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# Journal of Life Science and Biomedicine



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# Journal of Life Science and Biomedicine

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**Research Paper**

**Diagnosis and Surgical Treatment of Patients with Mirizzi Syndrome.**

Nazirov F.G., Akbarov M.M., Nishanov M.Sh.  
*J. Life Sci. Biomed.*, 8(3): 45-53, 2018;  
 pii:S225199391800008-8

**Abstract**

Introduction. Among patients undergoing cholecystectomy, the Mirizzi syndrome (MS) occurs from 0,06% to 5,7%, and it is a difficult problem in all stages of diagnosis and surgical treatment. To make a correct diagnosis in the all modern methods, surgical intervention may be done in less than in 12-32% cases. Materials and methods. From 1994 to 2016, 122 patients with MS (20 to 84 years old, on average 50,9±0,5 years old) were operated. Patients were separated by the Csendes classification of MS. Taking into account the development of diagnosis system, the choice of tactics and mode of operative treatment, all patients were divided into two groups. Control group including 69 patients were operated from 1994 to 2008 and the main group contained 53 patients operated from 2009 to 2016. On a number of clinical and laboratory methods of investigation it was applied modern instrumental investigation methods such as: x-ray examination of gastro-intestinal tract, ultrasound investigation (USI), multi spiral computer tomography (MSCT), endoscopic examination of stomach and duodenum, endoscopic retrograde pancreatocholangiography (ERPCHG), percutaneously-transhepatic cholangiography. Results. The diagnostic value of USI before operation was in the following: suspicion of I type of MS was noted in 24,3% of patients, in 37,6% of patients it was suspected the existent of II-IY types. On USI before operation in 5,4 % of patients it was verified I type and in 18,8 % of patients II-IY type of MS. The use of MRI and MSCT in MS verification may increase the efficacy of diagnosis particularly in 2 times in the comparison with USI. But, for patients with MS 1 type, this indication remains relatively low and composes only 33,3%. This method of diagnosis is more effective in patients with MS 2-4 type because of exact diagnosis in 75,0% cases. The most detailed verification was noted on ERPCHG in MS 1 type (83,3%). In SM 2-4 type the efficacy of ERPCHG was 81,4%. Uncomplicated post-operative period was noted in 83,0% of patients of main group, while in patients of control group this indication was only 56,5%. Such difference was noted both in indications of lethality (1,9% in main group against 7,2% in control) and in specific complications (15,1% in main group against 39,1% in control). Conclusion. It is concluded that the significant increasing of topical diagnosis level of MS 1 type in main group (till 42,9%), and for patients with MS 2-4 type this indication in main group increased till 19,2% in the comparison with control group. At the same time, stepwise use of all complex of diagnostic monitoring may increase the efficacy of correct diagnosis till 97-99% in patients with MS 2-4 type. In pre-established MS 1-2 type it is more effectively the using of laparoscopic interventions, and in cases of MS 3-4 type a priority remains for the choice of open operations (CHEC+draining of choledocha by Ker).



**Keywords:** Mirizzi Syndrome, Mechanical Jaundice, Ultra Sound Investigation, Multi Spiral Tomography.

[Full text-[PDF](#)]

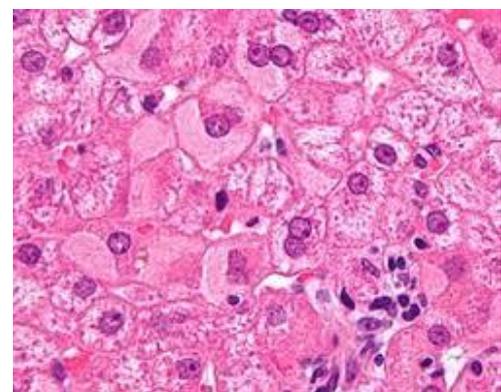
**Research Paper**

**The Effect of Chronic Diffuse Liver Pathology on the Risk of Intra- and Post-Hepatectomy Complications**

Nazirov F.G., Akbarov M.M., Ibadov R.A., Khakimov Y.U., Sirojiddinov K.K.  
*J. Life Sci. Biomed.*, 8(3): 54-60, 2018;  
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**Abstract**

Improvement of the technical aspects of liver resections reduces the risk of many specific intra- and post-operative complications. However, post-resection liver failure (PRLF) remains a difficult problem that significantly complicates the post-operative period. To assess the effect of chronic diffuse liver pathology on the frequency of complications of liver resections, the control group of 81 patients, operated in the NSCS Department of hepato-and-biliary tract surgery and in the Department of surgery of portal hypertension and pancreatoduodenal zone from 1998 to 2009 was studied. The patients were divided into 2 groups: group A was composed of patients with concomitant diffuse liver disease, namely chronic viral hepatitis and steatosis (53 patients; 65.4%) and group B included 28 patients; 34,6% with no concomitant liver pathology. The PRLF frequency analysis showed that the development of severe complications in the early postoperative period clearly correlated with the presence of diffuse liver disease. In patients with no chronic liver diseases, PRLF occurred in 2 cases (7.1%) after extensive liver resections (2 of 28). In patients with hepatic pathology,



PRLF of varying severity developed in 18.9% (10 of 3). After extensive liver resections PRLF developed more than twice as often in the patients with chronic liver disease: 28.6% versus 13.3% (8 of 28 vs. 2 of 13). After segmental resections, PRLF occurred only in patients with chronic pathologies of the liver (8.0%). Concomitant chronic diffuse liver diseases caused a significant decrease in the functional status of hepatocytes, i.e. a decline of hepatic extraction fraction in 17.1% ( $67.5 \pm 2.3\%$  vs.  $81.4 \pm 1.9\%$ ) and an increase in half-life elimination of the radiopharmaceutical drop to 26,5% ( $37.2 \pm 1.7$  min vs.  $29.4 \pm 1.2$  m) ( $P < 0.001$ ) in comparison with group B. Thus, hepatectomy in concomitant chronic diffuse liver pathology increases the risk of PRLF associated with reduced functional reserve of hepatocytes and slower compensatory regeneration process.

**Keywords:** Diffuse Changes in the Liver, Post-Operative Complications.

[Full text-[PDF](#)]

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# Diagnosis and Surgical Treatment of Patients with Mirizzi Syndrome

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## ABSTRACT

**Introduction.** Among patients undergoing cholecystectomy, the Mirizzi syndrome (MS) occurs from 0,06% to 5,7%, and it is a difficult problem in all stages of diagnosis and surgical treatment. To make a correct diagnosis in the all modern methods, surgical intervention may be done in less than in 12-32% cases. **Materials and methods.** From 1994 to 2016, 122 patients with MS (20 to 84 years old, on average 50,9±0,5 years old) were operated. Patients were separated by the Csendes classification of MS. Taking into account the development of diagnosis system, the choice of tactics and mode of operative treatment, all patients were divided into two groups. Control group including 69 patients were operated from 1994 to 2008 and the main group contained 53 patients operated from 2009 to 2016. On a number of clinical and laboratory methods of investigation it was applied modern instrumental investigation methods such as: x-ray examination of gastro-intestinal tract, ultrasound investigation (USI), multi spiral computer tomography (MSCT), endoscopic examination of stomach and duodenum, endoscopic retrograde pancreatocolangiography (ERPCHG), percutaneously-transhepatic cholangiography. **Results.** The diagnostic value of USI before operation was in the following: suspicion of I type of MS was noted in 24,3% of patients, in 37,6% of patients it was suspected the existent of II-IY types. On USI before operation in 5,4 % of patients it was verified I type and in 18,8 % of patients II-IY type of MS. The use of MRI and MSCT in MS verification may increase the efficacy of diagnosis particularly in 2 times in the comparison with USI. But, for patients with MS 1 type, this indication remains relatively low and composes only 33,3%. This method of diagnosis is more effective in patients with MS 2-4 type because of exact diagnosis in 75,0% cases. The most detailed verification was noted on ERPCHG in MS 1 type (83,3%). In SM 2-4 type the efficacy of ERPCHG was 81,4%. Uncomplicated post-operative period was noted in 83,0% of patients of main group, while in patients of control group this indication was only 56,5%. Such difference was noted both in indications of lethality (1,9% in main group against 7,2% in control) and in specific complications (15,1% in main group against 39,1% in control). **Conclusion.** It is concluded that the significant increasing of topical diagnosis level of MS 1 type in main group (till 42,9%), and for patients with MS 2-4 type this indication in main group increased till 19,2% in the comparison with control group. At the same time, stepwise use of all complex of diagnostic monitoring may increase the efficacy of correct diagnosis till 97-99% in patients with MS 2-4 type. In pre-established MS 1-2 type it is more effectively the using of laparoscopic interventions, and in cases of MS 3-4 type a priority remains for the choice of open operations (CHEC+draining of choledocha by Ker).

