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Classification, Diagnosis, and Management of Patients with Biliary Sludge and Early-Stage Cholelithiasis (Literature Review and Expert Council Resolution)

Sayar R. Abdulkhakov[1,2], Dmitry S. Bordin[3,4,5], Oleg S. Vasnev[3], Natalia N. Vetsheva[6], Oksana Yu. Zolnikova[7], Yury A. Kucheryavyy[8], Sabir N. Mekhtiev[9,10], Alexey V. Okhlobystin[7], Elena V. Parfenchikova[3], Karina L. Raikhelson[9,11], Diana E. Rumyantseva[7], Vladimir I. Simanenkov[12], Evgeny G. Solonitsin[11,13], Elena N. Shirokova[7], Yulia O. Shulpekova[7]*

[1] *Kazan (Volga Region) Federal University, Kazan, Russian Federation*
[2] *Kazan State Medical University, Kazan, Russian Federation*
[3] *Loginov Moscow Clinical Scientific Center, Moscow, Russian Federation*
[4] *Russian University of Medicine, Moscow, Russian Federation*
[5] *Tver State Medical University, Tver, Russian Federation*
[6] *Russian Medical Academy of Continuous Professional Education, Moscow, Russia*
[7] *I.M. Sechenov First Moscow State Medical University (Sechenov University), Moscow, Russian Federation*
[8] *Ilyinskaya Hospital, Krasnogorsk, Moscow Region, Russian Federation*
[9] *Academician I.P. Pavlov First Saint Petersburg State Medical University, Saint Petersburg, Russian Federation*
[10] *Gastroenterological Centre Expert, Saint Petersburg, Russian Federation*
[11] *Saint Petersburg State University, Saint Petersburg, Russian Federation*
[12] *North-Western State Medical University named after I.I. Mechnikov, Saint Petersburg, Russian Federation*
[13] *V.A. Almazov National Medical Research Center, Saint Petersburg, Russian Federation*

Background. On May 20, 2025, a Council of Experts was held in Moscow. The aim of the meeting was to discuss current understanding of the pathogenesis and clinical significance of biliary sludge.
Key points. The following definition of biliary sludge has been established: echogenic fluid within the gallbladder cavity without a clear acoustic shadow, which shifts with changes in body position without fragmentation into fine particles. The absence of an acoustic shadow distinguishes sludge from gallstones. The International Consensus of Experts in Pancreatobiliary Diseases (2023) proposed distinguishing between biliary sludge, microlithiasis (echogenic stones ≤ 5 mm with acoustic shadowing), and larger gallstones in the gallbladder and/or ducts. When managing a patient with biliary sludge, it is important to identify the underlying disease or condition predisposing to the development of sludge. The most important factors are genetic and demographic ones, dietary habits, conditions associated with rapid weight loss, and medications that affect bile composition or gallbladder function. Biliary sludge can be asymptomatic, with dyspeptic symptoms, or lead to complications typical of gallstones. Some data suggest that sludge is associated with idiopathic pancreatitis. The primary diagnostic method for sludge is transabdominal ultrasound. If clinical manifestations characteristic of cholelithiasis complications develop, the common bile duct becomes dilated, or stones are detected in the common bile duct, additional diagnostic testing using magnetic resonance cholangiopancreatography and/or endoscopic ultrasound is recommended. Clinical observations also suggest the potential for sludge to transform into gallstones. However, the view that biliary sludge is the first stage of gallstone disease was not shared by all Council members due to the high incidence of reversible sludge. At this stage, it is proposed to consider biliary sludge more as a risk factor or a specific form of gallstone disease. The only medication shown to dissolve biliary sludge is ursodeoxycholic acid.
Conclusion. The Expert Council adopted a resolution, the provisions of which emphasize the need for accurate diagnosis, individual assessment of risk factors for the development of biliary sludge, the feasibility of developing a scoring system for assessing biliary sludge, determining the location of ursodeoxycholic acid therapy for sludge, and the need to supplement the Clinical Guidelines of the Russian Ministry of Health for the diagnosis and treatment of cholelithiasis with sections devoted to the diagnosis and treatment of biliary sludge.
Keywords: biliary sludge, cholesterol, lithogenic bile, ursodeoxycholic acid
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Вопросы классификации, диагностики и ведения пациентов с билиарным сладжем и начальной стадией желчнокаменной болезни (обзор литературы и резолюция Совета экспертов)

С.Р. Абдулхаков[1,2], Д.С. Бордин[3,4,5], О.С. Васнев[3], Н.Н. Ветшева[6], О.Ю. Зольникова[7], Ю.А. Кучерявый[8], С.Н. Мехтиев[9,10], А.В. Охлобыстин[7], Е.В. Парфенчикова[3], К.Л. Райхельсон[9,11], Д.Е. Румянцева[7], В.И. Симаненков[12], Е.Г. Солоницын[11,13], Е.Н. Широкова[7], Ю.О. Шульпекова[7]*

[1] *ФГАОУ ВО «Казанский (Приволжский) федеральный университет», Казань, Российская Федерация*
[2] *ФГБОУ ВО «Казанский государственный медицинский университет» Министерства здравоохранения Российской Федерации, Казань, Российская Федерация*
[3] *ГБУЗ «Московский клинический научно-практический центр им. А.С. Логинова» Департамента здравоохранения города Москвы, Москва, Российская Федерация*
[4] *ФГБОУ ВО «Российский университет медицины» Министерства здравоохранения Российской Федерации, Москва, Российская Федерация*
[5] *ФГБОУ ВО «Тверской государственный медицинский университет» Министерства здравоохранения Российской Федерации, Тверь, Российская Федерация*
[6] *ФГБОУ ДПО «Российская медицинская академия непрерывного профессионального образования» Министерства здравоохранения Российской Федерации, Москва, Российская Федерация*
[7] *ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет), Москва, Российская Федерация*
[8] *АО «Ильинская больница», Красногорск, Московская область, Российская Федерация*
[9] *ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. академика И.П. Павлова» Министерства здравоохранения Российской Федерации, Санкт-Петербург, Российская Федерация*
[10] *ООО «Гастроэнтерологический центр Эксперт», Санкт-Петербург, Российская Федерация*
[11] *ФГБОУ ВО «Санкт-Петербургский государственный университет», Санкт-Петербург, Российская Федерация*
[12] *ФГБОУ ВО «Северо-Западный государственный медицинский университет им. И.И. Мечникова» Министерства здравоохранения Российской Федерации, Санкт-Петербург, Российская Федерация*
[13] *ФГБУ «Национальный медицинский исследовательский центр им. В.А. Алмазова» Министерства здравоохранения Российской Федерации, Санкт-Петербург, Российская Федерация*

Введение. 20 мая 2025 г. в Москве состоялся Совет экспертов, основной целью которого было обсуждение современных представлений о патогенезе и клиническом значении билиарного сладжа.

Основные положения. Утверждено следующее определение билиарного сладжа — эхогенное содержимое в полости желчного пузыря без четкой акустической тени, смещающееся при перемене положения тела без фрагментации на мелкодисперсные частицы. Отсутствие акустической тени отличает сладж от желчных конкрементов. Международный Консенсус экспертов в области панкреатобилиарных заболеваний (2023 г.) предложил разграничивать билиарный сладж, микролитиаз (эхогенные камни ≤ 5 мм с акустической тенью) и более крупные желчные камни в желчном пузыре и/или протоках. При ведении пациента с билиарным сладжем необходимо вычленять основное заболевание или состояние, предрасполагающее к развитию сладжа. Наиболее важны генетические и демографические факторы, особенности питания, состояния, связанные с быстрым снижением массы тела, медикаментозные воздействия, влияющие на состав желчи или функцию желчного пузыря. Билиарный сладж может протекать бессимптомно, с диспепсическими явлениями, а также приводить к развитию осложнений, характерных для желчнокаменной болезни. Некоторые данные свидетельствуют, что сладж ассоциирован с идиопатическим панкреатитом. Основной метод диагностики сладжа — трансабдоминальное УЗИ. При развитии клинических проявлений, характерных для осложнений желчнокаменной болезни, расширении общего желчного протока, выявлении конкрементов в общем желчном протоке рекомендуется проведение дополнительной диагностики с применением магнитно-резонансной холангиопанкреатографии и/или эндоскопического УЗИ. Клинические наблюдения также свидетельствуют о возможной трансформации сладжа в желчные камни, однако взгляд на билиарный сладж как на первую стадию желчнокаменной болезни был разделен не всеми участниками Совета в связи с высокой частотой обратимого сладжа. На данном этапе предложено рассматривать билиарный сладж скорее как фактор риска или особую форму желчнокаменной болезни. Единственным лекарственным препаратом, для которого показана способность вызывать растворение билиарного сладжа, является урсодезоксихолевая кислота.

