

**EPIDEMIOLOGICAL CHARACTERISTICS AND HEPATITIS C MICRO-
ELIMINATION IN CHILDREN: EXPERIENCE OF TOMSK REGION**

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**МИКРОЭЛИМИНАЦИЯ ГЕПАТИТА С У ДЕТЕЙ: ОПЫТ ТОМСКОЙ
ОБЛАСТИ**

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Abstract

Abstract. Viral hepatitis holds a leading place among infectious diseases. The morbidity rate of chronic hepatitis C (HCV) among children in the Russian Federation is 1.29 per 100,000 population [10]. Increasing access to antiviral therapy in childhood contributes to achieving the global health goal on HCV elimination.

Objective. To summarize the epidemiological characteristics, clinical features of chronic hepatitis C in children, and to evaluate the effectiveness of direct-acting antiviral (DAA) treatment in the pediatric cohort of the Tomsk region.

Materials and methods. The study included all children under 18 years of age diagnosed with chronic HCV and recorded in medical organizations of the Tomsk region. All children underwent standardized screening and were treated with DAAs according to the «Clinical guidelines for chronic viral hepatitis C in children (ID: 824)» [6].

Results. HCV was first diagnosed in children aged 0 to 3 years in 94.4% of cases (n=34). The median disease duration was 5 [3;8] years; 4 children were diagnosed within one year. Alanine aminotransferase activity levels did not exceed age-specific reference values; in 4 patients, mild cytolytic activity within five age-specific reference values was observed. Minimal viral load was found in 55.6% of patients, while 25% subjects exhibited high viraemia. Correlation analysis revealed a positive relationship between viremia level and disease duration ($r=0.46$, $p<0.05$). HCV genotypes 1 and 3 were found at similar frequencies (48% and 44%, respectively). All patients treated with DAAs achieved undetectable HCV RNA levels and showed normalized ALT levels post-therapy, demonstrating sustained virological response.

Conclusion. Expanding access to treatment and use of DAAs in children enabled HCV micro-elimination in the pediatric population within two years.

Keywords: children, chronic hepatitis C, epidemiology, genotype, fibrosis, direct-acting antiviral treatment, Tomsk region.

Резюме

Вирусные гепатиты занимают ведущее место в структуре инфекционных заболеваний. Показатель заболеваемости хроническим гепатитом С среди детей в РФ составляет 1,29 на 100 тыс. населения. Расширение доступа к противовирусной терапии в детском возрасте позволяет достигнуть мировой цели здравоохранения по элиминации хронического вирусного гепатита С. Цель исследования — обобщение эпидемиологических характеристик, особенностей естественного течения, исходов хронического вирусного гепатита С, оценка эффективности терапии препаратами прямого противовирусного действия у детей и подростков с хроническим вирусным гепатитом С на территории Томской области. Материалы и методы. В исследование включены все дети в возрасте до 18 лет с хроническим гепатитом С, состоявшие на диспансерном учете в медицинских организациях Томской области. Всем детям проведено стандартизованное обследование и лечение препаратами прямого противовирусного действия в соответствии с клиническими рекомендациями «Хронический вирусный гепатит С у детей. ID: 824». Результаты. Впервые диагноз «Хронический вирусный гепатит С» установлен у детей в возрасте от 0 до 3 лет – 94,4% детей (n=34). Средняя длительность заболевания составила 5 [3;8] лет, у 4 детей диагноз установлен в течение года. Уровень активности аланинаминотрансферазы не превышал пограничные значения возрастной нормы, у 4х пациентов отмечена низкая цитолитическая активность в пределах 5 возрастных норм. У 55,6% вирусная нагрузка была минимальная, у четверти пациентов диагностирован высокий уровень виремии. Корреляционный анализ выявил положительную зависимость между уровнем виремии и длительностью заболевания ($r=0.46$, $p<0,05$). Генотип 1 и генотип 3 встречались практически с одинаковой частотой (48% и 44% соответственно). Все пациенты, получившие препараты прямого противовирусного действия показали не обнаруживаемый уровень РНК гепатита С и отсутствие лабораторного синдрома цитолиза после

окончания терапии, достигнув устойчивого вирусологического ответа. Заключение. Расширение доступа к лечению и применению препаратов прямого противовирусного действия у детей позволило провести микроэлиминацию хронического гепатита С в детской популяции за 2 года.

