database (pISSN 1734-3402, eISSN 1734-3402, Scopus Cite Score-1.1, percentile - 37).

Scope and structure of the dissertation

The dissertation is presented on 130 pages, consists of an introduction, 5 sections, concluding part, conclusions, practical recommendations and 5 appendices. The work is illustrated with 30 tables and 36 figures. The list of references contains 141 sources.