How to Cite:
Omarov, N., Aimagambetov, M., Auyenov, M., Abdrakhmanov, S., Bulegenov, T., & Noso, Y. (2022). Obstructive jaundice syndrome of benign genesis and its surgical treatment. *International Journal of Health Sciences*, *6*(S7), 3133–3151. https://doi.org/10.53730/ijhs.v6nS7.12118

Obstructive jaundice syndrome of benign genesis and its surgical treatment

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***Abstract*---**Introduction: Obstructive jaundice in surgical hospitals is relatively common (2.6-23.7%). And it is one of the leader in the liver failure development with the severe homeostasis disorders appearanced. So, the analysis of the results of improving the surgical treatment of obstructive jaundice syndrome of benign genesis has been conducted from 2015 to 2019. Materials and Methods: The results of surgical treatment of 142 patients with cholelithiasis (gallstone disease) complicated by obstructive jaundice of benign genesis were analyzed: 95 females (66.9%) and 47 (33.1%) male patients. Patients were divided into two groups (experimental and control) according to the surgery method was used. Results: 5

Manuscript submitted: 9 April 2022, Manuscript revised: 18 June 2022, Accepted for publication: 27 July 2022

complications (7.2%) and in 5 patients (7.2%) were fixed in the experimental group. However, only in a single complication was the II degree of severity according to the Clavien-Dindo classification. Control group had more complications cases: 18 (24.7%) in 13 patients (17.8%) - (x2=7.922, p=0.005). Mortality rate was also different: absent in the main group and 4 cases (5.5%) in the control one because of hepatic-renal failure against the background of severe intoxication (2 cases), massive pulmonary embolism (1 case), and disseminated intravascular coagulation syndrome (1 case). Conclusions: The level of inflammatory and pain syndromes was reduced as well as the duration of hospitalization. Introduction in the practice of the developed surgical instruments and methods in the treatment of obstructive jaundice of benign genesis can improve the results of surgical treatment, reduce the incidence of complications by 3.43 times (p=0.015).

Keywords---choledocholithiasis, Mirizzi syndrome, obstructive jaundice, life quality.

Introduction

Jaundice is a condition in which the content of bilirubin in the blood rises and icteric coloration of the skin and visible mucous membranes appears. According to the mechanism of occurrence, three types of jaundice are distinguished: suprahepatic jaundice (hemolytic), hepatic (parenchymal), subhepatic (mechanical) [1-3]. The condition in which icteric staining of the skin and mucous membranes occurs, due to a violation of the outflow of bile and an increase in bilirubin in the blood and in other tissues, is called obstructive jaundice [4-6].

The most severe jaundice caused by persistent obstruction of the main bile ducts with the subsequent development of a clinic of obstructive jaundice (OJ) [7, 8]. With complete or partial blockage of the flow of bile through the bile ducts into the duodenum, mechanical or OJ appears [9, 10], as a result, a pathological increase in the concentration of bilirubin in the liver and through the portal vein system in the blood and other tissues, the development of appropriate clinical symptoms and numerous organ and tissues damage [11, 12]. For these reasons, they are divided into benign and malignant obstructive jaundice [13, 14]. In patients with obstructive jaundice of benign genesis, cholelithiasis most often occurs, in addition, there may be inflammatory strictures of the bile ducts, stenosis of the bile ducts, benign neoplasms of the liver and Falerian papilla [15, 16].

Although modern medicine is already highly developed, obstructive jaundice is still a serious pathological condition of the body that has problems in diagnosis and treatment [17]. The incidence rate can be defined as increased, and there is a forecast that the number of patients with obstructive jaundice will only increase. Modern scientific data allow us to conclude that the pathogenesis of this condition is only partially studied [18-20]. Causes of obstructive jaundice can be: anatomical anomalies (malformations): cysts of the common bile duct, atresia of

the biliary tract, hypoplasia of the bile ducts, diverticula of the duodenum; various benign diseases of the biliary tract: choledocholithiasis, inflammatory strictures of the biliary tract, acute papillitis, stenosis of the major duodenal papilla; inflammatory and parasitic diseases: acute cholecystitis, cholangitis, acute and chronic pancreatitis, alveo- and echinococcosis; and iatrogenic damage to the bile ducts.