Ключевые слова: дети, хронический гепатит С, эпидемиология, генотип, фиброз, терапия препаратами прямого противовирусного действия, Томская область.

1 Introduction

2 For many years, parenteral hepatitis in children has been a global health
3 problem and occupies a leading position among infectious diseases. The economic
4 burden associated with the diagnosis and treatment of viral hepatitis C (HCV) in
5 2024 in the Russian Federation (RF) amounted to nearly 80 billion rubles [16].
6 Approximately 58 million people worldwide are infected with hepatitis C virus,
7 including 11 million children aged 1 to 15 years, among whom viral replication is
8 detected in 6 million [10,16]. However, these statistics are continuously changing
9 due to the lack of reliable data on the number of infected children in several countries
10 [3,5,18-6]. According to data from the Centers for Disease Control and Prevention
11 (CDC), Russia ranks 5th in the prevalence of parenteral hepatitis among children
12 [17]. The low effectiveness of preventive measures against HCV infection, due to
13 the absence of a vaccine and the often-asymptomatic course of infection, impedes
14 timely and comprehensive control of the epidemic. Only 10% of infected individuals
15 are aware of their disease, while the others pose a serious threat as sources of
16 infection [3,18]. In 2022, the incidence of HCV among children in the Russian
17 Federation was 1.29 per 100,000 population.

18 In most developed countries, the primary route of infection in children is
19 perinatal transmission [10]. According to global epidemiological surveillance, the
20 average rate of vertical transmission of HCV in mono-infected pregnant women is
21 approximately 5.8% [10]. About 33% of children acquire the infection during
22 intrauterine development, while up to 50% of transmissions occur during the
23 intranatal period. Several factors significantly influence the likelihood of vertical
24 transmission of HCV [14].

25 One of the most significant factors is a high maternal viral load at delivery.
26 The risk of transmission is directly proportional to the level of viral ribonucleic acid
27 (RNA) in serum: at values above 10^5 IU/mL, the probability of transmission
28 increases, reaching its maximum at values above 10^7 IU/mL. Elevated alanine
29 aminotransferase (ALT) levels in the mother within 12 months before pregnancy or

30 at delivery — reflecting active viral replication and greater liver damage — serve as
31 an additional risk marker [17]. Other factors associated with viral transmission
32 include obstetric history. Invasive procedures such as chorionic biopsy or fetal scalp
33 electrode monitoring and a prolonged membrane rupture to delivery interval
34 exceeding six hours have been reliably linked to a higher risk of neonatal infection.
35 Similarly, complicated or prolonged labor increases maternal-fetal blood contact,
36 facilitating vertical viral transmission [7]. Coinfection with human
37 immunodeficiency virus type 1 (HIV-1) nearly doubles the transmission risk to
38 10.8% [3,10,18]. Contrary to earlier assumptions, caesarean delivery has not been
39 proven to reduce the risk of vertical HCV transmission. Older children are most
40 commonly infected through medical or non-medical procedures involving skin or
41 mucosal injury, possible contamination, and blood transfusions, although such cases
42 are rare [6,10]. Intravenous drug use is another known risk factor.

43 The natural course of HCV in children differs markedly from that in adults,
44 characterized by a higher rate of spontaneous clearance of HCV infection and
45 usually slow progression. Observational studies report spontaneous elimination of
46 HCV in 25% to 45% of children with perinatal HCV infection within the first two
47 years of life without specific treatment. The likelihood of spontaneous clearance is
48 higher in children with elevated ALT levels, possibly indicating a more robust
49 immune response. The progression chronic hepatitis largely depends on the age at
50 infection, in infants infected before one year of age, chronicity rates reach 90%,
51 whereas at six years old, they range from 40% to 60% [5].

52 The aim of the study is to generalize epidemiological characteristics, features
53 of the natural course, HCV outcomes, and to evaluate the effectiveness of DAA
54 therapy in children with chronic viral hepatitis C in the Tomsk region.

55 **2 Materials and Methods**

56 A single-center, prospective observational study was conducted. An
57 uncontrolled study without a control group to discover the effectiveness of a new
58 treatment method for a certain sample of patients. For ethical reasons, the study does

59 not include a control group, since the approved method of treatment is unacceptable
60 for patients with hepatitis C. The study included all children under the age of 18
61 years with chronic HCV who were registered at medical institutions in Tomsk and
62 the Tomsk region. Sampling was not performed due to the use of a complete
63 enumeration method.