## Original Article

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Mirizzi Syndrome,  
Mechanical Jaundice,  
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Investigation, Multi  
Spiral Tomography.

## INTRODUCTION

Mirizzi syndrome (MS) is quite rare pathology, the incidence of it among elder population composes of less 1% in a year in developed Western countries and 4,7-5,7% in developing countries [1-5]. A number of observations of Mirizzi syndrome is increasing at recent years, which associated with increase of morbidity of bile stone diseases, decreasing of surgical activity in acute cholecystitis attack and examination of patients, surgery progress of bile ducts, best knowledge of surgeons of this complication. At present, by the data of most authors,

the rate of morbidity of Mirizzi syndrome composes of 0,3-5%, and among patients with bile stone disease – 0,1-2,7% [3, 4, 6-13].

The standard in pre-operative diagnosis of Mirizzi syndrome for several decades is the methods of direct contrast of bile ducts. Among them the most often using method is endoscopic retrograde cholangiopancreatography, which is thought by some authors more informative in diagnosis of syndrome [6, 14]. Other authors indicate on high sensitivity and safety of pre-operative diagnosis methods such as spiral computer tomography, magnetic resonance cholangiopancreatography [14, 15, 16].

The issues in regard to surgical correction of Mirizzi syndrome remain undecided. In modern surgery there are different ways of treatment of this syndrome. They may be divided in endoscopic and surgical. Laparoscopic treatment methods are used successfully in I type of syndrome. At the same time, some authors consider that the syndrome of Mirizzi is absolute or relative contraindication for laparoscopic operation, especially not diagnosed in pre-operative period [16]. Antoniou et al. [6] in the literature review on using of laparoscopic technique in syndrome of Mirizzi points to 40% of access conversion, 20% of complications and 6% of repeated operations. But there are a number of publications, which authors point to possibility of using of laparoscopic technique under certain conditions [17-21]. Kwon and Inui [15] point to possibility of applying of laparoscopic method by experienced surgeon only in first type of syndrome.

Today the most of surgeons choose the performing of cholecystectomy from the bottom, completed with draining of choledocha [4, 22-24]. Difficulties in diagnosis, as well as necessity of modern their methods involving, enough wide range of using and recommending methods of surgical treatment, a few observations, and absence of single recommendations determine the actuality of studying of this problem.

## MATERIAL AND METHODS

The work was based on retrospective analysis of investigations of 122 patients with MS, treated in surgery departments of liver and bile ducts, and portal hypertension and pancreatoduodenal zone in republican specialized center of surgery named after V. Vakhidov from 1994 to 2016. Taking into account the development of diagnosis system, the choice of tactics and way of operative treatment all patients were divided into two groups. In control group it was included 69 patients, who were operated from 1994 to 2008. The main group contained 53 patients operated from 2009 to 2016.

The age of patients varied from 20 to 84 years old (on average  $50,9 \pm 0,5$  years old). The females were more – 88 patients against 34 male patients (the ratio 2,6:1). The main complains, having in admission, were pains on right upper quadrant of abdomen, periodical icterus of skin covering and sclera, clinical manifestations of cholangitis in the form of chill, increasing of body temperature. The pains on right upper quadrant of abdomen were noted by 122 (100%) patients, clinic of mechanical jaundice was observed in 90 (73,7%) of patients. The incidence of cholangitis was noted by 23 (18,8%) patients. In 7 (5,7%) patients there was incidence of hepatic insufficiency.

Terms from the beginning of disease to the moment of admission into clinic were different in our patients and varied from 1 month to 33 years, and in some cases the duration of disease was unknown, including patients with asymptomatic cholechololithiasis. Duration of bile stone history was as follows: till 1 years in 45 (36,9%) patients, from 1 to 3 years in 14 (11,5%) patients, more than 3 years in 56 (45,9%) patients, and in 7 (5,7%) patients the duration of disease was not identified. In 30 (24,5%) patients the attack of pains was the first time and in 92 (75,5%) patients there were two or more attacks in history. Symptoms of mechanical jaundice in history were observed in 21 (17,2%) patients.

Along with the clinical and laboratory methods of investigation it was applied modern instrumental investigation methods such as: x-ray examination of gastro-intestinal tract, ultrasound investigation (USI), multi spiral computer tomography (MSCT), endoscopic examination of stomach and duodenum, endoscopic retrograde pancreatocholangiography (ERPCHG), percutaneously-transhepatic cholangiography. Including of one or another method into investigation was determined with the help of appropriate indications. The tactics of surgical treatment of patients with MS was made depending on the type of syndrome. Patients were distributed with the help of Csendes A classification for MS (Table 1).

### Ethical approval

The review board and ethics committee of RSCS named after acad. V.Vakhidov approved the study protocol and informed consents were taken from all the participants.

**Table 1.** Distribution of patients by the type of Mirizzi syndrome (MS)

Type of SM	Main group		Control group		All	
	abs.	%	abs.	%	abs.	%
Type I	14	26,4%	23	33,3%	37	30,3%
Type II	13	24,5%	24	34,8%	37	30,3%
Type III	23	43,4%	19	27,5%	42	34,4%
Type IV	3	5,7%	3	4,3%	6	4,9%
Total	53	100,0%	69	100,0%	122	100,0%

abs. = absence of single recommendations

## RESULTS AND DISCUSSION

In our clinic it was hospitalized 16549 patients with bile stone disease. From this group 14820 (89,5%) patients were operated. Other patients were discharged because of different reasons (severity of concomitant diseases, necessity of rehabilitation after elimination of the block for bile flow in mechanical jaundice (MJ), abandonment of an operation and other). In general, for the whole group of operated patients the developing rate of MS composed 0,82% (122 from 14820 patients). For all 122 patients it was made the USI of organs of abdomen. From the data of [table 2](#), which shows diagnostic efficacy of USI in verification of this diagnosis, it has been mentioned that the most low diagnostic efficacy of USI has been noted in group of patients with SM I type, with largest percentage of not established diagnosis.

Active using of MRI and MSCT in surgery of liver and extrahepatic bile ducts, which attracted specialist dealing with the problem of MS, allowed significantly increasing percentage of exact diagnosis. In [table 3](#) it was showed the indications of efficacy assessment of MRI and MSCT using in our patients. The using of MRI or MSCT in verification of MS may increase the efficacy of diagnosis practically in 2 times in comparison with USI. But, for patients with MS type 1 this indication remains relatively low and composes only 33,3%. The highest efficiency of this diagnosis method is determined in patients with SM 2-4 type with exact made diagnosis in 75,0% of cases. Next, it is performing of ERPCHG, which is not only diagnostic stage but also realizes treatment function. Indications of efficacy of ERPCHG in diagnosis of MS were presented in [table 4](#). From the [table 4](#), it is noted more meaningful verification of ERPCHG in MS 1 type (83,3%). In SM 2-4 type the efficacy of ERPCHG composed 81,4%. On the [Picture 1 \(A, B\) and 2](#) it is demonstrated all parties of ERPCHG of topical diagnosis of MS.