Заключение. В ходе Совета экспертов была принята резолюция, положения которой подчеркивают необходимость корректной диагностики, индивидуальной оценки факторов риска развития билиарного сладжа, целесообразности разработки балльной системы оценки билиарного сладжа, определения места терапии сладжа урсодезоксихолевой кислотой и необходимости дополнения клинических рекомендаций Минздрава РФ по диагностике и лечению желчнокаменной болезни разделами, посвященными диагностике и лечению билиарного сладжа.

Ключевые слова: билиарный сладж, холестерин, литогенная желчь, урсодезоксихолевая кислота

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Introduction

On May 20, 2025, a Council of Experts was convened in Moscow with the aim of discussing current understandings of the pathogenesis and clinical significance of biliary sludge. The issue of the tactics of managing patients with biliary sludge (from Latin: “biliaris” meaning “bilious”, and from English “sludge” meaning “mud”, “silt” or “suspension”) and its association with cholelithiasis (or gallstone disease, GSD) remains very relevant. The generalisation of accumulated experience is complicated by the fact that studies sometimes define biliary sludge differently, confuse the concepts of sludge and microlithiasis, analyse different categories of patients, and use different diagnostic methods (ultrasound, bile microscopy, etc.).

Definition of biliary sludge

The concept of “biliary sludge” arose at the end of the 20th century in connection with the introduction of transabdominal ultrasound into clinical practice. For a considerable period, it was accepted that the distinction between biliary sludge and microlithiasis resided exclusively in the diagnostic approach employed: the presence of biliary sludge was detected using ultrasound, and the presence of microlithiasis was determined by microscopic examination of bile. In the medical literature, these terms have frequently been used interchangeably [1, 2]. However, in recent decades, the view on biliary sludge has changed, which is associated with the active use of endosonography (endoscopic ultrasound, endoUS). In some cases, the term “biliary sludge” may refer to any pathological changes in the contents of the gallbladder. An analysis of literary data shows that there are still no uniform criteria for defining not only biliary sludge, but also microlithiasis [1, 2]. A clinical study which involved 41 experts in endosonography demonstrated that even among these specialists, no consensus was reached on the diagnostic criteria for biliary sludge and microlithiasis [3]. This terminological ambiguity has the potential to give rise to disagreements between physicians, which in turn affects the choice of treatment strategy by gastroenterologists and surgeons.

The Committee of the Russian Association of Specialists in Ultrasound Diagnostics in Medicine has approved the following definition of biliary sludge: echogenic contents in the cavity of the gallbladder without a clear acoustic shadowing, shifting with a change in body position without fragmentation into fine particles. The absence of acoustic shadowing distinguishes sludge from biliary calculi.

The International Consensus of Experts in Pancreatobiliary Diseases (2023) proposed to differentiate between biliary sludge (discrete hyperechoic contents without acoustic shadowing), microlithiasis (echogenic stones ≤ 5 mm in size with acoustic shadowing) and larger gallstones in the gallbladder and/or ducts (size > 5 mm with acoustic shadowing) [4].

Professor N.N. Vetsheva emphasised the necessity of interpreting hyperechoic structures measuring 3 to 5 mm with an acoustic shadowing as a calculus. The terms “microlith” and “microlithiasis” should not be used when describing the gallbladder lumen during ultrasound examination. These terms originated from studies on endoscopic interventions in pancreatology and have little practical application; if an acoustic shadowing is present on ultrasound, the image should be interpreted as consistent with cholelithiasis. Sludge should also be distinguished from “suspension” which is characterised by the presence of minute echogenic structures against an anechoic contents within the gallbladder, which appear to be suspended or in the form of sediment that disintegrates into individual suspended particles when the patient’s body position changes. In certain instances, the sludge zone may exhibit immobility, yet be avascular as determined by colour Doppler imaging, which distinguishes it from a tumour.

Consequently, experts adopted the following definition of biliary sludge: echogenic contents in the gallbladder cavity, determined by ultrasound, without a clear acoustic shadow and shifting with a change in body position without fragmentation into fine particles.

Pathogenesis and risk factors

Risk factors for the development of biliary sludge are generally similar to those for cholelithiasis (Table) [5–7]. The most common causes of biliary sludge, like cholelithiasis, are sudden weight loss, pregnancy, and metabolic dysfunction with insulin resistance. Patients with metabolic dysfunction frequently exhibit excessive development of visceral adipose tissue, arterial hypertension, signs of fatty liver disease, impaired glucose tolerance, and Frederiksen type IIb and IV dyslipidaemia.

Table. Risk factors for the development of biliary sludge
Таблица. Факторы риска развития билиарного сладжа

Groups of factors ***Группы факторов***	**Diseases and conditions** ***Заболевания и состояния***
Factors contributing to impaired gallbladder emptying *Факторы, способствующие нарушению опорожнения желчного пузыря*	▪ Pregnancy / *Беременность* ▪ Insulin resistance / *Инсулинорезистентность* ▪ Surgical interventions on the upper gastrointestinal tract (impaired cholecystokinin production) *Оперативные вмешательства на верхних отделах желудочно-кишечного тракта (нарушение продукции холецистокинина)* ▪ Mechanical obstructions (stents, stenosis, tumors, large cystic duct stump) *Механические препятствия (стенты, стенозы, опухоли, большая культя пузырного протока)* ▪ Gallbladder dysfunction / *Дисфункция желчного пузыря* ▪ The patient's critical condition, development of acute calculous cholecystitis *Критическое состояние пациента, развитие острого акалькулезного холецистита* ▪ Prolonged fasting, total parenteral nutrition, very low calorie diet *Длительное голодание, полное парентеральное питание, очень низкокалорийное питание* ▪ Use of drugs that slow motility: glugo-like peptide-1 and glucose-dependent insulinotropic polypeptide receptor agonists, octreotide, estrogens, opioids *Применение лекарств, замедляющих моторику: агонисты рецепторов глюканоподобного пептида-1 и глюкозозависимого инсулинотропного полипептида октреотид, эстрогены, опиоиды*
Increased levels of deconjugated bilirubin in bile *Повышение содержания деконъюгированного билирубина в желчи*	▪ Hemolysis / *Гемолиз* ▪ All conditions in which there is infection of the bile ducts or increased intestinal permeability *Все состояния, при которых наблюдается инфицирование желчных путей или повышение кишечной проницаемости*
Increased secretion of cholesterol into bile *Повышение секреции холестерина в желчь*	▪ Insulin resistance / *Инсулинорезистентность* ▪ Carriage of lithogenic genes (Lith) / *Носительство генов литогенности (Lith)* ▪ Pregnancy / *Беременность* ▪ Taking estrogens, fibrates / *Прием эстрогенов, фибратов* ▪ "Western" type of nutrition / *«Западный» тип питания* ▪ Rapid weight loss (> 10 % in 3 months) *Быстрое похудание (> 10 % за 3 месяца)* ▪ Slowing down of intestinal motility (increased absorption of cholesterol) *Замедление кишечной моторики (повышение всасывания холестерина)*
Deficiency of bile acids and phospholipids in bile *Дефицит желчных кислот и фосфолипидов в желчи*	▪ Liver diseases / *Заболевания печени* ▪ Diseases affecting the terminal part of the small intestine *Заболевания с поражением терминального отдела тонкой кишки* ▪ Insulin resistance / *Инсулинорезистентность* ▪ Carriage of the ABCB4 (MDR3) gene mutation (clinically, it may also manifest as intrahepatic biliary stones, intrahepatic cholestasis of pregnancy, progressive familial intrahepatic cholestasis, benign recurrent intrahepatic cholestasis, and recurrent pancreatitis) *Носительство мутации гена ABCB4 (MDR3) (клинически может проявляться также образованием внутрипеченочных желчных камней, внутрипеченочным холестазом беременных, прогрессирующим семейным внутрипеченочным холестазом, доброкачественным рецидивирующим внутрипеченочным холестазом, рецидивирующим панкреатитом)* ▪ Bile tract infection (conversion of primary bile acids to secondary bile acids) *Инфекция желчных путей (преобразование первичных желчных кислот во вторичные)*
Additional nucleating agents *Дополнительные нуклеирующие агенты*	▪ Use of ceftriaxone, cefotaxime, and ceftazidime *Применение цефтриаксона, цефотаксима и цефтазидима* ▪ Biliary tract infection (bacterial glycocalyx) *Инфекция желчевыводящих путей (гликокаликс бактерий)*

Pre-pregnancy excess body weight and elevated leptin levels have been shown to be strong predictors of sludge and biliary development [8].