64 The study was conducted in accordance with Declaration of Helsinki and the
65 study protocol was approved by the Ethics Committee of Siberian State Medical
66 University (Protocol no.9476/1 dated 29/05/2023). Informed voluntary consent to
67 participate in the study was obtained from the legal representatives and, where
68 applicable, from the patients themselves. Personal data of patients were anonymized.
69 All legal representatives and patients signed a voluntary informed consent to
70 participate in the study.

71 The study included all children and adolescents with chronic HCV infection
72 of both sexes, 3-18 years old or weighing > 12 kg (even if younger than 3 years)
73 during the time period from May 2023 to 2025. Thirty-five children were monitored.
74 The majority of the observed group were children aged 7–17 years, accounting for
75 58.3% (n = 21); patients under 1 year old constituted 2.7% (n = 1); those aged 1 to
76 3 years made up 14% (n = 5), and those aged 3 to 6 years were 25% (n = 9).

77 All children underwent a standardized examination in accordance with
78 “Clinical guidelines for chronic viral hepatitis C in children (ID: 824). Diagnosis
79 was confirmed by screening for HCV using enzyme immunoassay (EIA) and
80 detection of HCV RNA by polymerase chain reaction (PCR). During follow-up, all
81 patients underwent laboratory testing of indicators characterizing the main clinical-
82 pathogenic hepatitis syndromes (ALT/AST activity, bilirubin, albumin, total protein,
83 alkaline phosphatase), measurement of viral load, HCV genotype determination, and
84 screening for hepatitis B virus (HBsAg) and HIV infection. Molecular genetic
85 analysis by PCR was performed to determine HCV RNA (RealBest RNA HCV
86 1a/1b/2/3/4, Russia) levels and genotyping. HCV RNA levels below 50 IU/mL were
87 considered below the system’s sensitivity limit and interpreted as indeterminate.

88 Patients also underwent ultrasound examination (US) of the abdominal organs. The
89 degree of liver fibrosis was assessed using Fibroscan (FibroScan®Echosens, Paris,
90 France) as well as APRI and FIB-4 tests. Degree of liver fibrosis was categorized
91 into no fibrosis (F0), mild (F0-F1, F1), moderate (F1-2, F2) and marked (F3, F4).

92 The following data were collected from the patients' files: demographic data
93 (age and sex); risk factors of HCV acquisition (e.g. maternal HCV, intrafamilial
94 cases, blood product transfusion, hospitalization, operation, chemotherapy);
95 comorbidities; medication history (including previous HCV treatment and current
96 therapy for comorbidities); and general, systemic and abdominal examination.

97 For treatment, a drug of DAAs of glecaprevir/pibrentasvir in the form of
98 granules, covered, containing respectively 50 mg + 20 mg of drugs in 1 sachet. The
99 drug was prescribed children with a body weight of 12-20 kg, 3 sachets/day, 20-30
100 kg - 4 sachets/day, 30-45 kg - 5 sachets/day; in children weighing more than 45 kg,
101 the drug was prescribed single- multiples of 3 tablets/day containing, respectively,
102 100 mg + 40 mg drug substances each. Granules and patients took tablets with meals
103 for 8 non-del.

104 Standard statistical methods were used to analyze the data. The parameters
105 included in the analysis were age, sex, epidemiological and social history, clinical
106 history, and laboratory and instrumental indicators. Statistical processing was
107 performed using PSPP version 12.0 and Microsoft Excel for Windows 2011.
108 Qualitative variables are expressed in absolute numbers with an indication of
109 proportions (%) and calculation of the 95% confidence interval (CI) using the
110 Clopper-Pearson method. Differences between groups on qualitative variables were
111 assessed using Pearsons χ^2 (chi-square) test, with Yates' correction applied when
112 necessary. Quantitative variables are presented as median [Q1; Q3], where Me is the
113 median, and Q1 and Q3 are the first and third quartiles, respectively (for non-
114 parametric data). Correlation analysis was conducted using Spearman's rank
115 correlation coefficient. Differences were considered statistically significant at
116 $p < 0.05$.