Cholelithiasis occurs in women much more often compare to men (from 3:1 to 8:1). With age the number of patients increases significantly and after 70 years reaches 30% or more. Obstructive jaundice is a leading factor in the development of severe purulent-septic complications (acute cholangitis, liver abscesses, cholangiogenic abdominal sepsis) [21, 22]. OJ is accompanied by cholangitis in 20-40% of cases, the maximum (up to 40% cases) incidence of cholangitis is noted in the proximal block of the bile ducts [23-24]. OJ development is accompanied by cholestasis, cholemia and acholia. Cholestasis is characterized by the accumulation of hepatotoxic substances, mitochondrial dysfunction and impaired antioxidant protection in liver cells. Mitochondrial dysfunction is associated with increased production of free radicals and the development of oxidative damage. Cholemia is accompanied by vasodilation, a decrease in peripheral resistance, a decrease in the volume of circulating blood, and inhibition of the function of the reticuloendothelial system [25]. Acholia promotes colonization of the small and large intestines by pathogenic microflora, translocation of bacteria and endotoxin into the blood of the portal vein, which leads to the development of a systemic inflammatory response syndrome [26, 27]. At the same time, in addition to changes occurring in the liver, hemodynamic is disturbed, perfusion of organs and tissues decreases. Decrease in renal and glomerular blood flow deposition of bilirubin in the renal tubules is an important factor in the development of renal failure. A specific feature of OJ is a sharp decrease in the energy potential of the body, largely due to hypoxia, disruption of the main metabolic pathways for the metabolism of glucose and other substrates in various tissues, which leads to high postoperative mortality [28].

In the presence of prolonged OJ, a violation occurs in the hemostats system and is accompanied by hepatic-renal failure, causing a decrease in the immune status of patients, which leads to the development of infection in the biliary tract. Mortality rates among patients with obstructive jaundice reach 20-60% [29-30]. Postoperative mortality among patients with benign OJ is 5.6-6.3% [31]. Postoperative complications in patients with OJ range from 15.6 to 63.4%, and mortality can reach 25-30%. At the same time, these indicators are 3-4 times higher than in cases with preliminary decompression of biliary obstruction [32]. Postoperative mortality in jaundice of "benign genesis" is 5.6-6.3%, with jaundice of "tumor genesis" - 10.6-25.7%. Sometimes, due to the severity of the condition of patients after palliative surgery, the mortality rate may be higher than after radical interventions [33]. An indisputable risk factor for the development of a destructive-inflammatory process in the area of the gallbladder neck (Hartmann pocket), cystic duct, is the presence of calculous cholecystitis, leading to narrowing of the hepatic duct and the formation of vesicocholedochal fistula [34].

The purpose of this study was to analyze the results of improving the surgical treatment of patients with benign obstructive jaundice syndrome (OJS).

Materials and Methods

Trial design

The current single-center clinical prospective study has been complied with the principles of the Declaration of Helsinki; the study was based on the experience of the adult surgical department of the University Hospital of the Non-Profit Joint-Stock Company "Medical University of Semey" (UH NPJSC "MUS"), at the clinical bases of the Department of Hospital and Pediatric Surgery. The study was approved by the Ethics Committee (No. 1, 28, September, 2018).

We have taken care about such criteria for inclusion in the study: 1) obstructive jaundice syndrome of benign genesis has been diagnosed; 2) age from 18 years to 90 years; 3) obtaining the informed consent of the patient for surgical treatment by the proposed method and the study of the data obtained in a scientific study.

The criteria for exclusion from the study were: 1) obstructive jaundice of the malignant genesis of the hepatobiliary region; 2) patients refusal; 3) the presence of acute myocardial infarction and acute cerebrovascular accident, relapse of a chronic disease, mental illness; 4) pregnancy III-IV trimester and lactation time.

The results of surgical treatment of 142 patients with cholelithiasis (gallstone disease) (GSD) complicated by obstructive jaundice of benign genesis (OJBG) were analyzed within the study from 2015 to 2019. There were 47 men (33.1%) and 95 women (66.9%). The average age was 64.5±5.4 years. All patients, depending on the treatment method, were divided into two groups (main and comparison).

The main (experimental) group included 69 (48.6%) patients, in the diagnosis and treatment of which methods developed in the clinic were used. Of these, in 53 (76.8%) patients has been restored the outflow of bile in patients with obstruction of the terminal part of the choledochus choledochoduodenoanastamosis (CDA) according to the clinic method (Republic of Kazakhstan (RK) patent 108142); in 5 (7.2%) patients was conducted the method of hepaticocholedochojejunostomy in Mirizzi syndrome III-IV type (RK patent 107273); in 11 (16%) patients was used the method of cholecystohepaticocholedochoplasty for cholecystohepaticocholedochal fistulas III-IV type (RK patent 107801).

The control (comparison) group included 73 (51.4%) patients treated with traditional surgical methods. Of these, 52 (71.2%) patients were completed CDA according to Yurash-Vinogradov; 4 patients (5.5%) have got choledocholithotomy with drainage of the choledochus according to Kehr; in 3 (4.1%) was used hepaticojejunostomy disconnected loop according to Roux method; in 6 (8.2%) was conducted dissociation of the cholecystoduodenal fistula (Mirizzi syndrome V type (classification of Csendens-Beltran, 2008)) with suturing the opening in the duodenum with double-row sutures; in 8 (11%) hepaticojejunostomy with intestinal anastomosis according to Brown and plug according to Shalimov has been used.