Dietary factors and characteristics of the intestinal microbiota can exert a considerable influence on the development of sludge. Western pattern diet, which is characterised by a high consumption of saturated fats, animal protein and simple carbohydrates, promotes the formation of a "pro-inflammatory" intestinal microbiome, increased intestinal permeability and increased lipopolysaccharide flow to the liver where it can inhibit the conversion of cholesterol into bile acids, which contributes to the oversaturation of bile with cholesterol [9].

In some cases, sludge is not related to cholelithiasis (for example, sludge that develops during therapy with ceftriaxone and consists of salts of the drug). Modern approaches do not allow us to distinguish between biliary sludge leading to stone formation and its reversible variants.

Epidemiology

According to published data, the prevalence of biliary sludge is 1.7 to 1.8 % among outpatients exhibiting no specific digestive complaints and 6.7 % among patients who do experience digestive complaints. With rapid weight loss, the incidence of sludge can reach 25 %, during pregnancy it can raise to 30 %, in ceftriaxone administration - up to 40 %, and with total parenteral nutrition it can be 50 % [10]. In 2011, Professor A.A. Ilchenko indicated that the frequency of stone formation in the general population was 9–12 % over 2–3 years of observation [11, 12].

Clinical manifestations

Biliary sludge does not cause clinical symptoms in most patients. The development of obstruction and inflammation may result in the manifestation of biliary or pancreatic pain and inflammation symptoms. Dyspeptic symptoms (pain and a feeling of fullness in the epigastric region after eating, nausea, belching, heartburn) may be associated with impaired gallbladder contractility (dysfunction) and/or caused by concomitant motility disorders of the upper gastrointestinal tract.

Experts unanimously supported the position that when analysing the clinical presentations, it is necessary to sort out the symptoms of the underlying disease or condition that predisposes to the sludge development. The most common factors that lead to the development of bile duct and cholelithiasis include genetic and demographic factors, nutritional characteristics (including those associated with weight loss), and diseases, conditions and medications that affect the composition of bile or the function of the gallbladder [13].

Biliary sludge can lead to severe complications, such as acute cholecystitis, acute cholangitis and acute pancreatitis, by obstructing the outflow tract of bile and pancreatic secretions [14]. With an average follow-up period of 21 months, complications developed in around a quarter of patients with sludge: acute acalculous and calculous cholecystitis — in 13.4 % of patients (on average, 93 days after sludge was detected), acute pancreatitis — in 3.8 % of patients (on average, 204 days), and choledocholithiasis — in 1 % of patients [14]. These data are generally consistent with the results of another study in which acute acalculous cholecystitis developed in 7.1 % of patients over a period of 6.5 to 37.5 months, with a stone formation frequency of 12 % [15]. In patients with gallbladder sludge and initial history of typical biliary pain, the risk of developing complications within 5 years is 2.6 times higher and is 33.9 % vs. 15.8 % in the control cohort with sludge but no pain (p = 0.021). The 5-year cumulative incidence of acute cholecystitis in the cohort experiencing pain was 15.6 % (compared to 5.3 % in the control cohort); for acute cholangitis it was 15.5 % (compared to 5.3 %), and for acute pancreatitis it was 18.4 % (compared to 11.1 %) [16]. This study shows that sludge associated with probable inflammatory changes and pain is more likely to result in complications.

Acute pancreatitis that is not associated with alcohol consumption or any other known risk factors is usually referred to as "idiopathic" and may be caused by the presence of biliary sludge. In pancreatology, the term "microliths" is widely used alongside "sludge", making it difficult to distinguish cases where pancreatitis is caused by stones that have already formed. The severity of acute biliary pancreatitis caused by biliary sludge did not differ from that caused by biliary stones (p = 0.62). The incidence of hyperbilirubinemia at the time of hospitalisation in patients with sludge and pancreatitis was not statistically different from incidence of pancreatitis caused by biliary stones (p = 0.36) [17].

A significant proportion of experts have noted that up to 50 % of cases of idiopathic pancreatitis may be associated with the presence of biliary sludge or small calculi [4, 18]. Several studies have examined the role of cholecystectomy in cases of idiopathic acute pancreatitis where there is no obvious presence of biliary calculi. A multicentre randomised trial showed that the recurrence rate of idiopathic acute pancreatitis was reduced following laparoscopic cholecystectomy. Sludge or very small calculi were detected during surgery in 58 % of cases [19]. Another retrospective study confirms that performing a cholecystectomy after an initial episode of idiopathic acute pancreatitis significantly reduces the recurrence

rate [20]. These studies had two methodological shortcomings: the study protocol did not include endo-ultrasound for all patients, and there was a lack of data on possible hypertriglyceridemia and drug history. However, a meta-analysis from 2020 confirmed that the recurrence rate of idiopathic pancreatitis after cholecystectomy is reduced even with endoscopic ultrasound and magnetic resonance cholangiopancreatography (MRCP) [21]. Endoscopic papillosphincterotomy has been shown to be equally effective in preventing new episodes of idiopathic pancreatitis, apparently due to restoring pancreatic juice outflow [22]. According to experts in pancreatology, ursodeoxycholic acid (UDCA) can be used to prevent the recurrence of idiopathic pancreatitis in cases of sludge where utilisation of laparoscopic cholecystectomy and papillosphincterotomy is limited [4]. When UDCA was prescribed, a reduction in the recurrence rate was observed in 75 % of patients who showed no pathological changes during endoscopic retrograde cholangiopancreatography (endoultrasound was not performed); this suggests that biliary sludge might have caused recurrent acute pancreatitis [23].

Diagnosis of biliary sludge

It is important to note that a diagnosis of biliary sludge is based on data from instrumental diagnostic methods, primarily transabdominal ultrasound of the biliary tract, although bile microscopy is still considered the "gold standard", which though is currently not used in clinical practice and is not included in medical care standards. Transabdominal ultrasound, given its relatively low cost, availability and non-invasiveness, is currently the initial stage of examination. The method's sensitivity in diagnosing gallbladder sludge ranges from 55 % to 90 %, with an average of 60 %. If ultrasound does not detect sludge or stones, but there are strong clinical findings that suggest their presence (especially recurrent idiopathic pancreatitis or signs of cholangitis), further imaging studies should be considered (Fig. 1). Endo-ultrasound reaches a sensitivity of over 90 % in diagnosing sludge. The diagnostic accuracy of MRCP has not been well studied, the sensitivity of endoscopic retrograde cholangiopancreatography is between 67 and 76 % [4, 6].

Professor N.N. Vetsheva noted that the terms "microlith" and "microlithiasis" should not be used to describe changes of the lumen of the GB during a transabdominal ultrasound scan. *The presence of a 3–5 mm hyperechoic structure with an acoustic shadowing should be characterised as a calculus.*

Transabdominal ultrasound has limited sensitivity (55–59 %) and specificity in detecting biliary sludge and small calculi in the common bile duct [3, 24, 25]. In this regard, according to current clinical guidelines, in the presence of episodes of biliary