117 **3 Results**

118 According to the federal statistical surveillance form No. 65, “Information on
119 Chronic Viral Hepatitis” of the Russian Federal State Statistics Service, also known
120 as Rosstat (Order of Rosstat No. 354 dated 25.07.2023), and data from the federal
121 register of viral hepatitis patients for 2023-2024, within the region and clinical
122 settings from 2023 to the present, 36 children were registered. The prevalence rate
123 of chronic hepatitis C was 16.6 per 100,000 children, or 0.017% of the infected
124 pediatric population. Among the observed group, 32 children were registered in the
125 clinic with chronic HCV at the end of 2023, and 4 children were newly diagnosed
126 in 2024. Analysis of gender distribution showed a predominance of male children
127 compared to females (95% CI: 46.5%–78.9%) (Table 1). The observed difference
128 from a 1:1 sex ratio was not statistically significant (exact binomial test, $p = 0.16$).

129 HIV/HCV co-infection infection was detected in three children, all of whom
130 acquired the infection vertically from their mothers (8.3%, 95% CI: 1.8%–22.5%);
131 no other parenteral hepatitis cases were identified. Comorbid conditions were
132 diagnosed in 4 out of 36 children (11.1%, 95% CI: 3.1%–26.1%), including single
133 cases of diabetes mellitus, nephrotic syndrome with minor glomerular changes,
134 bronchial asthma, and cerebral palsy (each 2.8%, 95% CI: 0.07%–14.5%). Although
135 each condition alone did not reach statistical significance ($p = 0.08$, indicating a
136 trend), the presence of any comorbid condition as a composite measure was
137 significant ($p = 0.02$).

138 Epidemiological history revealed a vertical route of HCV transmission in
139 94.4% of children ((94.4%, 95% CI: 81.3%–99.3%) born to HCV-infected mothers.
140 Two patients reported medical procedures involving skin or mucous membrane
141 injury as possible modes of infection; however, the validity of these reports could
142 not be confirmed (5.6%, 95% CI: 0.7%–18.7%). The predominance of the vertical
143 route was highly statistically significant (exact binomial test, $p < 0.0001$).

144 At the time of observation, HCV infection was asymptomatic in all patients;
145 cholestasis syndrome, hepatic signs, and hemorrhagic syndrome manifestations
146 were absent. At diagnosis, one child presented with a manifest form of HCV
147 accompanied by jaundice, while the other patients had no specific complaints.

148 HCV RNA load data were available for 29 out of 36 children (80.6%). Among
149 these, 20 patients (69.0%, 95% CI: 49.2%–84.7%) had a low viral load ($\leq 800,000$
150 IU/L), while 9 patients (31.0%, 95% CI: 15.3%–50.8%) had a high viral load
151 ($\geq 800,000$ IU/L). The predominance of low viral load did not reach statistical
152 significance when compared to an expected equal distribution (exact binomial test,
153 $p = 0.06$). The association between HCV genotype and viral load among the 25
154 children with known genotypes was found no significant ($p = 1.00$). Correlation
155 analysis revealed a positive association between viremia level and disease duration
156 ($r = 0.46$, $p < 0.05$). Genotype distribution was determined in 25 out of 36 children
157 (69.4%). The most prevalent genotypes were genotype 1 ($n=12$, 48%) and genotype
158 3 ($n=11$, 44%), while genotype 2 was rare ($n=2$, 8%). The analysis by Fisher test
159 confirmed a statistically significant difference in genotype frequencies ($p = 0.02$),
160 indicating a true predominance of genotypes 1 and 3 in this pediatric cohort. No
161 cases of mixed genotype infection were identified. In 11 patients, genotyping was
162 not performed due to the use of pangenotypic antiviral drugs in therapy.

163 Liver stiffness measurement by Fibroscan was available for 15 out of 36
164 children (41.7%). Among these, the majority had no significant fibrosis: 8 children
165 (53.3%) were classified as F0 (METAVIR), and 4 (26.7%) as F1. Clinically
166 significant fibrosis (F2 or higher) was observed in 3 children (20.0%), including two
167 with F2 (13.3%) and one with F3 (6.7%). No children presented with cirrhosis (F4).
168 Due to the small sample size, exact 95% confidence intervals (CIs) were calculated
169 using the Clopper-Pearson method. The proportion of children with significant
170 fibrosis (F2-F3) was 20.0% (95% CI: 4.3%–48.1%). Analysis of the liver
171 elastography data revealed a significant positive correlation between the severity of

172 liver fibrosis and both disease duration ($r = 0.6$, $p < 0.05$) and patient age ($r = 0.58$,
173 $p < 0.05$).