Patients were followed up in the postoperative period for at least 2 years (average duration in the main group was 27.5±3.3, in the comparison group 29.4±4.5 months).

In most cases, patients were hospitalized on an emergency basis. The patients' aged distribution according to the World Health Organization (WHO) recommendations (2016) is presented in the table 1. The distribution of this indicator among the selected groups had no differences ($x2=0.016$, $p>0.1$).

The average age at the main (experimental) group was 64.5±5.6 years, and at the control group - 64.6±5.3 years.

Determination of the severity of OJBG was conducted by the classification of Galperin (2014) [35] (Tab. 2).

The post-surgery patients' life quality was appreciated by two methods using: the generally accepted methodology SF-36 (The 36-Item Short Form Survey) and GSRS (Gastrointestinal Symptom Rating Scale) [36]. The first one was based on the concept of personalized treatment of patients from the moment of initial treatment to the radical elimination of the causes that caused OJ. The other one was based on the development of new methods currently used to eliminate biliary hypertension, taking into account the etiology, level of block, class severity of obstructive jaundice, as well as the ultimate strategic goal of treatment.

The results were analyzed by comparing the results of treatment of patients in the comparison group (n=73), who were admitted for treatment to the surgical department for the period 2015-2019, and the main group (n=69), treated during 2015-2019.

Statistical Processing

Statistical processing of the material obtained in the course of the study was carried out on a computer using the applied static programs "SPSS for Windows" and STATISTICA 6.1 (StatSoft, Inc., USA). To determine the required sample size, a calculation formula (1) was used when comparing two frequencies [37].

$$n = \frac{(A+B)^2 \times (p_1 \times (100-p_1) + p_2 \times (100-p_2))}{(p_1-p_2)^2} \quad (1)$$

The significance level was taken equal to 0.05; the power of the study was 90%, the expected frequency in the main group was 30%, and in the control one - 60%; the size of the general population (the number of patients with diagnosed OJBG) for 10 years was 627 persons. Calculations gave us possible to get the required number of each clinical group as 64 persons. In the analysis parametric and nonparametric methods have been used. Continuous values are presented as arithmetic means and error of the mean (M±m). Comparison of quantitative characteristics was carried out using Student's t-test, for continuous variables - paired Student t-test. If the numerical series did not correspond to the

applicability parameters of the Student's t-test (no normal distribution of values or equality of variances according to the Kolmogorov-Smirnov test), a non-parametric method was used (Mann-Whitney in independent groups or Wilcoxon for the dynamics of indicators in one group). We have used the construction of four-field contingency tables to determine the relative risk. The value of the relative risk was determined by the following formula (2):

$$RR = \frac{\frac{A}{A+B}}{\frac{C}{C+D}} = \frac{A \cdot (C+D)}{C \cdot (A+B)},$$

(2)

where A, B, C, D are the number of observations in the cells of the contingency table.

The values of the boundaries of the 95% confidence interval were determined as follows:

The Upper Limit (3):

$$e^{ln(RR)+1,96 \cdot \sqrt{\frac{B}{A \cdot (A+B)} + \frac{D}{C \cdot (C+D)}}}$$

(3)

The Lower Limit (4):

$$e^{ln(RR)-1,96 \cdot \sqrt{\frac{B}{A \cdot (A+B)} + \frac{D}{C \cdot (C+D)}}}$$

(4)

The assessment of the relationship of qualitative features by the magnitude of inertia and the assessment of the significance of this relationship by the criterion χ^2, with the limitation of the number of categories under consideration n<10, used the two-sided Fisher's exact test. P<0.05 was taken as the boundary indicator of statistical significance.

Results

The analysis of all hospitalized patients (both in an emergency and planned manner) (Tab. 1 and Tab. 3) shows the same number of patients of young, middle, elderly and senile age in studied groups, and the age group over 60 years prevailed among patients, relative the number of which was 69.7% (n=99). So, the experimental and the control groups were completely comparable in terms of age and gender.

OJS was observed least often in patients in the age group from 18 to 44 years - 7.7% (n=11). The pain syndrome in was actual for 123 (86.6%) patients with OJBG syndrome, and for 112 (78.9%) patients with external manifestations of jaundice. Signs of cholangitis were detected in 56 (39.4%) patients (Tab. 4).

The following etiological factors of OJBG have been identified (Table 5).

The duration of OJ (from the moment of occurrence to hospitalization) varied from 3 days to 5 months. The types of surgical intervention performed depending on the method in the patients' group are presented by Tab. 6.