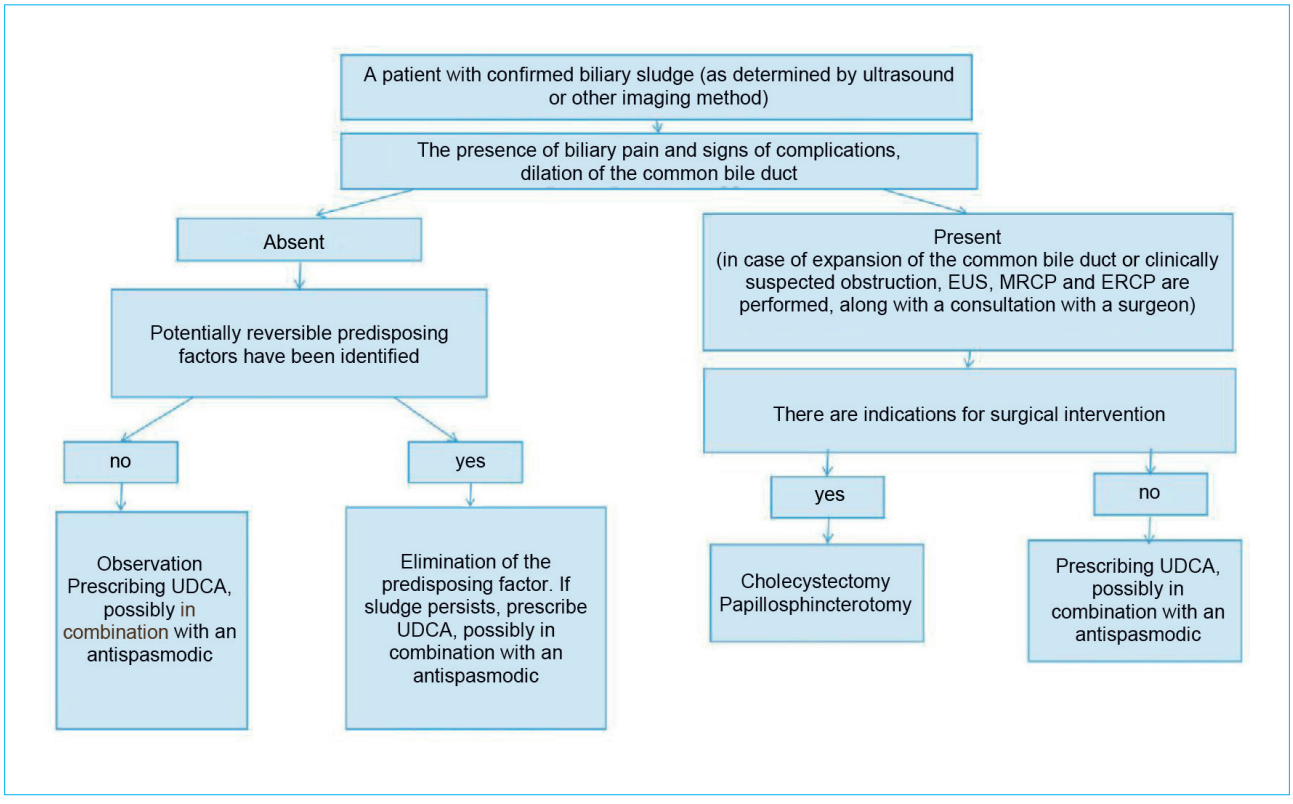

Figure. Examination plan and management tactics for biliary sludge
Рисунок. План обследования и тактика ведения при билиарном сладже

pain, dilation of the common bile duct or insufficient information from ultrasound to assess stones, it is advisable to perform MRCP, and as an alternative or additional method, endoscopic ultrasound (endoUS) of the pancreatobiliary zone [25].

MRCP and endo-ultrasound demonstrate high diagnostic value in detecting choledocholithiasis (including calculi up to 5 mm) and bile duct strictures, with a sensitivity of 97–98 % and 93–95 %, respectively. They can also provide an accurate assessment of the condition of the pancreas. However, endo-ultrasound is more sensitive at detecting small calculi (less than 5 mm) and biliary sludge [12]. E.V. Parfenchikova, Dr. Sci. (Med.), and E.G. Solonitsyn, Cand. Sci. (Med.), both noted that using endoUS can significantly reduce the risk of general complications arising from endoscopic retrograde cholangiopancreatography (ERCP). Biochemical criteria are unreliable predictors of choledocholithiasis [26]. By performing endoUS first, ERCP can be safely avoided in two-thirds of patients with suspected common bile duct calculi [27]. The ASGE Guidelines recommend using endoscopic ultrasonography or magnetic resonance cholangiopancreatography to select patients for therapeutic ERCP in cases of acute pancreatitis [28].

Thus, the experts have reached a consensus that in the presence of clinical manifestations characteristic of cholelithiasis, dilation of the common bile duct, and detection of stones in the common bile duct, it is recommended to perform additional diagnostics using MRCP and/or endoscopic ultrasound.

The natural course of biliary sludge and its possible connection with cholelithiasis

The relationship between biliary sludge and cholelithiasis was discussed during the Expert Council meeting.

A plethora of studies have indicated a high incidence of reversible sludge; conversely, in certain cases, biliary stones have been observed to develop. For instance, in a retrospective study encompassing 104 patients with a mean follow-up period of 21 months, sludge was resolved in 83 % of cases, and biliary stones were observed in 8.6 % of patients [14]. A prospective study of 96 patients, followed for an average of 37.8 months, showed that sludge resolved without recurrence in 17.7 % of cases, resolved with recurrence in 60.4 % of cases, and formation of asymptomatic stones was noted in 8.3 % of cases [29]. A large-scale study of 3,254 women found that pregnant women frequently experience the formation and recurrence of sludge and biliary stones; however, overall, 4.2 % of women continued to have sludge or gallstones after delivery, and 0.8 % of women underwent cholecystectomy within the next year.

Referring to the previous classification of cholelithiasis [11], Professor S.N. Mekhtiev suggested creating an updated classification, where biliary sludge would remain the first stage of cholelithiasis and the cholelithiasis stage after cholecystectomy would also be recognised. The validity of this assertion is substantiated by the observation that biliary sludge and cholelithiasis share virtually identical risk factors; in experimental models, biliary stones formation occurs through a sludge stage, and clinical observations indicate that sludge can also transform into stones. Cholelithiasis and biliary sludge can cause similar complications. However, not all members of the Council shared this point of view due to the frequent occurrence of sludge reversal and the lack of stone formation.

At this stage, it has been proposed to consider biliary sludge to be either a risk factor or a specific type of cholelithiasis. Professor K.L. Raikhelson raised the issue of developing a more comprehensive classification of biliary sludge that would clearly indicate predisposing factors and the characteristics of the course of the disease and development of complications. Based on this, it would be possible to identify forms of sludge that are more likely to progress to cholelithiasis and that require more active monitoring. It is in this regard that experts noted the need to classify biliary sludge as a stage, a pre-stage, or a special form of cholelithiasis. This proposal also carries the obvious risk of overdiagnosing cholelithiasis.

Yu.A. Kucheryavyy, Cand. Sci. (Med.), proposed the idea of creating a scoring system for assessing biliary sludge based on risk factors and other indicators. A rating scale of this kind would help clinicians to assess the potential reversibility of sludge, and to identify forms of sludge that require active treatment and/or dynamic monitoring. Creating such a validated scale requires special analytical work.

Management tactics

It is crucial to identify reversible risk factors and eliminate them, which enables sludge to be resolved (Table 1). This reverse development is particularly evident in cases of sludge formation during pregnancy and when the mechanical obstruction to bile flow is removed [5].

In the current Russian Clinical Guidelines on cholelithiasis, biliary sludge is mentioned as a concept and condition that may precede cholelithiasis. When deciding whether treatment for biliary sludge is necessary, it is important to identify and attempt to modify the risk factors and conditions that contributed to its development. In some cases, modifying risk factors can lead to sludge disappearing. If complications develop, surgical interventions are performed [30]. In the absence of

clinical symptoms indicating damage to the biliary tract and pancreas in a patient with sludge, it is customary in a number of countries to adopt an observational approach without treatment; active screening for sludge is also not carried out in the absence of symptoms [31].

However, another approach is also justified: taking measures to conservatively dissolve sludge in order to prevent stone formation and complications. UDCA is the only drug that has been shown to cause the dissolution of biliary sludge. The healing action of UDCA is based on its ability to inhibit the enzyme responsible for synthesising cholesterol, and to reduce cholesterol absorption in the intestine.

Therefore, UDCA may help to reduce the concentration of cholesterol in bile. UDCA's high hydrophilicity promotes the dispersion of cholesterol crystals. An increase in the UDCA concentration in bile is reflected in the ternary phase diagram, which shows the ratio of the main components and the rheology of bile: there is an expansion of the right two-phase zone (containing vesicles and micelles), which indicates a reduction in the formation of solid crystals [32]. UDCA promotes the removal of excess cholesterol from the muscle cells of a gallbladder, which is reflected in a normalised response to contractile stimuli [33].