Results in a cumulative distribution of patients by type of performed operative treatment are presented in [table 5](#). One should mention, the specter of operative intervention variants have been practically identical in both groups that characterize persistent conservatism in choice of operative approach during long-term period, except the using of holedohoduodenoanastomoz (CHDA), which at present practically is not applied. At the same time, a number of open cholecystectomy (CHEC) with draining of choledocha by Ker, at present, is dominant operation in MS and corresponds to modern standards in the choice of operative treatment type.

In [table 6](#) it is noted the increasing of laparoscopic intervention rate performed in control group (9,4% against 3,8%), in the smallest amount of conversion (3,8% against 15,9% respectively). Nevertheless, amount of open operative interventions was practically the same in both groups. The distribution of patients depending on the performing of stage tactics in MS is presented in [table 7](#), which shows that this indication composed 37,7% in main group against 10,1% in control group. Such big difference in indications points to significant changes in MS treatment tactics of complicated mechanical jaundice (MJ) with mandatory use of one of the ways of biliary decompression before main operative stage.

The most principal moment in benign surgical pathology is assessment of this type of intervention by recent results. Assessment of surgical treatment of patients with MS we decided to consider with position: 1) analysis of recent results of surgical treatment of MS in comparison groups; 2) comparison analysis of structure and the rate of post-operative complications depending on the type of MS; 3) distribution of post-operative complications depending on the type of operation; 4) assessment of surgical intervention risk in patients with MS.

As can be seen from [diagram 3](#), which shows general structure of comparison results of surgical treatment of MS, it is mentioned significant difference by all indications in comparison groups. Thus, uncomplicated post-operative period was noted in 83,0% of patients of main group, while in patients of control group this indication composed only 56,5%. Such difference was noted both in indications of lethality (1,9% in main group against 7,2% in control) and specific complications (15,1% in main group against 39,1% in control).

Next analyzed item was to study the rate of post-operative complications depending on the type of MS (Table 8). Thus, the seam failure of choledocha was noted in 1 patients (7,1%) with MS 1type and in 4 (15,4%) patients with MS 3-4 type in main group. In control group this complication was noted in 2 patients (8,7%) with MS 1 type, in 4 patients (16,7%) with MS 2 type and in 5 patients (22,7%) with MS 3-4 type.

**Table 2.** Diagnostic efficacy of USI in verification of MS

Type of MS	Number	Suspicion on MS		Accurately verified		Undiagnosed	
		abs.	%	abs.	%	abs.	%
type I	37	9	24,3%	2	5,4%	26	70,3%
Type II-IV	85	32	37,6%	16	18,8%	37	43,6%
Total	122	41	33,6%	18	14,7%	63	51,7%

**Table 3.** Diagnostic efficacy of MRI and MSCT in verification of MS

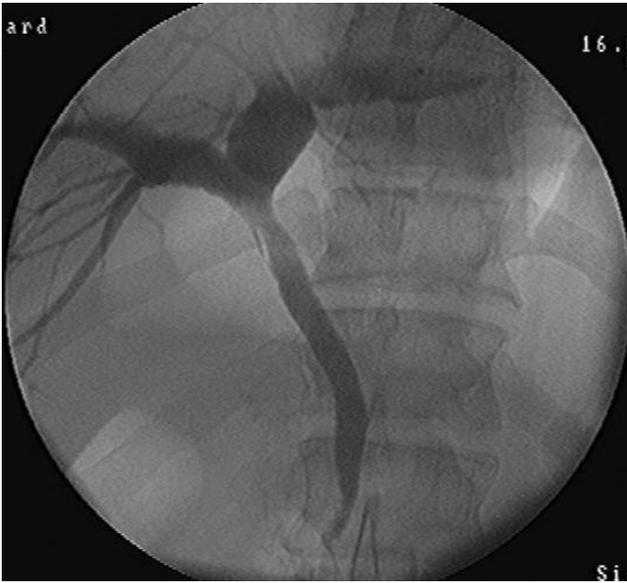
Type of MS	Number	Suspicion on SM		Accurately verified		Undiagnosed	
		abs.	%	abs.	%	abs.	%
Type I	9	3	33,3%	3	33,3%	3	33,3%
Type II-IV	45	6	15,0%	33	82,5%	6	15,0%
Total	54	9	16,7%	36	66,6%	9	16,7%

**Table 4.** Diagnostic efficacy of ERCHPG in verification of MS

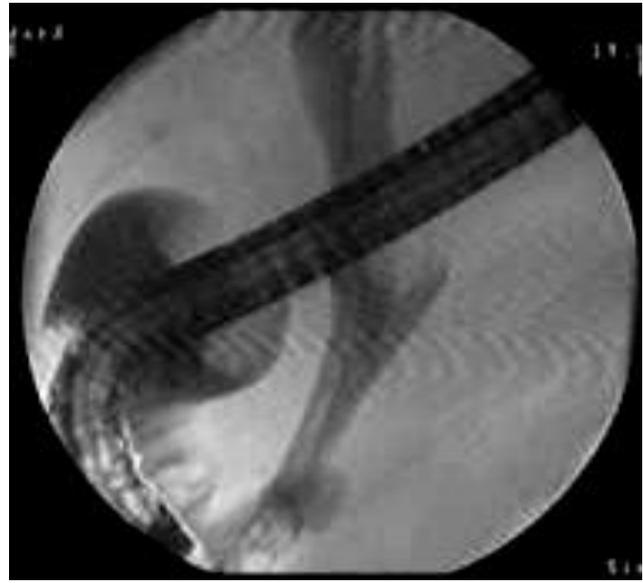
Type of MS	Number	Suspicion on MS		Accurately verified		Undiagnosed	
		abs.	%	abs.	%	abs.	%
Type I	6	2	33,3%	3	50%	1	16,7%
Type II-IV	70	10	14,3%	47	67,1%	13	18,6%
Total	76	12	15,8%	50	65,8%	14	18,4%

**Table 5. A cumulative distribution of patients by type of performed operative treatment**

Type of operation	Control group		Main group	
	abs.	%	abs.	%
<b>Open operation</b>	<b>55</b>	<b>79,7%</b>	<b>42</b>	<b>79,2%</b>
Cholecystectomy	11	15,9%	4	7,9%
CHEC+draining by Ker	15	21,7%	27	50,9%
CHEC+plastic+ draining by Ker	17	24,6%	3	5,7%
CHEC+ Pikovskiy	5	7,2%	3	5,7%
HepJA	3	4,3%	2	3,8%
CHEC, restoring hepatiko choledocha on carcass drainage	2	2,9%	3	5,7%
CHEC, dissociation of duodenal fistula, application of HepDA	2	2,9%	0	0,0%
<b>Laparoscopic anastomosis</b>	<b>2</b>	<b>2,9%</b>	<b>5</b>	<b>9,4%</b>
<b>Laparoscopic operation with draining of choledocha by Pikovskiy</b>	<b>1</b>	<b>1,4%</b>	<b>2</b>	<b>3,8%</b>
<b>Laparoscopic operation with draining of choledocha on T- shaped drainage</b>	<b>0</b>	<b>0,0%</b>	<b>2</b>	<b>3,8%</b>
<b>Laparoscopy with conversion</b>	<b>11</b>	<b>15,9%</b>	<b>2</b>	<b>3,8%</b>
Cholecystectomy	3	4,3%	3	5,7%
CHEC+draining by Ker	5	7,2%	3	5,7%
CHEC+plastic+ draining by Ker	4	5,8%	1	1,9%
CHEC+ Pikovskiy	1	1,4%	0	0,0%
HepJA	0	0,0%	1	1,9%
CHEC, restoring hepatiko choledocha on carcass drainage	4	5,8%	1	1,9%
CHEC, dissociation of duodenal fistula, application of HepDA	3	4,3%	1	1,9%



A) Gallbladder was arrested. GHD was squeezed from the outside, along the lateral contour, perhaps by gallbladder (MS 1 type). Suprastenotic ectasia of right, left and general hepatic ducts.