The Clavien-Dindo scale [38] was used to assess the severity of postoperative complications (Tab. 7).

Complications developed on the 2-3rd day after the operation. In the experimental group 5 patients (7.2%) had 5 complications. And only in a single case was observed a complication of the II degree of severity according to the used classification (postoperative pancreatitis).

In the control group there were 18 (24.7%) various complications included in the classification in 13 patients (17.8%). Differences between groups were statistically significant ($x2=7.922$, $p=0.005$).

There were no fatal cases in the experimental group. The control one had 4 fatal cases (5.5%) which have been caused by liver and kidney failure against the background of severe intoxication (2 cases), massive pulmonary embolism (1 case), and disseminated intravascular coagulation syndrome (1 case). Difference between groups in this indicator wasn't significance.

It should be stated that the use of the developed approaches to the treatment of patients with OJBG indicates the advantage of the developed approaches, which manifests itself in the presence of a number of significant differences with the comparison group. We have analyzed the level of pain syndrome, assessed using the Visual Analogue Scale (VAS) (Fig. 1).

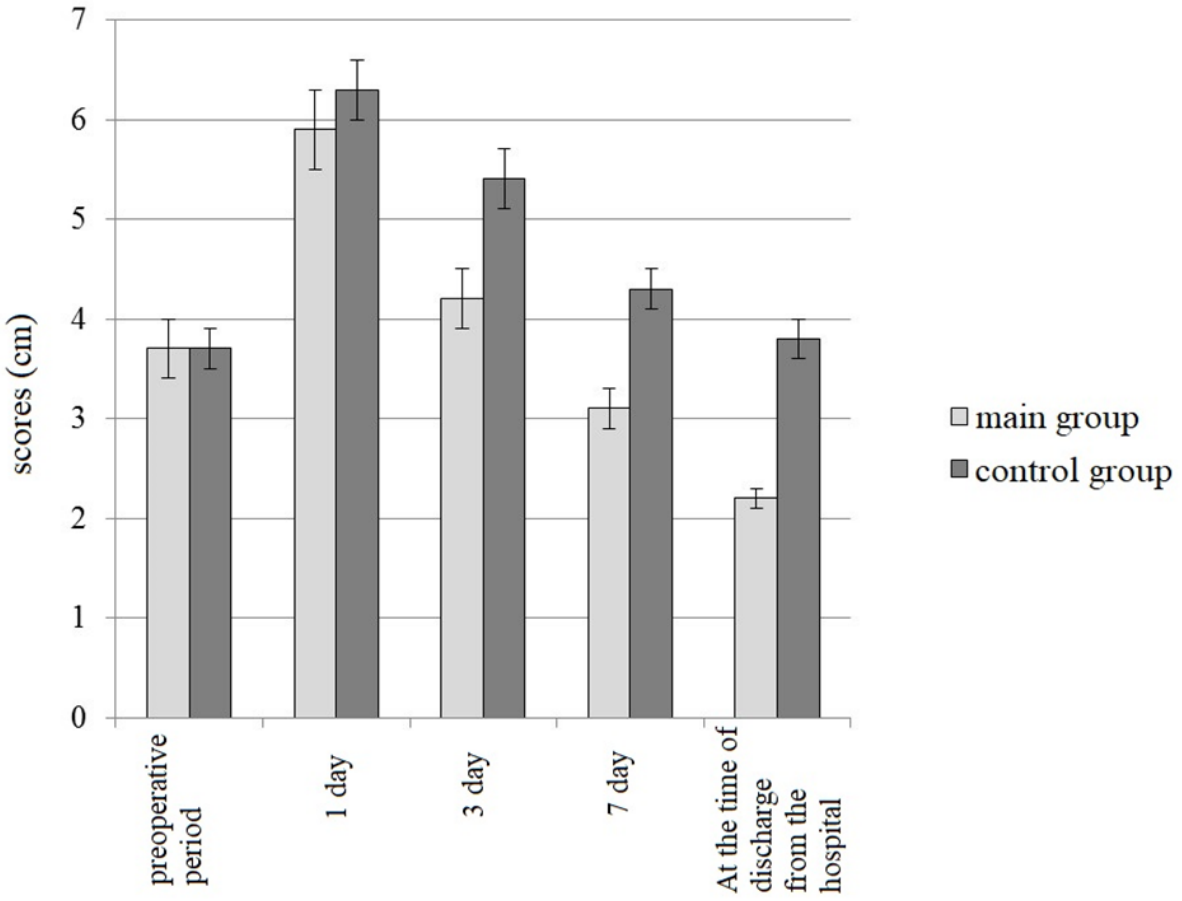

Figure 1. Intensity of postoperative pain and their comparison

From the data presented in the figure, it can be seen that there were differences between the groups in the direction of reducing the degree of pain in the main group. The degree of these differences was 28.9% on the third day, up to 38.7% after 7th days, and up to 72.7% at the time of discharge of the patient ($p>0.05$; $p=0.028$; $p=0.007$). The duration of inpatient treatment in the compared groups had significant differences.