174 HCV was first diagnosed in 94.4% of children ($n=34/36$, 95% CI: 81.3%–
175 98.9%) aged 0 to 3 years. The median duration of the disease was 5 [3; 8] years, and
176 four children were diagnosed within one year (Table 2).

177 In the study of biochemical indicators, it was found that in most cases (88.9%)
178 the activity level of alanine aminotransferase (ALT) did not exceed the upper limit
179 of the age-specific reference range: four patients demonstrated mildly increased
180 cytolytic activity within 5 times the age norm. Hypertransaminasemia was diagnosed
181 in one child co-infected with HIV and in another child with infantile cerebral
182 paralysis as a comorbid condition.

183 All patients underwent ultrasound examination of the abdominal organs.
184 Abdominal ultrasound was performed in all 36 children. Diffuse liver changes were
185 observed in 6 patients (16.6%, 95% CI: 6.4%–32.8%), hepatomegaly in 7 patients
186 (19.4%, 95% CI: 8.2%–36.0%), and splenomegaly in 1 patient (2.8%, 95% CI:
187 0.07%–14.5%). No fibrotic or cirrhotic changes were detected by ultrasound in any
188 patient (0%, 95% CI: 0.0%–9.7%).

189 Anamnesis revealed that all children had received antiviral therapy with
190 interferon alfa-2b administered rectally in courses of varying duration, without
191 achieving viral remission. One patient showed spontaneous viral elimination over a
192 2-year retrospective observation. None of the patients in the study group had
193 experience with pegylated interferon or ribavirin.

194 All children with HCV older than 3 years of age, regardless of genotype,
195 received an 8-week course of glecaprevir/pibrentasvir at appropriate age-based
196 dosages. The median age at therapy initiation was 8 [5; 12] years. No serious drug-
197 related adverse effects requiring therapy discontinuation were observed during
198 treatment. Virological response was monitored in all children at 12 weeks after

219 treatment completion according to regulations. All patients who received
220 glecaprevir/pibrentasvir therapy achieved undetectable HCV RNA levels and
221 showed no laboratory evidence of cytolysis syndrome post-therapy, indicating a
222 sustained virological response.

223 **4 Discussion**

224 Study Limitations

225 When interpreting the results obtained, several methodological limitations
226 that may affect the degree of reliability and the generalizability of the conclusions
227 must be considered.

228 The studied patient cohort is characterized by a limited sample size (n=...),
229 which precludes stratification of patients by key variables (age, sex, comorbid
230 conditions) for multivariate analysis and increases the risk of statistical errors.

231 The absence of a control group limits the ability to assess the specificity of the
232 identified elastographic and serum markers and to determine the extent to which
233 changes in liver stiffness are attributable to the course of chronic hepatitis C (CHC)
234 rather than to other underlying conditions. The inclusion of a healthy control group
235 or a comparison group (e.g., patients with non-alcoholic fatty liver disease without
236 diabetes mellitus) in the study design at this stage was deemed ethically and
237 organizationally challenging, as it would not align with the principles of bioethics.

238 Patient enrollment was conducted exclusively at medical institutions in the
239 Tomsk region. The obtained results reflect the situation in a specific region and limit
240 the possibility of extrapolating the findings to other populations.

241 The cross-sectional study design allows only for the establishment of
242 associations between the studied factors and liver fibrosis at the time of inclusion,
243 but it does not allow for tracking the dynamics of the process. The absence of a
244 prospective follow-up phase precludes the assessment of fibrosis progression rates,
245 the frequency of regression during therapy, or the incidence of adverse outcomes
246 (cirrhosis, hepatocellular carcinoma) in the studied cohort.

227 The combination of the aforementioned factors (small sample size, incomplete
228 elastography data, and lack of a control group) determines the preliminary nature of
229 the conclusions. The absence of a control group and the limited geographic scope
230 prevent the identified prevalence and degree of fibrosis from being considered
231 definitive population parameters. In this regard, the presented results should be
232 viewed as a hypothesis requiring verification in prospective, controlled studies with
233 stricter inclusion criteria.

