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CLINICAL CASE OF CORRECTION OF VENTRICULAR SEPTAL DEFECT COMBINED WITH AN ANOMALY OF THE SYSTEMIC VENOUS CONNECTION OF THE INFERIOR VENA CAVA

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Abstract

Interrupted inferior vena cava is a rare condition that can occur either in isolation or in combination with asplasia or polysplasia syndromes. Abnormal development of systemic veins is closely related to atrial situs. In levocardia, there are signs of abdominal organ inversion, which is called visceral situs. The present paper describes a clinical case of a infant with a large interventricular septal defect combined with interrupted inferior vena cava with azygous continuation of visceral situs ambiguous heterotaxy. The defect plasty was performed at the operation, and the complete venous cannulation required for artificial circulation was performed by the correctly chosen method of drainage of the superior venous system - through the auricle of the right atrium and the inferior venous system - through a separate hepatic vein cannulation, with a good clinical result.

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The authors declare that they have no conflicts of interest

Keywords:
interrupted inferior vena cava, heterotaxy, case report, congenital heart disease, heart surgery

Төменгі қуысты көктамырының жүйелік көктамырлық қосылу аномалиясы мен қарыншааралық перденің ақауын түзетудің клиникалық жағдайы

Қуатбеков Қ.Н.[1], Егізеков А.Л.[1], Мишин А.В.[1], Мұсағалиев Д.Т.[1], Байжігітов Н.Б.[1], Сүйеубеков Б.Е.[1], Ботабеков Т.Е.[2]

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Аңдатпа

Төменгі қуысты көктамырдың үзілісі - бұл сирек кездесетін ауру, ол оқшауланған, аспления немесе полиспления синдромдарымен бірге пайда болуы мүмкін. Жүйелік тамырлардың қалыптан тыс дамуы жүрекшелік situs-пен тығыз байланысты. Левокардияда висцеральды ситус деп аталатын іш қуысының инверсиясының белгілері бар. Бұл жұмыста қарыншааралық перденің үлкен ақауы бар емшектегі нәрестенің клиникалық жағдайының сипаттамасы, төменгі қуыс көктамырдың үзілуімен және жалғасы azygos венасы висцеральды гетеротаксиямен situs ambiguous. Операцияда ақау пластикасы жасалады, ал жүрек-өкпе айналымы кезінде қажетті толық көктамырлық канюляция жоғарғы көктамырлы жүйені дренаждаудың дұрыс таңдалған әдісімен – оң жақ жүрекшенің құлақшасы және төменгі көктамырлық жүйе арқылы – бауыр көктамырының жеке канюляциясы арқылы, жақсы клиникалық нәтижемен жүзеге асырылады.

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Клинический случай коррекции дефекта межжелудочковой перегородки в сочетании с аномалией системного венозного соединения нижней полой вены

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Аннотация

Перерыв нижней полой вены – редкое заболевание которое может встречаться как изолированно, так и в сочетании с синдромами аспления или полиспления. Аномальное развитие системных вен тесно связано с предсердным situs. При левокардии обнаруживаются признаки инверсии брюшных органов, которое называют висцеральным ситусом. В настоящей работе представлено описание клинического случая грудного ребёнка с большим дефектом межжелудочковой перегородки в сочетании с перерывом нижней полой вены и продолжением в вена azygos висцеральной гетеротаксией situs ambiguous. На операции выполнена пластика дефекта, а необходимая при искусственном кровообращении полная венозная канюляция осуществлена правильно выбранным способом дренирования верхней венозной системы – через ушко правого предсердия и нижней венозной системы – через отдельную канюляцию печёночной вены, с хорошим клиническим результатом.

Ключевые слова: *перерыв нижней полой вены, гетеротаксия, клинический случай, врождённые пороки сердца, операция на сердце*

Introduction

Inferior vena cava tear (IVC) is a rare disorder occurring in isolation or in combination with asplenia or polysplenia syndromes [1]. The subhepatic part of the IVC is absent, indicating a violation of the fusion of the yolk and subcardinal fetal parts of the IVC; it is replaced by a dilated unpaired or semi-unpaired vein that continues into the thorax, either into the superior vena cava or into the brachiocephalic veins.

Cardiac systemic venous return of blood is normally through the vena cava and coronary sinus. The most important anomalies of the vena cava appear to be an extra left superior vena cava (LSVC) and rupture of the LSVC with unpaired continuation, sometimes draining into the left atrium (LA) with clinical cyanosis. In all variants there is total abnormal drainage of hepatic veins directly into the right atrium (RA) or into the LA. In 60% of cases there are bilateral superior vena cava (SVC) draining into bilateral morphologically left atria. LSVC can drain into the coronary sinus. In 90% of patients there is an unpaired continuation of the IVC into the SVC. In situs inversus, the systemic venous return is a mirror image of the normal one. Unpaired continuation of IVC in left atrial isomerism significantly influences tactical and technical decisions in hemodynamic correction of unifocalizing malformations. Among many IVC anomalies, double and left IVC occur with the frequency of 3% and 0.5%, respectively. In patients with double IVC, the right and left IVC ascend from the iliac veins on both sides of the spine to the level of the hepatic veins. These anomalies are technically important for a surgeon.

The most significant anomalies of IVC are subhepatic rupture of IVC with unpaired continuation and abnormal drainage of IVC into the left atrium, causing cyanosis. The rupture of the IVC with unpaired continuation being the most frequent anomaly of the IVC occurs in 0.6% of patients with congenital heart disease (CHD) and usually with left atrial isomerism. The hepatic part of IVC is absent, below the level of renal veins it is normal. Without taking the hepatic veins, the IVC is drained instead of the RA through the dilated unpaired vein into the right superior vena cava (RSVC) or occasionally into the RA. The hepatic veins drain directly to the RA. Neparate continuation of IVC is often combined with complex cyanotic CHD, less often with simple malformations, it is not registered in asplenia syndrome. This defect creates difficulties during cardiac catheterization and can complicate surgical correction of the underlying malformation. A wide RSVC is a sign of an unpaired continuation of the IVC into the SVC. This anomaly itself does not require correction. During surgery, the SVC should be cannulated with a wide catheter. It is necessary to avoid overlapping the site where the unpaired vein enters the SVC. When the IVC is drained through the left unpaired vein into the LSVC and the coronary sinus, cannulation of the vena cava system should be done through the coronary sinus. The LSVC can also be directly cannulated. When cannulation of abnormal systemic veins is technically difficult, hypothermic perfusion with a single

venous cannula in RA is advisable. Direct venous cannulation through the opened RA can be performed during hypothermic arrest of the artificial circulation. Abnormal drainage of hepatic veins can be partial or complete. Normally, veins from both lobes of the liver drain into the IVC. Partial drainage of hepatic veins directly into the right atrium is most common in right atrial isomerism, but also in situs solitus or situs inversus. Cases of partial drainage into the coronary sinus have been described. Total abnormal hepatic venous connection is observed in left atrial isomerism. Veins can drain into the heart in one or two trunks.

Abnormalities can be diagnosed on echocardiography (ECHO), CT, MRI [2]. Anomalies of hepatic vein inflow play a significant role in the immediate and long-term results of Fontan surgery, as they are not included in the pulmonary circulation. The positive effect consists in decompression of the systemic venous return, which is manifested by reduced duration and intensity of pleural exudation. The negative long-term effect consists in the development of intrahepatic venous connections and intrapulmonary fistulas, leading to increased right-left shunting. Interrupted inferior vena cava with azygotic continuation is associated with cardiovascular and extracardiac anomalies, the most frequent anomalies being cardiac malformations and visceral heterotaxy [3, 4]. Angiographic confirmation of the anatomy of the unpaired system is important when planning surgical correction of patients with left isomerism [5].

Case study

A one-year-old 9 kg baby was admitted to our clinic on 11.30.2022 with the diagnosis: Situs ambiguous. VSD. PFO. Interrupted inferior vena cava with azygous continuation. PH., with complaints of dyspnea and rapid fatigue when walking. Basic diagnostic tests were performed: ECG, ECHO, catheterization cardiopulmonoangiography. The defect was confirmed by ECHO data: Levocardia. Situs ambiguous. Left-sided location of the liver. IVC was not dilated, a break above the confluence of the renal veins with continuation in the unpaired vein and SVC. SVC in the RA, not dilated. LA 1.8 cm. The pulmonary veins flow into the LA. Valve apparatus, coronary arteries without pathology. Aorta: 1,1 cm. PA 1.2 cm; right branch 0.9 cm, left branch 0.8 cm. RV 73%. Average pressure in the RV was 25 mmHg. Interventricular septum: perimembranous aneurysm, aneurysm gate diameter 0.8 cm with defects of 0.2 cm and 0.36 cm. Interatrial septum: defect with a defect closer to the mouth of the PFO 0.1 cm. Cardiac cavities: left parts of the heart are moderately dilated.

To clarify the cardiac anatomy and extracardiac vascular structures, we performed inferior cavography, angiopulmonography, tonometry from the pulmonary artery trunk: the common femoral vein was catheterized with the following pressure records in mmHg: in the LA trunk 25/11, mean 17; in the RV 25/16 mean 14; in the RA 11/4. There is patency throughout the entire length of the IVC, and there is an infiltration of the IVC into the SVC (Figure 1). Angiopulmonography: the trunk and branches of the PA are of normal diameter, passable, the end branches of the PA can be traced throughout (Figure 2), the parenchymal phase is uniformly enhanced on both sides. The left and right pulmonary veins are drained into the LA in the phase of the levogram. In the phase of the left-side diagram, there is an intensive discharge of contrasting blood from the LA cavity into the RA cavity due to the ASD.

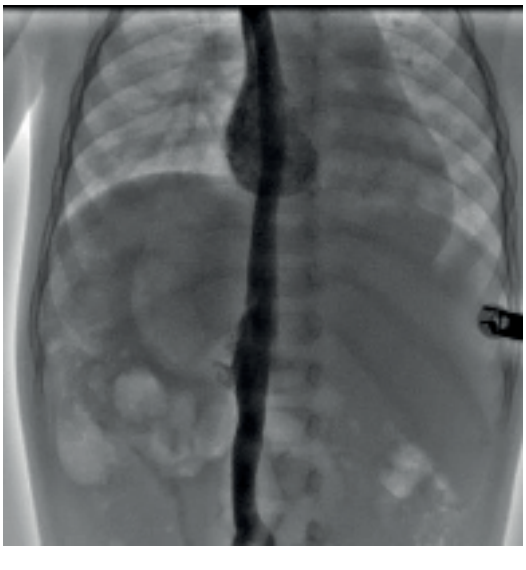
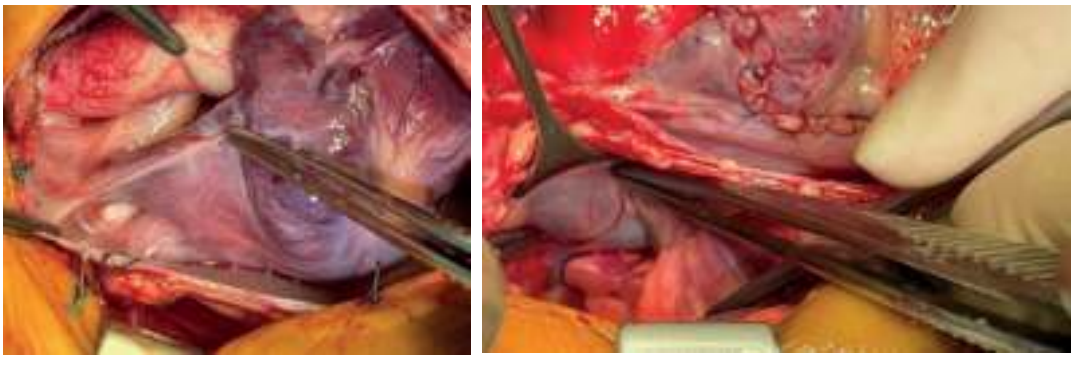


Figure 1.
Angiogram. Interrupted inferior vena cava with azygous continuation

Figure 2.
Angiogram. The trunk and branches of the PA

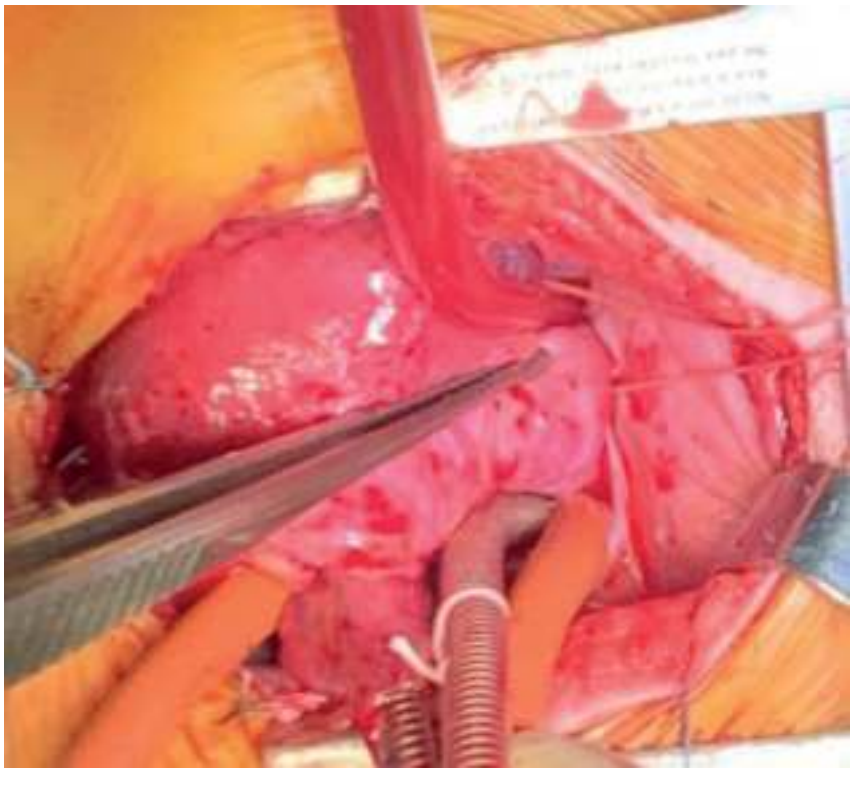
12/09/2022 a planned surgical correction was performed under the conditions of cardiopulmonary bypass: VSD plasty with an autopericardial patch, suturing PFO. Intraoperatively: The right heart sections were enlarged in size. The PA trunk was identified as Ao in diameter, unstressed, the vena azygos (Figure 3A) was dilated, on the right pleural cavity side there was an infiltration of the IVC - rupture of the IVC with azygos-continuation (unpaired continuation) into the SVC (Figure 3B), the hepatic vein mouth was identified in the place of its normal location in the RA.

Figure 3.
Intraoperative photo:
A - IVC dilated at the site of vena azygos inflow;
B - interrupted inferior vena cava with azygous continuation



The aorta was cannulated, separate cannulation of IVC through the RA ear, separate cannulation of the hepatic vein (Figure 4) with access to complete artificial circulation.

Figure 4.
Intraoperative photo.
Cannulated hepatic vein



Standard VSD with autopericardial patch was performed. There were no complications, the patient was admitted to the Intensive Care Unit. On control ECHO: interventricular septum was tight, left ventricular ejection fraction was 71%. First degree tricuspid valve insufficiency. The right parts of the heart were moderately dilated. No fluid was detected in the pericardium. On the first postoperative day the child was transferred to a specialized department, a week later he was discharged.

Discussion

Abnormal development of systemic veins is closely related to atrial situs. In situs solitus and situs inversus, the spectrum of anomalies is limited and predictable. The coronary sinus is always present, and the probability of significant venous return anomalies is low. However, in atrial heterotaxy and isomerism, there are marked abnormalities of atrial anatomy (common atrium) and venous return. In these conditions they are frequent, bizarre, but relatively standard depending on situs. If there is normal levocardia, no obvious CHD and at the same time there are signs of abdominal organ inversion, this condition in practice is also called visceral situs, assuming that the inversion should be complete, mirror, by the type of isolated dextrocardia. In visceral situs, even in the absence of obvious CHD, there is a significantly increased risk of abdominal heterotaxy and, accordingly, of such formidable complications as biliary atresia, gastrointestinal stenosis and atresia, incomplete bowel turn, intestinal volvulus [6].

In our case, the child in combination with CHD showed levocardia, situs ambiguous with inversion of internal organs (liver on the left). Interrupted inferior vena cava with azygous continuation was determined during the operation, it was decided to drain the superior venous return through the RA ear, and considering a satisfactory hepatic vein mouth flowing into the RA, we managed to cannulate it in isolation, which allowed us to perform total venous return of the body.

Conclusion

In our clinical case we encountered a rare anomaly of combined congenital heart pathology and interrupted inferior vena cava with azygous continuation of visceral situs ambiguous heterotaxy. The task we had to accomplish during VSD radical correction to drain the entire venous system as completely as possible during the artificial circulation was successfully achieved due to the correctly chosen method of drainage of the superior venous system - through the right atrial auricle and the inferior venous system - through separate cannulation of the hepatic vein, with a good clinical result.

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METHOD FOR OPTIMIZING CT VOLUMETRY OF THE LIVER IN RELATED TRANSPLANTATION

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Abstract

Computed tomography volumetry is the standard method for preoperative estimation of liver volume. Despite the development of various software, the trend towards discrepancy in the calculation of liver volume compared with any of the methods and intraoperative graft weight remains.

The aim of the study *was to optimize the manual method of CT volumetry donor' liver, determine its accuracy and compare it with the standard method.*

Material and methods. *A single-center prospective study including data from 60 liver donors who underwent computed tomography, CT volumetry and liver transplantation at the National Scientific Surgery Center named after A.N. Syzganov for the period 2018-2022.*

Results*. The Pearson correlation between the right liver lobe volume estimated by the standard method and the graft weight was 0.730 (p<0.01), the Pearson correlation between the liver volume calculated by the optimized method (-10 HU) and the graft was 0.757 (p<0.01), and the correlation between the optimized method (-20 HU) and graft weight – 0.860 (p<0.01). The Pearson correlation coefficient of the optimized method (-20 HU) is statistically significantly higher than the correlation coefficient of the standard manual method (p=0.026), the difference between the correlation coefficient of the optimized method (-10 HU) and the standard one is statistically insignificant (p=0.375). The degree of discrepancy between the optimized method (-20 HU) was 8.4%, manual method - 12.7%. There is a statistically significant difference between the degree of discrepancy between the standard manual and optimized method (-20 HU) (p=0.029).*

Conclusions*. Optimization of the manual CT volumetry method with a decrease in the liver density threshold by 20 HU demonstrated a statistically significantly high correlation coefficient with the graft weight, and also significantly reduced the degree of discrepancy.*

Keywords:
Computed tomography, CT volumetry, liver transplantation, liver donor, optimization.

Туыстық трансплантация кезінде бауырдың КТ-волюметриясын оңтайландыру әдісі

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Аңдатпа

Компьютерлік-томографиялық волюметрия – бауыр көлемін операция алдында бағалауға арналған стандартты әдіс. Түрлі бағдарламалық жасақтамалардың дамуына қарамастан, трансплантаттың интраоперациялық салмағы мен бауыр көлемін есептеудің кез-келген әдістерімен салыстырғанда сәйкессіздік тенденциясы сақталып отыр.

Зерттеудің мақсаты *– донор бауырының КТ-волюметриясы мануальды әдісін оңтайландыру, оның нақтылығын анықтау және стандартты әдіспен салыстыру.*

Материалдар мен әдістері. *2018-2022 жж. аралығында А.Н. Сызғанов атындағы Ұлттық ғылыми хирургия орталығында бауыр трансплантациясы және КТ-волюметрия, Компьютерлік томографиядан өткен 60 бауыр донорының мәліметтерін қамтитын бір орталықтық проспективтік зерттеу.*

Нәтижелері*. Стандартты әдіс арқылы есептелген бауырдың оң жақ үлесінің көлемі мен графт массасы аралығындағы Пирсон корреляциясы 0.730 (p<0.01) құрады, оңтайландырылған әдіс (-10 HU) арқылы есептелген бауыр көлемі мен графтың арасындағы Пирсон корреляциясы 0.757 (p<0.01), ал оңтайландырылған әдіс (-20 HU) арасындағы корреляция (p<0.01) құрады.*

Түйін сөздер:
Компьютерлік томография, КТ-волюметрия, бауыр трансплантациясы, бауыр доноры, оңтайландыру.

Оңтайландырылған әдістің (-20 HU) Пирсон корреляциясының коэффициенті стандартты мануальды әдіс корреляциясының коэффициентіне қарағанда статистикалық тұрғыдан жоғары (p=0.026), оңтайландырылған әдіс (-10 HU) пен стандартты әдіс корреляциясының коэффициенттері арасындағы айырмашылық статистикалық тұрғыдан елеусіз (p=0.375). Оңтайландырылған әдістің айырмашылық дәрежесі 8,4%-ды, ал мануальды әдістің алшақтық дәрежесі 12,7%-ды құрады. Стандартты мануальды және оңтайландырылған әдістің (-20 HU) айырмашылық дәрежелері арасында статистикалық тұрғыдан маңызды айырмашылық байқалады (p=0.029).

***Қорытынды**. Бауырдың тығыздық шегін 20 HU-ға азайта отырып КТ волюметрияның мануальды әдісін оңтайландыру графт салмағы мен корреляциясының статистикалық жоғары коэффициентін көрсетті, сондай-ақ алшақтық дәрежесін едәуір төмендетті.*

Метод оптимизации КТ-волюметрии печени при родственной трансплантации

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Ключевые слова:
Компьютерная томография, КТ- волюметрия, трансплантация печени, донор печени, оптимизация.

Аннотация

Компьютерно-томографическая волюметрия является стандартным методом предоперационной оценки объема печени. Несмотря на развитие различных программных обеспечений, тенденция к расхождению в расчёте объема печени по сравнению с любым из методов и интраоперационным весом трансплантата сохраняется.

***Цель исследования** - оптимизировать мануальный метод КТ-волюметрии печени донора, определить его точность и сравнить со стандартным методом.*

***Материал и методы.** Одноцентровое проспективное исследование, включающее данные 60 доноров печени, прошедших Компьютерную томографию, КТ-волюметрию и трансплантацию печени в Национальном научном центре хирургии имени А.Н. Сызганова за период 2018-2022 гг.*

***Результаты.** Корреляция Пирсона между объемом правой доли печени рассчитанный стандартным методом и массой графта составила 0,730 (p<0,01), корреляция Пирсона между объемом печени рассчитанный оптимизированным методом (-10 HU) и графтом составила 0,757 (p<0,01), а корреляция между графтом и оптимизированным методом (-20 HU) – 0,860 (p<0,01). Коэффициент корреляции Пирсона оптимизированного метода (-20 HU) статистически значимо выше, чем коэффициент корреляции стандартного мануального метода (p=0,026), различие между коэффициентом корреляции оптимизированного метода (-10 HU) и стандартного - статистически незначимо (p=0,375). Степень расхождения оптимизированного метода (-20HU) составило - 8,4%, мануального метода -12,7%. Отмечается статистическое значимое различие между степенью расхождения стандартного мануального и оптимизированного метода (-20 HU) (p=0,029).*

***Выводы.** Оптимизация мануального метода КТ-волюметрии с уменьшением порога плотности печени на 20 HU продемонстрировало статистически значимо высокий коэффициент корреляции с весом графта, а также значимо снизила степень расхождения.*

Introduction

Owing to technical improvements and the standardization living donor liver transplantation (LDLT) has become as effective as cadaveric liver transplantation. Inadequate liver volume is among the most common cause donor exclusion [1]. Accurate quantification of the liver volume necessary for avoiding metabolic mismatches between donor and recipient which may result in "small for size" of "large -for-size syndrome" and ultimately in an increased risk of graft rejection [2] The remnant volume in living donors should be at least 30% of the liver volume since donor safety has absolute priority [3]. CT volumetry has been widely used for preoperative graft volume measurement in LDLT [4].

Liver transplantation from a related donor in Kazakhstan has been carried out since 2011[5].

Heymsfield S. et al. [6] were the first to calculate preoperative liver volume in 1970, since then many software packages have been developed.

Our previous study showed that the manual method was more accurate than the semi-automatic method, had a lower degree of discrepancy compared to the semi-automatic and automatic methods [7]. However, the degree of discrepancy of the manual method still remained high – 12,7%. In this study, we considered methods for optimizing the manual method, compared it with the standard one, and determined its accuracy.

The aim of the study was to optimize the manual method of CT volumetry donor' liver, determine its accuracy and compare it with the standard method.