In the experimental group this indicator was 8.3±0.7, in the control one - 12.8±0.8 days. The degree of difference was 54.2% ($p=0.019$).

Among the long-term complications, the frequency of restenoses was estimated, which was 6.8% in the control group and 2.9% in the main one (RR=2.36, $p=0.023$). Significantly more often than in the main group, hospitalization was required for the patients operated by traditional methods. Differences between groups were RR=5.67, $p<0.001$. In this case, only hospitalizations associated with the underlying disease were taken into account.

Almost all indicators of the late postoperative period in the experimental group had significant differences from the control one in the direction of improving the treatment course. We have studied the patients' life quality index in dynamics according to the SF-36 and GSRS scale (Fig. 2).

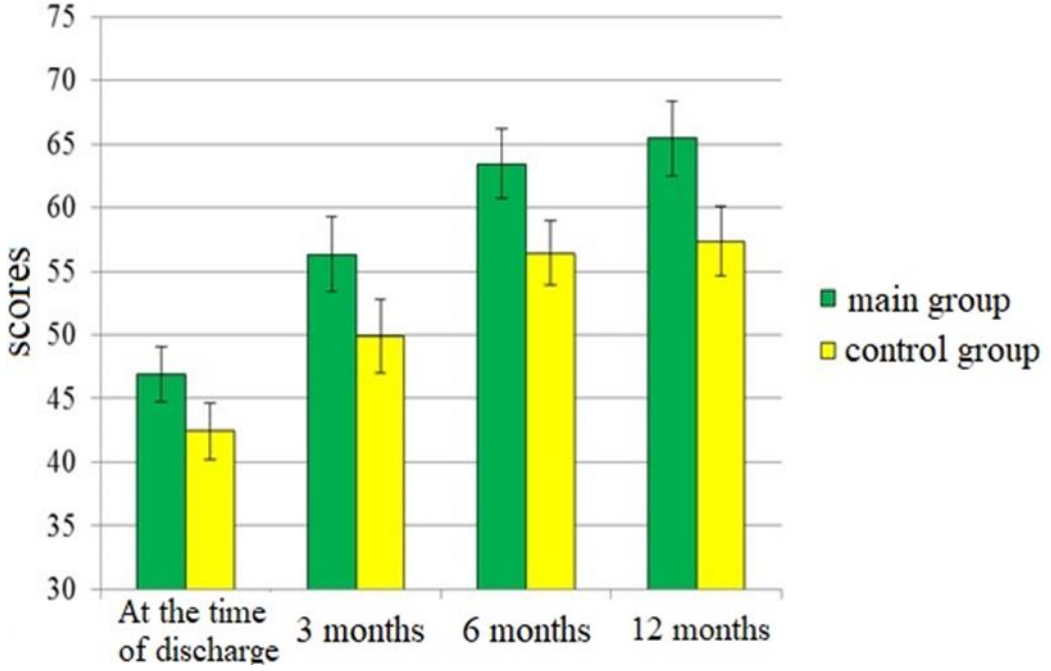

Figure 2 - Quality of life (SF-36) by groups in dynamics and their difference

Significant differences were identified at 6 and 12 months according to the integral indicator of the SF-36. At the same time, their numerical level was moderate (12.4%, p=0.047 and 14.3%, p=0.038). The total quality of life score on the GSRS scale differed by 14.6% at discharge (not significant), 47.3% - after 3 months (p=0.023), 83.8% - after 6 months (p=0.005); and 105.7% - in time a year (p=0.003).

Discussion

Jaundice, in particular mechanical, remains a fairly common problem. It is registered in 12.0-25.2% of cases in diseases of the hepatopancreatoduodenal zone. Experimental data shows the causes of OJ of benign origin are stones in 50%, malignant neoplasms in 40%, stenosis and stricture of the biliary tract in 10% [39]. According to Mamoshin et al. [40] cholelithiasis affects about 10% of the world's population. In 10–20% of such patients, choledocholithiasis occurs in combination with breast cancer. The incidence of cholelithiasis in the USA almost doubles every 10 years. At the end of the 20th century were registered more than 5 million in Germany, and more than 15 million in the USA, and about 10% of the adult population suffered from this disease [40-41].