234 The results of the study are consistent with existing literature on the course of
235 HCV infection in children and adolescents [2,13,14]. The age distribution was
236 predominantly represented by school-age children. Among HCV patients, the
237 average duration of disease was 5 years. The presence of comorbid conditions in this
238 cohort suggests that children with chronic hepatitis C may be at an increased risk for
239 concomitant diseases, highlighting the need for comprehensive clinical evaluation.
240 The primary route of HCV transmission in children is vertical. The disease course is
241 typically latent, accompanied by minimal laboratory changes, yet characterized by
242 replacement of healthy liver tissue with connective tissue. Liver elastography
243 revealed varying degrees of fibrosis in the absence of clinical symptoms. However,
244 advanced liver disease was present in a subset of this pediatric cohort, despite the
245 overall mild profile. Notably, while no fibrosis was detected on ultrasound,
246 subsequent elastography revealed significant fibrosis (F2–F3) in three children (see
247 above), highlighting the limited sensitivity of conventional ultrasound for detecting
248 early-stage liver fibrosis. The development of liver fibrosis is associated with disease
249 duration and increases the risk of life-threatening complications. An inactive
250 inflammatory process in liver tissue corresponds with a low viral load. The genotype
251 distribution in children mirrors that observed in adults [2].

252 Until recently, a major obstacle to eliminating HCV in children was the
253 absence of antiviral drugs with proven clinical efficacy and pediatric approval.
254 However, the introduction of direct-acting antiviral (DAA) agents marked
255 significant progress in HCV therapy, fundamentally changing the management

256 approach. The incorporation of DAAs into clinical practice has opened new
257 opportunities for effective HCV elimination in children, demonstrating high rates of
258 sustained virological response (SVR) and improved safety profiles compared to
259 interferon-based regimens [18]. This breakthrough has increased access to therapy
260 and improved prognosis for pediatric patients with HCV.

261 The most significant modifications to the pediatric HCV treatment protocol
262 were proposed by the professional communities of ESPGHAN and WHO in 2018.
263 Their recommendations advocated discontinuation of interferon-based regimens due
264 to low efficacy and significant adverse effects, advising delayed treatment initiation
265 with DAAs until children reach 12 years of age. In 2019, the first DAA regimens
266 with high safety and efficacy were approved in the Russian Federation for treating
267 chronic HCV of all genotypes in patients aged 12 to 17 years, and in 2022, approval
268 was extended to children over 3 years old. A major breakthrough in HCV treatment
269 in the Russian Federation, enabling microelimination of HCV among the pediatric
270 population, was the decision by the expert council of the Foundation “Circle of
271 Kindness” dated 02.03.2023. According to Protocol No. 15, HCV was included in
272 the list of severe, life-threatening, and chronic diseases, including rare (orphan)
273 diseases. This document facilitated rapid access to DAAs for children suffering from
274 HCV. The results of the present study confirmed the high effectiveness of DAA use
275 in children aged 3 to 17 years. A strength of our study is the inclusion of children
276 with comorbid conditions such as viral coinfection (human immunodeficiency
277 virus). Over two years, the Foundation “Circle of Kindness” supported a
278 microelimination program for pediatric HCV in the Tomsk region. The conducted
279 antiviral therapy gives a stable virological response in 100% of cases and contributes
280 to the normalization of biochemical parameters, as well as the regression of fibrosis
281 in all children who received glecaprevir+pibrentasvir for 8 weeks [4,21]. Our study
282 demonstrated that the pangenotypic DAAs therapy achieved comparable rates to
283 those observed with earlier studies (100%) [1,9,12,20]. Short regimens, in our
284 opinion, contribute to increased adherence to treatment. Although our study did not

285 evaluate other regimens, future studies are needed to evaluate their efficacy in real
286 pediatric populations.

287 Our findings affirm the safety and efficacy of the pangenotypic DAAs in these
288 special pediatric subgroups. This supports the micro-elimination approach
289 advocated by the World Health Organization, targeting high-risk HCV populations
290 and those exposed via vertical transmission. Furthermore, our study highlights the
291 role played by the Russian government in subsidizing the prices of DAAs,
292 facilitating their widespread availability to both adult and pediatric populations. The
293 financial model adopted by Russian national HCV elimination program supports the
294 feasibility and sustainability in other countries. Since vaccination against HCV has
295 not yet been developed, the most effective method for the further spread of this
296 infection is the early detection and treatment of children and adolescents suffering
297 from CHC using direct antiviral agents. In the near future, children may become the
298 first category of patients in which the elimination of HCV infection in Russia has
299 been achieved.