Materials and methods

Single center prospective study including data from 60 liver donors. All donors underwent Computed tomography of the abdominal with the introduction of a contrast agent, CT volumetry and liver transplantation at the Hepatopancreobiliary Surgery and Liver Transplantation Department of the National Scientific Center of Surgery named after. A.N. Syzganov for the period 2018-2022 years.

This study was approved by the ethics committee of the Kazakhstan National Medical University named after. S.D. Asfendiyarov (No. 3 (109) dated March 31, 2021).

Inclusion criteria were adult transplantation (over 18 years of age) with a right-sided hepatectomy and a left lobe volume of at least 35%. Patients who had CT scans at other hospitals were excluded. All liver donors had healthy livers, and patients with hepatic steatosis were also excluded from the study.

Computer Tomography

Multiphasic CT was performed in the cranio-caudal direction using a 160-slice MDCT scanner (Canon Aquilion, Prime SP) and slice thickness in the axial and coronal planes: 5 mm (pre-contrast) or 3 mm (post-contrast) with no interslice gap. A soft tissue B20 kernel was used in all cases. All patients received 1.6 ml/kg of body weight (corresponding to 560 mg Iodine/kg) of a non-ionic, iso-osmolar dimeric contrast medium (Iodixanol, Visipaque 320, GE Healthcare, Inc., Milwaukee, WI). Pre-warmed contrast medium (CM) was administered.

Images were obtained during the hepatic arterial, portal-venous and delayed phases (25–40, 70 and 180 s, respectively, after the start of contrast medium injection).

Portal-venous dataset from all examinations was transferred from Picture Archiving and Communication System (PACS), and volume of the right lobe of the liver was calculated using Volume analysis software.

The estimation was carried out in calculation of the total liver volume and calculation of the left lobe plus segment I in order to establish the remnant liver volume. Resection planes for liver segmentation passed through the right side of the middle hepatic vein and gallbladder bed. The resulting volume was further compared with the intraoperative weight of the graft. Estimated liver volumes are presented in milliliters (ml), graft weight in grams (g).

Standard manual CT volumetry method on the Vitrea -Volume Analysis workstation

On each axial scan, the outline of the liver was drawn manually with the mouse cursor using the pencil tool. The inferior vena cava, portal vein with major branches, and gallbladder were excluded from the ROI. Total liver volume and residual liver volume were obtained by summing the volume at each section. To determine the volume of the liver without vessels, an allowable density threshold was set in the toolbar, which corresponded to the density of the liver, thus the volume of vessels was excluded. The minimum threshold was 30 HU., the maximum varied based on the density of each liver. The program changed the coverage intensity of the isolated liver parenchyma based on the given density. Thus, the maximum density threshold was set, which covered the entire liver parenchyma without blood vessels. The results were saved as a screenshot (Figure 1).

Figure 1. Calculation of the volume of the liver by the standard method. The maximum density threshold is 180 HU

Optimized CT volumetry method on the Vitrea workstation

With the optimized method, the volume calculation was carried out in the same way as with the standard one: on each axial scan, the contour of the liver was drawn manually with the mouse cursor using the pencil tool. Vessels were also excluded from the study area. For optimization, we changed the allowable density threshold. The minimum remained the same 30 HU. For the optimization method, we lowered the maximum density threshold by 10 HU and by 20 HU. The results obtained were saved as a screenshot (Figure 2).

Figure 2.
Calculation of the liver volume by the optimized method. Maximum density threshold
a) 170 HU
b) 160 HU

Intraoperative graft weight measurement

At the back table after resection, the graft was flushed by a surgeon with saline and histidine-tryptophan-ketoglutarate (Custodiol) solutions to remove blood. Afterward, the graft was weighed on electric scales.

Statistics: The Kolmogorov-Smirnov test was used to determine the normality of the sample distribution. For descriptive statistics, mean ± standard deviation (SD) was used. The liver volume calculated by the standard method and two optimization methods (-10 HU) and (-20 HU) was compared with the weight of the graft. The discrepancy of each program was presented as a percentage (%), the 100% value of which was the weight of the graft. Pearson's correlation was also applied to compare each of the method.

A p value <0,05 was used to determine statistical significance. Statistical analysis was carried out using the SPSS program (IBM corp., 19 version).

Results

The average volume of the whole liver estimated by the standard method was 1322±

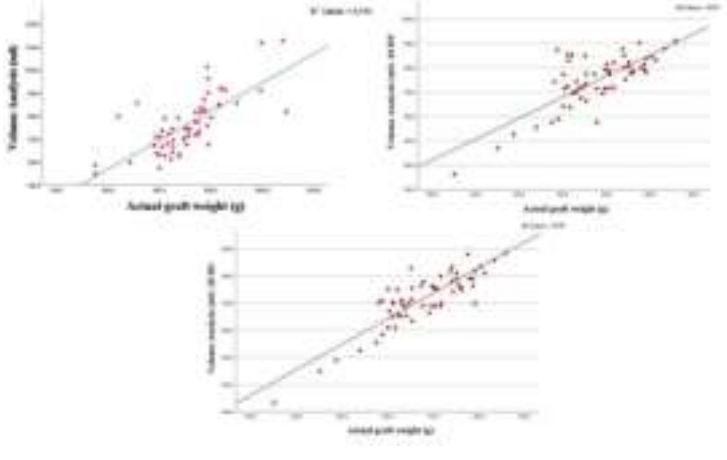

Figure 3.
Pearson correlation between
a) standard manual method with graft weight,
b) optimized method (-10 HU) with graft weight,
c) optimized method (-20 HU) with graft weight

There is a statistically significant difference between the correlation coefficient of the standard and optimized manual method (-20 HU) (p=0,026) and a non-significant difference between the standard and optimized (-10 HU) method (p=0,375).

The degree of discrepancy between the optimized method (-20 HU) was 8,4%, the manual method -12.7%. There is a statistically significant difference between the degree of discrepancy between the standard manual and the optimized method (-20 HU) (p=0,029).

Discussion

Martel et al. [8] reported in their study that a discrepancy of about 5% between the calculated volume and the actual graft weight can affect the clinical outcome. Binomial proportions and 95% confidence intervals were created for this comparison. When using measured volume as a reference standard, estimated volume has been shown to result in a clinically significant overestimation in up to one-third of patients, which may influence clinical decision making to prevent liver failure or small size syndrome.

These syndromes include residual liver weight unable to maintain adequate organ function, resulting in hyperbilirubinemia, coagulopathy, ascites, encephalopathy, and hypoalbuminemia, and ultimately postoperative death.

Depside of investigation of the automated method Park R et al. in his work studies the accuracy of the automatic method using a deep learning algorithm (deep learning assisted), however, the automatic program shows a large error in comparison with the mass of the graft and is 17% [4].

Mayer et al. [9] in his study, he provides data on the absence of statistically significant differences between the studied volume of the liver with a small slice thickness (<3 mm) and with a larger slice thickness (>3 mm). In our study, we performed CT volumetry on 3 mm slices.

Xie T et al. [10] in his work was studies Couinaud automatic segmentation during liver resection; in this work, an automated program is compared with a manual one. However, there are no statistically significant results when comparing the two methods, moreover, the authors state that the manual method remains the gold standard for calculating liver volume.

In our study, the optimized method (-20 HU) showed a percentage of discrepancy of 8.4%, despite the fact that this figure is more than 5%, it still showed more accurate results compared to the previous methods we studied. Thus, the optimized method helps to reduce the risk of postoperative complications.

Some studies have compared the estimated liver volume and graft weight with and without blood [11]. In the present study, the weight of the actual graft was measured intraoperatively after blood drainage. When assessing the volume of the liver in each program, vessels were excluded.

Manual assessment of liver volume included a liver density threshold. Despite the given liver density threshold, CT volumetry showed an overestimation of the results and, consequently, a discrepancy between the calculated liver volume and the transplant. Taking into account the influence of the above factors, the change in the rheological properties of the graft, we used a decrease in the liver density threshold as a method for optimizing CT volumetry.

To reduce the calculated liver volume and obtain more accurate results, we changed the maximum liver threshold: decreased by 10 HU and by 20 HU. Thus, a decrease in the density threshold by 20 HU demonstrated a statistically significant correlation coefficient with the weight of the graft, and also significantly reduced the degree of discrepancy to 8,4%.

Conclusion

The optimized manual method (-20 HU) showed a statistically significant Pearson correlation coefficient with graft weight, as well as a decrease in the degree of discrepancy compared to the standard manual method.

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The authors declare that they have no conflicts of interest

Keywords:
minimally invasive heart surgery, thoracoscopy, ventricular septal defect, cardiopulmonary bypass

THORACOSCOPY VERSUS STERNOTOMY IN THE CORRECTION OF A VENTRICULAR SEPTAL DEFECT: A SINGLE CENTER EXPERIENCE

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Abstract

Objective: *To compare the immediate outcomes of thoracoscopy and median sternotomy in patients undergoing ventricular septal defect repair.*

Materials and methods. *We analyzed 59 patients diagnosed with VSD who were operated on at the SCCCST from 2012 to 2021. All patients were divided into two groups: group 1 included patients in whom thoracoscopic access was used (n=27), group 2 included the method of complete median sternotomy (n=32).*

Results. *There were no statistically significant differences in complications in the postoperative period and no in-hospital mortality. The duration of the procedure and the duration of cardiopulmonary bypass in the thoracoscopy group were longer than in the sternotomy group. Blood loss during and after surgery was lower in the thoracoscopy group than in the sternotomy group. Hence, less blood and plasma transfusion was required in the thoracoscopy group than in the sternotomy group. The length of stay in the intensive care unit, the time spent on mechanical ventilation, bed days after surgery, the use of analgesics were statistically lower in the thoracoscopy group than in the sternotomy group. It should be noted that the length of the skin incision in patients in the thoracoscopy group was significantly less than in the second group.*

Conclusion. *Thoracoscopic approach for VSD correction is an effective and low-traumatic method that does not increase the risk of surgical complications. Routine use of this technique requires a study on a larger sample of patients.*

Қарыншалық перде ақауын түзетудегі стернотомия мен торакоскопия әдістерін салыстыру: бір орталықтың тәжірбиесі

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Аңдатпа

Жұмыстың мақсаты *- қарыншалық перде ақауларын қалпына келтіретін науқастардағы*

торакоскопияның тікелей нәтижелерін орта стернотомиямен саРесейлыстыру.

Материал мен әдістері. *Біз 2012-2021 жылдар аралығында Тараз қаласындағы кардиохирургия және трансплантология ғылыми-клиникалық орталығында ота жасалған қарыншалық перде ақау диагнозымен 59 науқасқа талдау жасадық. Барлық емделушілер екі топқа бөлінді: 1-топқа торакоскопиялық қолжетімділікті пайдаланған пациенттер (n=27), 2-топқа толық орта стернотомия әдісін қолданған пациенттер (n=32).*

Нәтижелер. *Операциядан кейінгі кезеңде және стационар ішілік өлім-жітімсіз асқынулар бойынша статистикалық маңызды айырмашылықтар болған жоқ. Операцияның ұзақтығы мен кардиопульмональды шунттау ұзақтығы торакоскопиялық топта стернотомия тобына қарағанда ұзағырақ болды. Операция кезінде және одан кейінгі қан жоғалту стернотомия тобына қарағанда торакоскопиялық топта төмен болды. Демек торакоскопиялық топта стернотомия тобына қарағанда аз қан және плазма азырақ құйылды. Реанимация бөлімінде болу ұзақтығы, өкпенің жасанды вентиляциясына кеткен уақыт, операциядан кейінгі төсек күндері, анальгетиктерді қолдану стернотомия тобына қарағанда торакоскопиялық топта статистикалық төмен болды. Айта кету керек, торакоскопия тобындағы науқастарда тері шрамы ұзындығы екінші топқа қарағанда айтарлықтай кіші болды.*

Қорытынды. *Хирургиялық асқынулардың қаупін арттырмайтын тиімді және төмен травматикалық әдіс ретінде қарыншалық перде ақау түзетудің торакоскопиялық әдісі қолданылады. Бұл әдісті күнделікті қолдану пациенттердің үлкен үлгісін зерттеуді талап етеді.*

Түйінді сөздер:
минималды инвазивті жүрек хирургиясы, торакоскопия, қарыншалық перде ақауы, жүрек-өкпе қан айдау аппараты

Торакоскопия против стернотомии при коррекции дефекта межжелудочковой перегородки: опыт одного центра

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Аннотация

Цель исследования *- сравнить непосредственные исходы торакоскопии со срединной стернотомией у пациентов перенесших коррекцию дефекта межжелудочковой перегородки.*

Материалы и методы. *Анализированы 59 пациентов с диагнозом ДМЖП, которые оперированы в «Научно-клинический центр кардиохирургии и трансплантологии» г. Тараз с 2012 по 2021 гг. Все пациенты разделены на две группы: в 1 группу вошли пациенты, у которых использован торакоскопический доступ (n=27), во 2 группе применен метод полной срединной стернотомии (n=32).*

Результаты. *Не было статистически значимых различий осложнений в послеоперационном периоде и без госпитальной летальности Продолжительность операции и длительность искусственного кровообращения в группе торакоскопии были больше, чем в группе со стернотомии. Кровопотеря во время операции и после операции была ниже в группе в торакоскопии, чем в группе стернотомии. Следовательно, что потребовало меньше переливание крови и плазмы в группе торакоскопии, чем в стернотомии. Продолжительность пребывания в отделении реанимации, время нахождения на искусственной вентиляции легких, койко-дни после операции, применение анельгетиков были статистически ниже в группе торакоскопии, чем в группе стернотомии. Следует отметить, что длина кожного разреза у пациентов в группе торакоскопии был достоверно меньше, чем во второй группе.*

Заключение. *Торакоскопический доступ при коррекции ДМЖП используется как эффективный и малотравматичный метод, не увеличивающий риск хирургических осложнений. Для рутинного использования данной техники необходимо изучение на более большой выборке пациентов.*

Конфликт интересов:
Авторы заявляют об отсутствии конфликта интересов

Ключевые слова:
минимально инвазивная хирургия сердца, торакоскопия, дефект межжелудочковой перегородки, аппарат искусственного кровообращения

Introduction

Ventricular septal defect is one of the most common congenital heart defects, accounting for 10% or 1.5 cases per 1000 newborns [1]. In 1954, Lilehei performed the first VSD repair through a median sternotomy. For many years, the median longitudinal sternotomy has remained the standard approach to the surgical treatment of VSD, which shows good postoperative results and minimal mortality. However, this method has a number of disadvantages: greater trauma, increased risk of wound infection, and a long stay in the hospital [2].

In recent years, fully endoscopic techniques have been developed for VSD closure using robotic surgical systems and without the use of robotics. [3, 4, 5, 7, 8, 9, 10]. However, still there is insufficient evidence for the use of thoracoscopy in VSD repair. In addition, the thoracoscopic method is not robotic and very few people in the world use this technology.

Purpose: to study the safety and efficacy of thoracoscopic VSD closure. We compared the immediate outcomes of thoracoscopy and median sternotomy in patients undergoing ventricular septal defect repair.

Materials and methods

We analyzed 59 patients diagnosed with VSD who were operated on at the Scientific and Clinical Center of Cardiac Surgery and Transplantology from 2012 to 2021. All patients were divided into two groups: group 1 included patients in whom thoracoscopic access was used (n=27), group 2 included the method of complete median sternotomy (n=32). The choice of surgical approach was based on the joint decision of the surgeon and the patient (Figure 1).

Inclusion Criteria: isolated ventricular septal defect; age more than 5 years; body weight more than 15 kg.

Figure 1. Correction of VSD through three ports

CPB was performed by cannulation of the right femoral artery and vein + right jugular vein under normothermia. To ensure adequate venous return, a vacuum was connected to the venous line, the negative pressure was uregulated from -20 to -40 mm Hg. The pericardium was dissected longitudinally, 3 cm above the phrenic nerve, from the ostium of the inferior vena cava to the ascending aorta. Then the superior and inferior vena cava were isolated, clamped with tourniquets.

CPB was carried out under normothermic conditions. The aortic clamp was placed on the ascending aorta through port 1. A Chitwood clamp was used to clamp the ascending aorta through port 1, but only to correct VSD. A cardioplegic cannula was passed through port 1 into the aortic root for blood cardiopelgia. Then, after cardiac arrest, an incision was made in the right atrium parallel to the atrioventricular sulcus, which were also taken on handles. A 3 mm long incision was made in the region of the oval fossa to relieve the left heart. The septal leaflet of the tricuspid valve was incisied towards the base to visualize a true VSD (Figure 2).

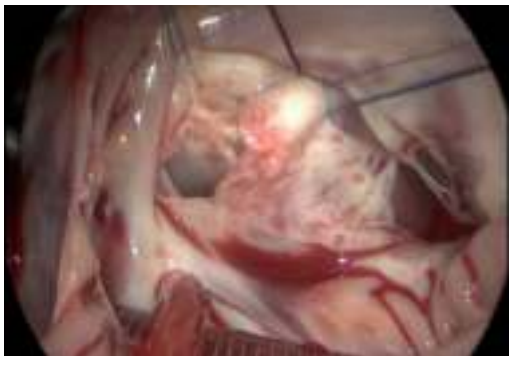

Figure 2. Perimembranous VSD

Next, VSD closure was performed using an autopericardium treated with glutaraldehyde. If the diameter of the defect was less than 4 mm, suturing was performed, if it was more than 4 mm, horizontal mattress stitches were placed on the linings using a 4/0 prolene threads. After closure of the VSD, the integrity of the septal leaflet of the tricuspid valve was restored (Figure 3).

Figure 3.
VSD closure

Sealing the incision in the region of the oval fossa and the right atrium. Prevention of air embolism was carried out using negative pressure through a catheter located on the ascending aorta, additionally by carbon dioxide insufflation. The Chitwood clamp was removed from the ascending aorta, then, after hemodynamic stabilization, cardiopulmonary bypass was completed. Transesophageal echocardiography was performed to check the patch. After the protamine sulfate is given, hemostasis was performed, a drainage tube was installed in port 3. Decannulation of the right femoral vein and artery, the right jugular vein. Layered sutures on the wound.

Patients of the 2nd group were operated by the standard method - complete median sternotomy using conventional anesthesia, under cardiopulmonary bypass with central cannulation of the great vessels.

Statistical analysis

Statistical processing of the material was performed using the IBM SPSS Statistics 26 software package (Chicago, IL, USA) and Jamovi (Version 1.6.9) https://www.jamovi.org. All quantitative variables were checked for the type of distribution using the Shapiro-Wilk test. Quantitative traits with an approximate normal distribution were described in the form of mean value and standard deviation (M±SD), in the case of a non-normal distribution, as a median and 25th, 75th percentile (Me (Q1-Q3)). Categorical data were described with absolute values and percentages. Comparison of two groups in terms of a quantitative indicator having a normal distribution, under the condition of equality of variances, was performed using the Student's t-test, with unequal variances, it was performed using the Welch t-test. Comparison of two groups in terms of a quantitative indicator, the distribution of which differed from the normal one, was performed using the Mann-Whitney U-test. Comparison of percentages in the analysis of four-field contingency tables was performed using Pearson's chi-square test (for expected phenomena values greater than 10), Fisher's exact test (for expected phenomena values less than 10). Comparison of percentages in the analysis of multifield contingency tables was performed using Pearson's chi-square test.

Results

Demographic and preoperative clinical characteristics did not differ in both groups (Table 1)

Table 1.
Demographic and preoperative clinical characteristics

Variable	Thoracoscopy (Group 1, n=27)	Sternotomy (Group 2, n=32)	P-value
Age, years (Me (Q1-Q3)	12(8 – 20)	13(9 – 22)	0,653
Gender, men, n (%)	15 (55,6)	17 (53,1)	0,852
Weight, kg (Me (Q1-Q3)	35(24 – 59)	32(24 – 59)	0,921
BSA (Me (Q1-Q3)	1(1 – 2)	1(1 – 2)	0,796
CHF II according to NYHA, n (%) III по NYHA, n (%)	12 (44,4) 15 (55,6)	12 (37,5) 20 (62,5)	0,589
Qp/Qs (Me (Q1-Q3)	2 (2 – 2)	2(2 – 2)	0,048
LV EF % M ± SD c 95% CI	63 ± 4 (62 – 65)	65 ± 4 (64 – 67)	0,081
PAP (Me (Q1-Q3)	22 (20 – 25)	23 (20 – 25)	0,706
CT ratio M ± SD c 95% CI	52 ± 4 (50 – 54)	53 ± 7 (51 – 56)	0,356

Note: Data presented as mean ± SD or n (%); Abbreviations: BSA, body surface area; CHF, chronic heart failure; NYHA, New York Heart; Association; Qp/Qs, ratio of Pulmonary -to- Systemic flow; LVEF, left ventricular ejection fraction; PAP, pressure in the pulmonary artery; MS, CT, cardiothoracic; CI, confidence interval.

Intraoperative data are presented in Table 2. The duration of the operation and the duration of cardiopulmonary bypass in the thoracoscopy group were longer than in the sternotomy group. Blood loss during and after surgery was lower in the thoracoscopy group than in the sternotomy group. Hence, less blood and plasma transfusion was required in the thoracoscopy group than in the sternotomy group.

Table 2.
Intraoperative variables

Variable	Thoracoscopy (Group 1, n=27)	Sternotomy (Group 2, n=32)	P-value
Operating time, min M±SD c 95% CI	256±26 (246–267)	211±42(195–226)	< 0,001
Aortic cross-clamping, min M±SD c 95% CI	69±17 (63–76)	33±12 (29–38)	< 0,001
CPB, min (Me (Q1-Q3)	94 (73–110)	57(44–68)	< 0,001
Intra-op blood loss, ml (Me (Q1-Q3)	100(100–100)	150(100–212)	0,004
Packed red blood cell, n (%)	11 (40,7)	20 (62,5)	0,095
FFP, n (%)	0 (0,0)	14 (43,8)	< 0,001

Note: Data presented as mean ± SD or n (%); Abbreviations: CI, confidence interval; CPB, cardiopulmonary bypass; FFP, fresh frozen plasma

There were no statistically significant differences in complications in the postoperative period and no in-hospital mortality (Table 3). The length of stay in the ICU, the time spent on mechanical ventilation, bed days after surgery, the use of analgesics were statistically lower in the thoracoscopy group than in the sternotomy group.

Table 3.
Details of various postoperative findings and complications

Variable	Thoracoscopy (Group 1, n=27)	Sternotomy (Group 2, n=32)	P-value
ICU, hours (Me (Q1-Q3)	16 (14–18)	21 (19–22)	< 0,001
Lung ventilation (Me (Q1-Q3)	105 (70–115)	180 (135–218)	< 0,001
PAP post-op (Me (Q1-Q3)	20 (20–23)	20 (20–23)	0,514
Total blood loss post-op, ml (Me (Q1-Q3)	170 (120–190)	190 (140–250)	0,027
analgesics total for three days, mg (Me (Q1-Q3)	650 (575–675)	750 (650–850)	< 0,001
incision length, mm (Me (Q1-Q3)	50 (42–55)	150 (128–180)	< 0,001
bed days post-op, days (Me (Q1-Q3)	7 (6–8)	8 (7–9)	< 0,001
MI, n (%)	0	0	1
Stroke, n (%)	0	0	1
AKF, n (%)	0	0	1
Reoperation, n (%)	0 (0,0)	2 (6,2)	0,495
Residual shunts, n (%)	1 (3,7)	1 (3,1)	1,000
Wound infection, n (%)	0 (0)	2 (6,2)	0,495
Cannulation site complications, n (%)	1 (3,7)	0 (0,0)	0,458
Hydrothorax, n (%)	2 (7,4)	2 (6,2)	1,000
Atelectasis, n (%)	2 (7,4)	0 (0,0)	0,205
AV block post-op	0	0	1
Pericardial effusion	0	0	1
Hospital mortality, n (%)	0	0	1

Note: Data presented as mean ± SD or n (%); Abbreviations: ICU, intensive care unit; PAP, pressure in the pulmonary artery; MI, myocardial infarction; AKF, acute kidney failure.

It should be noted that the length of the skin incision in patients in the thoracoscopy group was significantly less than in the second group.