The problems of OJ arising in the diagnosis and differentiation of the disease that cause it complicate the determination of surgical tactics and the timing of surgical treatment [42].The progress of biliary surgery has not yet come to a complete understanding of the pathogenesis of disorders and pathological conditions in the body due to a violation of the outflow of bile from the biliary tract. The problem of effective treatment of patients with obstructive jaundice remains relevant, despite the impressive results of biliary surgery [43-44].

Late treatment leads to complications of obstructive jaundice such as purulent cholangitis, liver abscesses, gastrointestinal bleeding, biliary sepsis, encephalopathy and hepatic coma, which are observed in half of patients, and can lead to death in 14-27% of cases. Despite modern advances in the fight against obstructive jaundice, the lethality of liver failure, irreversible dysfunction of hepatocytes, remains high 5.6-6.3% [45-46].

The results of our study showed that the control method we proposed and the developed method for using minimally invasive methods of internal drainage of the biliary tract provided an additional therapeutic effect in patients of the main group.

Analysed according to the Clavien–Dindo classification [38] results showed the differences in the results of the study were revealed, in particular, the frequency of postoperative complications in the main group decreased and had statistical significance ($x2=7.922$, $p=0.005$). The absence of fatal cases in the main group was also noted.

Our studies have made it possible to find the most rational ways of treating patients in modern conditions using minimally invasive technologies.

The main causes of death in patients with obstructive jaundice are liver failure and developing endogenous intoxication, caused, in particular, by an increase in the level of ammonia, unsaturated fatty acids, lactate and pyruvate, bilirubin, bile acids, products of enzymatic and autolytic tissue breakdown, proteolytic enzymes, aromatic amino acids and hydrocarbons, uremic toxins, mediated by activated cascades of cellular and humoral immunity, excessive accumulation of other products of normal and disturbed metabolism. Under the influence of endogenous and exogenous factors, a functional and structural-morphological imbalance is formed in the immunoreactivity system, which is manifested by a decrease in the number of immunocompetent cells, their functional deficiency, and an imbalance in the cytokine regulation system [47-49]. The main fatal causes in patients with benign OJ are the progression of liver failure after surgery on the biliary tract [50]. And our study did not show statistically significant differences in this indicator in the studied groups.

When comparing the intensity of the pain syndrome in both groups, there was a decrease in the pain syndrome in the main group, the degree of these differences was 28.9% on the 3rd day, up to 38.7% after 7 days and up to 72.7% at the time of discharge of the patient ($p>0.05$; $p=0.028$; $p=0.007$, respectively). It is important that there were differences between the groups in the direction of

reducing the degree of pain in the main group to 72.7% at the time of discharge of the patient from the hospital.

We have identified significant differences in terms of quality of life between the surveyed groups. They manifested themselves mainly in the course of outpatient treatment. There were clear differences between the questionnaires. A specialized method for assessing the quality of life, while maintaining the trends common with SF-36, gave significantly more pronounced differences between the groups, which we consider adequate in view of the greater frequency and severity of complications when using traditional methods of surgical treatment.

In general, according to the results of the study, the duration of the patient's stay in the hospital was reduced to 4.5 bed-days.

In the study of the quality of life according to the SF-36 questionnaires, it was revealed that in patients in the main group with the use of new developed methods, the quality of life improved significantly and significant differences were identified at 6 and 12 months. And with the specialized GSRS methodology, it was revealed that the total indicator of quality of life on this scale differed, was statistically insignificant only at discharge, and was statistically significant otherwise.