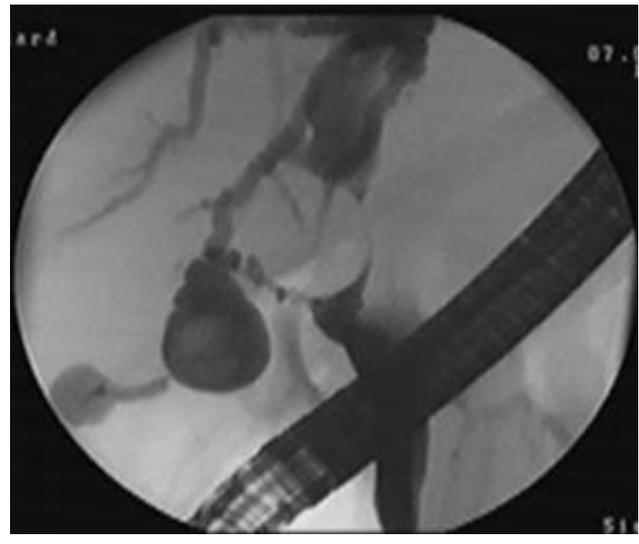


B) Gallbladder was arrested. GHD was squeezed from the outside (MS 2 type), with the aim of decompression of biliary tract it was performed the stenting of general bile duct.

**Picture 1 A, B.** Imaging of MS in its EPHGDS verification



A) On the level of confluence of cystic duct there is repletion defect, deforming lateral contour of general hepatic duct. Intrahepatic ducts and general hepatic duct (GHD) above the level of compression are enlarged (MS 3 type)



B) Symptom of «sandglass» with defect of the whole semicircle repletion of GHD (MS 4 type). Slow roundabout contrast of proximal part of choledochus at the expense of vesicular-choleal fistula

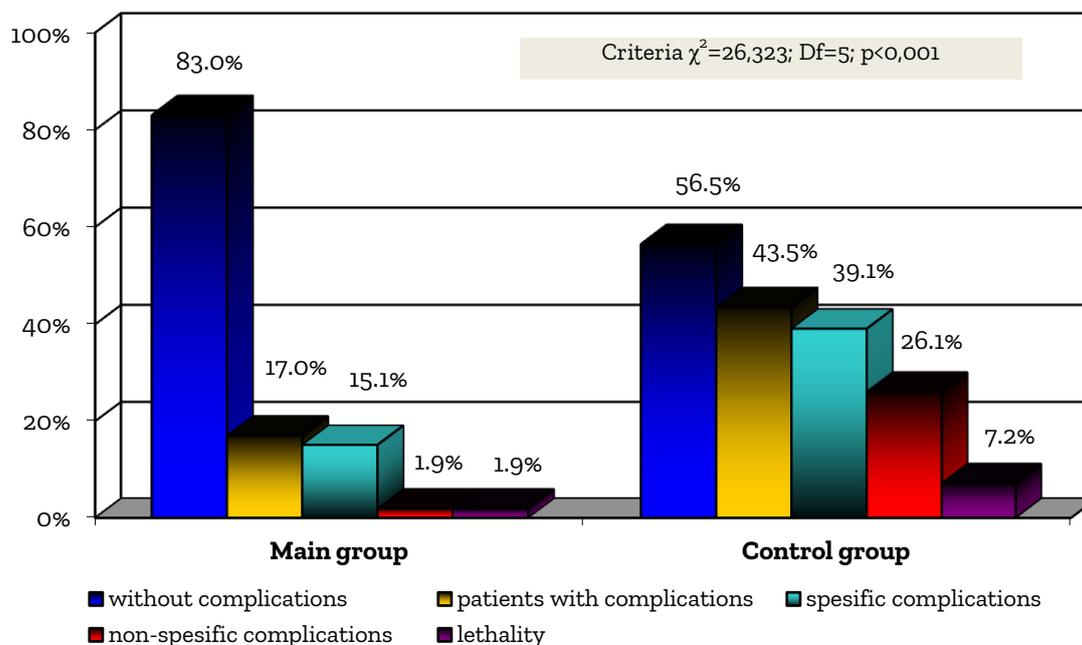
**Picture 2 A, B.** Imagine of MS in its EPHGDS verification

**Table 6.** Type of operative treatment of Mirizzi syndrome in comparison groups

Type of operation	Main group		Control group		All	
	abs.	%	abs.	%	abs.	%
Open operation	42	79,2%	55	79,7%	97	79,5%
Laparoscopic operation	9	17,0%	3	4,3%	12	9,8%
Laparoscopy with conversion	2	3,8%	11	15,9%	13	10,7%
Criteria of authenticity by operation type	$\chi^2=9,030; Df=3; p=0,037$					
Open and laparoscopy with conversion	44	83,0%	66	95,7%	110	90,2%
Total	53	100,0%	69	100,0%	122	100,0%

**Table 7.** The distribution of patients by the type of two-stage intervention

First stage of treatment	Main group		Control group	
	abs.	%	abs.	%
PTCHG	8	15,1%	2	2,9%
Nosobiliary draining	7	13,2%	3	4,3%
Lost drainage	5	9,4%	2	2,9%
Total	20	37,7%	7	10,1%
Criteria of authenticity	$\chi^2=8,527$ ; Df=3; p=0,047			



**Diagram 3.** Results of surgical treatment of MS

**Table 8.** The rate of post-operative complications depending on the type of MS

The group and type of operation	The seam failure of choledocha		Progression of liver insufficiency		Bleeding		Residual stone		Non-specific complications of organs		Suppuration of wound or sub diaphragmatic abscess	
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
<b>Control group</b>												
Type I of MS	2	8,7%	1	4,3%	0	0,0%	1	4,3%	6	26,1%	0	0,0%
-Open operation	2	13,3%	1	6,7%	0	0,0%	0	0,0%	6	40,0%	0	0,0%
-Laparoscopic operation	0	0,0%	0	0,0%	0	0,0%	1	50,0%	0	0,0%	0	0,0%
Type II of MS	4	16,7%	1	4,2%	0	0,0%	3	12,5%	4	16,7%	2	8,3%
-Open operation	3	16,7%	1	5,6%	0	0,0%	2	11,1%	3	16,7%	2	11,1%
-Laparoscopy with conversion	1	16,7%	0	0,0%	0	0,0%	1	16,7%	1	16,7%	0	0,0%
Type III and IV of MS	5	22,7%	4	18,2%	2	9,1%	1	4,5%	8	36,4%	1	4,5%
-Open operation	5	22,7%	4	18,2%	2	9,1%	1	4,5%	8	36,4%	1	4,5%
<b>Main group</b>												
Type I of MS	1	7,1%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%
-Open operation	1	12,5%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%
Type II of MS	0	0,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%
Type III and IV of MS	4	15,4%	0	0,0%	1	3,8%	1	3,8%	1	3,8%	1	3,8%
-Open operation	4	15,4%	0	0,0%	1	3,8%	1	3,8%	1	3,8%	1	3,8%

The low diagnostic efficiency of USI in verification of MS was noted in group of patients with MS I type, with the highest percentage of not established diagnosis (57,1% in main and 78,3% in control groups). Nevertheless, in main group almost in 2 times it was increased the percentage of typing diagnosis. The highest percentage of correct made diagnosis was noted in patients with MS II-IV type (23,1% against 15,2% respectively). In main group of patients with MS II-IV type it was decreased significantly the percentage of unverified diagnosis (30,8% against 54,3% respectively).