Discussion

Ventricular septal defects (VSDs) are the most common type of congenital heart disease, and when indicated, surgical closure is considered the gold standard of care. [1]. The elimination of VSD is of fundamental importance to perform at an early age, however, the natural course of the defect may be asymptomatic, and some patients undergo correction at an older age. There are various surgical methods to eliminate VSD [2, 3]. For many years, the median longitudinal sternotomy, which provides wide access to the heart, has remained

the standard approach to the surgical treatment of VSD. However, this method has a number of disadvantages: greater trauma, lengthening of the patient's stay in the hospital, the likelihood of developing infectious complications, and a rough postoperative scar [3]. With the development of endovascular technologies, most VSDs can be eliminated using special devices, however, for patients who have some anatomical features: the chordal filaments of the tricuspid valve are attached to the edge of the VSD, the location of the VSD is close to the fibrous ring of the tricuspid and aortic valves, surgical treatment remains the main method of VSD closure [4]. As an alternative to complete sternotomy, many surgeons have begun to widely use thoracoscopic VSD correction using video endoscopic equipment [5,6]. Thoracoscopic access provides sufficient visualization of the main vessels of the heart and intracardiac structures, reduces pain, reduces the need for transfusion of blood components, preserves the anatomical integrity of the chest bone skeleton and can significantly reduce the skin incision, achieving an excellent cosmetic effect [7, 8].

Currently, many reports have shown that morbidity and mortality after thoracoscopic VSD correction is not inferior to other surgical approaches and is a feasible and safe procedure, while reducing surgical trauma, reducing blood loss, reducing postoperative pain and faster recovery [9,10]. The results of our experience confirm the same advantages in thoracoscopic correction of ASD and VSD in children and adolescents, although the average duration of CPB and aortic clamping in the thoracoscopy group was significantly longer than in the sternotomy group [11]. We attribute this to such features of thoracoscopy as a longer preparatory stage (cannulation of peripheral vessels, installation of ports), the use of long endoscopic instruments, work at a great depth of the wound at an unusual viewing angle of the operating surgeon through the monitor.

Indeed, the reduction in hospital days during VSD correction, which increases the throughput of the hospital as a result, reduces the consumption of hospital resources, however, at the initial stages of training, we encountered complications associated with cannulation of the femoral arteries to provide peripheral CPB.

Conclusion

Thoracoscopic approach for VSD correction is used as an effective and low-traumatic method that does not increase the risk of surgical complications. Routine use of this technique requires a study on a larger sample of patients.

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S100B PROTEIN CONTENT IN ISCHEMIC STROKE AND ITS PROGNOSTIC VALUE IN PATIENTS SUBJECTED TO INVASIVE INTERVENTIONS

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Conflict of interest:
The authors declare that they have no conflicts of interest

Keywords:
ischemic stroke; protein S100B; prognosis

Abstract

The aim of the study *is to determine the levels of the S100B protein in patients with ischemic stroke and evaluate its relationship with the size of brain tissue damage, stroke severity, and clinical outcomes.*

Materials and methods. *The study included 113 patients with acute ischemic stroke, hospitalized within the first day after its onset and subjected to invasive treatment. 101 men and 12 women were examined, including 32 at the age of 50-60, 64 at the age of 61-70, 17 at the age of 71-80. parameters and degree of functional deviations according to the NIHSS scale.*

Results. *The content of S100B during the initial determination on average for the group significantly exceeded the level determined in the control by 3.22 times (p=0.025). There was a direct dependence of the content of S100B on the size of the stroke. A moderate increase in the indicator on the 3rd day relative to the determined one on the 1st day and a decrease on the 7th day after the development of the stroke were revealed. There was no significant dependence of S100B content on the presence of comorbidities. The influence of the studied parameter on the degree of neurological deficit was determined only in patients with a large stroke size.*

Ишемиялық инсульттегі S100B протеинінің құрамы және инвазивті араласуларға ұшыраған науқастардағы оның болжамдық мәні

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Түйінді сөздер:
ишемиялық инсульт; ақуыз S100B; болжау

Аңдатпа

Зерттеудің мақсаты *- ишемиялық инсультпен ауыратын науқастарда S100B протеинінің деңгейін анықтау және оның ми тінінің зақымдану аймағының өлшемімен, инсульттің ауырлығымен және клиникалық нәтижелерімен байланысын бағалау.*

Материалдар мен тәсілдер. *Зерттеуге жедел ишемиялық инсультпен ауыратын, оның басталуынан кейінгі бірінші тәулікте ауруханаға жатқызылған және инвазивті емге ұшыраған 113 пациент қамтылды. NIHSS шкаласы бойынша 101 ер және 12 әйел тексерілді, оның ішінде 50-60 жаста - 32, 61-70 жаста - 64,*

71-80 жаста - 17. Параметрлері мен функционалдық ауытқу дәрежесі.

Нәтижелер. *Топ бойынша бастапқы анықтау кезінде S100B мазмұны орта есеппен бақылауда анықталған деңгейден 3,22 есе (p=0,025) айтарлықтай асып түсті. S100B мазмұнының инсульт өлшеміне тікелей тәуелділігі болды. 1-ші күні анықталғанға қатысты 3-ші күні көрсеткіштің орташа жоғарылауы және инсульт дамығаннан кейін 7-ші күні төмендеуі анықталды. S100B мазмұнының қатар жүретін аурулардың болуына айтарлықтай тәуелділігі болған жоқ. Зерттелетін параметрдің неврологиялық тапшылық дәрежесіне әсері тек инсульт мөлшері үлкен науқастарда анықталды.*

Содержание белка S100B при ишемическом инсульте и его прогностическое значение у больных, подвергнутых инвазивным вмешательствам

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Ключевые слова:
ишемический инсульт; белок S100B; прогноз

Аннотация

Цель работы *- определение уровней белка S100B у пациентов с ишемическим инсультом и оценка его связи с размером области поражения мозговой ткани, тяжестью инсульта и клиническими исходами.*

Материалы и методы. *В исследование включены 113 пациентов с острым ишемическим инсультом, госпитализированных в течение первых суток после его начала и подвергнутых инвазивному лечению. Обследован 101 мужчина и 12 женщин, из них в возрасте 50-60 лет – 32, 61-70 лет – 64, 71-80 лет – 17. Осуществляли определение белка S100B на 1, 3 и 7 сутки, а также комплекса клинико-лабораторных параметров и степени функциональных отклонений по шкале NIHSS.*

Результаты. *Содержание S100B при первичном определении в среднем по группе значимо превысило уровень, определенный в контроле, в 3,22 раза (p=0,025). Имелась прямая зависимость содержания S100B от размера инсульта. Выявлено умеренное повышение показателя на 3 сутки относительно определенного на 1 сутки и снижение на 7 сутки после развития инсульта. Не было выявлено существенной зависимости содержания S100B от наличия сопутствующей патологии. Влияние исследованного показателя на степень неврологического дефицита определено только у пациентов с большим размером инсульта.*

Introduction

Stroke is one of the leading causes of death in developed countries and up to now can take the first place among diseases leading to disability [1, 2]. The frequency of strokes in the population increases with age, up to 80% of them are ischemic [3].

There is a complex of pathogenetic mechanisms of ischemic stroke, including regular changes in cerebral hemodynamics and, further, metabolic disorders of nerve and glial tissues.

Recently, biochemical markers have become important in the identification of brain damage. Among the family of Ca2+-modulated proteins, S100B is mainly produced by astrocytes. S100B plays an important role in the growth, differentiation and repair of nerves [4, 5, 6, 7]. At physiological levels of concentration, this protein causes a protective effect, but elevated extracellular concentrations lead to cell damage, which may be associated with the pathophysiology of neurodegenerative processes [6]. With brain damage, S100B easily spreads into the cerebrospinal fluid, as well as into the blood [5, 6]. A number of studies have reported an increase in S100B levels due to trauma and various ischemic conditions [8].

Purpose of the study is to determine the levels of the S100B protein in patients with ischemic stroke and evaluate its relationship with the size of brain tissue damage, stroke severity, and clinical outcomes

Materials and methods

The study included 113 patients with acute ischemic stroke, hospitalized during the first day after its start. 101 men and 12 women were

examined, including 32, 61-70 aged 50-60 years years - 64, 71-80 years - 17.

The study was conducted in 2019-2022.

The control group consisted of 40 clinically healthy individuals, comparable in sex and age.

Criteria for inclusion in the study:

- instrumentally verified ischemic stroke;
- the full scope of the examination according to the Study Protocol;
- invasive intervention in all patients. Exclusion Criteria:
- hospitalization more than 24 hours after the onset of a stroke;
- the development of a stroke due to trauma, tumor, infectious process;
- the presence of a diagnosed brain tumor or a malignant neoplasm of another localization,
- transient ischemic attack,
- epidural, subdural or subarachnoid hemorrhage;
- history of head trauma or acute myocardial infarction within the last 3 months.

The risk assessment criteria for the examined patients included age, gender, concomitant cardiovascular risk factors, radiological data, and results of a neurological examination on the 1st, 3rd, and 7th days from the onset of a stroke. Neurological examinations were recorded using the NIHSS scale.

The NIHSS score was divided into main grades: 0–1: normal, 2–7: mild, 8–14: moderate, 15 and above: severe [9].

On the 1st, 3rd and 7th days from the development of a stroke, venous blood was taken (5 ml each). After incubation at room temperature for about 20 minutes to achieve complete coagulation, the serum was separated by 10 minutes of centrifugation at 4000 rpm. Serum samples were stored in Eppendorf tubes at -80°C until analysis. Results were reported in ng/mL after sample analysis according to the kit protocol using the ELISA method and the Human S100B ELISA kit (S100B; BioVendor Research and Diag). Nostic Products, Brno, Czech Republic).

Stroke subtypes were grouped as TACI (total anterior circulation stroke), PACI (partial anterior circulation stroke), POCI (posterior circulation stroke), and LACI (lacunar stroke) according to the OCSP classification [10].

Magnetic resonance imaging (MRI) was performed on an MRI tonometer (MAGNETOM Avanto; Siemens Healthcare, Erlangen, Germany) with a field strength of 1.5 T.

The volume of the lesion was calculated from the slice thickness of 5 mm in the axial plane and the gap between the cross sections of 1.5 mm in diffusion-weighted images. At discharge from the hospital, patients were divided into two groups of functional impairment according to the modified Rankin scale: normal-mild and moderate-to-severe [11].

Statistical analysis. The SPSS 20 program was used. Descriptive statistical methods (mean, standard deviation), Friedman test for repeated measures of several groups, Kruskal-Wallis test for comparison of several groups, Mann-Whitney U-test for comparison of two groups, correlation were used to evaluate the data. Spearman's test and Pearson's exact $\chi 2$ test for comparing qualitative data. The boundary level of the presence of statistical significance was taken $p<0,05$.

Results

The results were evaluated by the average values of laboratory and clinical parameters at various times. They are presented in the charts (Figure 1, 2, 3) and in the table 1.

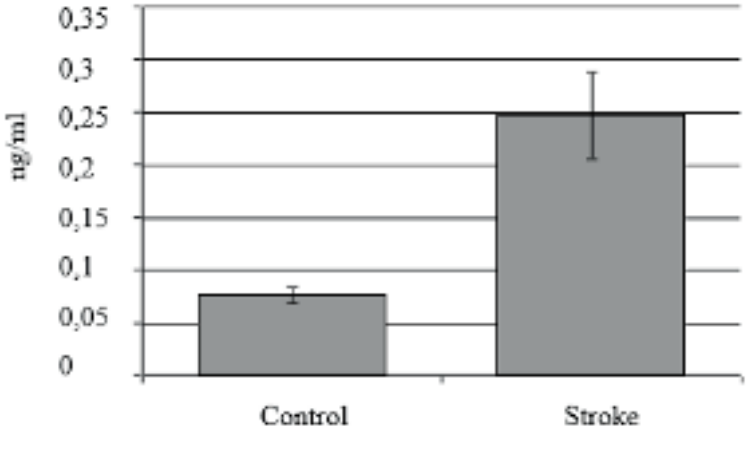
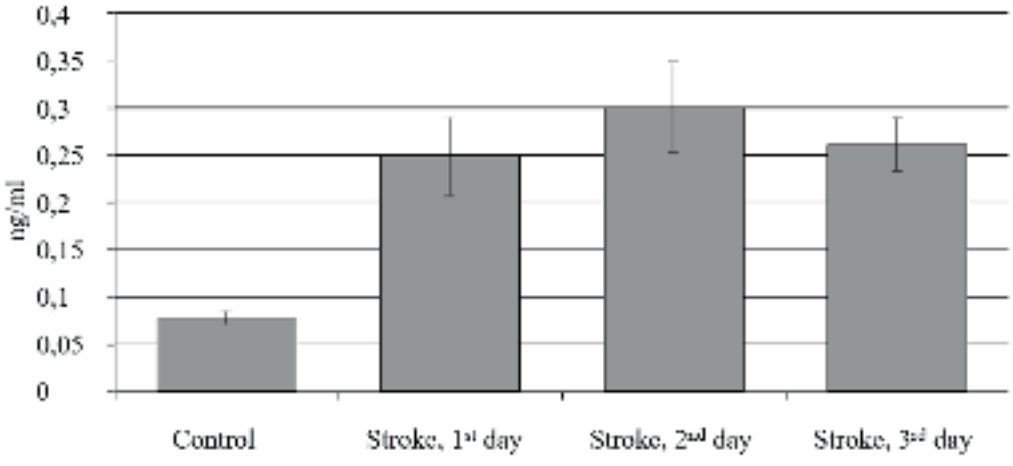


Figure 1.
The level of S100B content at the initial determination in comparison with the control

The content of S100B during the initial determination on average for the group significantly exceeded the level determined in the control by 3.22 times (p=0.025).

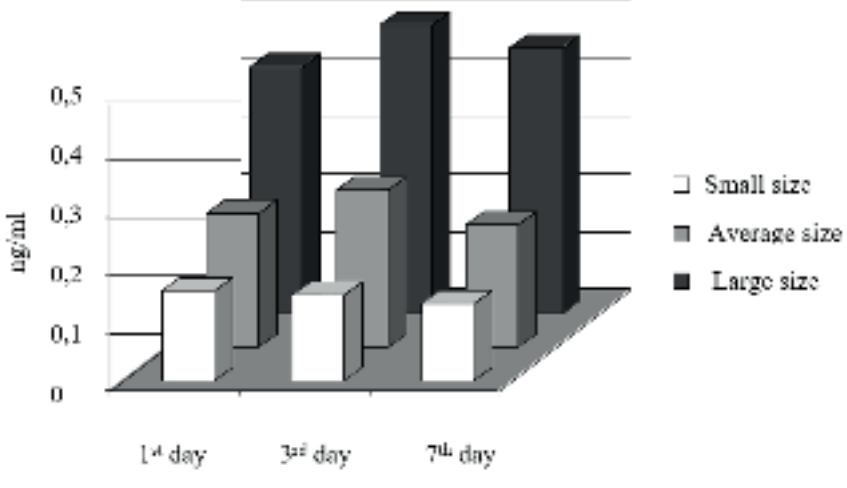
There were significant differences in the content of S100B depending on the size of the stroke. Thus, the average value of the indicator for small strokes exceeded the control one by 2.01 times, with medium ones by 2.99 times and with large ones by 5.55 times (p=0.043, p=0.003 and p<0.001, respectively). There were also significant differences between all groups of patients with stroke, except for small and medium stroke.

Figure 2.
Dynamics of S100B content in the general group



A certain dynamics of S100B content in the blood was observed. Initially (up to 3 days), its value increased, and by 7 days it decreased. However, there were no significant differences between the indicators for this period.

Figure 3.
The level of S100B in dynamics depending on the size of the stroke



In the dynamics, an unambiguous, but insignificant trend towards a decrease in the indicator was revealed in case of a small stroke, while with an average size of the lesion and with a large stroke, an increase in the S100B protein content was noted within 3 days and a tendency to decrease after 7 days from the development of a stroke.

Table 1.
Relationships of S100B content in dynamics, risk factors and sizes of ischemic stroke

	Groups								
	Mild stroke, n=47			Average stroke, n=38			Large stroke, n=28		
	1 day	3 day	7 day	1 day	3 day	7 day	1 day	3 day	7 day
Gender male, n=101	0,151	0,163	0,149	0,229	0,237	0,235	0,442	0,497	0,458
Female	0,129	0,147	0,133	0,201	0,218	0,199	-	-	-
Age 0-61 y., n=32	0,199	0,185	0,176	0,255	0,270	0,242	0,436	0,488	0,430
61-90 y.	0,106	0,130	0,115	0,187	0,209	0,201	0,470	0,519	0,467
BP, n=96	0,148	0,153	0,146	0,234	0,258	0,248	0,481	0,493	0,470
No BP	0,138	0,147	0,137	0,227	0,222	0,195	0,399	0,420	0,419
Ischemic heart disease, n=27	0,154	0,156	0,155	0,244	0,253	0,251	0,490	0,528	0,500
No	0,132	0,140	0,129	0,215	0,218	0,197	0,421	0,455	0,432
DM, n=18	0,169	0,172	0,161	0,249	0,260	0,245	0,442	0,497	0,458
No DM	0,126	0,135	0,124	0,208	0,212	0,207	-	-	-

As a result of comparing the content of S100B in dynamics in the presence of various risk factors, it was found that in men this marker of tissue damage is more pronounced than in women. It was also found to be higher in relatively young individuals, with the exception of those who had large ischemic brain damage.

The presence of arterial hypertension,

coronary heart disease and diabetes mellitus did not significantly affect the values of the studied indicator. There were only tendencies to excess in all compared pairs of values in the presence of aggravating factors, especially coronary artery disease.

When determining the severity of disorders on the Rankin scale, it was determined that 94 patients had no clinical symptoms or they were mild, 19 had moderate or severe symptoms. Its distribution depending on the content of S100B during the initial determination is shown in Table 1.

In the structure of functional outcomes, a certain dependence on the content of the S100B protein is noticeable. It can be traced in all selected subgroups and reaches a degree of significance in large stroke (p=0.043). However, it should be noted that no significant differences were found on average across the group.

Discussion

Recently, many studies have been conducted to determine the frequency of post-stroke injuries and assess their impact on the prognosis of the diseas. Neurological examination or repeated neuroimaging may not be sufficient if cooperation with the patient cannot be established or if the patient is in a coma. In these circumstances, the presence of a marker that can be controlled in serum may provide convenience. One of the latest studied neurobiochemicals is S100B, a complex protein that modulates neuroglia interaction [11]. The correlation between lesion size and serum levels of this protein, as well as its association with early clinical and/or functional outcome in acute post-stroke patients, has been noted in several studies. Miao Y et al. [12], determined that serum level of Hyc altered slightly whatever the type of the heart disease, but it did not change in cases of minor cases; nevertheless, CRP level is significantly raised in all types of inflammations and in AMI.

However, when comparing the percentage change in S100B values on days three and five with that on day one, no significant difference was found between the mild and moderate and severe groups. Unlike other studies, we found approximately the same high levels of S100B during the first and third days and suggest that late (at the end of the first day) the time of admission of patients to the hospital or inaccurate timing may lead to disease progression. inflammation in the area of necrosis. Measurements of the highest levels of S100B on the third day may be associated with the effect of edema occurring 2-3 days after ischemic stroke, in which there is necrosis of a large number of astrocytes and the progression of inflammation, causing deterioration of the blood-brain barrier.

The Middelheim Multidisciplinary Stroke Study reported that S100B protein levels in the cerebrospinal fluid of 89 stroke patients (68 ischemic strokes, 21 TIAs) obtained at admission (mean 8 hours) and 35 healthy volunteers correlated with the volume of brain tissue lesion, stroke frequency, outcome severity (NIHSS) [14]. Kenangil et al showed that S100B values in 26 patients with acute stroke assessed on days 1, 3 and 7 reached maximum levels in patients with strokes associated with closure of more than 2/3 of the area of the middle cerebral artery on day 3, and they defined these results as poor outcome and disability. Elting et al. compared the relationship of S100B protein levels to clinical findings in 21 patients with ischemic stroke, 18 with TIA, and 10 patients with traumatic brain injury with that of 28 healthy controls. A correlation was found between the highest S100B levels measured on day 3 and NIHS scores on days 1 and 10. In trauma patients, the highest levels of S100B were found during the first day, and a correlation was found with the Glasgow Coma Scale on admission. In a study by Buttner et al, serum S100B protein levels were measured at 12 hours, 24 hours, and 2, 3, 4, 5, 7, and 10 days in 26 patients with stroke in the anterior circulation region, as well as with a clinical condition. The highest levels of S100B were determined on days 2 and 3 after the onset of symptoms in patients with more extensive strokes and more severe neurological deficits on admission, but no relationship was found between these higher values and prognosis [13]. In two separate studies, Wunderlich et al. found a strong correlation between neurological conditions and serum S100B concentrations in patients with ischemic stroke and stated that it has high predictive value in assessing early prognosis. In a study by Fassbender K. et al, it was shown that S100 protein levels correlate with the size of damage in ischemic stroke, and, in addition, its concentrations measured after 10, 24, and 72 hours correlate well with the patient's neurological status.

Conclusion

In our study, there was a correlation between lesion size and increased S100B levels, as well as between stroke severity (according to the NIHSS scale) and S100B levels. Therefore, we concluded that stroke severity or clinical situation is associated not only with the number of neurons that have undergone necrosis, but also with critical locations of necrosis. The identification of a weak correlation between the functional status in the first month and the maximum level of S100B on the 3rd day led us to think about S100B as an insufficient prognostic marker. Another conclusion was that gender and concomitant systemic diseases such as diabetes, hypertension and HL in patients with ischemic stroke do not affect the level of S100B. This observation may mean that S100B is a possible marker of brain injury. Thus, high levels

of S100B protein in the peripheral blood after ischemic stroke were found, which correlated well with the size of the lesion, but weakly correlated with disability. Even if the S100B content may be insufficient to predict prognosis in traumatic brain injury, its content in peripheral blood can be used as a marker of brain damage in ischemic stroke.

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AUTOIMMUNE AND HEMATOLOGICAL STATUS OF GRAVES' DISEASE PATIENTS

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The authors declare that they have no conflicts of interest

Keywords:
Grave's disease, autoimmune disorders, anemia, rates of severity of anemia, morphological types of anemia.

Abstract

Purpose of the study: *comparative assessment of hematological and autoimmune status of patients with Graves' disease (GD).*

Materials and methods. *43 GD patients aged between 19 and 64 years, 26 of which were women and 17 were men, have been examined. Assessment of hemograms of examined patients helped to reveal anemia in 28(65.1%) examined patients (group I). In 15 (34.9%) patients (group II) anemia was not detected. Mild anemia was diagnosed in 25 (89.3%), moderate anemia – in 3 (10.7%) patients. Hemoglobin, hematocrit, erythrocyte count and erythrocyte indices MCV, MCH, MCHC, serum Fe and ferritin status was chaecked in clinical analysis. The immune status was assessed by the level of CD3+, CD4+, CD8+, CD19+, CD4+/CD8+, CEC, Ef, TSHRAb and hormonal status by the level of TSH, T4 free.*

Results. *Microcytic anemia was determined in 15 (53.6%) patients, normocytic - in 12 (42.8%), macrocytic - in 1 (3.5%) patient due to volume of erythrocytes' MCV. According to morphological criteria of MCH (mean content of hemoglobin in erythrocyte) anemia hypochromic type of anemia was noted in 15 (53.6%) patients, normochromic - in 12 (42.8%), hyperchromic - in 1 (3.5%) patient. In 15 (53.6%%) patients in the group I microcytic - hypochromic anemia was diagnosed, which is characteristic for iron-deficient anemia; in 12 (42.8%) patients was verified normocytic-normochromic anemia, which has morphological parameters of anemia of chronic diseases and in 1 (3.5%) patient macrocytic-hyperchromic anemia.*

Comparative assessment of HGB level and indicators of iron metabolism in GD patients with anemia detected decreasing of HGB by 20%, serum Fe by 20%, ferritin by 29% compared to the corresponding control values. More pronounced depletion of the iron depot (ferritin) due to the fact that the development of anemia is preceded by a "latent iron deficiency", an indicator of which is ferritin.

Conclusions. *GD is characterized by high frequency of anemia (65.1%), mostly mild form (89.3%), microcytic-hypochromic (53.6%), characteristic of iron deficiency anemia. The severe hematological disorders, detected among GD patients with anemia are accompanied by deep autoimmune changes and hyperfunction of the thyroid gland.*

Грейвс ауруы бар науқастардың аутоиммунды және гематологиялық жағдайы

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Аңдатпа

Зерттеудің мақсаты *- Грейвс ауруы (ГА) бар науқастардағы гематологиялық және аутоиммундық жағдайды салыстырмалы бағалау.*

Материал және әдістер. *19 жастан 64 жасқа дейінгі ГА бар 43 адам тексерілді. Олардың ішінде 26 әйел, 17 ер адам бар. Тексерілген пациенттердің гемограммасын бағалау 28 (65,1%) адамда (1-топ) анемияны анықтады. 15 (34,9%) науқастарда (2-топ) анемия байқалмады. Жеңіл дәрежелі анемия 25 (89,3%), орташа дәрежеде - 3 (10,7%) науқастарда байқалды. Клиникалық қан анализінде гемоглобин, гематокрит, эритроциттер саны және MCV, MCH, MCHC, Сарысу Fe және ферритиннің эритроциттік индекстері анықталды. Иммундық мәртебе CD3+, CD4+, CD8+, CD19+, CD4+/ CD8+, ОСК, Эф, TSHRAb*

деңгейлері бойынша бағаланды. Гормоналды күй - TSH, T4 free деңгейінде.