Additionally, UDCA stimulates choleresis to a moderate extent by improving the excretion of bile acids through the apical membrane of the hepatocyte via the bile acid transporter (bile salt export pump, BSEP), and by stimulating the secretion of bicarbonates by the biliary epithelium. This action could be useful for treating bilirubin sludge. Choleresis promotes the formation of a protective "bicarbonate umbrella" on the epithelial surface [34]. According to Product Information Letter, UDCA is prescribed at a dose of 10 mg/kg/day for 6–24 months, and its administration can be combined with that of an antispasmodic to improve bile outflow into the duodenum. An intermediate ultrasound control is carried out 3–4 months after the start of treatment. According to domestic authors, the frequency with which biliary sludge was resolved after 3 months of UDCA use ranged from 19 to 49 %; after 6 months — from 60.9 to 82.9 %; and after 12 months — from 70.7 to 91.4 % (depending on the drugs used) [35]. A meta-analysis of 6 studies involving a total of 671 patients showed that the overall frequency of sludge dissolution reached 52 % within 3 months and 78.2 % within 6 months when generic UDCA drugs were used; when the original drug from Germany was used, the frequency was 88.4 % [36]. A multicentre observational study using UDCA (Urdoxa®) as part of a combination therapy for biliary sludge (with 1,056 participants) showed that 89.8 % of patients experienced regression of their sludge after 6 months of treatment. By the sixth month of observation, a significant decrease was noted in the proportion of patients experiencing pain on palpation in the gallbladder area, falling from 36.1 to 0.04 %. According to the SF-36 questionnaire, a significant improvement in patients' quality of life indicators was noted. High patient adherence to treatment was observed throughout the study period (83.3–90.1 %) [37]. Due to the presence of concomitant pathologies, primarily metabolically associated fatty liver disease, 16.7 % of patients initially demonstrated elevated serum aminotransferase activity, 7.3 % showed elevated total bilirubin levels, 3.1 % displayed elevated alkaline phosphatase activity, and 16.8 % manifested elevated gamma glutamyl transpeptidase activity. In the vast majority of patients, these indicators normalised during UDCA therapy. In 16.8 % of patients with initially elevated liver enzyme levels, normalisation of these indicators was achieved by the 6th month of Urdoxa® therapy, probably due to UDCA's positive effect on NAFLD, which often accompanies biliary sludge and cholelithiasis [37]. An adverse event was reported as being associated with UDCA use in only 0.003 % of cases which is chologenic diarrhoea, that resolved on its own [37].

Experts shared their views on which categories of patients with biliary sludge are most likely to benefit from UDCA prescription. In particular, UDCA is probably warranted even in the absence of symptoms if sludge does not resolve spontaneously and the patient has a family history of cholelithiasis. Developing a scoring system for biliary sludge could help to select candidates for treatment.

The justification for prescribing UDCA for sludge is also supported by its effectiveness at the stage of stone formation; however, this is true only for the cases when the stones are small and do not contain any significant amount of calcium. A meta-analysis of 16 randomised controlled trials (n = 819) demonstrated that UDCA monotherapy at low (less than 7 mg/kg/day) and higher doses (at least 7 mg/kg/day) for a period of more than 6 months, achieves dissolution of radiolucent biliary stones in 37.3 % of cases [38]. No serious side effects were observed during studies of UDCA therapy; the only adverse event was diarrhoea, which developed in 2 to 9 % of patients [39]. UDCA reduces the risk of biliary calculi formation after bariatric surgery by 73 %. According to the current guidelines, UDCA should be prescribed at a dose of 500–600 mg per day for 6 months following bariatric surgery [40]. The high risk of recurrence of stone formation (25–64 % after 5 years and 49–80 % after 10 years) is a reason given in a number of national guidelines for refusing to perform drug-induced litholysis with UDCA for the treatment of cholelithiasis. However, the risk of recurrence could probably be reduced

by carrying out repeated courses of prophylactic treatment.

Based on literary data and practical recommendations of Russian and foreign consensuses, the Expert Council adopted the following resolution:

1. Transabdominal ultrasound is the primary method of diagnosing biliary sludge. MRI, CT and endo-ultrasound can be employed as additional methods.

2. In a transabdominal ultrasound examination, biliary sludge is defined as echogenic content in the gallbladder cavity that does not produce a clear acoustic shadow and is displaced when the body position is changed but does not fragment into fine particles. A hyperechoic structure with a clear acoustic shadowing should be interpreted as a calculus.

3. The definition of biliary sludge considers only its location in the gallbladder, so any echogenic content in the biliary tract outside the gallbladder should be considered an indication for further examination, such as MRCP and/or endo-ultrasound, with decision made in relation to surgical approach to patient management.

4. It is necessary to improve the awareness of ultrasound diagnostic physicians, therapists, gastroenterologists, general practitioners and surgeons so they are able to correctly describe and interpret the ultrasound presentation of biliary sludge.

5. Given the high risk of pancreatobiliary complications in patients with biliary sludge, it is advisable to conduct a comprehensive clinical assessment of the risks of progression and development of complications in a particular patient, with mandatory dynamic observation.

6. It is necessary to modify the classification of biliary sludge, associated and not associated with cholelithiasis, to introduce all risk factors.

7. Patients with biliary sludge and no clinical symptoms should undergo dynamic monitoring, considering the combination of risk factors for cholelithiasis progression by performing ultrasound once every 3 to 6 months.

8. The frequency with which biliary sludge transforms into cholelithiasis, as well as the risk of complications, dictates the need for dynamic patient monitoring as well as supports the appropriateness of using drug therapy with UDCA preparations, which should be prescribed based on the combination of risk factors and ultrasound presentations.

9. Patients diagnosed with biliary sludge who are not showing any clinical symptoms should be recommended a diet and undergo dynamic ultrasound monitoring every 3 months; if biliary sludge persists, litholytic therapy with UDCA is indicated.

10. For patients with biliary sludge with clinical symptoms manifestation, except for the biliary colic, drug therapy with UDCA at a dose of 8–15 mg/kg/day is recommended, with an assessment of the effectiveness using ultrasound after 3 to 6 months.

11. Data on the safety of using UDCA allow the drug to be prescribed for a long period of up to 12 months or more, with ultrasound monitoring after 3 to 6 months. The presence of asymptomatic gallbladder calculi (including radiopaque ones) does not limit the use of UDCA when there are other indications to use it, such as biliary sludge, cholestatic diseases, fatty liver disease and drug-induced liver injury.

12. To effectively monitor the progression of biliary sludge and assess the risk of stone formation and complications, it is advisable to develop a scoring system to evaluate this risk.

13. The clinical guidelines of the Ministry of Health of the Russian Federation on cholelithiasis should be supplemented with sections devoted to the diagnosis and treatment of biliary sludge.

References / Литература

1. *Peery A.F., Crockett S.D., Murphy C.C., Lund J.L., Dellon E.S., Williams J.L., et al.* Burden and cost of gastrointestinal, liver, and pancreatic diseases in the United States: Update 2018. *Gastroenterology*. 2019;156(1):254–72.e11. DOI: 10.1053/j.gastro.2018.08.063
2. *O'Morain N., O'Morain C.* The burden of digestive disease across Europe: Facts and policies. *Dig Liver Dis.* 2019;51(1):1–3. DOI: 10.1016/j.dld.2018.10.001
3. *Quispel R., Schutz H.M., Hallensleben N.D., Bhalla A., Timmer R., van Hooft J.E., et al.* Do endosonographers agree on the presence of bile duct sludge and the subsequent need for intervention? *Endosc Int Open.* 2021;9(6):E911–7. DOI: 10.1055/a-1452-8919
4. *Żorniak M., Sirtl S., Beyer G., Mahajan U.M., Bretthauer K., Schirra J., et al.* Consensus definition of sludge and microlithiasis as a possible cause of pancreatitis. *Gut*. 2023;72(10):1919–26. DOI: 10.1136/gutjnl-2022-327955
5. *Wang H.H., Li T., Portincasa P., Ford D.A., Neuschwander-Tetri B.A., Tso P., et al.* New insights into the role of Lith genes in the formation of cholesterol-supersaturated bile. *Liver Res.* 2017;1(1):42–53. DOI: 10.1016/j.livres.2017.05.005
6. *Шульпекова Ю.О., Попова И.Р., Нечаев В.М.* Функциональные заболевания желчевыводящих путей и желчнокаменная болезнь: анализ возможной взаимосвязи. *Российский журнал гастроэнтерологии, гепатологии, колопроктологии.* 2024;34(4):94–103. [*Shulpekova Yu.O., Popova I.R., Nechaev V.M.* Functional disorders of the biliary tract and cholelithiasis: Analysis of a possible relationship. *Russian Journal of Gastroenterology, Hepatology, Coloproctology.* 2024;34(4):94–103. (In Russ.)].DOI: 10.22416/1382-4376-2024-34-4-94-103
7. *Biddinger S.B., Haas J.T., Yu B.B., Bezy O., Jing E., Zhang W., et al.* Hepatic insulin resistance directly promotes formation of cholesterol gallstones. *Nat Med.* 2008;14(7):778–82. DOI: 10.1038/nm1785
8. *Ko C.W., Beresford S.A., Schulte S.J., Matsumoto A.M., Lee S.P.* Incidence, natural history, and risk factors for biliary sludge and stones during pregnancy. *Hepatology.* 2005;41(2):359–65. DOI: 10.1002/hep.20534