Verification of diagnosis on the base of totality of main USS signs of MS allows to increase diagnostic efficacy of this method till 18,9% in all types, and for 2-4 type particularly till 23,1%. The use of MRI and MSCT in verification of MS allows increasing the efficiency of diagnosis in 2 times in comparison with USS. But, for patients with MS 1 type this indication remains relatively low and composes only 33,3%. The highest efficiency of this diagnosis method is revealed in patients with MS 2-4 type with exact made diagnosis in 75,0% cases. The efficacy of ERPCHG in MS 1 type composes 66,7%, and in MS 2-4 type it increases till 75,8%, which associated with increasing of efficiency of beam diagnostic methods, not with the improvement of technical components of this method. It was noted significant increasing of topical diagnosis level of MS 1 type in main group (till 42,9%), and for patients with MS 2-4 type this indication in main group increased till 19,2% in comparison with control group. At the same time, stage using of all complex of diagnostic monitoring may increase the efficacy of making of correct diagnosis till 97-99% in patients with MS 2-4 type.

The use of stage surgical tactics, when on the first stage it was performed one of the variants of small-invasive biliary tract decompression, was characterized with the increasing of amount of planned surgical interventions (90,6% against 69,6%), the highest percentage of applying of laparoscopic technologies (16,98% against 4,35%) in minimal quantity of conversion (3,8% against 15,94%) and as a result: uncomplicated post-operative period was noted in 83,0% of patients of main group, while in patients of control group this indication composed only 56,5%. Such difference was noted both in indications of lethality (1,9% in main group against 7,2% in control) and specific complications (15,1% in main group against 39,1% in control).

Renouncement from emergency surgery in favor of actively expectant tactics in MS allows to increase the rate of good results after operation till 26,5%, to reduce the quantity of specific and non-specific post-operative complications till 24,0% and 24,2% respectively, and lethality till 5,3%.

## CONCLUSION

The main tasks of therapeutic and diagnostic tactics in MS in the condition of given qualified and specialized medical care are follows:

- Collection of anamnestic data and determination of risk factors of MS developing;
- Use of high technologic beam diagnosis with establishment the character of complication;
- Assessment of efficiency of combined use of all diagnostic complex in MS verification;
- Assessment of severity stage of clinical course of syndrome, determination of complicated course of underlying disease and concomitant pathology;
  - In patients with MJ, the first stage of therapeutic tactics is one of the ways of small-invasive endoscopic or endovascular decompression of biliary tract;
  - In preliminarily established MS 1-2 type the preference should be given to laparoscopic intervention, and in the case of revealing of MS 3-4 type the priority remains for the choice of open operation (CHEC+draining of choledocha by Ker).

## DECLARATIONS

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### Authors' Contributions

All authors contributed equally to this work.

### Competing interests

The authors declare that they have no competing interests.

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# The Effect of Chronic Diffuse Liver Pathology on the Risk of Intra- and Post-Hepatectomy Complications

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## ABSTRACT

Improvement of the technical aspects of liver resections reduces the risk of many specific intra- and post-operative complications. However, post-resection liver failure (PRLF) remains a difficult problem that significantly complicates the post-operative period. To assess the effect of chronic diffuse liver pathology on the frequency of complications of liver resections, the control group of 81 patients, operated in the NSCS Department of hepato-and-biliary tract surgery and in the Department of surgery of portal hypertension and pancreatoduodenal zone from 1998 to 2009 was studied. The patients were divided into 2 groups: group A was composed of patients with concomitant diffuse liver disease, namely chronic viral hepatitis and steatosis (53 patients; 65.4%) and group B included 28 patients; 34.6% with no concomitant liver pathology. The PRLF frequency analysis showed that the development of severe complications in the early postoperative period clearly correlated with the presence of diffuse liver disease. In patients with no chronic liver diseases, PRLF occurred in 2 cases (7.1%) after extensive liver resections (2 of 28). In patients with hepatic pathology, PRLF of varying severity developed in 18.9% (10 of 3). After extensive liver resections PRLF developed more than twice as often in the patients with chronic liver disease: 28.6% versus 13.3% (8 of 28 vs. 2 of 13). After segmental resections, PRLF occurred only in patients with chronic pathologies of the liver (8.0%). Concomitant chronic diffuse liver diseases caused a significant decrease in the functional status of hepatocytes, i.e. a decline of hepatic extraction fraction in 17.1% ( $67.5 \pm 2.3\%$  vs.  $81.4 \pm 1.9\%$ ) and an increase in half-life elimination of the radiopharmaceutical drop to 26.5% ( $37.2 \pm 1.7$  min vs.  $29.4 \pm 1.2$  m) ( $P < 0.001$ ) in comparison with group B. Thus, hepatectomy in concomitant chronic diffuse liver pathology increases the risk of PRLF associated with reduced functional reserve of hepatocytes and slower compensatory regeneration process.

## Original Article

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Liver Resection,  
Diffuse Changes in the  
Liver,  
Post-Operative  
Complications.

## INTRODUCTION

Development of new techniques of liver resection widened significantly the opportunities for surgical interventions for primary and secondary focal processes in the liver. The list of indications for liver resection has been increased in the recent decade that led to introduction of one- and two-steps extended resections [1-3]. An increase in quality and volume of surgeries has drawn great attention to various risk factors influencing the outcomes of surgical treatment [4].

Improvement of the technical aspects of liver resection allowed leveling the risk of many specific post-resection complications. However, post-resection liver failure (PRLF) remains to be a difficult challenge up to the present time, in particular, prevention of its development and reduction of severe hepatargia frequency [4-6].

Acute PRLF is one of the most severe complications of expanded liver resection. It may be the cause of 18-75% of lethal outcomes [8]. The main cause seems to be low pre-operative functional liver reserve or insufficient volume of the parenchyma after liver resection [15]. In patients with diffuse or marked dystrophic changes of the parenchyma, insufficient volume of the residual hepatic tissue, and severe concomitant diseases of the cardio-vascular system and respiratory organs, as well as the problem of prevention of acute PRLF are still significant [9].

Liver resection is possible in cirrhosis A by the classification of Child-Pugh, in some observation in cirrhosis B, but it is contraindicated for patients with cirrhosis C [10, 11]. In the randomized study of liver pathology conducted in 2004, the Barcelona Clinic Board developed the classification of hepatocellular cancer (Barcelona - Clinic Liver Cancer staging system) taking into account the tumor process and severity of liver cirrhosis [12]. It should be used when it was impossible to choose an optimal method of treatment for a concrete situation, e.g. liver resection or transplantation, radiofrequency destruction or transarterial chemoembolization or medicinal therapy [8].

The study of many factors rendering direct effects on the PRLF frequency resulted in identification of the criteria divided into factors related to patients' profile, surgical intervention type and postoperative management of patients. High frequency of chronic diffuse pathology of the liver is associated, first of all, with viral hepatitis while the alimentary factor seems to be the regional peculiarity. In viral hepatitis, the risk of development of post-resection complications was caused by the viral activity and progressing cytolysis and liver fibrosis while an increase in the body mass index was concomitant by development of fatty hepatosis which, if prolonged, may lead to functional disorders of hepatocytes with cholestasis and progressing fibrosis.

Objective of the present study was investigating the effect of concomitant chronic diffuse liver pathology to results of resections performed due to benign and malignant liver focal neoplasms.