Нәтижелер. *MCV эритроциттерінің көлемі бойынша микроциттік анемия 15 (53,6%), нормоцитарлы – 12 (42,8%), макроциттік – 1 (3,5%) науқаста анықталды. MCH анемиясының морфологиялық көрсеткіші бойынша (эритроциттегі гемоглобиннің орташа мөлшері) анемияның гипохромды түрі 15 (53,6%), нормохромды – 12 (42,8%), гиперхромды – 1 (3,5%) науқаста байқалды. 1-ші топтағы науқастардың 15-інде (53,6%) темір тапшылығы анемиясына тән микроцитарлы-гипохромды анемия байқалды, 12 (42,8%) науқастарда созылмалы аурулар анемиясының морфологиялық параметрлері бар нормоцитарлы-нормохромды анемия және 1 (3,5%) науқаста макроцитарлы-гиперхромды анемия верификацияланды.*

Анемиясы бар ГА бар емделушілерде HGB деңгейі мен темір алмасуының көрсеткіштерін салыстырмалы бағалау тиісті көрсеткіштермен салыстырғанда HGB 20% - ға, сарысулық Fe 20%-ға, ферритиннің 29%-ға төмендегенін анықтады. Темір қоймасының (ферритин) неғұрлым айқын сарқылуы анемияның дамуының алдында "жасырын темір тапшылығы" болатындығына байланысты, оның көрсеткіші ферритин болып табылады.

Қорытындылар. *BG анемияның жоғары даму жиілігімен сипатталады (65,1%), көбінесе жеңіл дәрежеде (89,3%), темір тапшылығы анемиясына тән микроцитарлы-гипохромды (53,6%). Анемиясы бар ГА бар адамдар тобында анықталған айқын гематологиялық бұзылулар терең аутоиммунды өзгерістермен және қалқанша безінің гиперфункциясымен қатар жүреді.*

Аутоиммунный и гематологический статус пациентов с болезнью Грейвса

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Аннотация

Цель исследования *– сравнительная оценка гематологического и аутоиммунного статуса у пациентов с болезнью Грейвса.*

Материал и методы. *Обследовано 43 лица с БГ в возрасте от 19 до 64 лет. Среди них 26 женщин, 17 мужчин. Оценка гемограммы обследованных пациентов выявила анемию у 28 (65,1%) лиц (1-ая группа). У 15 (34,9%) больных (2-ая группа) анемия не наблюдалась. Анемия легкой степени отмечалась у 25 (89,3%), средней степени тяжести - у 3 (10,7%) больных. В клиническом анализе крови определяли гемоглобин, гематокрит, количество эритроцитов и эритроцитарные индексы MCV, MCH, MCHC, сывороточное Fe и ферритин. Иммунный статус оценивали по уровню CD3+, CD4+, CD8+, CD19+, CD4+/ CD8+, ЦИК, Эф, TSHRAb. Гормональный статус – по уровню TSH, T4 free.*

Результаты. *По объему эритроцитов MCV микроцитарная анемия определялась у 15 (53,6%), нормоцитарная – 12 (42,8%), макроцитарная – 1 (3,5%) пациента. По морфологическому показателю анемии MCH (среднее содержание гемоглобина в эритроците) гипохромный тип анемии отмечался у 15 (53,6%%), нормохромный – 12 (42,8%), гиперхромный – 1 (3,5%) больного. У 15 (53,6%%) пациентов 1-ой группы отмечалась микроцитарно - гипохромная анемия, что характерно для железодефицитной анемии, у 12 (42,8%) больных верифицирована нормоцитарно-нормохромная анемия, имеющая морфологические параметры анемии хронических заболеваний и у 1 (3,5%) больного макроцитарно-гиперхромная анемия.*

Сравнительная оценка уровня HGB и показателей обмена железа у пациентов с БГ с анемией выявила снижение HGB на 20%, сывороточное Fe на 20%, ферритина на 29% в сравнении с соответствующими контрольными показателями. Более выраженное истощение депо железа (ферритин) связано с тем, что развитию анемии предшествует «латентный дефицит железа», показателем которого является ферритин.

Выводы. *БГ характеризуется высокой частотой развития анемии (65,1%), чаще легкой степени (89,3%), микроцитарно-гипохромной (53,6%), характерной для железодефицитной анемии. Выявленные в группе лиц с БГ с анемией выраженные гематологические нарушения сопровождаются глубокими аутоиммунными изменениями и гиперфункцией щитовидной железы.*

Конфликт интересов: *Авторы заявляют об отсутствии конфликта интересов*

Ключевые слова: *болезнь Грейвса, аутоиммунные нарушения, анемия, степень тяжести анемии, морфологические типы анемии.*

Relevance

Although more than 100 years have passed since the first description of autoimmune thyroiditis in 1912 by the Japanese physician Hashimoto Hakaru, and nearly 200 years since the publication of the world-famous article "Palpitation with enlarged thyroid gland" by the Dutch physician Robert James Graves in 1835, nevertheless mechanisms of autoimmune diseases of the thyroid gland (TG) are still not fully studied [1, 2, 3]. Currently, both the Grave's disease and autoimmune thyroiditis (AIT) are considered as the classic organ-specific autoimmune diseases [4, 5]. Scientists have paid attention to relationship between the autoimmune process in the thyroid gland and hematological diseases only in recent decades. The risk of anemia in autoimmune diseases of the thyroid gland may be due to pernicious anemia and atrophic gastritis, celiac disease, autoimmune hemolytic syndrome, celiac disease or rheumatic diseases [6, 7, 8, 9]. Few studies dedicated to identifying of link between anemia and thyroid disease show contradictory results regarding the incidence of anemia in hyperthyroidism. Some scientists revealed anemia in 30,2%-40.9% of patients with hyperthyroidism [10], others – in 17.9% [11], thirds – in 2,8% [12]. The literature data on types of anemia in hyperthyroidism also are contradictory [10, 13].

Although influence of excess thyroid hormones is well-known fact, the exact pathogenesis of GD anemia remains unclear [14, 15]. Along with this, some authors found that even against the background of euthyroidism there is a significant positive relationship between the level of free thyroid hormones, hemoglobin and the level of erythrocytes, conducting large cohort studies [16, 17]. M'Rabet-Bensalah K. et al (2016) determined that only in 5% of cases anemia is associated with TG hormonal imbalance [11].

Suggested causes of anemia in hyperthyroidism are stimulation of erythropoiesis by thyroid hormones, causing bone marrow hypoplasia, decreasing of mean content volume (MCV), hematopoietic stem cell dysfunction (such as myelodysplasia), shortened lifespan of red blood cells, and inefficient use of iron [6, 18, 19].

Thus, anemia in patients with DG is multifaceted process, the mechanisms of which are not yet fully studied. Mutually aggravating course of anemia and GD is a clinical problem.

Purpose of the study – comparative assessment of hematological and autoimmune status of patients with Graves' disease.

Materials and methods

43 GD patients, underwent surgery in the department of endocrine surgery of Scientific Center of Surgery named after M.A.Topchubashov, aged between 19 and 64 years, including 26 women and 17 men, have been observed. Assessment of hemograms of examined patients helped to detect the anemia in 28 (65.1%) examined patients (group I). In 15 (34.9%) patients (group II) anemia was not detected. Mild anemia was detected in 25 (89.3%), moderate anemia – in 3 (10.7%) patients. Hemoglobin and erythrocyte indices MCV (mean erythrocyte volume), MCH (mean HGB content in erythrocyte), MCHC (mean concentration of HGB in erythrocyte mass) were checked in clinical analysis. Additionally, the levels of serum iron (Fe-ser) and ferritin (Fr) were determined (Roche kit).

Anemia was diagnosed at a hemoglobin level of 120 g/l or less in women and 130 g/l or less in men (WHO, 2001). Phenotyping of blood lymphocytes was conducted by means of fluorescent microscope for markers CD3+ (total population of T-lymphocytes), CD4+ (T-helpers), CD8+ (T-cytotoxic suppressors), CD19+ (B-lymphocytes) (panel LLC-Sorbent, Moscow) and results were accounted as %. The content of the CEC in the blood serum was carried out according to the method of Yu.A. Grinevich, A.N. Alferov, 1981, in modification [20]. Well-known method for studying peripheral blood, the Zinkham-Conley method, modified by E.N. Novoselova was used for determining of erythrophagocytosis in blood plasma [21]. The level of hormones TSH and T4 free (set by Roche) and antibodies to the TSH receptor (TSHRAb) also were detected (set by Roche). Mathematical analysis of achieved results was conducted using the Excel 2017 software package. The structural characteristics of the variational series (mean, error of the mean), and to assess the differences between the samples, the nonparametric Wilcoxon-Mann-Whitney test also was used [22].

Results and discussion

According to the volume of erythrocytes (MCV) microcytic anemia was determined in 15 (53.6%) patients, normocytic - in 12 (42.8%), macrocytic - in 1 (3.5%) patient. According to morphological indicators of anemia hypochromic type of anemia MCH was noted in 15 (53.6%), normochromic - in 12 (42.8%), hyperchromic – in 1 (3.5%) patient. In 15 (53.6%) patients of group I they found microcytic - hypochromic anemia, which is characteristic for iron deficiency anemia, normocytic-normochromic anemia, which has morphological parameters of anemia of chronic diseases was verified in 12 (42.8%) patients and 1(3.5%) patient had macrocytic-hyperchromic anemia.

Table 1.
Hemogram of patients with DG before surgery (M±m)

Indicator		Almost healthy (n=15)	GD with anemia (n=28)	GD without anemia (n=15)	"All patients" with GD (n=43)
HGB, g/l	Hemoglobin concentration	133.2±1.8	107.2±1.6* *	132.7±2.6^	116.3±2.4*
RBC x 10^{12}/l	RBC count	4.3±0.07	4.4±0.1	4.8±0.1*^	4.6±0.08*
HCT, %	Hematocrit	39.8±0.5	33.0±0.4* *	39.8±0.8^	35.3±0.6*
CI	Color indicator	0.92±0.006	0,77±0,01*	0,82±0,02*	0,79±0,01*
MCV, fl	Mean volume of erythrocyte	91.9±0.6	75.8±1.7*	82.5±1.5*^	77.9±1.4*
MCH, pg	Average content of HGB in erythrocyte	30.8±0.2	25.6±0.6*	27.7±0.6*^	26.3±0.4*
MCHC, g/dl	Mean concentration of HGB in erythrocyte mass	33.4±0.04	33.6±0.05	33.3±0.3	33.6±0.1
Fe-ser., mmol/l	Serum iron content	18.4±1.3	14.7±0.3* *	16.0±0.5^	15.5±0.5*
Fr, ng/ml	Ferritin	35.9±2.0	25.5±1.8*	33.0±1.1^	28.1±1.3*

Note: * - statistical significance of differences relative to data in practically almost healthy people; ^ - statistical significance of differences between groups of patients with and without anemia; * - statistical significance of differences between groups of patients with anemia and "all patients"

As it is seen on the Table 1, HGB level, color score, mean erythrocyte volume, mean erythrocyte HGB, serum iron, ferritin in pre-surgery period in the group "all patients" (n=43) statistically significantly lower than the corresponding indicators of the control group, and mean concentration of HGB in erythrocytes practically does not differ from the norm. The given violations are mostly associated with changes in patients of the group I. Changes of all indicators in this group of patients have more pronounced character in comparison with the group "all patients" on three indicators such as HGB, hematocrit and serum iron levels, which significantly different from each other (p<0.05). All indicators of patients in group I, except MCHC, significantly different from corresponding indicators of the 2nd group. Aa a result of assessment of HGB level and iron metabolism indicators authors determined in patients of group I decrease in HGB by 20%, serum Fe by 20%, ferritin by 29%, compared to control indicators (Table 1). More pronounced iron depletion (ferritin) is related with the fact that the development of anemia is preceded by a "latent iron deficiency", an indicator of which is ferritin. Only the number of erythrocytes, the color index, the average volume of erythrocytes and the average content of hemoglobin in erythrocytes are significantly reduced in comparison with the control indicators (p<0.05) in patients of group II (p<0,05).

Table 2.
Immunogram of persons with GD before surgery (M±m)

Indicators	Almost healthy (n=15)	GD with anemia (n=28)	GD without anemia (n=15)	GD "all patients" (n=43)
CD3+, %	66,5±1,4	47,8±1,1*	50,1±1,3*	48,8±0,8*
CD4+, %	37,9±0,9	30,2±0,6*	29,8±0,9*	30,0±0,5*
CD8+,%	28,3±0,8	18,5±0,4*	19,9±0,6*	19,0±0,4*
CD4+/CD8+	1,4±0,04	1,6±0,03*	1,5±0,04^	1,6±0,02*
CD19+,%	11,3±0,6	18,6±0,5*	17,8±0,6*	18,4±0,4*
CIC, r.u.	64,3±1,5	98,2±1,7*	77,0±1,8*^	86,5±2,2*
FU, %	0,8±0,08	2,5±0,3*	1,2±0,08*^	2,1±0,2*

Note: * - statistical significance of differences relative to data in practically almost people: ^ - statistical significance of differences between groups of patients with and without anemia

Immunological disorders, detected in patients, are associated with the etiology and pathogenesis of GD. The values of indicators of the group "all patients", the 1st and 2nd groups (except the immunoregulatory index of the 2nd group) differ from control indicators (p<0.05) (Table 2). Comparative evaluation of immunograms of patients of the 1st and 2nd groups revealed more profound changes in patients with GD with anemia according to three indicators of autoimmunity (CD4+/CD8+, CIC, FU) which statistically differ from indicators of GD patients without anemia.

Table 3.
Levels of TSHRAb, TSH and T4 free in GD patients before surgery (M±m)

Parameters	TSHRAb	TSH	T4 free
All patients (n =43)	10,8±0,8*	0,1±0,01*	16,9±2,9*
GD with anemia (n =28)	10,9±1,0*	0,1±0,02*	13,9±2,5*
GD without anemia (n =15)	10,6±1,3*	0,1±0,03*	22,4±7,1*
Norm	<1,75 – negative >1,75 – positive (IU/l)	0,32-5,2(mIU/l)	0,7-1,8(ng/dl)

Note: * - statistical significance of differences compared to the norm

Studying of hormone levels and antibodies to the TSH receptor also revealed changes characteristic for GD. The level of antibodies to the TSH receptor is significantly increased compared to the norm in all groups and T4free level, and the TSH level is significantly lower in comparison with the norm (Table 3).

Conclusion

GD is characterized by high frequency of development of anemia (65.1%), mostly the mild form (89.3%), and microcytic-hypochromic (53.6%), characteristic for iron deficiency anemia.

The comparative assessment of HGB level and indicators of iron metabolism in GD patients with anemia has revealed decreasing of HGB by 20%, serum Fe by 20%, ferritin by 29% compared to the corresponding control values. A more pronounced depletion of the iron depot (ferritin) is associated with the fact that the development of anemia is preceded by a "latent iron deficiency", an indicator of which is ferritin.

Diagnosing of severe hematological disorders in group of GD patients with anemia are accompanied by deep autoimmune changes and hyperfunction of the thyroid gland.

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A COMPARATIVE ANALYSIS OF PERFORMANCE INDICATORS FROM THE SURGICAL DEPARTMENT OF A MULTIDISCIPLINARY HOSPITAL IN DYNAMIC OVER 5 YEARS (2017-2021)

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Keywords:
indicators, surgical department, multidisciplinary hospital, outpatient surgery.

Abstract

Many countries have actively implemented reforms over the last two decades to increase the productivity of their healthcare systems and the effectiveness of treatment and prevention activities. And the classical indicators of hospital performance such as the use of hospital beds and the quality of hospital care are the main indicators of good management in a hospital.

Material and methods. *The object of the study is the medical and statistical performance indicators of the surgical department and the surgical day hospital of the multidisciplinary hospital in Almaty for 5 years (2017–2021). As a source of information, an electronic database of the statistical department of the hospital was used. Medical statistical analysis was applied as a method of study. This type of study is a cross-sectional study based on a retrospective descriptive analysis of official statistics.*

Results. *In terms of dynamics, the structure of those treated in the surgical department does not change. However, there is a significant decrease in the amount of planned surgical pathology compared to the slight drop in hospitalization (a decrease of -40%), possibly due to a decrease in the volume of government orders (a decrease of -43.4%). Within the framework of the state order, the indicator of the average length of stay of a patient in a hospital, in general, tends to decrease from 8,5 in 2017 to 8,2 in 2021. A higher level of surgical activity in the surgical department (76,4% vs. 62,6% in surgical departments in 2021), a lower postoperative complication rate (0,2% vs. 0,3%), and a lower postoperative mortality (0,7% vs. 1,1%) were stated as positive indicators of surgical service. In 2021, the frequency of emergency operations in the surgical department was roughly the same, at 19,1%; the total share of outpatient surgery (for all profiles) in the structure of all surgery was 11,3%.*

Conclusion. *The identified deterioration in the use of hospital beds in the surgical department (decrease in bed turnover, increase in the average duration of one case of hospitalization, decrease in the planned number of bed days) requires improvement of the planning and control system for hospitalization. Perhaps this problem is relevant for many multidisciplinary hospitals.*

Көп бейінді ауруханаңың хирургиялық бөлімшесінің 5 жылдағы динамикадағы көрсеткіштерін салыстырмалы талдау (2017-2021 ж.)

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Аңдатпа

Соңғы екі онжылдықта көптеген елдер денсаулық сақтау жүйесінің өнімділігін арттыруға және емдеу-профилактикалық іс-шаралардың тиімділігін арттыруға бағытталған реформаларды белсенді түрде жүзеге асыруда. Ал стационардағы дұрыс басқарудың негізгі көрсеткіштері аурухана жұмысының классикалық көрсеткіштері, аурухана төсек-орындарын пайдалану және стационарлық көмек көрсету сапасы болып табылады.

Материал және әдістері. *Зерттеу нысаны – Алматы қаласындағы көпсалалы ауруханаңың хирургиялық бөлімшесі мен күндізгі хирургиялық стационардың 5 жылдағы (2017-2021 жж.)*

Түйінді сөздер: көрсеткіштер, хирургиялық бөлім, көпсалалы стационар, амбулаториялық хирургия.

медициналық-статистикалық нәтижелік көрсеткіштері. Ақпарат көздері ретінде ауруханының статистикалық бөлімінің электронды базасы пайдаланылды. Медициналық статистикалық талдаудың қолданылатын әдістері. Зерттеу түрі: ресми статистиканың ретроспективті сипаттамалық талдауына негізделген қималық зерттеу.

Нәтижелері. *Динамикадағы хирургиялық бөлімде емделгендердің құрылымы өзгермейді. Бірақ стационарға жатқызу деңгейінің шамалы төмендеуі аясында жоспарлы хирургиялық патология жиілігінің күрт төмендеуі байқалады (кему -40% 0), мүмкін мемлекеттік тапсырыс көлемінің азаюына байланысты (кему -43,4% 0). Мемлекеттік тапсырыс шеңберінде науқастың стационарда болуының орташа ұзақтығы көрсеткіші, жалпы алғанда, 2017 жылғы 8,5-тен 2021 жылы 8,2-ге дейін төмендеу үрдісіне ие. Хирургиялық жұмыстың жақсы көрсеткіштері атап өтілді: хирургиялық бөлімшеде хирургиялық белсенділіктің жоғары деңгейі (2021 жылы хирургиялық профиль бөлімшелерінде 76,4% қарсы 62,6%), операциядан кейінгі асқынулардың төмен жиілігі (0,2% қарсы 0,3%) және операциядан кейінгі өлім-жітімнің төмен деңгейі (0,7% қарсы 1,1%). Хирургиялық бөлімдегі шұғыл операциялардың жиілігі шамамен бірдей болды және 2021 жылы 19,1% құрады, бүкіл хирургия құрылымындағы амбулаториялық хирургияның жалпы үлесі (барлық профильдер бойынша) 11,3%.*

Қорытынды. *Хирургиялық бөлімшеде төсек қорын пайдалану көрсеткіштерінің анықталған нашарлауы (төсек айналымының төмендеуі, ауруханаға жатқызудың бір жағдайының орташа ұзақтығының өсуі, төсек-күн жоспарының төмендеуі) ауруханаға жатқызуды жоспарлау және бақылау жүйесін жетілдіруді талап етеді. Мүмкін, бұл мәселе көптеген көп салалы ауруханаларға қатысты болуы мүмкін.*

Сравнительный анализ показателей деятельности хирургического отделения многопрофильного стационара в динамике за 5 лет (2017-2021 гг.)

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Аннотация

Во многих странах последние два десятилетия активно реализуются реформы, направленные на повышение производительности системы здравоохранения, рост эффективности лечебно-профилактической деятельности. И основными индикаторами рационального управления в стационаре остаются классические показатели деятельности стационара, использования коечного фонда и качества стационарной помощи.

Материал и методы. *Объектом исследования являются медико-статистические показатели деятельности хирургического отделения и хирургического дневного стационара многопрофильного стационара г. Алматы за 5 лет (2017-2021 гг.). В качестве источников информации использовалась электронная база данных статистического отдела стационара. Использованы методы медицинского статистического анализа. Тип исследования: поперечное исследование, основанное на ретроспективном описательном анализе официальных статистических данных.*

Результаты. *Структура пролеченных в хирургическом отделении в динамике, в целом, не меняется. Но наблюдается резкое снижение частоты плановой хирургической патологии на фоне небольшого снижения уровня госпитализации в стационар (убыль -40%0), возможно, из-за уменьшения объема госзаказа (убыль -43,4%0). В рамках госзаказа показатель средней длительности пребывания больного в стационаре, в целом, имеет тенденцию к снижению с 8,5 в 2017 г. до 8,2 в 2021 г. Отмечены хорошие показатели хирургической работы: более высокий уровень хирургической активности в хирургическом отделении (в 2021 г. 76,4% против 62,6% в отделениях хирургического профиля), более низкая частота послеоперационных осложнений (0,2% против 0,3%) и более низкий уровень послеоперационной летальности (0,7% против 1,1%). Частота экстренных операций в хирургическом отделении была примерно одинаковой и составила в 2021 г. 19,1%, общая доля амбулаторной хирургии (по всем профилям) в структуре всей хирургии - 11,3%.*

Заключение. *Выявленное ухудшение показателей использования коечного фонда в хирургическом отделении (снижение оборота койки, рост средней длительности одного*

Ключевые слова: *показатели, хирургическое отделение, многопрофильный стационар, амбулаторная хирургия.*

случая госпитализации, снижение плана койко-дней) требует совершенствования системы планирования и контроля госпитализации в больницу. Возможно, эта проблема актуальна для многих многопрофильных стационаров.

Introduction

Many countries have actively implemented reforms over the last two decades to increase the productivity of the healthcare system and the effectiveness of treatment and prevention activities. These economic reforms are associated with the implementation of mandatory health insurance systems and unified national health accounts [11], as well as the strengthening of the role of quality in medical care provision and the widespread implementation of a paid medicine system in state medical organizations.

The main intra-system sources of financial savings in the healthcare system are rational management of medical care, stimulation of responsibility for the patient, coordination of the work of all services and links in the system, and organization of centralized competitive purchases and supplies of medicines to the MO [8]. The main in-hospital sources of savings remain the reduction in the cost of a case of hospitalization (including through the use of modern, effective organizational and clinical technologies) and the reduction of in-hospital costs without compromising the quality of medical care (including using hospital-replacing technologies). The economic evaluation of the effectiveness of treatment [2,6] is carried out in terms of money and medical and statistical indicators, such as the duration of hospitalization, the frequency of postoperative complications, the duration of postoperative hospitalization, the duration of temporary disability, etc. These indicators are important criteria for the effectiveness of treatment [12, 1].

The main indicators of rational management in a hospital are the classic indicators of hospital activity (provision of the population with inpatient care; workload of medical personnel; material and technical and medical equipment); the use of hospital beds (structure of the hospital bed; bed occupancy per year; average length of stay of a patient in a bed; turnover beds); and the quality of inpatient care (hospital mortality, postoperative mortality, the frequency of postoperative complications, daily mortality, the percentage of matching diagnoses of the direction, clinical and pathoanatomical) [3, 7].