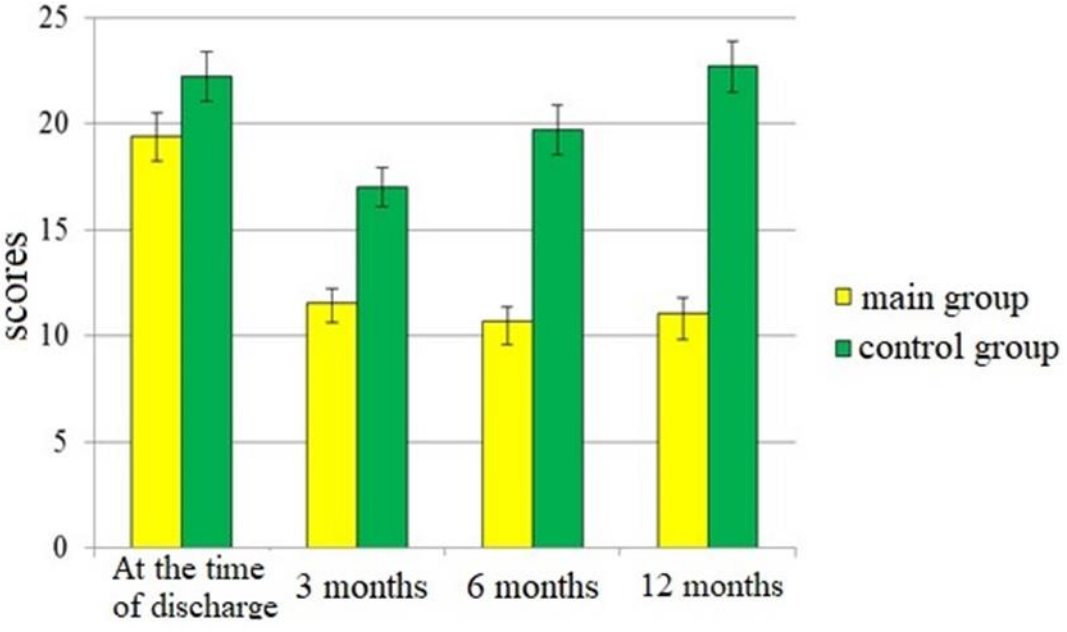

Figure 3. Quality of life (GSRS) by groups and their dynamics

Thus, it should be stated that the use of the developed approaches to the treatment of patients with OJBG syndrome indicates the advantage of the developed approaches, which manifests itself in the presence of a number of significant differences with the comparison group. The proposed method was applied without complications in patients in the main group with Mirizzi type IV syndrome.

Conclusions

OJBG is a frequent and complex surgical pathology. Using the proposed complex of improvements in operational tactics in patients with OJBG a significant decrease in the frequency of early postoperative complications was determined. So, in the experimental group there were only complications of I-II severity class (according to Clavien-Dindo). In the control group were fixed complications of III-V classes. Differences in the frequency of complications were 2.9 times (t=0.045) in the group of patients with and 2.3 times in the group with type III-IV Mirizzi syndrome (t=0.048). Using the experimental approach has the effect of fatal cases absent. In the postoperative period, there was a decrease in the level of inflammatory syndrome, immunity disorders, and pain syndrome. Hospitalization time was significantly reduced.

Analysis of the postoperative life quality has observed the significant differences in favor of the use of the developed set of measures. SF-36 scales fixed differences in 6 and 12 months after surgery. The GSRS questionnaire has fixed differences in 3 and 12 months; and the values of the total indicator were significantly higher in the main (experimental) group (68.3% after 6 months (p=0.011) and 87.5% after 12 months (p=0.008) in case of both Multiple choledocholithiasis and Postcholecystectomy syndrome), and by 114.6% in Mirizzi type III-IV syndrome in time of 6 months (p=0.006) and 130.7% in time of the year (p=0.003)).

The proposed method of hepaticocholedochoejejunostomy allows to restore the outflow of bile into the intestine, eliminate the use frame drainage and to prevent the development of stricture of hepaticocholedochoejejunostomy, which improves long-term results of treatment of patients with type IV Mirizzi syndrome.

Statements

Conflict of interest. There are no conflicts of interest in the presented study.
Financing. There was no funding from third-party organizations and medical representations in the current research.

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Tables

Age Groups	The main group				The comparison group			
	Male *(n=25)*		Female *(n=44)*		Male *(n=25)*		Female *(n=44)*	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Young (18-44 years)	*2*	8.0	2	4.5	0	0.0	7	13.7
Average (45-59 years)	7	28.0	9	20.5	5	22.7	11	21.6
Old (60-74 years)	12	48.0	22	50.0	10	45.5	23	45.1
Senile (75-90 years)	4	16.0	11	25.0	7	31.8	10	19.6

Tab. 1. Division of groups by age (results of own research)

Class	Indicators	Points	Main group (n=69)		Control one (n=73)		x^2	P
			Count	%	*Count*	%		
Class A (mild degree)	Total bilirubin <60 μmol/L Total protein >65 g/L Prothrombin index >80% Cholangitis absent	1 1 1 1	16	23.2	13	17.8	0.632	>0.1
Class B (medium degree	Total bilirubin 65–200 μmol/L Total protein 55–64 g/L Prothrombin index 60-80% Cholangitis (intermittent)	2 2 2 2	28	40.6	31	42.5	0.052	>0.1
Class C (severe degree)	Total bilirubin > 200 μmol/L Total protein < 55 g/L Prothrombin index < 60% Symptoms of cholangitis	3 3 3 3	25	36.2	29	39.7	0.184	>0.1

Tab. 2. Determination of the severity of jaundice in patients according to the classification of E.I. Galperin (2014) [35].