## MATERIAL AND METHODS

To identify indications and modality of liver resection, particularly the extended one, it is necessary to take into consideration all specific factors effecting on the peri-operative period. The control group of 81 patients was analyzed to evaluate the effect of chronic diffuse process in the liver on the frequency of liver resection complications. The patients were operated in the Department of liver and biliary tract surgery and in the Department of portal hypertension and pancreato-duodenal zone surgery of the National Specialized Center for Surgery (Tashkent, Uzbekistan) in 1998 - 2009. The patients were divided into group A composed of patients with concomitant diffuse liver pathology, namely chronic viral hepatitis and fatty hepatosis (53 patients; 65.4%), and group B of 28 patients with no liver pathology.

Among 53 patients with concomitant liver pathology, 31 had viral hepatitis and 22 had fatty hepatosis. In 28 cases (34.6%), extended liver resections were performed; in 25 cases, various variants of segmentectomies (30.9%) were used, in 14 cases of viral hepatitis and 11 – in fatty hepatosis. In the group of patients with no chronic liver pathology, major resections were performed in 18.5% of cases (in 15 of 81), segmentectomy was performed in 16.0% (13 patients).

During examination of the patients in the pre- and postoperative periods, the dynamic monitoring of clinical and biochemical blood indicators was conducted. Radionuclide investigation of the hepatic blood volume was performed on the gamma-camera (FO Gamma LFOV with computer PDP 11/34. USA) using the technique of dynamic and static scintigraphy. Colloid radiopharmaceutical  $^{99m}\text{Tc}$ -technetium of native production was used as the activity indicator (0.6 MBk/kg of body mass). Deconvolution analysis applied to process the obtained radio-chronograms yielded in identification of two parameters characterizing the functional activity of liver parenchyma:

1. Fr extr - the parameter of the liver extraction fraction (%).
2.  $T_{1/2}$  - the period of the radiopharmaceutical half-life elimination (min) characterizing excretive liver function.

The hepatocyte functional activity was evaluated with radioisotope scintigraphy in 34 patients in the pre-operative period and on day 5-7 after extensive liver resection. In 22 cases, the patients had concomitant chronic diffuse liver pathology and 12 patients did not have liver pathology. Findings of clinical examination were processed with the method of variational statistic developed by W.S. Gosset (Student) and R.A. Fisher. The average and standard error ( $M \pm m$ ) were calculated. The findings were considered reliable if the level of the significance of the reliability indicator of the difference of average values ( $P$ ) was no more than 0.05. The statistic processing of the obtained findings and their graphic presentation were performed on the PEVM "Pentium-4" using the standard MS Excel-XP, Statistica 6.0, BIostat.

### Ethical approval

The review board and ethics committee of Republican Specialized Center of Surgery named after acad.V.Vakhidov approved the study protocol and gave permission.

## RESULTS AND DISCUSSION

The study of PRLF frequency showed that development of this life-threatening complication in the early post-operative period clearly correlated with the presence of diffuse liver pathology. For instance, in group B, PRLF occurred in 2 cases after extensive liver resections, it accounted 7.1% (2 of 28). In group A, the frequency of PRLF of various severities was 18.9% (10 of 53). The total frequency of PRLF development in the groups under study was 14.8% (12 of 81)

It should be noted that severe PRLF in group developed in 9.4% of cases (in 5 patients) in 4 cases it was accompanied by chronic viral hepatitis and in one case by fatty hepatosis. In group B, severe PRLF was diagnosed in one patient (4.5%). Severe PRLF was the consequence of extensive liver resection in all cases. After extensive liver resection PRLF complicated the post-operative period twice more often in chronic liver pathology: 28.6% vs. 13.3% (8 of 28 vs. 2 of 13). In segmental resections, PRLF was found only in group 2 (8.0%).

The parameters of the liver extraction fraction in concomitant chronic diffuse liver pathology in the pre- and post-operative periods are presented in figure 1. Concomitant chronic diffuse liver pathology in patients with focal neoplasms contributes to reliable reduction ( $P < 0.001$ ) of the hepatocyte functional status, that was clearly expressed by the reduction of the liver extraction fraction by 17.1% ( $67.5 \pm 2.3\%$  vs.  $81.4 \pm 1.9\%$ ). This suggests that lower functional reserve of hepatocytes is associated with PRLF high frequency in the patients with concomitant liver pathology in the early post-operative period.

In addition to the fraction of liver extraction we studied half-life elimination period of radiopharmaceutical (RP) from the liver. The presence of concomitant chronic diffuse pathology in the patients with focal neoplasms provides reliable prolongation of the RP half-life elimination period by 29.8% (from  $29.4 \pm 1.2$  min to  $42.1 \pm 3.6$  min) ( $P < 0.001$ ) in comparison with the group with no parenchymatous processes.

In group A, on days 5-7 after the surgery, reliable prolongation of the RP half-life elimination period was noted in comparison with the preoperative period (from  $37.2 \pm 1.7$  min to  $64.5 \pm 4.2$  min, respectively;  $P < 0.001$ ). In group B, an increase in this parameter value was noted: from  $29.4 \pm 1.2$  min to  $42.1 \pm 3.6$  min ( $P < 0.001$ ) (Figure 2). The dynamics of the liver function changes in the post-operative period was monitored by biochemical blood tests (total protein, albumin, ALT, AST, bilirubin). In the majority of patients, on day 1 after the surgery, the levels of ALT, AST and total bilirubin in the blood serum increased the number of total protein and, particularly, albumin fraction reduced both in the study group and the controls.

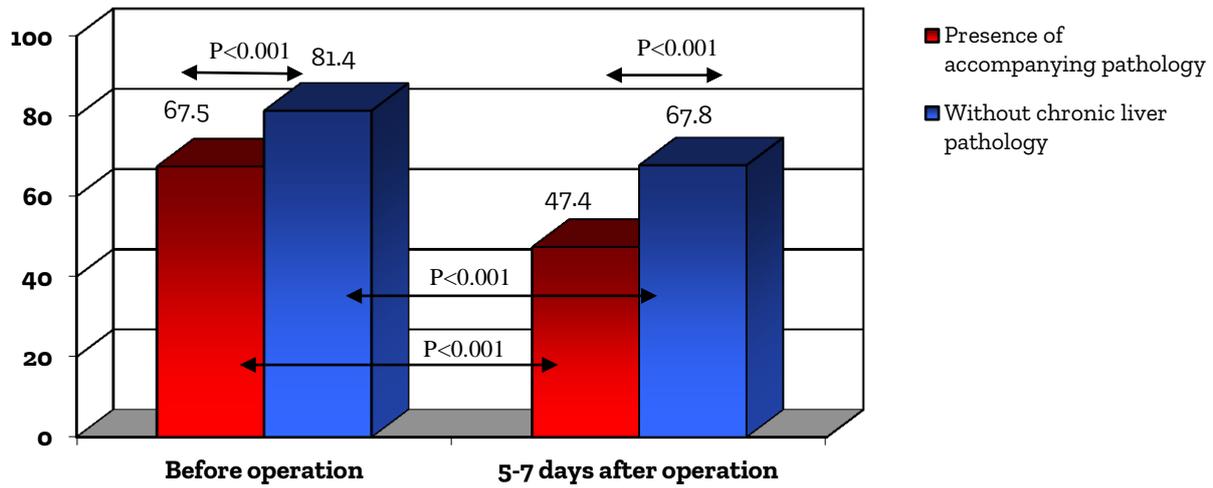
However, reliably ( $P < 0.05$ ) quicker restoration of the parameters closer to the physiological values was observed in group B ( $11.3 \pm 0.4$  days), while the parameters in group A approached the normal value in  $16.5 \pm 0.7$  days (Table 1). Surgical interventions in the patients with diffuse liver changes were always associated with a high risk of complications both in the post-operative period and during the surgery. Profuse, difficult for control intra-operative hemorrhages in these patients present special difficulties for surgeons.