The purpose of the study is to characterize the activities of the surgical department of a multidisciplinary hospital in dynamics over 5 years (2017-2021) in order to identify reserves for improving the organization of surgical care in the hospital.

Material and methods

The object of the study is the medical and statistical performance indicators of the surgical department and the surgical day hospital of the multidisciplinary hospital in Almaty for 5 years (2017–2021). As a source of information, an electronic database of the statistical department of the hospital was used. Medical statistical analysis was applied as a method of study. This type of study is a cross-sectional study based on a retrospective descriptive analysis of official statistics.

Results

In terms of dynamics, the number of treated patients in the Almaty Multidisciplinary Hospital for 2017–2021 (Figure 1) was In general, the hospital decreased from 11127 to 10754 with a negative increase of 3,4%, while in 2019 the maximum number of hospitalizations was noted (11791 people, an increase of 8,1% compared to 2018).

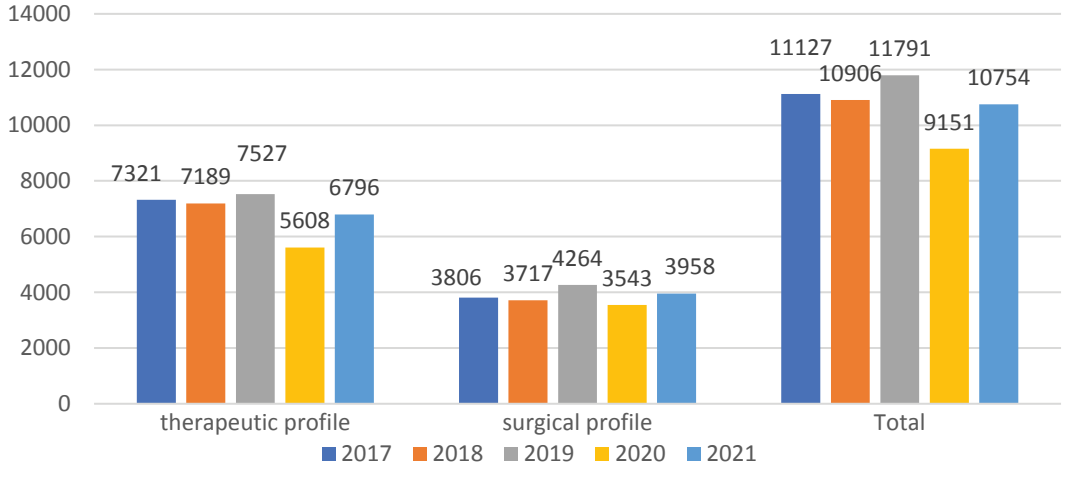


Figure 1.
Dynamics of the total number of treated patients in for 2017-2021

In terms of dynamics, the number of treated patients in the hospital for 2017–2021 (Figure 1). In general, hospitalizations decreased from 11127 to 10754 with a negative increase of 3,4%, while in 2019 the maximum number of hospitalizations was noted (11791 people, an increase of 8,1% compared to 2018), largely due to the overall increase in coronavirus infection and, in particular, complications after COVID-19. A similar increase is typical for departments of the therapeutic profile in general (+4,7% to +14,7%) and the surgical profile in general (+4,7% to +14,7%). For a separate surgical department, a significant negative increase (-40%) was noted, which indicates a sharp decrease in the frequency of planned surgical pathology, including abdominal diseases, possibly due to a decrease in the volume of government orders.

In 2020, there was a significant decrease in the volume of total hospital admissions (from 11,791 to 9,151 people, an increase of - 22,4%), which was largely due to quarantine measures due to the coronavirus epidemic. A similar trend is typical for the departments of the therapeutic profile (negative growth of 25,5%) and the surgical profile (negative growth of 16,9%), as well as separately for the surgical department (20,0%).

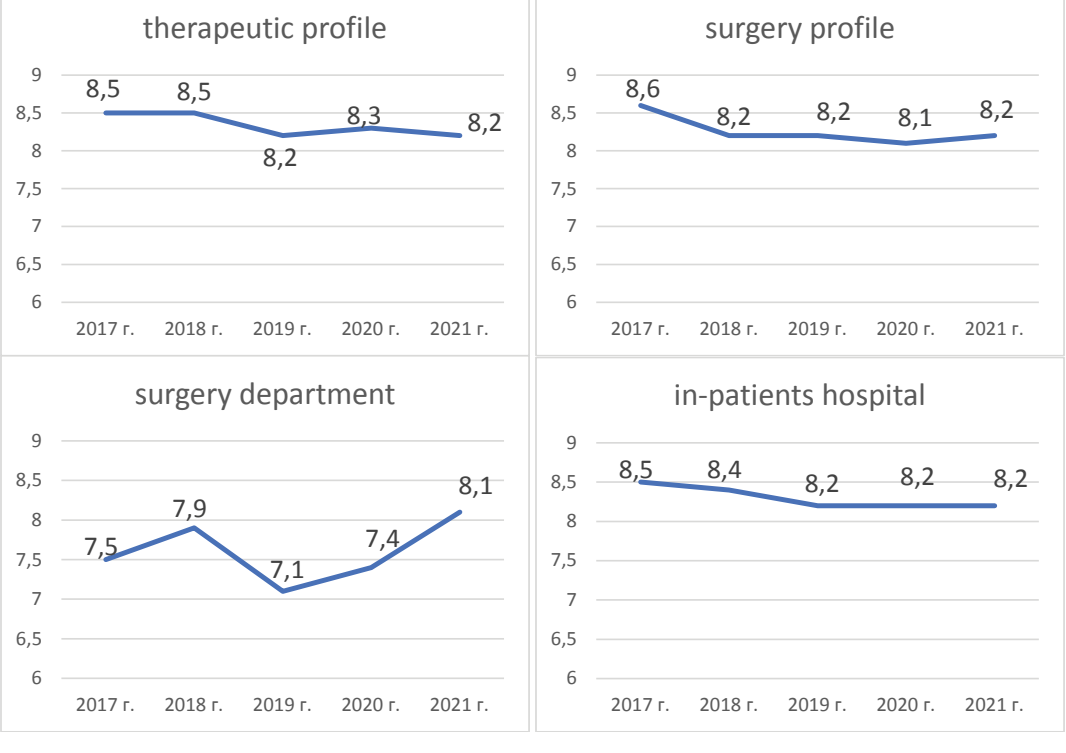
The surgical department is characterized by a gradual decrease in the volume of hospitalizations from 855 in 2017 to 513 (negative growth of -40,0%).

Similar trends were noted for the dynamics of the indicator of the total number of bed days in the hospital as a whole, as well as separately for the departments of therapeutic and surgical profiles. The surgical department is characterized by a gradual decrease in the number of bed days from 5549 in 2017 to 3445 (negative growth of - 37,9%).

In dynamics, the indicator of the average length of stay of a patient in a hospital almost does not change and is equal to 7,9 bed-days. This indicator is higher in the departments of the therapeutic profile (8,1–8,3 bed-days) and lower in the departments of the surgical profile (7,3–8,2), and since 2018 it has been trending towards a gradual increase. And in the surgical department, this indicator is also gradually increasing from 2019 onward, from 6,2 to 6,7 in 2021. However, it should be noted that this is an aggregate indicator for hospitalization of patients on a state order and on a paid basis.

The indicator of the average length of stay of a patient in a hospital under the state order, in general, tends to decrease from 8.5 in 2017 to 8,2 in 2021 (Figure 2). The same dynamics are typical for therapeutic departments in general (with 8,5 to 8,1 bed days) and for surgical departments (from 8,6 to 8,2 bed days). But in a separate surgical department, this indicator is unstable, and in 2021 it rose to 8,1.

Figure 2.
Dynamics of the average duration of hospitalization under the state order in the hospital for 2017-2021



The bed turnover rate in the surgical department tends to decrease from 46.5 in 2017 to 32,7 in 2021 (Figure 3), which may be due to the impact of the pandemic, which influenced the decrease in hospitalization rates. The increase in the average duration of one hospitalization in the department from 6,4 days in 2017 to 7,3 days in 2021 is also an unfavorable factor in

hospital management. It should be noted the unsatisfactory situation with the implementation of the plan of bed days: there is a decrease in the indicator from 100,6% in 2017 to 72,2% in 2021, which indicates that the department is unprofitable; however, this gap is filled by the provision of paid medical services in this department. The situation is similar with the bed occupancy rate per year: its extremely low values also indicate incorrect planning.

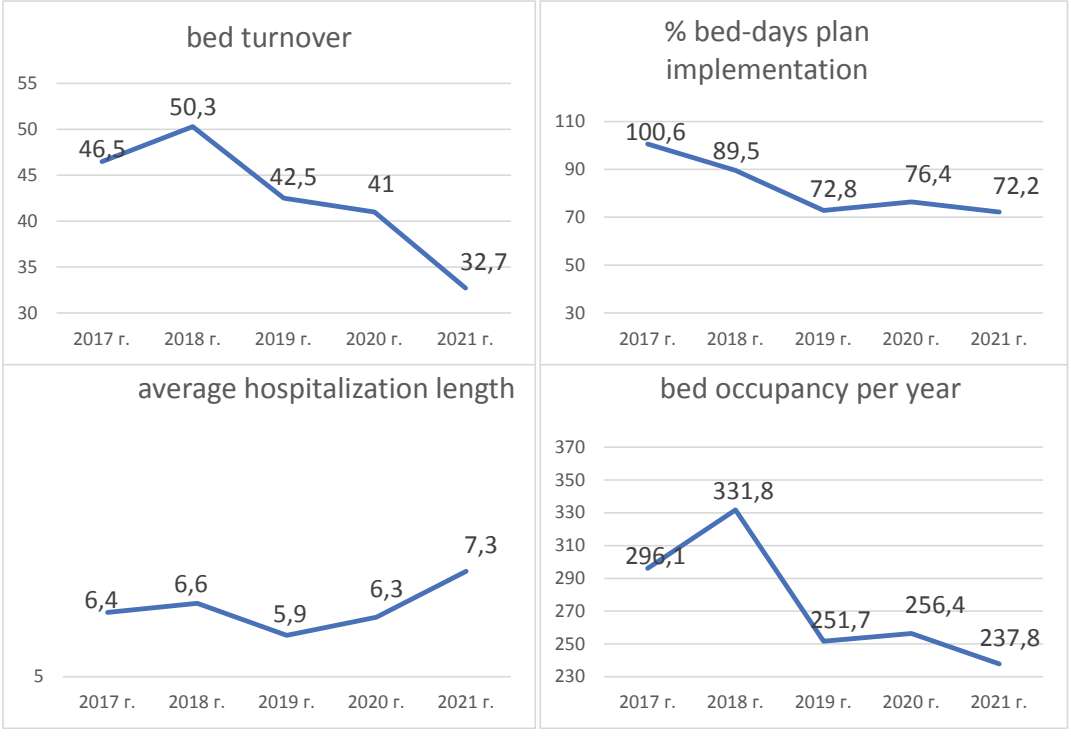


Figure 3.
Dynamics of bed performance indicators in the surgical department of the multidisciplinary hospital for 2017-2021

In 2021, the ratio of paid to state-ordered hospitalizations in the multidisciplinary hospital was 34,4% to 65,6% (Figure 4). The rate of paid hospitalization is comparatively higher in therapeutic departments compared to surgical departments (38% versus 27,7%). It should be noted that in a separate surgical department, the frequency of paid hospitalization is very high (41,3%).

In 2021, the ratio of paid to state-ordered hospitalizations in the multidisciplinary hospital was 34,4% to 65,6% (Figure 4). The rate of paid hospitalization is comparatively higher in therapeutic departments compared to surgical departments (38% versus 27,7%).

It should be noted that in a separate surgical department, the frequency of paid hospitalization is very high (41,3%).

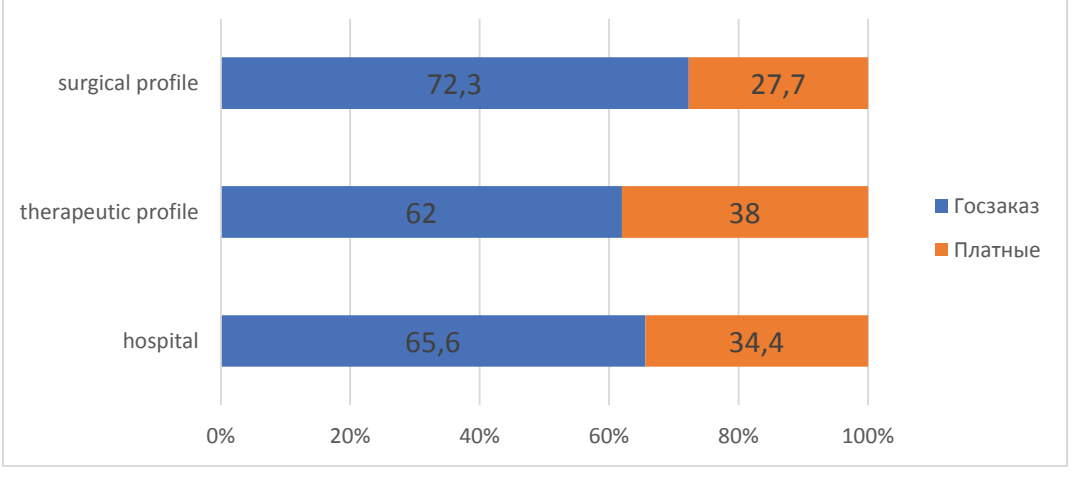


Figure 4.
The ratio of paid to unpaid hospitalization under the state order (by the number of hospitalized patients) in the multidisciplinary hospital in 2021 (V%)

At the same time, the total volume of hospitalizations under the state order in the MSA hospital increased from 6,401 in 2017 to 6,868 in 2021 (an increase

of 7.3%). Similar trends were noted for departments of the therapeutic and surgical profiles (an increase of +6,5% and +8,6%). But in the surgical department, the volume of hospitalizations under the state order decreased from 438 in 2017 to 248 in 2021 (a negative increase of 43,4%). At the same time, the total volume of hospitalizations under the state order in the disciplinary hospital increased from 6,401 in 2017 to 6,868 in 2021 (an increase of 7,3%). Similar trends were noted for the therapeutic and surgical profiles (an increase of 6,5% and 8,6%, respectively). But in the surgical department, the volume of hospitalizations under the state order decreased from 438 in 2017 to 248 in 2021 (a negative increase of 43,4%).

The total volume of paid hospitalizations in the MSA hospital decreased from 4,726 in 2017 to 3,886 in 2021 (an increase of 17.8%), but at the same time, a positive trend has been noted over the past year. Similar trends were noted for the departments of therapeutic and surgical profiles (increases of -23,7% and -3,8%, respectively), as well as for the surgical department, which went from 417 in 2017 to 265 in 2021 (a negative increase of -36,5%).

The sharp decrease in the total number of paid hospitalizations in 2020 is apparently associated with the COVID-19 pandemic and the quarantine regime, while the increase in 2021 is due to the return of the population to a normal mode of life.

Thus, against the background of a slight decrease in the level of hospitalization in the multidisciplinary hospital in the surgical department, this volume decreased significantly (from 855 to 513 people; a negative increase of -40% 0), which indicates a sharp decrease in the frequency of elective surgical pathology, incl. about abdominal diseases, possibly due to a decrease in the volume of government orders (from 438 in 2017 to 248 in 2021; a negative increase of -43,4%0). The sharp decrease in the total number of paid hospitalizations in 2020 is apparently associated with the COVID-19 pandemic and the quarantine regime, while the increase in 2021 is due to the return of the population to a normal mode of life.

Thus, against the background of a slight decrease in the level of hospitalization in the multidisciplinary hospitals surgical department, this volume decreased significantly (from 855 to 513 people; a negative increase of -40% 0), which indicates a sharp decrease in the frequency of elective surgical pathology, including abdominal diseases, possibly due to a decrease in the volume of government orders (from 438 in 2017 to 248 in 2021; a negative increase of -43,4% 0).

Accordingly, this process was accompanied by a gradual decrease in the number of bed-days from 5549 to 3445 (negative growth of -37,9%). As part of the state order, the indicator of the average length of stay of a patient in a hospital, in general, tends to decrease from 8,5 in 2017 to 8,2 in 2021, but in the surgical department, this indicator is unstable, and in 2021 it rose to 8,1. In the structure of hospitalizations in the surgical department, the frequency of paid hospitalizations is very high (41,3%), but the volume of paid hospitalizations decreased from 417 in 2017 to 265 in 2021 (a negative increase of -36,5%), possibly due to the COVID-19 pandemic and the quarantine regime. A negative situation was noted with the deterioration of the bed capacity in the surgical department: a decrease in bed turnover (from 46,5 in 2017 to 32,7 in 2021), an increase in the average duration of 1 case of hospitalization (from 6,4 to 7,3), and a decrease in the number of bed days (from 100,6% to 72,2%), which indicates that the department is unprofitable.

A comparison of the indicators of surgical work in the surgical department and in general according to the ISA for 2017-2021 (Figure 5) revealed positive results: a higher level of surgical activity in the surgical department (in 2021, 76,4% vs. 62,6% in surgical departments), a lower rate of postoperative complications (0,2% vs. 0,3% in surgical departments), and a lower rate of postoperative complications (0,2% vs. 0,3% in surgical departments). However, the average length of a patient's stay in bed before surgery is slightly longer (1,5 days versus 1,2).

In 2021, the frequency of emergency operations in the surgical department was roughly the same, at 19,1%.

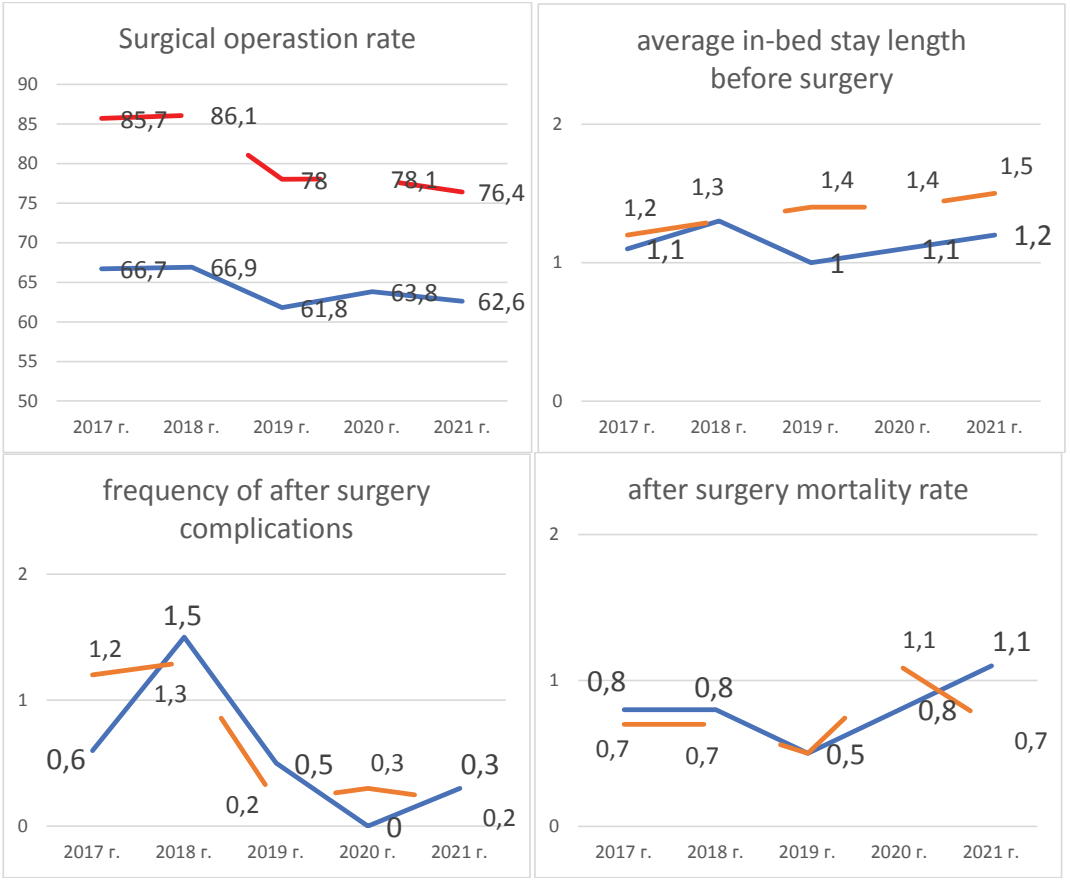


Figure 5.
Dynamics of surgical work indicators in the surgical department (dotted line) and in the hospital in general (solid line) for 2017-2021

In the dynamics of 2017-2021 The structure of treatment outcomes for patients in the multidisciplinary surgical department changed, with an increase in the recovery rate (from 55,1% to 60,3%) and a decrease in the mortality rate (from 0.7% to 0.2%).

Thus, in the structure of those treated in the surgical department, slightly more than half are people over the age of 50 (58,7%), and half were paid patients (49,9%). In the nosological structure of hospitalization in the surgical department of a hospital in 2021, diseases of the digestive system are leading (81,2%), neoplasms are in second place (9,8%), and diseases of the skin and subcutaneous tissue are in third place (5,5%). Of the pathologies of the gastrointestinal tract, cholecystitis/cholangitis (32,5%) and cholelithiasis (30,9%) are the most common, followed by hernias (15,2%) and acute pancreatitis (12,1%).

There was a higher level of surgical activity in the surgical department (in 2021, 76,4% vs. 62,6% in surgical departments), a lower incidence of postoperative complications (0,2% vs. 0,3%), and a lower postoperative mortality rate (0,7% versus 1.1%). In 2021, the frequency of emergency operations in the surgical department remained roughly the same, at 19.1%. In terms of dynamics, the structure of treatment outcomes for patients in the surgical department improved, with an increase in the recovery rate (from 55,1% to 60,3%) and a decrease in the mortality rate (from 0,7% to 0,2%).

Discussion

Thus, in the structure of those treated in the surgical department, slightly more than half are people over the age of 50 (58,7%), and half are paid patients (49,9%). In the nosological structure of hospitalization in the surgical department of a hospital in 2021, diseases of the digestive system are leading (81,2%), neoplasms are in second place (9,8%), and diseases of the skin and subcutaneous tissue are in third place (5,5%). Of the pathologies of the gastrointestinal tract, cholecystitis/ cholangitis (32,5%) and cholelithiasis (30,9%) are the most common, followed by hernias (15,2%) and acute pancreatitis (12,1%). This structural characteristic of patients is similar to the results of Russian researchers [5, 9].

For 2017-2021 against the background of a slight decrease in the level of hospitalization in the multidisciplinary hospitals surgical department, this volume decreased significantly, almost 2 times (a decrease of -40% 0), which indicates a sharp decrease in the frequency of planned surgical pathology, possibly due to a decrease in the volume of state orders (a decrease of -43,4% 0). Accordingly, this process was accompanied by a gradual decrease in the number of bed-days

(a decrease of -37,9%). As part of the state order, the indicator of the average length of stay of a patient in a hospital, in general, tends to decrease from 8,5 in 2017 to 8,2 in 2021, but in the surgical department, this indicator is unstable, and in 2021 it rose to 8,1. In the structure of hospitalizations in the surgical department, the frequency of paid hospitalizations is very high (41,3%), but the volume of paid hospitalizations has decreased (decrease -36,5%), possibly due to the COVID-19 pandemic and the quarantine regime. A negative situation was noted with the deterioration of the bed capacity in the surgical department: a decrease in bed turnover (from 46,5 in 2017 to 32,7 in 2021), an increase in the average duration of 1 case of hospitalization (from 6,4 to 7,3), and a decrease in the number of bed days (from 100,6% to 72,2%), which indicates that the department is unprofitable.

A higher level of surgical activity in the surgical department (in 2021, 76.4% vs. 62.6% in surgical departments), a lower incidence of postoperative complications (0.2% vs. 0.3%), and a lower postoperative mortality rate (0.7% versus 1.1%) have been indicated as positive trends in surgical service. The frequency of emergency operations in the surgical department was approximately the same and amounted to 19,1% in 2021. In dynamics, the structure of treatment outcomes for patients in the surgical department improved with an increase in the recovery rate (from 55,1% to 60,3%) and a decrease in the mortality rate (from 0,7% to 0,2%). When comparing our results with the data of Russian researchers, it was found that the surgical activity was higher (62,6–76,4% vs. 60,6%), but the turnover of the surgical bed was lower (46,5–32,7 vs. -60,3%) and above the average length of stay (6,4–7,3 versus 5,5–6,0) [4, 10], which indicates the need to rationalize the system of in-hospital planning and control of the hospitalization process.