Group	Emergency hospitalization		Planned hospitalization	
	Count	%	*Count*	%
Main group (n=69)	60	87.0	9	23.0
Comparison group (n=73)	64	87.7	9	22.3
Total	124	87.3	18	12.7

Tab. 3. Hospitalization of patients with obstructive jaundice of benign genesis

Clinical manifestations of the disease	**Eperimental group (n=69)**		**Control group (n=73)**		x^2	P
	Count	%	*Count*	%		
Jaundice	54	78.3	60	82.2	0.346	>0.1
Fever	23	33.3	27	37	0.207	>0.1
Chills	27	39.1	29	39.7	0.005	>0.1
Pain syndrome	60	87.0	63	86.3	0.013	>0.1
Nausea	47	68.1	61	83.6	4.647	0.025
Vomit	40	58	48	65.8	0.912	>0.1
Skin itching	45	65.2	62	85	7.423	0.010
Weakness	59	85.5	63	86.3	0.018	>0.1
Darkening of the urine	53	76.8	60	82.2	0.632	>0.1

Tab. 4. Clinical manifestations of benign obstructive jaundice

Causes of obstructive jaundice	Experimental group (n=69)		Control group (n=73)		x^2	P/t
	Count	%	*Count*	%		
Calculous cholecystitis with Multiple choledocholithiasis	25	36.2	25	34.2	0.061	>0.1
Calculous cholecystitis, Multiple choledocholithiasis with narrowing of the terminal part of the common bile duct	7	10.1	9	12.3	0.169	>0.1
Calculous cholecystitis, Multiple choledocholithiasis and Mirizzi syndrome (II type)	10	14.5	14	19.2	0.554	>0.1
Calculous cholecystitis with Mirizzi syndrome (III type)	8	11.6	9	12.3	-	>0.1
Calculous cholecystitis with Mirizzi syndrome (IV type)	8	11.6	6	8.2	-	>0.1
Calculous cholecystitis with Mirizzi syndrome (Va,b type)	0	0.0	6	8.2	-	>0.05
Calculous cholecystitis, Multiple choledocholithiasis and Infringed stone of Vater's papilla	2	2.9	5	6.8	-	>0.1
Postcholecystectomy syndrome with residual holedocholithiasis	6	8.7	3	4.1	-	>0.1
Postcholecystectomy syndrome, recurrent holedocholithiasis and hepaticojejunostomy stricture (according to Roux)	1	1.4	0	0.0	-	-
Postcholecystectomy syndrome, extended stricture of the bile ducts and terminal choledochus	0	0.0	1	1.4	-	-
Postcholecystectomy syndrome, residual holedocholithiasis and stricture of biliodigestive anastomosis (according to Yurash-Vinogradov)	1	1.4	0	0.0	-	-
Calculous cholecystitis with Intrahepatic hepaticolithiasis (Caroli disease)	1	1.4	0	0.0	-	-

Tab. 5. The main causes of obstructive jaundice of benign genesis

Operation types	The main group (n=69)		Control group (n=73)	
	Count	%	*Count*	%
Choledochoduodenoanastomosis according to Yurash-Vinogradov	-	-	52	71.2
Hepaticojejunostomy according to Roux	-	-	11	15.1
Hepaticocholedochoplasty (Disconnection of the cholecystoduodenal fistula with suturing of the hole in the duodenum)	-	-	10	13.7
Cholecystohepaticojejunoanastomosis according to the clinic method (RK patent 107273)	5	7.2	-	-
Cholecystohepaticocholedochoplasty according to the clinic method (RK patent 107801)	11	16.0	-	-
Choledochoduodenoanastomosis according to the method of the clinic (RK patent 108142)	53	76.8	-	-

Note: The authors of this article are the authors of the named patents for inventions of the Republic of Kazakhstan (RK).

Tab. 6. Surgical operations in the syndrome of obstructive jaundice of benign genesis (Experimental Data)

The nature of the complications	Severity of complications	The main group (n=69)		Control group (n=73)		T
		Count	%	*Count*	%	
Minimal accumulation of subcutaneous fluid (seroma)	*I*	2	2.9	3	4.1	0.45
Minimal bleeding between skin sutures	*I*	2	2.9	1	1.4	0.73
Pancreatitis after surgery	*II*	1	1.7	1	1.4	0.89
Cholangitis	*II*	-	-	4	5.5	0.078
Minimal bile flow after removal drainage according to Kera	*II*	-	-	1	1.4	0.88
Blind pocket formation	*III a*	-	-	2	2.7	0.65
Excessive intra-abdominal bile leakage. Partial failure of the biliodigestive anastomosis	*III b*	-	-	1	1.4	0.88
Stricture of terminal choledochus after Kera drainage	*III b*	-	-	1	1.4	0.88
Hepatic and renal insufficiency	*IVb*	-	-	2	2.7	0.65
Massive pulmonary embolism	*V*	-	-	1	1.4	0.88
Disseminated intravascular coagulation syndrome (DIC)	*V*	-	-	1	1.4	0.88
Total	-	5	7.2	18	24.7	0.005

Tab. 7. Complications in the postoperative period (classification of Clavien–Dindo)