9. *Dikopoulos N., Weidenbach H., Adler G., Schmid R.M.* Lipopolysaccharide represses cholesterol 7-alpha hydroxylase and induces binding activity to the bile acid response element II. *Eur J Clin Invest*. 2003;33(1):58–64. DOI: 10.1046/j.1365-2362.2003.01079.x
10. *Jüngst C., Kullak-Ublick G.A., Jüngst D.* Microlithiasis and sludge. *Best Pract Res Clin Gastroenterol.* 2006;20(6):1053–62. DOI: 10.1016/j.bpg.2006.03.007
11. *Ильченко А.А., Дрожжина Ю.В.* Литолитический и гипохолестеринемический эффекты урсотерапии при холестерин-ассоциированной патологии желчного пузыря. *Consilium Medicum*. 2011;13(8):28–32. [*Ilchenko A.A., Drozhzhina Yu.V.* Litholytic and hypocholesterolemic effects of ursotherapy in cholesterol-associated gallbladder pathology. *Consilium Medicum*. 2011;13(8):28–32. (In Russ.)].
12. *Saglam A., Derwig I., Sezik M., Tuncer S.C., Ozcil M.D., Kasap B., et al.* The incidence of biliary sludge in first trimester pregnancies with hyperemesis gravidarum and its effect on the course of hyperemesis gravidarum. *J Obstet Gynaecol.* 2022;42(6):1775–81. DOI: 10.1080/01443615.2022.2038106
13. *Министерство здравоохранения Российской Федерации.* Желчнокаменная болезнь. Клинические рекомендации. 2024. [*Ministry of Health of the Russian Federation.* Gallstone disease. Clinical guidelines. 2024. (In Russ.)]. URL: https://cr.minzdrav.gov.ru/view-cr/877_1
14. *Hill P.A., Harris R.D.* Clinical importance and natural history of biliary sludge in outpatients. *J Ultrasound Med.* 2016;35(3):605–10. DOI: 10.7863/ultra.15.05026
15. *Janowitz P., Kratzer W., Zemmler T., Tudyka J., Wechsler J.G.* Gallbladder sludge: Spontaneous course and incidence of complications in patients without stones. *Hepatology*. 1994;20(2):291–4.
16. *Lee Y.S., Kang B.K., Hwang I.K., Kim J., Hwang J.H.* Long-term outcomes of symptomatic gallbladder sludge. *J Clin Gastroenterol*. 2015;49(7):594–8. DOI: 10.1097/MCG.0000000000000202
17. *Sirtl S., Bretthauer K., Ahmad M., Hohmann E., Schmidt V.F., Allawadhi P., et al.* Severity of gallstone-, sludge-, or microlithiasis-induced pancreatitis — all of the same? *Pancreas*. 2024;53(8):e633–40. DOI: 10.1097/MPA.0000000000002349
18. *Aronen A., Guilabert L., Hadi A., Kiudelis V., Panaitescu A., Wlodarczyk B., et al.* Idiopathic acute pancreatitis (IAP) — a review of the literature and algorithm proposed for the diagnostic work-up of IAP. *Transl Gastroenterol Hepatol.* 2024;9:71. DOI: 10.21037/tgh-23-125
19. *Räty S., Pulkkinen J., Nordback I., Sand J., Victorzon M., Grönroos J., et al.* Can laparoscopic cholecystectomy prevent recurrent idiopathic acute pancreatitis?: A prospective randomized multicenter trial. *Ann Surg*. 2015;262(5):736–41. DOI: 10.1097/SLA.0000000000001469
20. *Stevens C.L., Abbas S.M., Watters D.A.* How does cholecystectomy influence recurrence of idiopathic acute pancreatitis? *J Gastrointest Surg*. 2016;20(12):1997–2001. DOI: 10.1007/s11605-016-3269-x
21. *Umans D.S., Hallensleben N.D., Verdonk R.C., Bouwense S.A.W., Fockens P., van Santvoort H.C., et al.* Recurrence of idiopathic acute pancreatitis after cholecystectomy: Systematic review and meta-analysis. *Br J Surg*. 2020;107(3):191–9. DOI: 10.1002/bjs.11429
22. *Chebli J.M., Duarte Gaburri P., Meirelles de Souza A.F., de Castro Ferreira L.E., Andrade Chebli L., Ferrari A.P. Jr., et al.* "Idiopathic" acute pancreatitis due to sphincterotomy in high-risk patients. *Am J Gastroenterol.* 2000;95(10):3008–9. DOI: 10.1111/j.1572-0241.2000.03232.x
23. *Testoni P.A., Caporuscio S., Bagnolo F., Lella F.* Idiopathic recurrent pancreatitis: Long-term results after ERCP, endoscopic sphincterotomy, or ursodeoxycholic acid treatment. *Am J Gastroenterol.* 2000;95(7):1702–7. DOI: 10.1111/j.1572-0241.2000.02292.x
24. *Lee Y.S., Kang B.K., Hwang I.K., Kim J., Hwang J.H.* Long-term outcomes of symptomatic gallbladder sludge. *J Clin Gastroenterol*. 2015;49(7):594–8. DOI: 10.1097/MCG.0000000000000202
25. *Ko C.W., Sekijima J.H., Lee S.P.* Biliary sludge. *Ann Intern Med*. 1999;130(4 Pt 1):301–11. DOI: 10.7326/0003-4819-130-4-199902160-00016
26. *Anderloni A., Galeazzi M., Ballarè M., Pagliarulo M., Orsello M., Del Piano M., et al.* Early endoscopic ultrasonography in acute biliary pancreatitis: A prospective pilot study. *World J Gastroenterol*. 2015;21(36):10427–34. DOI: 10.3748/wjg.v21.i36.10427
27. *Liu C.L., Fan S.T., Lo C.M., Tso W.K., Wong Y., Poon R.T., et al.* Comparison of early endoscopic ultrasonography and endoscopic retrograde cholangiopancreatography in the management of acute biliary pancreatitis: A prospective randomized study *Clin Gastroenterol Hepatol.* 2005;3(12):1238–44. DOI: 10.1016/s1542-3565(05)00619-1
28. *ASGE Standards of Practice Committee; Maple J.T., Ben-Menachem T., Anderson M.A., Appalaneni V., Banerjee S., Cash B.D., et al.* The role of endoscopy in the evaluation of suspected choledocholithiasis. *Gastrointest Endosc.* 2010;71(1):1–9. DOI: 10.1016/j.gie.2009.09.041
29. *Lee S.P., Maher K., Nicholls J.F.* Origin and fate of biliary sludge. *Gastroenterology.* 1988;94(1):170–6. DOI: 10.1016/0016-5085(88)90626-9
30. *Wang H.H., Portincasa P., Liu M., Tso P., Wang D.Q.* Similarities and differences between biliary sludge and microlithiasis: Their clinical and pathophysiological significances. *Liver Res.* 2018;2(4):186–99. DOI: 10.1016/j.livres.2018.10.001
31. *Fujita N., Yasuda I., Endo I., Isayama H., Iwashita T., Ueki T., et al.* Evidence-based clinical practice guidelines for cholelithiasis 2021. *J Gastroenterol.* 2023;58(9):801–33. DOI: 10.1007/s00535-023-02014-6.
32. *Wang D.Q., Carey M.C.* Complete mapping of crystallization pathways during cholesterol precipitation from model bile: Influence of physical-chemical variables of pathophysiologic relevance and identification of a stable liquid crystalline state in cold, dilute and hydrophilic bile salt-containing systems. *J Lipid Res.* 1996;37(3):606–30.
33. *Guarino M.P., Cong P., Cicala M., Alloni R., Carotti S., Behar J.* Ursodeoxycholic acid improves muscle contractility and inflammation in symptomatic gallbladders with cholesterol gallstones. *Gut.* 2007;56(6):815–20. DOI: 10.1136/gut.2006.109934
34. *Решетняк В.И., Маев И.В.* Механизм повреждения мелких холангиоцитов при первичном билиарном холангите. *Эффективная фармакотерапия.* 2024;20(2):72–84. [*Reshetnyak V.I., Maev I.V.* Mechanism of damage to small cholangiocytes in primary biliary cholangitis. *Effective Pharmacotherapy.* 2024;20(2):72–84. (In Russ.)]. DOI: 10.33978/2307-3586-2024-20-2-72-84
35. *Хлынов И.Б., Акименко Р.И., Гурикова И.А., Лосева М.Э., Марченко О.Г.* Билиарный сладж: опыт терапии в реальной клинической практике. *Лечащий врач.* 2019;4:80–3. [*Khlynov I.B., Akimenko R.I., Gurikova I.A., Loseva M.E., Marchenko O.G.* Biliary sludge: Experience of therapy in real clinical practice. *Lechaschi Vrach*. 2019;4:80–3. (In Russ.)].
36. *Кучерявый Ю.А., Черемушкин С.В.* Оценка терапевтической эффективности референтного препарата урсодезоксихолевой кислоты и его аналогов в растворении билиарного сладжа. *Consilium Medicum.* 2022;24(12):860–4. [*Kucheryavy Yu.A., Cheremushkin S.V.* Evaluation of the therapeutic efficacy of the reference drug ursodeoxycholic acid and its analogs in dissolving biliary sludge. *Consilium Medicum*. 2022;24(12):860–4. (In Russ.)].
37. *Райхельсон К.Л., Кондрашина Э.А., Пазенко Е.В.* Влияние урсодезоксихолевой кислоты на симптомы и качество жизни пациентов с билиарным сладжем (исследование АУРА). *РМЖ*. 2024;6:26–30. [*Reichelson K.L., Kondrashina E.A., Pazenko E.V.* Ursodeoxycholic acid effect on the symptoms and life quality of patients with biliary sludge (AURA study). *RMJ*. 2024;6:26–30. (In Russ.)].
38. *May G.R., Sutherlandt L.R., Shaffer E.A.* Efficacy of bile acid therapy for gallstone dissolution: A meta-analysis of randomized trials. *Aliment Pharmacol*