It should also be noted that, in order to assess the level of innovative technologies used in surgery, we did not find data on accounting for the volumes of laparoscopy and endoscopy in the system of Kazakhstan statistics.

Conclusion

The structure of those treated in the surgical department in terms of dynamics, in general, does not change. But there is a sharp decrease in the frequency of planned surgical pathology against the background of a slight decrease in the level of hospitalization in a hospital (a decrease of -40% 0), possibly due to a decrease in the volume of government orders (a decrease of -43,4% 0). Within the framework of the state order, the indicator of the average length of stay of a patient in a hospital, in general, tends to decrease from 8,5 in 2017 to 8,2 in 2021. Good indicators of surgical work were noted: a higher level of surgical activity in the surgical department (in 2021, 76,4% vs. 62.6% in surgical departments), a lower postoperative complication rate (0,2% vs. 0,3%), and a lower postoperative mortality (0,7% vs. 1,1%).

The identified deterioration in the use of beds in the surgical department (decrease in bed turnover, increase in the average duration of 1 case of hospitalization, decrease in the planned number of bed days) requires improvement of the system for planning and monitoring hospitalization in the hospitals. Perhaps this problem is relevant for many multidisciplinary hospitals.

The frequency of emergency operations in the surgical department was approximately the same and amounted to 19,1% in 2021; the total share of outpatient surgery (in all profiles) in the structure of all surgery was 11,3%. And if the frequency of emergency surgery cannot be controlled, then the volume of outpatient surgery can be increased.

For a systematic assessment of the level of innovative technologies used in surgery, it is necessary to include in the system of Kazakhstan statistics accounting for the volume of laparoscopy and endoscopy, as well as accounting for the characteristics of outpatient surgery (noosophical structure, gender, and age characteristics of patients), because the analysis of such information on a national scale will provide an opportunity to rationally plan the volume of outpatient surgery, including under government orders.

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The authors declare that they have no conflicts of interest

Keywords:
COVID-19 pandemic, critical care, intensive care service organization.

INTENSIVE CARE SERVICE OPTIMIZATION FOR COVID-19 PANDEMIC IN ALMATY CITY

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Abstract

Since the beginning of the spread of coronavirus infection in the world, the number of infected has exceeded 102.5 million people, and more than 2.2 million people have died. In Kazakhstan, according to the world statistics of COVID-19, the 59th place in the number of detected cases of COVID-19 and the 68th place in deaths from coronavirus was noted. The vast majority of patients with COVID-19 have a mild or moderate illness, but 5% of those with a critical course of the disease require treatment in an intensive care unit. The length of stay in the intensive care unit averages 10.8 days, however, in 22.7% of patients, the duration of treatment in the ICU exceeds 30 days. In order to improve treatment outcomes, many clinics use a team work methodology that requires a sufficient number of highly qualified medical personnel. However, due to the shortage of personnel in intensive care units, measures are being taken to retrain medical personnel of other specialties. At the same time, short training courses do not always improve the results of treatment in a high quality and lead to a deterioration in the results of most patients.

Алматы қаласында COVID-19 пандемия жағдайында қарқынды емдеуді оңтайландыру

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Түйінді сөздер:
COVID-19 пандемия, қарқынды емдеу, қарқынды емдеу көмегін ұйымдастыру

Аңдатпа

Коронавирустық инфекция таралғаннан бастап,осы уақытқа дейін әлем бойынша инфекция жұқтырғандар саны 102,5 млн адамнан асты және2,2млн адам қайтыс болды. Дүниежүзілік статистикаға сәйкес Қазақстан COVID-19 инфекциясының анықталу жағдайы бойынша 59-орында және қайтыс болған науқастар саны бойынша 68-орында тұр. COVID-19-ды жұқтырған науқастардың басым бөлігінде ауру жеңіл немесе орташа ауыр түрінде өтеді, ал 5% науқастарда инфекция аса ауыр ағымда өтеді және бұл науқастар қарқынды терапия бөлімшесі жағдайында ем алуды қажет етеді. Науқастардың қарқынды терапия бөлімшесінде болуұзақтығы орташа есеппен 10,8 күнді құрайды. Дегенмен 22,7% науқастардың қарқынды терапия бөлімшесінде ем қабылдау ұзақтығы 30 немесе одан көп күнді құрайды. Көптеген клиникаларда емнің нәтижесін жақсарту мақсатында командалық жұмыс тәсілін қолданадыБұл тәсілмен жұмыс атқару жоғары білікті мамандар санының жеткілікті болуын қажет етеді. Дегенмен, реанимация бөлімшесінде кадр тапшылығына байланысты, өзге мамандықтағы медициналық қызметкерлерді қайта даярлау шаралары атқарылады Қысқа дайындық курстары, әдетте,реанимациялық көмектің сапасын жақсартпайды және емдеу нәтижесінің нашарлауына әкеліп соқтырады.

Оптимизация интенсивной терапии в условиях пандемии COVID-19 в городе Алматы

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Ключевые слова:
COVID-19 пандемия, организация службы интенсивной терапии

Аннотация

С момента начала распространения коронавирусной инфекции в мире, число зараженных превысило 102,5 млн человек, и более 2,2 млн человек умерли. В Казахстане, согласно мировой статистике COVID-19, отмечено 59-е место по числу выявленных случаев COVID-19 и 68-е место по смертности от коронавируса. У значительного большинства пациентов, болеющих COVID-19, заболевание протекает в легкой или средней форме, однако, у 5% при критическом течении заболевания, необходимо лечение в отделении интенсивной терапии. Продолжительность пребывания в отделении интенсивной терапии составляет в среднем 10,8 дня, однако у 22,7% пациентов продолжительность лечения в ОИТ превышает 30 дней. В целях улучшения результатов лечения, многие клиники используют методику бригадной работы, требующей достаточного числа высококвалифицированного медицинского персонала. Однако, в связи с нехваткой кадров в отделениях реанимации, принимаются меры по переподготовке медицинского персонала других специальностей. При этом, короткие курсы подготовки не всегда высококачественно улучшают результаты лечения и приводят к ухудшению результата большинства пациентов..

Background

In late December 2019, an unusual outbreak of pneumonia characterized by fever, dry cough and wasting, as well as gastrointestinal symptoms in some patients, was recorded at the South China Seafood Wholesale Market in Wuhan, Hubei province, China. The outbreak affected approximately 66% of the seafood market staff; the market was closed on January1, 2020, after an epidemiological alert was issued by the local health laboratory on December 31, 2019. However, the following month (January), thousands of people were involved in an unusual pneumonia outbreak in China, including many provinces (e.g., Hubei, Zhejiang, Guangdong, Henan, andHunan) and cities (Beijing and Shanghai). It has also spread rapidly to other countries such as Thailand, Japan, the Republic of Korea, Vietnam, Germany, the US and Singapore. The first case of the disease was recorded in Kazakhstan on March 20, 2020.

As of February 6, 2020, WHO recorded a total of 28,276 confirmed cases and 565 deaths in at least 25 countries worldwide. It was later confirmed to be a new strain of beta coronavirus, called the 2019 novel coronavirus, similar to the severe acute respiratory syndrome outbreak 17 years ago(SARS 2003 was caused by a different beta coronavirus).

The causative agent of the novel coronavirus infection is thought to be combination of the bat coronavirus, but its origin is apparently unknown; it was named SARS-CoV-2 by the International Committee on Virus Classification on February 11, 2020. At the same time, the World Health Organization (WHO) decided in 2019 that the official name of the novel corona virus infection would be Coronavirus Infections (COVID-19). Given the widespread and rapid spread of SARS-CoV-2, the WHO announced on11 March 2020 that aCOVID-19 pandemic had begun.

Many of the efforts being made to prepare for the pandemic will help buy time to strengthen the health system and improve the efficiency of infrastructure but will do little to optimize the most essential component of health care: medical and support staff in intensive care units.

Trained multidisciplinary specialists (intensivists) are needed to deliver healthcare to critically ill patients. These specialists should be able to control all problems associated with complex diseases and comorbidities or worsening conditions [1].

From open news sources, we know that in order to reduce the load in the intensive care unit and protect staff from infection, each hospital creates separate teams for various routine but dangerous operations under coronavirus infection: tracheal intubation teams, cardiopulmonary resuscitation teams [2, 3], consultation teams a team for intra-hospital transportation of critically ill patients, a team of physiotherapists, etc. At the same time, the composition and appointment of such teams is determined by each individual clinic. For example, in some Chinese hospitals, the tracheal intubation and resuscitation teams include from 4 to18 specialists each.

Such an approach requires a large number of dedicated and well-trained staff. There is also a debate about the appropriateness of such teams, believing that a well-equipped specialized kit for intubation and a ‘point’ for resuscitation would greatly reduce the need for such a team [4].

Tele consultation centers are mostly organized by medical faculties or universities. These centers include specialists from different disciplines such as intensive care, respiratory, hematology, neurology, nephrology and epidemiology. The aims of these centers often include the development of recommendations and guidelines as well as consultative support

[2]. These centers do not provide practicalhelp.

In many developed countries, health systems are largely private and business-oriented and there is no unified approach to management. For example, in the USA, where the health system is highly decentralized, the lack of a single central authority to manage and organize health services has been analyzed as a major disadvantage. On the other hand, the federal government lacks sufficient authority to make such decisions and attempts to centralize the health system on a voluntary basis are often subject to criticism and misunderstanding [5].

In the face of an acute shortage of human resources, many national health authorities have made some attempts to train health professionals from other specialties, such as doctors and nurses, to work in intensive care units. Short-term, superficial courses aim to quickly train the maximum number of intensivists. This, as a rule, leads to a decrease in the quality of intensive care provided and consequently does not decrease morbidity and mortality.

All the above activities are usually decentralized and can only be implemented in specific clinics. This makes it difficult to assess the resources of intensive care units across a city, region or even a country.

In the aspect of the shortage of medical personnel in intensive care units, in order to concentrate information on the available resources and the condition of patients of each medical institution, in our opinion, the most effective will be creation of mobile multi-functional intensive care teams. These teams include well-trained intensive care doctors who can provide coordination, methodological, advisory and practical assistance in every intensive care unit, while covering all clinics of a region. For they can concentrate and analyze information about the technical, medical, and human resources of each intensive care unit and collect information about the condition and dynamics of patients' state in these departments.

Such teams have great potential for providing the listed types of assistance in a timely manner to optimize the therapeutic, diagnostic, and anti-epidemic processes in intensive care units.

In the context of the COVID-19 pandemic, the WHO has set the following tasks for health systems:1) slow down and stop the transmission of the virus; 2) ensure optimal care for all patients; 3) minimize the negative impact of the epidemic on health systems, social services, and economic activity.

To solve these problems, to ensure a timely increase in the volume of clinical and sanitary-epidemiological measures, the WHO document "Practical aspects of the organization of COVID-19 case management in medical institutions and at home" was prepared with a description of the key actions to be taken in each of the following transmission scenarios: absence of cases; sporadic cases; clusters of cases; spread of the virus among the population.

While most COVID-19 patients have mild (40%) or moderate (40%) severity disease, about 15% develop severe disease requiring oxygen support, and 5% have extremely severe disease (critical) with complications such as respiratory failure, acute respiratory distress syndrome, sepsis, septic shock, thromboembolism and/or multiple organ failure, including acute kidney and heart damage [6]. Advanced age, smoking [7, 8], and comorbidities such as diabetes, arterial hypertension, ischemic heart disease, chronic lung disease, and cancer have been reported as risk factors for the development of severe illness and death. The results of multivariate analysis confirmed that advanced age, a high score by SOFA scale assessment, and D-dimer> 1 μg /Lare also risk factors.

The mortality rate of patients in intensive care units may be as high as 40-61%. In some regions it may reach up to 90%, despite the use of high-tech methods of intensive therapy [9, 10, 11].

In addition, providing of intensive care in some clinics was quite problematic due to the lack of resources because of very large number of severe patients.

While COVID-19 has spread globally, the burden on healthcare system is not homogenous. Several regions in Italy that have experienced rapid spread of the virus reported lack of resources in the healthcare system, which appears to have contributed to the high mortality rate [10]. At the same time, clinics in Canada located in regions with a smaller number of infected people reported a mortality rate of resuscitation patients of about 15% [12].

The first reports on patients' profile came from the China Center for Disease Control and Prevention: that of the more than 44,000 confirmed cases of COVID-19, about 81% were asymptomatic or had mild symptoms such as cough, fever, fatigue and myalgia. Although home treatment and self-isolation are appropriate measures for these cases, 14% developed severe disease and 5% developed critical illness requiring ICU hospitalization. Patients with severe COVID-19 typically have a respiratory rate ≥ 30 breaths per minute, oxygen saturation ≤ 93%, and lung infiltrates> 50%, and are at high risk of clinical deterioration and critical illness, including acute respiratory distress syndrome. Hospitalization should be mandatory for patients who develop severe symptoms; however, ICU space should be occupied by patients with the most severe forms, depending on the capacity of the health care system.

Despite differences in culture and practice

around the world, most centers report that about 25% of hospitalized patients require transfer to an ICU [13].

Patients with severe disease should be closely monitored as rapid progression from moderate to severe ARDS can occur.

Acute hypoxic respiratory failure is the most frequent complication occurring in 60–70% of patients admitted to the ICU. Patients at high risk of developing ARDS are people over 65 years of age with high fever (T> 39ºC), neutrophilia, lymphocytopenia, elevated markers of liver and kidney failure (aspartate aminotransferase, alanine aminotransferase, creatinine, and urea), elevated acute phase proteins such as inflammatory markers (highly sensitive C-reactive protein, procalcitonin and serum ferritin) and increased values associated with clotting function (prothrombin time, fibrinogen, and D-dimer).

The main criteria for transfer to ICU include high oxygen demand equal to or exceeding 6–8 L / min to achieve peripheral oxygen saturation ≥90–92%, respiratory failure, shock, acute organ dysfunction, and patients at high risk of clinical deterioration. However, in many countries, due to a shortage of beds in intensive care units, it has generally been the case that only patients requiring intubation and invasive mechanical ventilation have been admitted to the intensive care unit.

In China, Italy and the United States, 70-90% of patients admitted to the intensive care unit required invasive ventilation on the very first day. 65,9% of patients required vasopressor and inotropic support. Acute renal failure was observed in 27,1% of patients admitted to the ICU. At the same time, the average length of stay of patients in the ICU was 10,8 days. Ay 22,7% the duration of treatment in the ICU was 30 days or more.

The COVID-19 pandemic requires more resources, the replenishment of intensive care teams with new staff, a reorganization of the department and a change in protocol. All this can lead to vulnerability and loss of control over all professionals. In many cases, intensives must make their choices based on local politics, structural resources and team ability [14].

Faced with serious challenges in providing medical care to patients with COVID-19, many hospitals around the world have identified the main problems: insufficient number of beds in medical institutions; insufficient number of beds in intensive care units; insufficient number of intensive care doctors; insufficient number of nurses in intensive care and intensive care units; insufficient number of artificial lung ventilation devices.

The pronounced shortage of both medical and non-medical personnel limits the real possibilities of medical institutions.

The surge in demand for health care is adding to the pressure on inpatient unit capacity, affecting the intensive care sector the most.

Rapidly changing conditions necessitate constant professional development of personnel, as well as frequent and accurate information update.

Most countries, along with the organization of logistics activities to equip and provide hospitals with medicines, personal protective equipment, medical equipment, increase the hospital bed capacity, attract additional medical personnel, and create counseling centers. At the state level, programs for additional financing, training, and attracting specialists are being developed, new clinics are being built.

The governments of many countries has taken several measures to organize, optimize and improve the health sector during the pandemic [15].

One of the most important factors contributing to the successful recovery of patients is the team model of care. This model of care has been used in many departments for many years, most often in emergency departments. This model includes three important factors: 1) completion of the nursing assignment; 2) related equipment and medical supplies; and 3) infection control.

As Coronavirus Disease 2019 (COVID-19) spread, it became apparent in many countries that there were not enough beds, ventilators, or personnel in intensive care units to accommodate patients. Many clinics have stopped planned hospitalizations by 100% or almost 100%. In the United States, many cities have brought together specialists in real time to form a multi-disciplinary team of leaders, including hospital administrators, doctors, nurses, intensive care specialists, and healthcare experts. The first goal was to define the minimum physical space, equipment and personnel needed to provide care to ventilated patients in crisis settings, and then to develop new coordinated staffing models that could be adapted for both large academic health centers and small ones, as well as regional hospitals. Following the establishment of system-wide standards, similar integrated steering groups were created at each clinic and met daily for the next two and a half months in spring 2020 to coordinate the opening (and then closing) of the units and directly oversee staffing.

At the peak of morbidity, many clinics were operating at ~ 250% of their pre-crisis capacity. The knowledge and skills of intensive care physicians and intensive care nurses are essential to ensure optimal treatment and care. Specialists in intensive care units, moreover, specialists trained in internal medicine were also lacking to meet the standards of personnel in

intensive care. It was also clear that, in contrast to patients usually admitted to intensive care units, COVID-19 patients had relatively uniform initial manifestations. Therefore, US clinics have shared the traditional roles and titles of doctors, nurses and created de novo teams. Some of the clinic staff have been certified as service personnel. Some of those present worked as trainees. Nurses, physiotherapists, perfusionists, and other healthcare professionals have made some of the tasks of intensive care nurses easier. Likewise, doctors and nursing staff from other departments assisted with some of the nursing tasks.

In Italy, the number of patients quickly became so large that the number of beds in intensive care units began to run out, causing chaos in both the medical community and the population [16]. On the other hand, one of the measures aimed at mitigating the situation was the creation of field hospitals, as well as the relocation of intensive care units specialized in certain conditions to treat patients with complications of COVID-19, as was the case with Bergamo. The cardiology department, where 60% of beds were occupied by patients positive for COVID-19 [17], in addition, pediatric hospitals with intensive care units were used for adults [18].

Despite this, the level of workload remained extremely high in the teams working on the front lines. These teams include intensive care physicians, nurses and physical therapists. Stress reactions in ICU staff were defined as organic, mental and social reactions to harmful stimuli experienced by a person [19].

It takes most nurses years to become clinically competent in caring for patients in intensive care units.

Thus, to provide quality care to critical patients with COVID-19, healthcare organizations will have to expand the several intensive care nurses they already have at their bedside.

One way to do this is to implement a model that has been used by nurses for decades: team staffing. Instead of assigning a small number of patients to a single nurse, managers assign a large group of patients to several staff members. The theory behind this approach is that the collective wisdom of a group provides better care for their assigned patients than a single nurse could do alone.

In the treatment of COVID-19, this approach has broadened the experience of a limited number of experienced intensive care nurses. These nurses, either experienced nurses or emergency nurses, lead the team. They are directly responsible for some very complex care activities but spend most of their time watching their team.

Most often in the USA, Italy, Spain, and other countries, where the number of patients exceeded the reserves of intensive care units, the following schemes were used: combination of an experienced ICU nurse with express trained nurses; combining intensive care staff with surgical staff for cross-training; appointment of paramedics as team leaders with nursing and support staff to work in the ICU.

The risk of the team model is that team members do not always have a clear understanding of what they are directly responsible for, leading to oversight or overlap in patient care and treatment. To create an effective model, you need to follow two guidelines below:

Clearly delineate team roles and responsibilities. The most important part of recruiting a team is clearly defining roles. There is no single answer to the question of what each team member should be responsible for - it depends on the composition of the team. However, to prevent missed or duplicate assistance, each team member needs to know exactly what caregiving actions they are responsible for and what their teammates will get.

As a starting point, ICU leaders should compile a list of COVID-19 treatment-related care activities. Basic nursing skills - initial assessment, basic intravenous administration - should be transferred to retrained nurses. Those critical care personnel should be subordinate to a team leader or be performed by cross-trained nurses under the supervision of a more experienced one.

An expert should be appointed and trained to delegate authority to team members. The choice of an employee as an expert will depend on the available staff of each organization. Emergency nurses and experienced critical care nurses are excellent leaders in COVID-19 teams. However, experienced operating theater nurses can also be considered as they have experience and competencies critical to the treatment of COVID-19 (specifically setting up and preparing ventilators).

Regardless of who the leader is, it is important to set clear limits on what they are responsible for and what they should delegate to other employees. Team leaders are likely to find it difficult to delegate authority, especially those with no formal leadership experience. Managers must actively support them in developing these skills. To do this, consider applying the following strategies: Train leaders to provide prompt feedback; another option is to develop and communicate a Feedback Guide to leaders.

Daily clinical rounds are a great opportunity to build report, review care plans, identify lacks, and re-delegate roles to team members. At the end of each shift, responsible persons ask employees about their work done. In addition to improving leadership skills, these tests can also serve as emotional support for all employees.

Colleagues from Europe, during the period of the influx of severe patients, have developed recommendations for increasing the capacity of intensive care units: When considering the possibility of increasing the areas of intensive care, it is necessary first of all to consider the possibility of using adjacent premises before opening remote ones; Maintain a normal nurse-to-patient ratio for as long as possible; A risk assessment should be carried out when considering the placement of personnel. This should be based on the individual experience and skills of staff [Royal College of Nursing UK.RCN guidance on redeployment - COVID-19]; The use of specialized ward staff as reinforcements in intensive care units must be carefully considered in accordance with the requirements of the intensive care unit. It must be admitted that at a time of an acute shortage of qualified specialists, during a pandemic all over the world, sometimes residents or young or inexperienced doctors were in place of doctors. For the treatment of seriously ill patients, volunteers or doctors who did not have special training in the field of intensive care were involved. All these were dictated by the circumstances when the crisis in the health care system was felt around the world, expressed in a lack of human and material resources.

A special role during the pandemic is played by nursing staff, whose acute shortage was also felt. Nurses are the link that directly brings to fulfillment all the treatment that the doctor prescribes. There is also a need to increase support staff to help nurses continue to deliver high-quality care.

During a pandemic, hospitals must establish an approved program to increase ICU staff who may be required to work beyond the usual minimum standards and guidelines [20]. This will require will and a non-standard approach in decision-making from the heads of health care institutions.

There is a need to provide an accelerated awareness program, timely education and retraining in the early stages of pandemic planning. In these conditions, it is possible to organize short-term improvement courses or even retraining of specialists: doctors and nurses. In case of emergency, we see it as expedient to use the labor of residents who have completed two years of study, who have mastered the most necessary knowledge and skills of conducting intensive therapy, under the supervision of doctors and mentors.

New staffing models have transformed ICU attendance into a supervisory function to disseminate the experience to 50 patients simultaneously and create new, non-traditional teams around them, with rapidly upgraded nurses and other staff [21], which is the subject of this research.

Thus, an analysis of the available literature indicates that, despite the availability of international experience, the problem of organizing medical care, especially intensive care, for patients with coronavirus infection remains open. Today, there are various models of a team approach in the provision of intensive care for patients with COVID-19 in hospitals. Although the work of teams with different functions in intensive care units is described, nevertheless, there are no examples of an integrated approach in the literature: providing both practical and advisory-methodological assistance in the treatment of patients with severe coronavirus pneumonia, covering all infectious hospitals of the whole metropolis.

All above and the experience gained in the work of intensive care doctors during the pandemic of the Republic of Kazakhstan, allowed us to identify three key lessons that helped our teams to succeed. We detail here the teams we created and the types of people who were able to fill each role. We discuss the lessons we have learned from implementation and our vision for the future intensive care unit in the hope that this can serve as a guideline for others should they face similar crises.

Materials and methods

We performed analysis of available world literature on optimization of intensive care services in countries with the highest number of cases of COVID-19. Review and analysis of scientific and available literature according to the Cochrane Library data, according to the PubMed, e-library, Web of Science and EMBASE databases, reference publications, special periodicals, monographs, scientific articles - 200 units.

The retrospective descriptive research also was carried out including government hospitals of the Almaty City, according to medical data received from the Almaty branch of the Republican Center for Electronic Health.

We assessed the work of the Center of Anesthesiology and Intensive Care, which coordinates the work of intensive care units of city hospitals. We performedthe analysis of intensive care indicators in patients with COVID-19 in Almaty Cityand demographic and medical data of patients were studied. A comparative analysis of the studied indicators was carried out before the start of the Center of Anesthesiology and Intensive Care and after the start of its work.

The study included 266 patients with COVID-19 who were in the departments of anesthesiology and resuscitation of the city of Almaty for the period from July 1 to August 31, 2020.