In our research, the intra-operative blood loss during the extensive liver resections was  $684 \pm 35$  ml in the patients with diffuse liver pathology, while in the absence of the concomitant pathology, the total volume of blood loss did not exceed  $574 \pm 29$  ml ( $P < 0.05$ ). In segmentectomies, the volume of the total intra-operative blood loss also reliably increased in group B against group A ( $529 \pm 26$  ml vs.  $433 \pm 16$  ml, respectively;  $P < 0.01$ ).

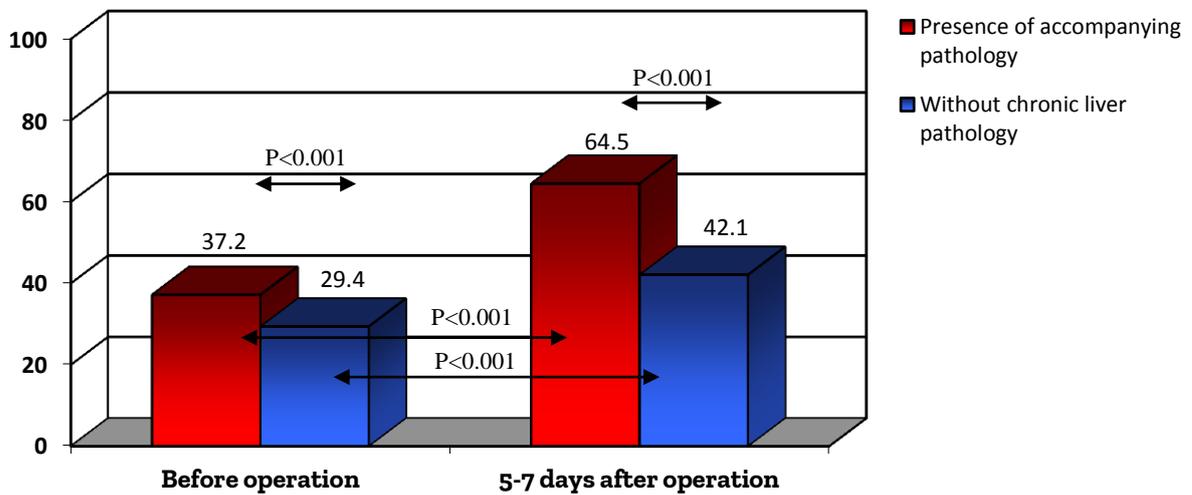
The hepato-duodenal ligament (HDL) had to be clipped for prevention hemorrhage in group D during extensive liver resection in 3 of 15 cases (20.0%), while in less traumatic segmental resections, HDL clipping was made in 2 cases of 13 (15.4%). Among 28 patients with concomitant pathology who had extensive liver resection, HDL clipping was required in 9 cases (32.1%), while in segmental resections, HDL clipping was made in 6 of 25 cases (24.0%).

Some hemodynamic disturbances and severe ischemia of the hepatic tissue occurred during HDL cross-clamping, the risk of postoperative complications increased. In the initially compromised liver parenchyma (cirrhosis, chronic hepatitis, and mechanic jaundice), the resistance to hepatic ischemia reduced, respectively, to occlusion of HDL. However, the increased complexity of the surgery in diffuse liver changes assumes prolongation of the duration of the HDL cross-clamping.

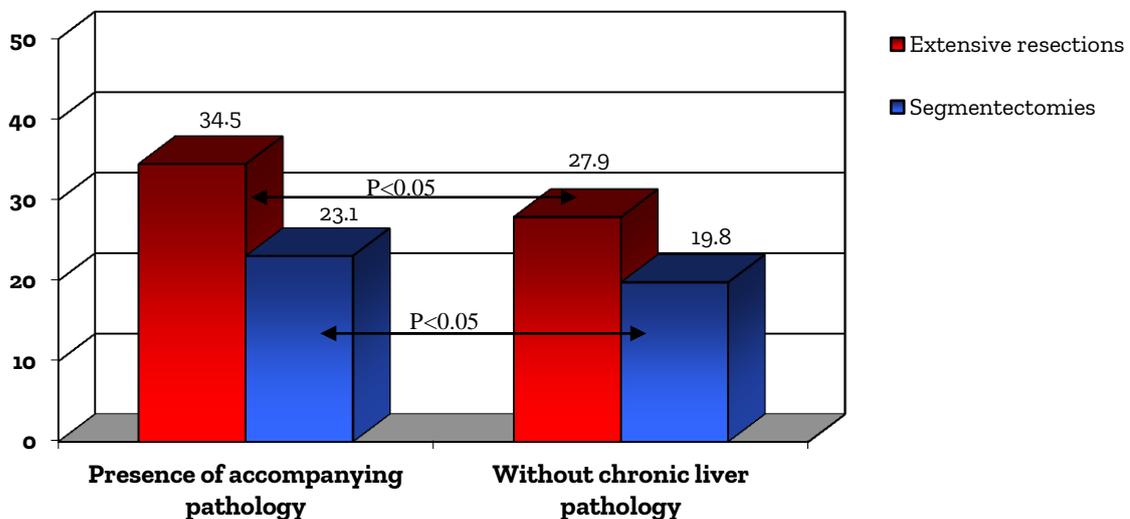
In extensive liver resections in patients with diffuse liver pathology, the duration of the cross-clamping was  $34.5 \pm 2.1$  min, while in group A, it was reliably shorter and on the average lasted  $27.9 \pm 1.7$  min ( $P < 0.05$ ). In less traumatic segmental resections, the total clamping duration in group B was  $19.8 \pm 1.3$  min., while in group A it reliably increased to  $23.1 \pm 1.9$  min ( $P < 0.05$ ) (Figure 3).



**Figure 1.** Evaluation of hepatocyte functional activity. Fraction of liver extraction (%) in concomitant chronic diffuse liver pathology before and after resection.



**Figure 2.** Evaluation of the functional activity of hepatocytes. RP half-life elimination period (min) in concomitant chronic diffuse liver pathology before and after liver resection.



**Figure 3.** Duration (min) of HDL clamping

**Table 1.** Dynamics of biochemical characteristics

Parameter	Concomitant liver pathology			No chronic liver pathology		
	Day 1	Day 5	Day 7	Day 1	Day 5	Day 7
<b>Total bilirubin, <math>\mu\text{mol/l}</math></b>	42.8 $\pm$ 2.9	39.0 $\pm$ 2.5*	31.2 $\pm$ 2.2*	35.6 $\pm$ 2.1	29.9 $\pm$ 2.4	24.6 $\pm$ 1.9
<b>Plasma protein, g/l</b>	47.9 $\pm$ 1.9	49.1 $\pm$ 1.7*	53.5 $\pm$ 1.8*	49.2 $\pm$ 2.2	53.7 $\pm$ 1.2	59.1 $\pm$ 1.6
<b>Albumin, g/l</b>	26.5 $\pm$ 0.8	28.4 $\pm$ 1.0	30.1 $\pm$ 1.1*	27.9 $\pm$ 0.6	30.6 $\pm$ 0.8	34.3 $\pm$ 0.7
<b>ALT, <math>\mu\text{mol/l}</math></b>	221.2 $\pm$ 16.6*	197.7 $\pm$ 3.2*	142.7 $\pm$ 13.1*	175.6 $\pm$ 11.8	159.2 $\pm$ 11.8	101.4 $\pm$ 0.5
<b>AST, <math>\mu\text{mol/l}</math></b>	185.3 $\pm$ 11.6*	149.2 $\pm$ 11.4*	102.9 $\pm$ 10.2*	150.5 $\pm$ 9.6	113.8 $\pm$ 11.0	74.3 $\pm$ 8.6
<b>Parameters normalization</b>	16.5 $\pm$ 0.7 days*			11.3 $\pm$ 0.4 days		

\* reliability of differences in the groups of comparison (P<0.05)

Taking into account the surgical technique complexity, presence of multiple aggravating factors in concomitant diffuse liver pathology, the surgery duration in this group of patients was reliably longer (on average 282 $\pm$ 16 min), and in group B the surgery lasted on average 228 $\pm$ 14 min (P<0.05). The segmental resections lasted 186 $\pm$ 13 min against 140 $\pm$ 11min in the controls (P<0.01).