Ther. 1993;7(2):139–48. DOI: 10.1111/j.1365-2036.1993.tb00082.x
39. *Hempfling W., Dilger K., Beuers U.* Systematic review: Ursodeoxycholic acid — adverse effects and drug interactions. *Aliment Pharmacol Ther.* 2003;18(10):963–72. DOI: 10.1046/j.1365-2036.2003.01792.x
40. *Sharma A., Shanti H., Nageswaran H., Best L.M.J., Patel A.G.* Role of ursodeoxycholic acid in the prevention of gallstones formation in bariatric patients — a systematic review and meta-analysis of randomised trials. *Obes Surg.* 2023;33(12):4115–24. DOI: 10.1007/s11695-023-06893-9

Information about the authors

Sayar R. Abdulkhakov — Cand. Sci. (Med.), Docent, Head of the Department of Fundamental Basics of Clinical and Internal Medicine, Institute of Fundamental Medicine and Biology, Kazan (Volga Region) Federal University; Associate Professor of the Department of Outpatient Therapy and General Medical Practice; Kazan State Medical University.
Contact information: SRAbdulhakov@kpfu.ru;
420008, Kazan, Kremlevskaya str., 18.
ORCID: https://orcid.org/0000-0001-9542-3580

Dmitry S. Bordin — Dr. Sci. (Med.), Head of the Department of Pathology of the Pancreas, Bile Tract and Upper Digestive Tract, Loginov Moscow Clinical Scientific Center; Professor of the Department of Propaedeutics of Internal Diseases and Gastroenterology of the Faculty of Medicine of the Semashko Scientific and Educational Institute of Clinical Medicine, Russian University of Medicine; Professor of the Department of General Medical Practice and Family Medicine, Tver State Medical University.
Contact information: dbordin@mail.ru;
111123, Moscow, Entuziastov Highway, 86.
ORCID: https://orcid.org/0000-0003-2815-3992

Oleg S. Vasnev — Dr. Sci. (Med.), Head of the Department of High-Tech Surgery and Surgical Endoscopy, Loginov Moscow Clinical Scientific Center.
Contact information: o.vasnev@mknc.ru;
111123, Moscow, Entuziastov Highway, 86.
ORCID: https://orcid.org/0000-0001-9116-9693

Natalia N. Vetsheva — Dr. Sci. (Med.), Professor of the Department of Ultrasound Diagnostics, Russian Medical Academy of Continuous Professional Education.
Contact information: n.vetsheva@mail.ru;
125993, Moscow, Barrikadnaya str., 2/1, build. 1.
ORCID: https://orcid.org/0000-0002-9017-9432

Oksana Yu. Zolnikova — Dr. Sci. (Med.), Professor of the Department of Propaedeutics of Internal Diseases, Gastroenterology, Hepatology of the N.V. Sklifosovsky Institute of Clinical Medicine, I.M. Sechenov First Moscow State Medical University (Sechenov University).
Contact information: zolnikova_o_yu@staff.sechenov.ru;
119435, Moscow, Pogodinskaya str., 1, build. 1.
ORCID: https://orcid.org/0000-0002-6701-789X

Сведения об авторах

Абдулхаков Сайяр Рустамович — кандидат медицинских наук, доцент, заведующий кафедрой фундаментальных основ клинической медицины внутренних болезней Института фундаментальной медицины и биологии, ФГАОУ ВО «Казанский (Приволжский) федеральный университет»; доцент кафедры поликлинической терапии и общей врачебной практики, ФГБОУ ВО «Казанский государственный медицинский университет» Министерства здравоохранения Российской Федерации.
Контактная информация: SRAbdulhakov@kpfu.ru;
420008, г. Казань, ул. Кремлевская, 18.
ORCID: https://orcid.org/0000-0001-9542-3580

Бордин Дмитрий Станиславович — доктор медицинских наук, заведующий отделом патологии поджелудочной железы, желчных путей и верхних отделов пищеварительного тракта, ГБУЗ «Московский клинический научно-практический центр им. А.С. Логинова» Департамента здравоохранения города Москвы; профессор кафедры пропедевтики внутренних болезней и гастроэнтерологии лечебного факультета Научно-образовательного института клинической медицины им. Н.А. Семашко, ФГБОУ ВО «Российский университет медицины» Министерства здравоохранения Российской Федерации; профессор кафедры общей врачебной практики и семейной медицины, ФГБОУ ВО «Тверской государственный медицинский университет» Министерства здравоохранения Российской Федерации
Контактная информация: dbordin@mail.ru;
111123, г. Москва, ш. Энтузиастов, 86.
ORCID: https://orcid.org/0000-0003-2815-3992

Васнев Олег Сергеевич — доктор медицинских наук, заведующий отделением высокотехнологичной хирургии и хирургической эндоскопии, ГБУЗ «Московский клинический научно-практический центр им. А.С. Логинова» Департамента здравоохранения города Москвы.
Контактная информация: o.vasnev@mknc.ru;
111123, г. Москва, ш. Энтузиастов, 86.
ORCID: https://orcid.org/0000-0001-9116-9693

Ветшева Наталья Николаевна — доктор медицинских наук, профессор кафедры ультразвуковой диагностики, ФГБОУ ДПО «Российская медицинская академия непрерывного профессионального образования» Министерства здравоохранения Российской Федерации.
Контактная информация: n.vetsheva@mail.ru;
125993, г. Москва, ул. Баррикадная, 2/1, стр. 1.
ORCID: https://orcid.org/0000-0002-9017-9432

Зольникова Оксана Юрьевна — доктор медицинских наук, профессор кафедры пропедевтики внутренних болезней, гастроэнтерологии, гепатологии Института клинической медицины им. Н.В. Склифосовского, ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет).
Контактная информация: zolnikova_o_yu@staff.sechenov.ru;
119435, г. Москва, ул. Погодинская, 1, стр. 1.
ORCID: https://orcid.org/0000-0002-6701-789X

Yury A. Kucheryavyy — Cand. Sci. (Med.), Docent, Scientific Director of the Gastroenterology Department, Ilyinskaya Hospital.
Contact information: proped@mail.ru;
143421, Moscow region, Krasnogorsk urban district, Glukhovo village, Rublevskoye Predmestye str., 2, build. 2.
ORCID: https://orcid.org/0000-0001-7760-2091

Sabir N. Mekhtiev — Dr. Sci. (Med.), Professor of the Department of Internal Diseases, Academician I.P. Pavlov First Saint Petersburg State Medical University; Chief Physician, Gastroenterology Centre "Expert".
Contact information: sabirm@mail.ru;
197022, Saint Petersburg, L'va Tolstogo str., 6–8.
ORCID: https://orcid.org/0000-0001-7367-9219