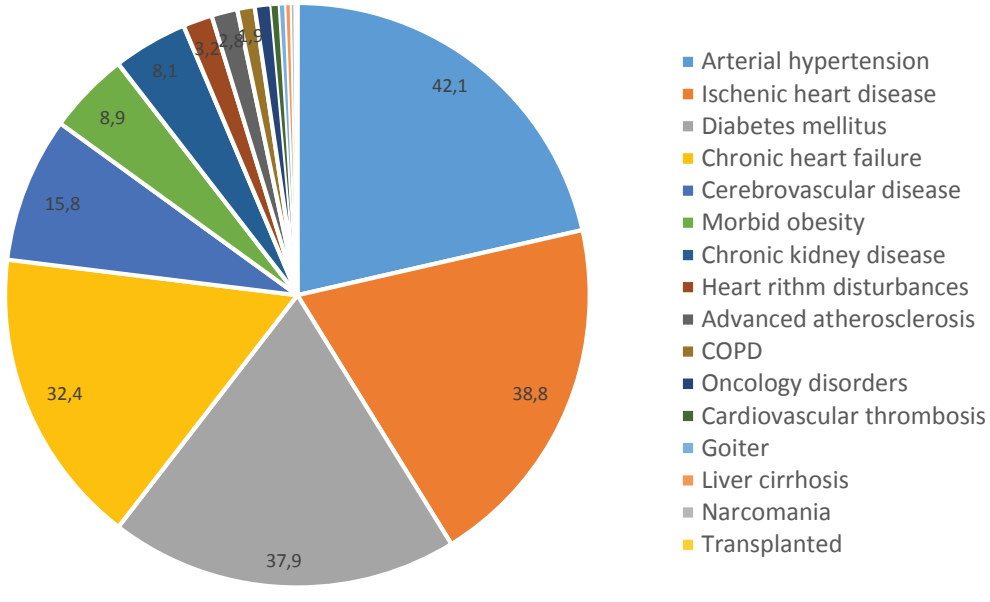
Results

Characteristics of patients in the intensive care units of infectious hospitals in the city. A daily analysis of the dynamics of the number

of severe patients in ICU and deaths in clinics providing medical care to patients with coronavirus infection was carried out.

The Figure 1 shows that most common comorbidities in intensive care unit patients were arterial hypertension, which accounted for 42.1% of all concomitant diseases. In second place, according to the prevalence of concomitant diseases in patients with covid pneumonia, patients with coronary artery disease 38.8%. They are followed by patients with concomitant CHF 32.4% and diabetes mellitus 37.9%, respectively. Then there are patients with cerebrovascular diseases with 15.8% and patients with chronic renal failure and cardiac arrhythmias, each of which accounted for 3.2%. Patients with cancer accounted for 1.8%. Patients with atherosclerosis and chronic obstructive pulmonary diseases accounted for 1.9% each. All other conditions: human immunodeficiency syndrome, obesity, thrombus formation, goiter, chronic anemia, conditions after organ transplantation, drug addiction and liver cirrhosis were less than 1% each.

Figure 1.
Comorbidity in patients in intensive care units



Study of the activities of the Center of Anesthesiology and Intensive care, which coordinates the work of the intensive care units of the city hospitals.

In the city of Almaty, to optimize intensive care for patients with severe forms of COVID-19, theCenter of Anesthesiology and Intensive Care was established. This Center consists of multi functional intensive care teams, including well-trained intensive care physicians, who simultaneously provide coordination, methodological, advisory, and practical assistance in the field - in intensive care units, covering all infectious diseases clinics in the city of Almaty. The legal basis for the functioning of the Center of Anesthesiology and Intensive Care was the order of the Public Health Department of Almaty.

Structure of the Center of Anesthesiology and Intensive Care: Head of the Center of Anesthesiology and Intensive Care- chief anesthesiologist of the Department of Healthcare of the Almaty city; Rapid-response Intensive careteams of the Center of Anesthesiology and Intensive Care; The head of the Rapid-response Intensive careteams which is a highly skilled intensivist, with medical science degree; Highly skilled intensivists - 4; Advisory and methodological group of the Center of Anesthesiology and Intensive Care; Highly experienced anesthesiologists and intensivists who areProfessors in the field of intensive care and anesthesiology.

We analyzed the activities of the Center of Anesthesiology and Intensive Carefor the month of July 2020. The Center of Anesthesiology and Intensive Carehas performed the following work: Familiarization and detour of infectious diseases clinics together with colleagues from Moscow. There are 14 hospitals in total (12 of them have 13 intensive care units + 2 hospitals of the ICU); Study of the personnel potential of intensive care units; Stratification of intensive care units according to echelons (1-3); A visit to the RGBR in infectious diseases hospitals is under way; Consultations of the RGBR are carried out in infectious diseases hospitals; If the need arises, the transfer of patients between infectious diseases hospitals of the city to provide treatment at a higher level; Participation in extended headquarters meetings – 12; Visits with practical and advisory assistance to city clinics – 249; Local consultations – 589; Concilium; Online (remotely) – 28; Onsite – 15;

Meetings of the Center for Anesthesiology and Intensive Care – 9.

The NEWS scale was used to assess the patient's condition.

The analysis showed that in the period from July 1 to August 31, 2020, 631 out of 4605 patients with COVID-19 viral infection were in the intensive care units of Almaty, which amounted to 13,7%.

The average age of patients was 64,3 (20-96) years, 337 men, 294 women. The average length of stay in the ICU was 3,7 days, the average length of stay in the clinic was 8.4 days. 98 patients survived; 168 patients died.

Table 1.
Indicators of patients with COVID-19

Index	Group I	Group II	p=
Total number of ICU patients	142	489	
Age (years)	64,8±12,1	65,1±14,5	0,54
Gender (M / F)	75/67	262/227	0,11
Daily number of ICU patients	35,9±3,6	43,9±1,9	<0,01
Duration of ICU stay (days)	1,38±2,9	4,21±4,3	<0,01
Length of hospital stay (days)	4,66±5,2	12,3±4,7	<0,01
Died (n)	108	257	<0,01
Length of stay in the ICU of the deceased (days)	0,83±1,4	2,31±2,4	<0,01
Mortalityin ICU (%)	76,1	52,6	<0,01

hus, all the studied indicators were divided into two groups: Group I — from July 1 to 14 and Group II — from July 15 to 31, 2020 (Table 1). The first group included data from 142 patients with COVID-19, the second group included data from 489 patients (Table 1). The groups did not differ in age. In both groups, men predominated: Group I – 52,8%, Group II –53,6%.

Patients of the first group were in the hospital for 4,66±5,2 (1-42) days, of which 1,38±2,9 (0-10) in the intensive care unit. The duration of stay in the hospital and the intensive care unit in patients of the second group was higher –12,3±4,7 (1-43) days in the hospital and 4,21±4,3 (0-13) days in intensive care. The average number of patients in the ICU during the day was 35,9±3,6 in the first group, 38,2±5,2 in the second group. The duration of stay in the intensive care unit for deceased patients was 0,83±1,4 days in the first group and 2,31±2,4 days in the second group.

When studying the duration of stay in the intensive care unit among deceased patients, it was found that the patients of the first group mostly died in the early stages, in the second group of patients only a third died on the first day (Figure 2).

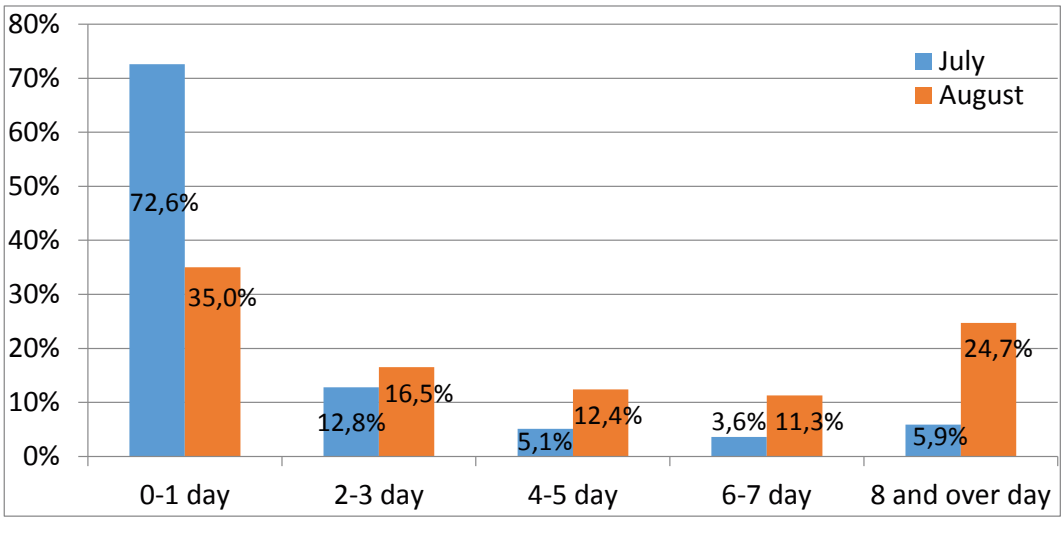


Figure 2.
Time of death in ICUs

Mortality in intensive care units was 76,1% in the first group and 52,6% in the second group. We revealed that the odds ratio OR (OddsRatio), when comparing the mortality of both groups, was 3,39 (95% CI: 2,01-5,71). The relative risk RR (RelativeRisk) was 1,57 (95% CI: 1,28-1,93).

With a decrease in the number of deaths on the first day, an increase in the daily number of patients in intensive care units is also associated (Figure 3).

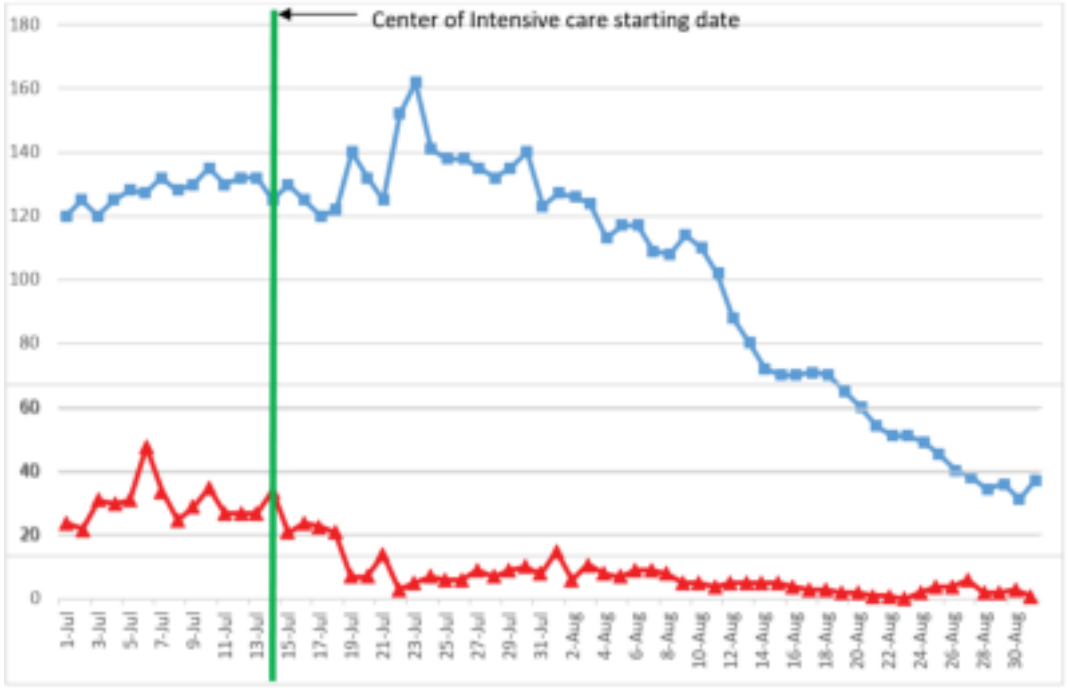


Figure 3.
Dynamics of the number of ICU patients and deaths in the studied groups.

Thus, the analysis of the activities of the Center of Anesthesiology and Intensive Careand the organization of assistance to patients in intensive care units of hospitals providing assistance to patients with coronavirus infection in order to effectively provide care to patients with coronavirus pneumonia, we have developed an algorithm for the interaction of specialists of the Center for Anesthesiology and Intensive Care, which describes the functions and interactions of each link, that is, doctors of the Center and hospitals.

Discussion

While most COVID-19 patients have mild (40%) or moderate (40%) severity, about 15% develop severe disease requiring oxygen support, and 5% have extremely severe (critical) course with complications such as respiratory failure, acute respiratory distress syndrome (ARDS), sepsis, septic shock, thromboembolism and / or multiple organ failure, including acute kidney and heart damage [6].

The mortality rate of patients in intensive care units at the peak of the first wave reached 40–61%, and in some regions up to 90%, despite the use of high-tech methods of intensive therapy [22–24].

Most of the undertaken activities do little to optimize the most essential element of health care, medical and support staff in intensive care units. To provide medical care to critically ill patients, trained multidisciplinary specialists (resuscitators) are required who can control any changes associated with both this complex disease and the decompensation of existing concomitant pathologies [7].

To reduce the workload on staff in intensive care units and protect them from infection, each hospital separately creates different teams that perform separate functions: a team for tracheal intubation, a team for cardiopulmonary resuscitation [8, 25], a team of consultants, a team transporting critically ill patients inside the hospital, teams of physiotherapists, etc. At the same time, the composition and appointment of such teams is determined by each clinic itself. For example, in hospitals in China, the team of specialists in tracheal intubation and the team for resuscitation involves 4-18 people in each, in addition to basic practical assistance in the departments of the clinic where these teams are created, they are engaged in methodological assistance in the form of developing various hospital guidelines and algorithms.

This approach requires many committed and well-trained staff. In addition, there is debate about the appropriateness of such teams, believing that the creation of a sufficient number of fully equipped special kits for tracheal intubation and “points” for resuscitation, significantly reduces the need for such teams [26].

Remote counseling centers are most often organized by medical schools and universities. These centers include specialists from various areas in the field of intensive care, pulmonology,

hematology, neurology, nephrology, epidemiology, and other areas of medicine. The tasks of these centers, in addition to advisory assistance, usually include the development of recommendations and guidelines [8]. Such centers do not provide practical assistance.

Experiencing a sharp shortage of personnel, health systems in many countries are taking measures to train and retrain medical personnel of other specialties to become doctors and nurses in intensive care units. Short and superficial courses designed to quickly train the maximum number of intensive care specialists, as a rule, lead to a deterioration in the quality of the resuscitation care provided, does not improve the results of treatment and mortality.

All above activities, in general, are of a decentralized nature and are applicable in individual clinics, which makes it difficult to assess the resources of intensive care units on a city or regional scale, and even more so in the country.

In the aspect of the shortage of medical personnel in intensive care units, as well as in order to concentrate information on the available resources and the condition of patients of each medical institution, in our opinion, the most effective will be to create mobile multifunctional resuscitation teams. These include well-trained intensive care physicians who can simultaneously provide coordination, methodological, advisory and practical assistance in the field - in intensive care units, covering all infectious diseases clinics of the settlement. By concentrating and analyzing information on the material, technical and human resources of individual intensive care units, information on the condition and dynamics of patients in these departments. Such teams have the potential to provide the listed types of assistance in a timely manner to optimize treatment, diagnostic and anti-epidemiological processes in intensive care units.

The need to create such teams is also dictated by the fact that during the period of the pandemic there is a massive admission of severe patients, which at a certain moment can cause discord and stagnation in the work of hospitals that were previously unprepared for such conditions. Therefore, coordination in the work of the resuscitation and intensive care services makes sense.

Using the example of the city of Almaty, where the Center for Anesthesiology and Intensive Care was created, which provides practical assistance on the ground, advice, methodological assistance and control over the organization and implementation of intensive care for patients with COVID-19, the effectiveness of this approach can be considered.

After the introduction of mobile resuscitation teams into the work of intensive care units, there is an increase in the duration of patients' stay in intensive care units and in the hospital. This situation is directly related to a significant decrease in the number of deaths in 0-1 days after admission to the hospital and the intensive care unit.

At the same time, the load on the intensive care units remained unchanged, the average number of patients per day was 35,9±3,6 in the first group, 38,2±5,2 in the second group.

Along with a decrease in the number of deaths in the early period of patients admission, as a result of the work of the Center of Anesthesiology and Intensive Care, there is a decrease in mortality in intensive care units from 76,1% to 48,4%.

Conclusion

Thus, the results of the study made it possible to draw the following:

Based on the study of international experience, it can be argued that there are different types of team approach in the treatment of patients with coronavirus infection in intensive care units. At the same time, there are no examples like those in our case, when a team of resuscitators provides comprehensive advisory and practical assistance to critically ill patients with COVID 19.

The average number of resuscitation patients who were daily in the city hospitals in July was 37.1 patients, of which 24.3% were patients in an extremely serious unstable condition. The main comorbidities were pathologies of the heart, brain, and kidneys. The severe course of pneumonia with coronavirus infection is accompanied by a high mortality rate.

The work of the resuscitation service in Almaty was optimized by creating an Anesthesiology and Resuscitation Center for the treatment of critically ill patients with COVID-19. The functioning of the Center leads to an improvement in treatment results, in the form of a significant reduction in mortality, which is confirmed by the odds ratio (OR) = 3.39 and relative risk (RR) = 1.57.

4. An algorithm for the interaction of specialists from the Center for Anesthesiology and Intensive Care with doctors of hospitals has been developed and is successfully applied in practice.

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DEVELOPMENT PATHS OF CLINICAL TOXICOLOGY IN THE ARMED FORCES OF THE REPUBLIC OF KAZAKHSTAN. A LITERATURE REVIEW

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Abstract

Without the development of clinical toxicology, the population is doomed to suffer great losses in the event of the use of chemical weapons or man-made disasters, since the national health structure will not be able to provide the necessary symptomatic and antidote care to the affected people. The development of clinical toxicology is necessary today because of the threat of latent methods of chemical attack, when prevention and chemical control structures become ineffective and the consequences of poisoning with an unknown poisoning agent have to be dealt with.

Қазақстан Республикасы қарулы күштерінде клиникалық токсикологияны дамыту жолдары. Әдебиет шолуы

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Мүдделер қақтығысы:
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Аңдатпа

Химиялық қауіпсіздік ұлттық қауіпсіздіктің бір бөлігі болып табылады. Өз кезегінде, клиникалық токсикология химиялық қауіпсіздіктің бір бөлігі болып табылады және оны дамытпай, химиялық қару немесе техногендік апат жағдайында халық үлкен шығындарға ұшырайды, өйткені елдің денсаулық сақтау құрылымы зардап шеккен адамдарға қажетті симптоматикалық және антидотты көмек көрсетеалмайды. Әсіресе, алдын-алу және химиялық күрес құрылымдары тиімді болмаған кезде және улы зат туралы мәліметтер болмаған жағдайда салдар мен күресу қажет болған кезде химиялық шабуылдың жасырын әдістерін қолданудың қазіргі шындықтарында клиникалық токсикологияның дамуы туралы мәселе өткір тұр.

Пути развития клинической токсикологии в вооруженных силах Республики Казахстан. Обзор литературы

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Аннотация

Химическая безопасность является частью национальной безопасности. В свою очередь клиническая токсикология является частью химической безопасности и без ее развития население обречено на огромные жертвы в случае применения химического оружия либо техногенной катастрофы, так как структура здравоохранения страны не сможет оказать необходимую симптоматическую и антидотную помощь пораженным людям. Особенно остро стоит вопрос о развитиии клинической токсикологии в сегодняшних реалиях применения скрытых способов химической атаки, когда структуры предупреждения и химической борьбы окажутся не эффективны и нужно будет бороться с последствиями в условиях отсутствия данных об отравляющем веществе.

Ключевые слова:
COVID-19 пандемия, организация службы интенсивной терапии

Relevance

The achievement of national security is only possible within the framework of a balanced system of regional and international security. In this regard, "the security system of Kazakhstan should be an integral part of the regional and global security system" [1].

At various stages of the country's development, uneven development of various components of security is noted due to emerging threats or funding deficits. Therefore, one of the strategic tasks is to establish a certain balance that allows for the balanced development of all types of security. For example, until we were faced with the threat of biological security in the form of the spread of coronavirus infection, no one considered the development of this area, and measures taken were actually in the form of reducing departments and abolishing services dealing with this issue. This experience has shown that national security needs to be approached comprehensively. Currently, due to the worsening political situation in the world, we believe that more attention should be paid to chemical security, which should be considered as one of the components of the overall national security system as well as a complex independent system. The identification and detailed elaboration of chemical security threats largely determine the overall state of societal security, the conditions in which it exists, and the development of the environment. Chemical threats can cause harm not only territorially, affecting neighboring countries, but also temporally, leaving their mark on generations of people [2].

Objective: Development of a concept for the advancement of clinical toxicology in the Armed Forces of the Republic of Kazakhstan.

We conducted a search of literature and regulatory acts freely available that provide insights into the organization of chemical safety abroad and in the Republic of Kazakhstan. A search using keywords yielded 2268 results, of which 692 were accessible. The majority of publications were excluded due to their thematic irrelevance to our research. As a result, several publications primarily authored by specialists from the United States, discussing the organization of toxicological services in different countries, were selected. Only one domestic article corresponded to the search criteria. Additionally, regulatory acts governing the organization of chemical safety in the Republic of Kazakhstan were selected.

Analysis of the global situation

The concept of warfare has evolved since the Second World War, with the popularization of the United States and NATO countries employing local armed conflicts to address political issues. In turn, the emergence of so-called "contactless" and hybrid warfare, starting with the war in Yugoslavia, has led to the development of insurgent movements funded from external sources. The territories occupied by insurgents are not bound by international law, and their pursuit of goals may involve the use of weapons of mass destruction (WMD). Considering the poorly developed infrastructure destroyed by combat operations, as well as the lack of sophisticated production capabilities, it is likely that insurgents will resort to various crude chemical agents and "dirty" radioactive materials.

For example, in Japan, two terrorist attacks occurred (in Matsumoto in 1994 and in the Tokyo subway in 1995) organized by the fanatical religious cult AumShinrikyo (Supreme Truth). The chemical weapon used was sarin. Approximately 70 tons of sarin were produced by the religious cult organization "AumShinrikyo" in Kamikuishiki, Japan, almost legally. Although there were 20 fatalities, the cult instilled fear in millions of people for a prolonged period. These acts of chemical terrorism were unprecedented, and the psychological impact of the chemical attack spread not only in Japan but also worldwide. In addition, over the following decade after the attack in Japan, according to a report from the US Department of Defense, numerous incidents involving biotoxins such as ricin and anthrax occurred [3].

After the September 11, 2001 attacks in the United States, the likelihood of insurgent and terrorist groups such as "Al-Qaeda" using chemical weapons increased significantly. As confirmation of this, in the fall of 2006, "Al-

Qaeda" and its affiliated groups used chlorine gas in combination with traditional car and truck bombings to sow panic in Iraq [4]. They chose this method of intimidation because among chemical, biological, and radiological weapons, the use of chemical substances is more probable due to their ease of production, simple delivery systems, and achievable psychological effect of discrediting authority and creating a sense of vulnerability with a lack of control over the situation [5]. In the case of a targeted conflict, rebels and saboteurs will employ chemical formulas for which there are no developed medical protective measures (MPM). Considering their covert usage, understanding the nature of the poison becomes impossible in our circumstances, making treatment very difficult to accomplish. The most recent example of the use of chemical weapons in such conflicts is the ongoing Syrian civil war [6].

Furthermore, in addition to the covert development of new chemical weapons in many countries that officially do not possess them, dual-use chemical compounds are being produced. There have been precedents where countries, under the guise of agricultural development, demanded expanding the spheres of Vx and norbornene use, and the use of conotoxin as an anesthetic [6]. Additionally, delivery systems, weapon technologies, and precise navigation technologies are being improved. All these features of development pose a complex challenge to Kazakhstan's national security, particularly chemical security.

Chemical security consists of several stages, with the first being measures to prevent attacks, followed by measures to reduce losses and eliminate the consequences. One link in the elimination of consequences is the elimination of medical and sanitary consequences of chemical weapon use, as well as chemical accidents in peacetime, which can be achieved through the development of clinical toxicology.

An example of prevention is the monitoring of dual-use chemicals. The area of interest includes collecting and analyzing the capabilities of neighboring countries in the production of potential chemical weapons and their existing industrial capacities for this purpose, as well as developing indicators of their testing or military use. Controlled items include precursors of specific chemical agents, pathogens used in biological weapons (BW), and dual-use equipment that can be used in chemical weapons. Thus, considering the unstable political situation, particularly in Afghanistan, the threat of the proliferation of chemical weapons is expected to increase in the coming years due to chemical weapons that are easy to produce, difficult to detect (as insurgents acquire more efficient delivery systems), and can be effectively used for political and psychological pressure.