Specific complications developed in the early post-operative periods in the groups under study in 30.9% of cases (25/81 patients). It should be noted that 19 of these 25 cases were the patients with concomitant diffuse liver pathology. These complications included: postoperative liver failure, intraperitoneal hemorrhages from the liver resection surface, bile secretion from the liver resection surface, ascitis, subdiaphragm abscess, acute coronary circulation disorders, and pleuropneumonia.

Acute liver failure observed in 12 cases (14.8%) appeared to be the most common and critically difficult complication. In 10 of 12 cases, this complication developed in group B and only in 2 cases (7.1%) in group A. The intraperitoneal hemorrhages occurred in 3 cases: 2 patients (3.8%) with concomitant liver pathology and 1 patient (2%) without any concomitant liver pathology. Secretion bile from the liver resection surface complicated the post-operative period in group A with concomitant pathology in 2 cases (3.8%), while in group B it occurred in one case (3.6%). PRLF complicated with postoperative ascitis was observed in 2 cases in group A and in 1 patient from group B (3.8% vs. 3.6, respectively). The subdiaphragm abscess revealed in one patient in group A (1.9%) was treated with percutaneous puncture-drainage. Pleuropneumonia in early post-operative period was diagnosed in 2 patients (2.5%): one case in group A, and one case in group B. The acute disorder of coronary circulation was observed in one case (19%) in the patients with concomitant liver pathology. The overall mortality in the groups under study accounted for 4.9% (4 of 81 cases). In 3 cases death was caused by PRLF (3.7%) and in one case it was due to massive intraperitoneal hemorrhage (1.2%). In group A, three patients died (5.7%): 2 of them had progressing PRLF; one patient had intraperitoneal hemorrhage. In group B, one patient died of PRLF (3.6%).

## CONCLUSION

1. Resection of liver in patients with chronic diffuse liver pathology increased the risk of PRLF development due to reduction of functional reserve of hepatocytes and slower compensatory process of regeneration.

2. The risk of post-resection liver failure in patients with concomitant chronic diffuse liver pathology increased from 7.1% to 18.9%, and extensive resection increased the risk to 28.6% in the structure of which the severe functional insufficiency of hepatocytes with possible prognosis of lethal outcome to 60%.

3. In the patients with focal process in the liver, concomitant chronic diffuse liver pathology provides reliable reduction of the hepatocyte functional status that reflects a decrease in liver extraction fraction by 17.1% (67.5 $\pm$ 2.3% against 81.4 $\pm$ 1.9%) and an increase in the half-life elimination of the radiopharmaceutical by 26.5% (37.2 $\pm$  1.7 min vs. 29.4 $\pm$  1.2 min) (P<0.001) in comparison with the group without parenchymatous processes.

4. According to scintigraphy, the liver resection induced reduction of hepatocyte functional activity reflected by a decrease in the fraction of liver extraction by 16.7% (from 81.4 $\pm$ 1.9% to 67.8 $\pm$ 3.4%) and increase in half-life elimination of the radiopharmaceutical by 29.8% (from 29.4 $\pm$  1.2 min to 42.1 $\pm$ 3.6 min) (P<0.001). In its turn, in concomitant chronic diffuse liver pathology, these parameters achieved 43.2% (from 67.5 $\pm$ 2.3% to 47.4 $\pm$ 4.5%) and 73.4% (from 37.2 $\pm$ 1.7 min to 64.5 $\pm$ 4.2 min) (P<0.001), respectively.

5. In early post-resection period, the functional insufficiency of the residual hepatocyte volume was reliably higher in the group with concomitant chronic diffuse liver pathology, that results in prolongation of the period of compensatory regeneration with normalization of the main biochemical blood parameters, on the average, on day  $16.5 \pm 0.7$  vs.  $11.3 \pm 0.4$  in the group with no concomitant liver diseases.

6. Chronic diffuse process in the liver contributed to an increase in the risk of intra-operative blood loss in segmental ( $P < 0.01$ ) and extensive ( $P < 0.05$ ) resections with an increase in the period of vascular isolation by Pringle's method from  $19.8 \pm 1.3$  min to  $23.1 \pm 1.9$  min and from  $27.9 \pm 1.7$  min to  $34.5 \pm 2.1$  min, respectively ( $P < 0.05$ ), as well as surgery duration from  $140 \pm 11$  to  $186 \pm 13$  min ( $P < 0.01$ ) and from  $228 \pm 14$  min to  $282 \pm 16$  min ( $P < 0.05$ ).

7. The risk of development of complications after resection performed to patients with concomitant chronic diffuse process in the liver rises from 21.4% to 35.8% increasing mortality rate from 3.6% to 5.7% and average duration of the hospital stay from  $23.7 \pm 0.9$  to  $28.7 \pm 1.0$  days ( $P < 0.001$ ).

## DECLARATIONS

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### Authors' Contributions

All authors contributed equally to this work.

### Competing interests

The authors declare that they have no competing interests.

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## Paper Submission Flow



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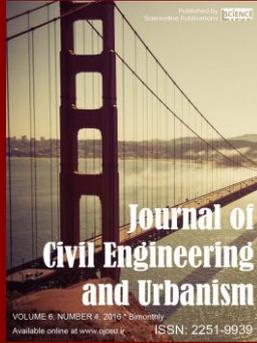
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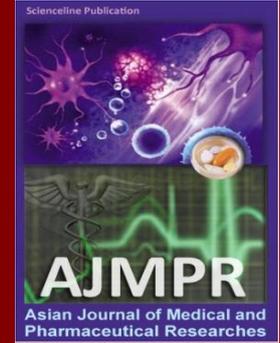
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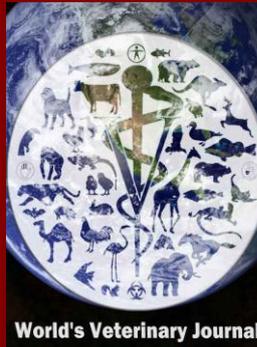
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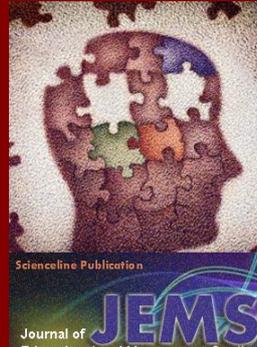
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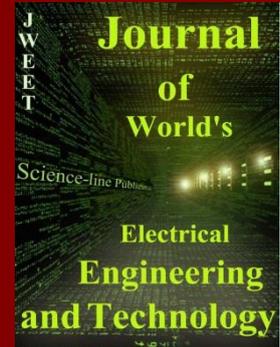
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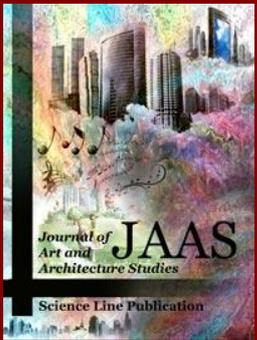
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