Alexey V. Okhlobystin — Cand. Sci. (Med.), Deputy Chief Physician for Science and Innovation in University Clinical Hospital No. 2, Associate Professor of the Department of Propaedeutics of Internal Diseases, Gastroenterology and Hepatology of the N.V. Sklifosovsky Institute of Clinical Medicine, I.M. Sechenov First Moscow State Medical University (Sechenov University).
Contact information: okhlobystin_a_v@staff.sechenov.ru;
119435, Moscow, Pogodinskaya str., 1, build. 1.
ORCID: https://orcid.org/0000-0002-4617-2292

Elena V. Parfenchikova — Dr. Sci. (Med.), Head of the Department of Endoscopy, Loginov Moscow Clinical Scientific Center.
Contact information: e.bystrovskaya@mknc.ru;
111123, Moscow, Entuziastov Highway, 86.
ORCID: https://orcid.org/0000-0002-6972-8644

Karina L. Raikhelson — Dr. Sci. (Med.), Professor of the Department of General Medical Practice (Family Medicine), Academician I.P. Pavlov First Saint Petersburg State Medical University; Professor of the Scientific, Clinical and Educational Centre of Gastroenterology and Dietetics, Saint Petersburg State University.
Contact information: kraikhelson@mail.ru;
197022, Saint Petersburg, L'va Tolstogo str., 6–8.
ORCID: https://orcid.org/0000-0002-8821-6142

Diana E. Rumyantseva — Cand. Sci. (Med.), Teaching Assistant of the Department of Propaedeutics of Internal Diseases, Gastroenterology, Hepatology of the N.V. Sklifosovsky Institute of Clinical Medicine, Physician at the De-partment of Gastroenterology of V.Kh. Vasilenko Clinic of Pro-paedeutics of Internal Diseases, Gastroenterology and Hepatology, I.M. Sechenov First Moscow State Medical University (Sechenov University).
Contact information: rumyantseva_d_e@staff.sechenov.ru;
119435, Moscow, Pogodinskaya str., 1, build. 1.
ORCID: https://orcid.org/0000-0001-7048-0538

Vladimir I. Simanenkov — Dr. Sci. (Med.), Professor of the Department of Internal Medicine, Nephrology and Clinical Pharmacology with the Course of Pharmaceutics, North-Western State Medical University named after I.I. Mechnikov.

Кучерявый Юрий Александрович — кандидат медицинских наук, доцент, научный руководитель отделения гастроэнтерологии, АО «Ильинская больница».
Контактная информация: proped@mail.ru;
143421, Московская обл., городской округ Красногорск, д. Глухово, ул. Рублевское предместье, 2, корп. 2.
ORCID: https://orcid.org/0000-0001-7760-2091

Мехтиев Сабир Насрединович — доктор медицинских наук, профессор кафедры внутренних болезней, ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. академика И.П. Павлова» Министерства здравоохранения Российской Федерации; главный врач, ООО «Гастроэнтерологический центр Эксперт».
Контактная информация: sabirm@mail.ru;
197022, г. Санкт-Петербург, ул. Льва Толстого, 6–8.
ORCID: https://orcid.org/0000-0001-7367-9219

Охлобыстин Алексей Викторович — кандидат медицинских наук, заместитель главного врача Университетской клинической больницы № 2 по науке и инновационной деятельности, доцент кафедры пропедевтики внутренних болезней, гастроэнтерологии и гепатологии Института клинической медицины им. Н.В. Склифосовского, ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет).
Контактная информация: okhlobystin_a_v@staff.sechenov.ru;
119435, г. Москва, ул. Погодинская, 1, стр. 1.
ORCID: https://orcid.org/0000-0002-4617-2292

Парфенчикова Елена Владимировна — доктор медицинских наук, заведующая отделением эндоскопии, ГБУЗ «Московский клинический научно-практический центр им. А.С. Логинова» Департамента здравоохранения города Москвы.
Контактная информация: e.bystrovskaya@mknc.ru;
111123, г. Москва, ш. Энтузиастов, 86.
ORCID: https://orcid.org/0000-0002-6972-8644

Райхельсон Карина Леонидовна — доктор медицинских наук, профессор кафедры общей врачебной практики (семейной медицины), ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. академика И.П. Павлова» Министерства здравоохранения Российской Федерации; профессор Научно-клинического и образовательного центра гастроэнтерологии и диетологии, ФГБОУ ВО «Санкт-Петербургский государственный университет».
Контактная информация: kraikhelson@mail.ru;
197022, г. Санкт-Петербург, ул. Льва Толстого, 6–8.
ORCID: https://orcid.org/0000-0002-8821-6142

Румянцева Диана Евгеньевна — кандидат медицинских наук, ассистент кафедры пропедевтики внутренних болезней, гастроэнтерологии, гепатологии Института клинической медицины им. Н.В. Склифосовского, врач отделения гастроэнтерологии Клиники пропедевтики внутренних болезней, гастроэнтерологии, гепатологии им. В.Х. Василенко, ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет).
Контактная информация: rumyantseva_d_e@staff.sechenov.ru;
119435, г. Москва, ул. Погодинская, 1, стр. 1.
ORCID: https://orcid.org/0000-0001-7048-0538

Симаненков Владимир Ильич — доктор медицинских наук, профессор кафедры внутренних болезней, нефрологии, общей и клинической фармакологии с курсом фармации, ФГБОУ ВО «Северо-Западный государственный медицинский университет им. И.И. Мечникова» Министерства здравоохранения Российской Федерации.

Contact information: visimanenkov@mail.ru;
191015, Saint Petersburg, Kirochnaya str., 41.
ORCID: https://orcid.org/0000-0002-1956-0070

Evgeny G. Solonitsyn — Cand. Sci. (Med.), Associate Professor of the Department of Faculty Surgery, Saint Petersburg State University; Endoscopist, V.A. Almazov National Medical Research Center.
Contact information: sevgen@mail.ru;
199106, St. Petersburg, 21st line of Vasilievsky Island, 8a.
ORCID: https://orcid.org/0000-0002-0794-232X

Elena N. Shirokova — Dr. Sci. (Med.), Professor of the Department of Propaedeutics of Internal Diseases, Gastroenterology, Hepatology of the N.V. Sklifosovsky Institute of Clinical Medicine, I.M. Sechenov First Moscow State Medical University (Sechenov University).
Contact information: shirokova_e_n@staff.sechenov.ru;
119435, Moscow, Pogodinskaya str., 1, build. 1.
ORCID: https://orcid.org/0000-0002-6819-0889

Yulia O. Shulpekova* — Cand. Sci. (Med.), Associate Professor of the Department of Propaedeutics of Internal Diseases, Gastroenterology, Hepatology of the N.V. Sklifosovsky Institute of Clinical Medicine, I.M. Sechenov First Moscow State Medical University (Sechenov University).
Contact information: shulpekova_yu_o@staff.sechenov.ru;
119435, Moscow, Pogodinskaya str., 1, build. 1.
ORCID: https://orcid.org/0000-0002-5563-6634

Контактная информация: visimanenkov@mail.ru;
191015, г. Санкт-Петербург, ул. Кирочная, 41.
ORCID: https://orcid.org/0000-0002-1956-0070

Солоницын Евгений Геннадьевич — кандидат медицинских наук, доцент кафедры факультетской хирургии, ФГБОУ ВО «Санкт-Петербургский государственный университет»; врач-эндоскопист, ФГБУ «Национальный медицинский исследовательский центр им. В.А. Алмазова» Министерства здравоохранения Российской Федерации.
Контактная информация: sevgen@mail.ru;
199106, г. Санкт-Петербург, 21-я линия Васильевского острова, 8а.
ORCID: https://orcid.org/0000-0002-0794-232X

Широкова Елена Николаевна — доктор медицинских наук, профессор кафедры пропедевтики внутренних болезней, гастроэнтерологии, гепатологии Института клинической медицины им. Н.В. Склифосовского; ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет).
Контактная информация: shirokova_e_n@staff.sechenov.ru;
119435, г. Москва, ул. Погодинская, 1, стр. 1.
ORCID: https://orcid.org/0000-0002-6819-0889

Шульпекова Юлия Олеговна* — кандидат медицинских наук, доцент кафедры пропедевтики внутренних болезней, гастроэнтерологии, гепатологии, Института клинической медицины им. Н.В. Склифосовского; ФГАОУ ВО «Первый Московский государственный медицинский университет им. И.М. Сеченова» Министерства здравоохранения Российской Федерации (Сеченовский Университет).
Контактная информация: shulpekova_yu_o@staff.sechenov.ru;
119435, г. Москва, ул. Погодинская, 1, стр. 1.
ORCID: https://orcid.org/0000-0002-5563-6634

Authors' contributions

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Вклад авторов

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* Corresponding author / Автор, ответственный за переписку