Measures to reduce losses include studying possible approaches to covert attacks carried out by saboteurs. The covert use of fast-acting and rapidly degrading compounds will result in a flow of affected military personnel and civilians in neighboring areas even after the self-liquidation of the source, discrediting the work of troops in radiological, chemical, and biological protection (RCBP). The lack of information about the properties of the poison will significantly increase the burden on medical facilities with increased bed occupancy over time [6].

In this situation, the actions of medical specialists, particularly the medical service, will be decisive in reducing the number of casualties. The use of pathogenetic and symptomatic therapy becomes especially relevant for managing life-threatening conditions.

Abroad and in Kazakhstan, unlike the structure during the Soviet era, the toxicology service consists of a Poison Control Center, which provides advisory services and collects toxicological information nationwide. Medical assistance to poisoned and affected individuals is provided in therapeutic departments of healthcare facilities or in intensive care units [7].

Nevertheless, debates on the principles of organizing the toxicology service continue in different countries, and even within the European community, there is no unified concept. This is due not only to traditional economic and social problems but also to the historically developed differences in the structure of medical services. The diversity of numerous terms (urgent, emergency, critical, life-threatening, extreme, etc.) indicates significant differences in approaching this issue. In this regard, the United States has taken a significant step forward by adopting the Emergency Medical Treatment and Active Labor Act (EMTALA), contrary to its own healthcare concept [8]. The situation described above is partially characteristic of Kazakhstan, but the medical issues in our country differ in many ways from those in the West.

Analysis of the situation in the Republic of Kazakhstan

Currently, active work is being carried out in our country in the field of chemical safety:

Ratification of 8 international conventions on chemical safety has been completed.

There are key regulatory acts (NPAs) for managing chemical events, including

the Environmental Code of the Republic of Kazakhstan [9], the Law of the Republic of Kazakhstan "On the Safety of Chemical Products" [10], and the Law of the Republic of Kazakhstan "On Civil Protection" [11].

The Commission on Biological Safety [12] was established, but it was abolished in 2017 [13]. In 2020, by the order of the Prime Minister of the Republic of Kazakhstan No. 77-r, the Council on Biological Safety [14] was established.

The Committee for Industrial Development of the Ministry of Industry, the Committee for Environmental Regulation and Control of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan, and the Committee for Sanitary and Epidemiological Control of the Ministry of Health of the Republic of Kazakhstan are responsible for the registration and monitoring (analysis) of industrial safety of hazardous production facilities, chemical substances in the atmospheric air, soil, and water bodies. Chemical accidents are investigated with the involvement of the Ministry of Emergency Situations of the Republic of Kazakhstan.

However, the role of the Ministry of Defense of the Republic of Kazakhstan in the structure of the organization for the elimination of chemical disaster consequences is not disclosed.

In Kazakhstan, as well as in most Western countries, the establishment of information and advisory toxicology centers is envisaged [15]. In 2019, a toxicology center was opened based on the Toxicology Department of the Emergency Medical Hospital in Almaty, but it was closed in 2020. Currently, there is no centralized center in the civil healthcare structure where all information would converge and a helpline would operate for the affected individuals, especially for remote healthcare institutions. In addition, in 2021, the toxicology department in the Emergency Medical Hospital was closed. There is no alternative solution to the problem of toxicological assistance. The advantage of domestic toxicology lies in the wide application of physical detoxification methods and the use of inexpensive antidotes. However, a weak aspect remains in laboratory diagnostics, which hinders the determination of the quantitative content of toxic substances in biological fluids.

Within the structure of the Ministry of Health of the Republic of Kazakhstan, there are five toxicology departments, with the largest and most experienced one located in the Almaty Emergency Medical Hospital (EMH).

Among the negative aspects, the country lacks education on toxicological literacy. There is no system for training medical personnel and the population in the specialization of toxic substances. In most countries, people have the right to know about themselves and the properties of pharmaceutical, household, and industrial products used. Insufficient active planning of response mechanisms by the toxicological service to emergencies related to massive chemical releases worldwide. In the case of mass chemical poisoning resulting from accidents or terrorist operations, a broader network of healthcare institutions, regional healthcare system leadership, and coordination of regional centers should be involved.

There is an ineffective system for accumulation and rational distribution of specific antidotes, especially in cases of group and mass poisonings. Many antidotes are not included in the list of the Kazakhstani National Drug Formulary, and their use is not regulated by a guaranteed volume of free medical assistance, although their application is necessary and life-saving in many poisoning cases (e.g., methylene blue, cytoflavin).

The toxicological service within the Armed Forces of the Republic of Kazakhstan (AF RK) presents a particular situation. In 2020, the Department of Radiological, Chemical, Biological Defense, and Environmental Safety was established within the structure of the Armed Forces [16]. However, despite this, military toxicology has not received proper development.

Currently, within the organization of medical toxicology in the structure of the Military Medical Administration of the Ministry of Defense of the Republic of Kazakhstan (MMU AF RK), there is a toxicologist-epidemiologist. However, there is no toxicological service, toxicology department, or a medical toxicologist unit directly involved in the provision of medical protection, treatment, and rehabilitation of individuals affected by poisoning within the structure of the Armed Forces of the Republic of Kazakhstan.

Taking into account the experience of post-Soviet countries, to address these issues, it is necessary to establish a department of military toxicology based on the Kazakhstan-Russian Medical Institute (there is a methodological teaching base for disaster medicine), and organize a course on "military toxicology" to train military specialists in emergency measures for mass poisoning. Additionally, the department will serve as a scientific and material base for the development of necessary documents for providing emergency assistance in the event of the use of weapons of mass destruction or technological catastrophes.

To organize the toxicological service, we propose the following as the first stage:

1. Appoint the most qualified and

experienced medical officer from the anesthesiology-reanimation doctors, who have professional training in toxicology, as the non-staff clinical toxicologist. This individual should possess in-depth and comprehensive knowledge of their specialty and have organizational abilities. For operational response, the non-staff toxicologist should be subordinated to the Chief Medical Officer of the Garrison (Regional Command, Military Hospital), and for specific matters, to the Chief of Staff of the MMU AF RK.

2. Make the instructions of the Chief Non-Staff Toxicologist regarding medical assistance to victims of toxicological incidents mandatory for the medical personnel and clinical units to follow.

3. Organize the work of the non-staff toxicologist based on the requirements of the legislation of the Republic of Kazakhstan and the guiding documents (orders, directives, instructions) of the Ministry of Defense of the Republic of Kazakhstan and the Chief Military Medical Administration.

4. In their activities, prepare the legal and material framework for establishing the toxicological service, develop proposals for the technical equipment of the service, its structure, and options for forming antidote stocks.

The second stage involves creating a Military Toxicology Center based on the Extracorporeal Detoxification Department of the Military Clinical Hospital of the Ministry of Defense of the Republic of Kazakhstan (equipped with medical equipment), the Military Medicine Center of the Armed Forces of the Republic of Kazakhstan (equipped with diagnostic equipment and instructors), and the Sanitary and Epidemiological Center of the AF RK (equipped with chemical reconnaissance and transport capabilities).

As the third stage, we propose forming mobile toxicological brigades in each Regional Command consisting of the following personnel: Brigade Leader - a doctor specializing in anesthesiology-reanimation (toxicologist), a physician specializing in therapy, an epidemiologist-toxicologist (from the Sanitary and Epidemiological Center of the AF RK) responsible for physical dosimetry and organizing sanitary (special) treatment, a chemical protection officer, a nurse-anesthetist, and a nurse.

The tasks of these brigades would include:

Organizing sanitary treatment of the affected individuals, decontamination, deactivation, and disinfection.

Medical sorting of the affected individuals, including determining the need and order of evacuation to specialized medical defense organizations and the Ministry of Health of the Republic of Kazakhstan.

Approving the composition of the brigades in Regional Commands and coordinating their presence and assigned roles with the Ministry of Emergency Situations and territorial defense agencies.

Providing medical assistance, including emergency specialized medical interventions.

Coordinating with other medical institutions and formations called upon to respond to the emergency, including providing consultative and methodological assistance.

Assisting in organizing the work regime in medical organizations and formations under conditions of chemical (radioactive) contamination, and conducting individual dosimetric control of their personnel.

The fourth stage is to equip the brigades with analyzers, kits, and antidotes. Due to the problem of supplying antidotes, we propose methods of providing toxicological assistance based on mediator syndromes and extracorporeal detoxification methods: hemosorption, hemodiafiltration, and plasmapheresis (these methods were introduced into the practice of military medicine in the Soviet Union but found a second life in the early 2000s when foreign countries implemented effluent methods in the treatment of acute poisonings). Train toxicological group specialists and non-permanent toxicologists in the treatment of poisonings using drugs registered in the republican drug formulary.

Conclusions

The establishment of a toxicological service within the structure of the military medicine of the Armed Forces of the Republic of Kazakhstan will:

1. Improve the quality of toxicological assistance;
2. Create guidelines for providing toxicological assistance;
3. Establish a coordination center within the structure of the AF RK to provide organizational and methodological assistance in case of mass poisonings;
4. Create mobile toxicological brigades capable of providing assistance in any part of the country within 24 hours;
5. Develop diagnostic methods and antidote therapy and train medical personnel in their application;
6. Continue to improve the stages of patient evacuation and routing depending on the etiology and severity of poisoning;
7. Organize toxicological literacy training in the AF RK.

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CURRENT ISSUES OF ASSESSING THE EFFECTIVENESS OF RADIOLOGICAL STUDIES CONDUCTED WITHIN THE GUARANTEED VOLUME OF FREE MEDICAL CARE AND IN THE SYSTEM OF MANDATORY SOCIAL HEALTH INSURANCE

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Keywords:
radiology, computed tomography, guaranteed volume of free medical care, system of mandatory social health insurance

Abstract

The purpose *of the study is to analyze the effectiveness parameters of the radiological service on the example of Almaty in 2022.*

Literature review of foreign and domestic literature concerning the issues of organization of radiology service for the period from 2005 to 2022 was carried out.

Conclusion. *Thus, to increase the value of imaging, cost management is required, in addition to improving quality and outcomes. Radiologists should be involved in calculating the costs of radiology examinations, and a review of the parameters for assessing the effectiveness of the radiology service is necessary.*

Тегін медициналық көмектің кепілдік берілген көлемі және міндетті әлеуметтік медициналық сақтандыру шеңберінде жүргізілетін радиологиялық зерттеулердің тиімділігін бағалаудың өзекті мәселелері

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Байгуисова Д.З. *– А.Н. Сызғанов атындағы ҰҒХО-ң сәулелі тәсілдермен зерттеу бөлімінің меңгерушісі, сәулелі зерттеу дәрігері, Алматы қ. ҚДБ-ң штаттан тыс бас радиологы, Алматы қ., Қазақстан, e-mail: dina_gallyamova@mail.ru*

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Авторлар мүдделер қақтығысының жоқтығын мәлімдейді

Түйінді сөздер:
радиология, компьютерлік томография, тегін медициналық көмектің кепілдік берілген көлемі, міндетті әлеуметтік медициналық сақтандыру

Аңдатпа

Зерттеудің мақсаты *– Алматы қ. бойынша 2022 ж. ішіндегі радиологиялық қызметтің тиімділігі параметрлеріне талдау жүргізу.*

2005-2022 жж. аралығындағы сәулелі диагностика қызметін ұйымдастыру мәселелеріне қатысты шетелдік және отандық әдебиеттерге әдеби шолу жүргізілді.

Қорытынды. *Осылайша, визуализацияның құндылығын арттыру үшін сапа мен нәтижелерді жақсартумен қатар шығындарды басқару қажет етіледі. Радиологтар радиологиялық зерттеулердің шығындарын есептеу жұмысына қатысуы керек, сондай-ақ радиологиялық қызметтің тиімділігін бағалау параметрлерін қайта қарау қажет.*

Актуальные вопросы оценки эффективности радиологических исследований проводимых в рамках государственного объема бесплатной медицинской помощи и обязательного социального медицинского страхования

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Ключевые слова:
радиология, компьютерная томография, государственный объем бесплатной медицинской помощи, обязательное социальное медицинское страхование

Аннотация

Цель исследования *– провести анализ параметров эффективности радиологической службы на примере г. Алматы за 2022 г.*

Был проведен литературный обзор зарубежной и отечественной литературы касательно вопросов организации службы лучевой диагностики за период с 2005 по 2022 г.

Заключение. *Таким образом, для увеличения ценности визуализации, требуется управление затратами, в дополнении к улучшению качества и результатов. Радиологи должны принимать участие в расчете затрат на радиологические исследования, а также является необходимым пересмотр параметров оценки эффективности радиологической службы.*

Relevance

For a long time, radiologists competing in fee-for-service settings have evaluated their performance using volume-based measures (e.g., the number of diagnostic procedures performed, overall and by modality) and revenue-based measures [10-12]. The notion of success among radiology department managers has been and continues to be defined as annual revenue growth, an increase in the annual number of imaging studies, and an increase in the ROI [13]. In the new era of health care reform, these parameters are no longer adequate to measure the success of radiology services.

To maximize the value of imaging, cost management is required, in addition to improving quality and outcomes.

In the subject of RK today, patients can receive medical services, (including all radiology examinations) under the guaranteed volume of Free Medical Care and Mandatory Social Health Insurance. State and private organizations can participate in fulfillment of the state order. Due to the lack of clear indications for studies, standards for conducting the studies themselves - it is very difficult to assess the validity of the conducted research, its quality from the law point of view.

№	Full service code	Service name	Cost
1 452	C03.013.006	Computed tomography of abdominal with contrast	29 705,58

Table 1.
Tariffs for medical services within the guaranteed volume of free medical care and (or) in the system of mandatory social health insurance

Let's consider the radiology service on the example of contrast-enhanced CT scan. As indicated in the table above, the cost reimbursed by the Social Health Insurance Fund to the medical organization where the abdominal CT scan with contrast enhancement was performed is about 29,706 tg. The name of the service itself, as well as other normative documents concerning radiological diagnostics do not specify how and in what quantity the contrasting substance should be administered. Thus, the amount of contrast media to be injected may vary, and the injection of contrast media may also be different (both manual and bolus), which certainly cannot but affect the cost of the examination and its quality. What is profitable for certain medical organizations fulfilling the state order, because no one evaluates the validity and quality of the study. For example, a patient with a body weight of 80 kg, according to world guidelines to obtain high-quality contrast and proper imaging requires the introduction of - at least 100 ml (contrast medium to body weight ratio, depending on contrast medium density: 320 mg/ml - 1.4 ml/kg; 370 mg/ml - 1.2 ml/kg). Consider the material costs of a medical organization for a CT scan.

Title	Unit of measure	Consumption rates	Amount
Thermal film №100 35*43 sm	pcs	1,0	1 200,0
Iodixanol 100 ml №1	ml	100,0	15 000,0
Disc DVD	pcs	1,0	65
Sodium chloride 0,9% 500ml	ml	60,0	20,9
Patient hose 250 sm	pcs	1,0	3 140,0
Pump hose	pcs	0,25	3 925,0
Intravenous cannula 24G	pcs	2,0	115,6
Summary			23 466,6

Table 2.
The material costs of a medical organization for a CT scan

The table does not take into account staff salaries, utility costs, and equipment depreciation. It follows from the above that it is impossible to cover costs and make a profit performing trials according to international standards, and therefore medical organizations have to save money somewhere. It turns out that on the quality of research.

With this in mind, radiologists should take the lead in working with administrators and other staff to calculate costs for specific procedures that will accurately reflect the use of resources.

In addition, there are many risks associated with undergoing advanced medical imaging, such as CT and MRI scans. These include specific risks associated with the procedure itself, including radiation exposure and possible reactions to the contrast agent. Patients accept these risks on the advice of their doctor, whom they trust to weigh these risks against the expected health benefits. Few patients, however, may be aware of the possibility that they are agreeing to an unnecessary examination when the important motive for scheduling the examination is economic gain for the physician rather than resolution of diagnostic uncertainty.

Studies conducted in the late 1980s and 1990s in the United States demonstrated a significant increase in the provision of CT and MRI scans in freestanding imaging centers, due to the fact that physicians who are not radiologists benefited financially from referrals. Numerous studies confirm this problem, which is a conflict of interest [3]. There have been no such studies in Kazakhstan to date, but if we look at the number of CT and MRI scans performed in public and private organizations in Almaty for 2022, we can see the following.

Table 3.
Data from the Republican Center for e-Health in Almaty performed by private organizations

	Total studies		Contrast enhancement	
	CT	MRI	CT	MRI
Total studies	109534	21367	23940	3585

Table 4.
Data from the Republican Center for e-Health in Almaty performed in state organizations

	Total studies		Contrast enhancement	
	CT	MRI	CT	MRI
Total studies	32713	12410	14260	2707

Of the 142247 CT examinations and 33777 MRI examinations performed under the Mandatory Social Health Insurance, 77% and 63%, respectively, were performed in private organizations.

Conclusion

It follows that in order to manage costs, to improve quality and outcomes, the health care system will need to revise the parameters for assessing the effectiveness of the radiology service, based on the following indicators:

- Evaluate the quality of the examinations performed;
- Evaluate the appropriateness of prescribed and conducted examinations;
- reduce the number of unnecessary examinations performed;
- demonstrate the impact of imaging services on patient outcomes;
- provide patients with timely access to imaging services;
- integrate health information technology;
- monitor and improve patient satisfaction;
- Minimize patient radiation exposure;
- Implement reminder systems for imaging services (e.g., mammography);
- Analyze information from new imaging studies with information already known from previous studies.

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«AsfenForum: жаңа ұрпақ – 2023» 1-Халықаралық форум, Алматы, Қазақстан

Ағымдағы жылдың 5-ші маусымында «AsfenForum: жаңа ұрпақ – 2023» 1-Халықаралық форум аясында медициналық бағыттар бойынша «Хирургия» секциясы сәтті өтті. А.Н. Сызғанов атындағы Ұлттық ғылыми хирургия орталығының беделді ғалымдары және жас мамандары, сондай-ақ Астана, Шымкент, Ақтөбе қалаларының медициналық ұйымдарының жас дәрігер мамандары 2 дәріс, 9 баяндама жасады. Секция соңында 3 жүлделі орындарға лайықты баяндамашылар тізімі ұсынылды.

ТРЕБОВАНИЯ ДЛЯ АВТОРОВ ЖУРНАЛА «ВЕСТНИК ХИРУРГИИ КАЗАХСТАНА»

Уважаемые авторы!

С 1 апреля 2018 года все статьи на публикацию принимаются на государственном или русском языках с обязательным переводом всей статьи на английский язык. Статьи без версии на английском языке будут отклонены.

Также учитывая требования Консультативной Комиссией (CSAB) Scopus об интернационализации авторов и аудитории редколлегия журналов рекомендуют публиковать статьи в соавторстве с учеными дальнего и ближнего зарубежья.

В журнале публикуются научные статьи и заметки, экспресс-сообщения о результатах исследований в различных областях естественно-технических и общественных наук.

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Редакция принимает на рассмотрение рукописи только на английском языке, присланные через официальный сайт журнала **www.vhk.kz.**

Материал статьи – абстракт на казахском, русском и английском языках, список литературы, рисунки, подписи к рисункам и таблицы, оформляется одним файлом; дополнительно каждый рисунок оформляется в виде отдельного файла. Если пересылаемый материал велик по объему, следует использовать программы для архивирования. Все страницы рукописи, в том числе таблицы, список литературы, рисунки и подписи к ним, следует пронумеровать.

Представленные для опубликования материалы должны удовлетворять следующим требованиям:

1. Содержать результаты оригинальных научных исследований по актуальным проблемам в области физики, математики, механики, информатики, биологии, медицины, геологии, химии, экологии, общественных и гуманитарных наук, ранее не опубликованные и не предназначенные к публикации в других изданиях. Статья сопровождается разрешением на опубликование от учреждения, в котором выполнено исследование.
2. Размер статьи 7-10 страниц (статьи обзорного характера – 15-20 стр.), включая аннотацию в начале статьи перед основным текстом, которая должна отражать цель работы, метод или методологию проведения работы, результаты работы, область применения результатов, выводы (аннотация не менее 20 предложений (150»300 слов) - (на английском языке) через 1 компьютерный интервал), таблицы, рисунки, список литературы (через 1 компьютерный интервал, размер шрифта – 14), напечатанных в редакторе Word, шрифтом Times New Roman, поля – верхнее и нижнее – 2 см, левое –3 см, правое –1,5 см. Количество рисунков – 5-10.

Структура должна соответствовать международной формуле IMRAD, где I – introduction (вступление), M – Methods (методы), R – Results (исследование), A – и, D – conclusion+ discussion (заключение, обсуждение результатов и выводы).

Название • Отображает суть работы • Краткое • Без аббревиатур.

Необходимо официально закрепить название организации на английском и сокращение

Резюме • Структурировано • Без аббревиатур • Передает структуру статьи – Зачем (актуальность) – Какими методами?

– Что получено – Как это изменило картину знаний. Именно его читают в первую очередь, только хорошее резюме может привлечь внимание!

Вступление • Актуальность работы • Какая задача поставлена • Почему

Методы • Перечисление • Если известные - дать ссылку

Если модифицировали – указать как • Описывать так что б могли повторить • Статистика!

Результаты • Допускается не хронологическое, а логическое повествование • Основные, а не все что были сделаны • Иллюстрируются минимально необходимыми сводными данны- ми (исходные могут быть в дополнительных материалах)

Обсуждения • Не повторять результаты • Сопоставить полученные данные с имеющимися • Обсудить возможные причины и следствия

Функции списка литературы: • Аргументировать идею • Сопоставить с существующими аналогами • Обозначить место данного исследования • Избежать плагиата • Для журнала и ученого = признание • Часто указаны только собственные работы или очень старые (самоцитирование допускается только 10-15% от общего списка литературы) • Кочующие ошибки

Различайте • Ссылки • Список литературы • Библиография Что

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Статья начинается на английском языке. В начале, посередине страницы, идет название статьи прописными жирными буквами, название статьи должно быть коротким и емким, согласно проведенного анализа около 30-40 символов на английском языке.

Далее на следующей строчке – инициалы и фамилии авторов обычным жирным шрифтом, затем на следующей строчке – название организации(ий), в которой выполнена работа, город, страна, затем на новой строчке – адреса E-mail авторов. С красной строки идут ключевые слова **(Key words)**, а на новой строчке – сама аннотация (**Abstract** – не менее **150** и более **300** слов).

Далее, после отбивки одной строки, начинается на русском языке. В начале статьи вверху слева следует указать индекс **УДК, МРНТИ.**

Затем, посередине страницы, пишется: 1) название статьи; авторы; 3) название организации; с красной строки – **Ключевые слова,** затем – **Аннотация** (оформление шрифтов, как на английском языке).

Отбиваем одну строку и начинается сама статья. Следом за статьей идет список **Литературы.** Ссылки на литературные источники даются цифрами в прямых скобках по мере упоминания (не менее 20).

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Статья в международном журнале:

1. Campry TS, Anders T. (1987) SNAP receptors implicated in vesicle targeting and fusion, Environ Pollut, 43:195-207. DOI: 10.1016/0269-7491(87)90156-4 (in Eng)

Статья в русскоязычном журнале, не имеющая англоязычной версии:

2. Ivanova TV, Samoilova NF (2009) Electrochemical Energetics [Elektrohimicheskaya energetika] 9:188-189. (In Russian)

Книги:

Timrat TA (2008) Soil pollution: origins, monitoring and remediation, second edition. Springer, Germany. ISBN: 978-3- 540-70777-6

Материалы конференции:

Monin S.A. (2012) Treatment techniques of oil-contaminated soil and water aquifers. Proceedings of International Conference on Water Resources and Arid Environment, Riyadh, Saudi Arabia. P.123.

Патенты:

Barin AB, Mukamedzhan NT (2000) A method for determination of 1,1-dimethylhydrazine and nitrosodimethylamine [Metodopredeleniya 1,1-dimetilgidrazina initrosodimetilamina]. Preliminary Patent of the Republic of Kazakhstan [Predvaritelnyi patent Respubliki Kazakhstan]. (In Russian)

Стандарты, ГОСТы:

RMG 61-2003. Indexes of accuracy, precision, validity of the methods of quantitative chemical analysis, methods of evaluation [GSI.Pokazatelitochnosti, pravilnosti, retsizionnosti metodik kolichestvennogo himicheskogo analiza. Metodyiotsenki]. Moscow, Russia, 2003. (In Russian)

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