300 **5 Conclusion**

301 The pediatric HCV cohort was characterized by predominantly school-age
302 children with vertically acquired infection (mean duration 5 years) and a high
303 prevalence of comorbid conditions. The disease followed a latent course with
304 minimal laboratory changes but notable fibrotic progression, underscoring the need
305 for comprehensive clinical evaluation beyond standard liver tests.

306 Conventional ultrasound demonstrated limited sensitivity for detecting early-
307 stage liver fibrosis, whereas elastography revealed significant fibrosis (F2–F3) even
308 in asymptomatic children. This confirms that elastography is essential for accurate
309 staging and should be routinely integrated into pediatric HCV assessment.

310 The inclusion of HCV in the "Circle of Kindness" Foundation's list of severe
311 diseases (2023) enabled rapid, state-subsidized access to direct-acting antivirals

312 (DAAs) for children. The Tomsk region experience exemplifies how federal policy
313 support can be effectively translated into regional microelimination programs.

314 Pangenotypic DAA therapy (glecaprevir/pibrentasvir) achieved 100%
315 sustained virological response, including in children with HIV coinfection,
316 confirming its safety and efficacy in vulnerable subgroups. Short 8-week regimens
317 further support treatment adherence.

318 Scaling the Tomsk model to other regions—through replication of the funding
319 mechanism and regional screening programs—could position the pediatric
320 population as the first in Russia to achieve HCV elimination.

ТАБЛИЦЫ

Table 1. Characteristics of the Study Sample

Characteristic	Absolute Number, n=35 (%)	95% CI (Clopper- Pearson)	P value
Gender			
male	22 (63.9)	46.2% – 79.2%	p = 0.16
female	13 (36.1)	20.8% – 53.8%	
Transmission			
vertical	34 (94.4)	81.3% – 99.3%	p < 0.0001
haemocontact	2 (5.6)	0.7% – 18.7%	
Biochemical parameters			
ALT elevated	4 (11.1)	3.1% – 26.1%	p = 0.10
Bilirubin elevated	0 (0)	0.0% – 9.7%	
Genotype			
1	12 (48)	27.8% – 68.7%	p = 0.02
2	2 (8)	1.0% – 26.0%	
3	11 (44)	24.4% – 65.1%	
Not defined	11 (33.3)	16.3% – 48.1%	
HCV RNA load			
≤ 800 000 IU/L	20 (55.6)	49.2% – 84.7%	p = 0.06
≥ 800 000 IU/L	9 (25)	15.3% – 50.8%	
No data	7 (19.4)	8.2% – 36.0%	
Fibroscan (METAVIR score)			
F0 (≤5,8 кПа)	8 (53.3)4 (26.7)	26.6% – 78.7%	0.02

F1 (от 5,9 до 7,2 кПа)	2 (13.3)	7.8% – 55.1%	
F2 (от 7,3 до 9,5 кПа)	1 (6.7)	1.7% – 40.5%	
F3(от 9,6 до 12,5 кПа)	0	0.2% – 31.9%	
F4 (>12,5 кПа)	21 (58.3)	0.0% – 21.8%	
No data		40.8% – 74.5%	
HIV/HCV co-infections	3 (8.3)	1.8% – 22.5%	p = 0.03
Treatment naive for DAAs	0		

Table 2. Initial Characteristics of Patients

Characteristic	Me [Q ₁ ; Q ₃]
Age at diagnosis, years	1 [0.4; 3]
Duration of disease, years	5 [3; 8]
Average age at initiation of antiviral therapy, years	8 [5; 12]
Biochemical parameters	
ALT, U/L	33 [19.66; 67]
AST, U/L	41 [25; 66]
Total bilirubin, mmol/L	7.62 [5.285; 11,7]
Albumin, g/L	46 [43.1; 48.2]
Coagulation system indicators	
Platelets, 10 ⁹ /L	289 [238; 316]
Fibrinogen, g/L	2.205 [1.9; 2,7]
Prothrombin index (PTI), %	96 [94; 100.6]
Activated partial thromboplastin time (aPTT), sec	33 [30; 36.8]
Prothrombin time, sec	16.25 [15; 17]
HCV RNA, copies/mL	308000 [90100; 1700000]
Calculated fibrosis indices	
APRI index	0.28 [0.22; 0.36]
FIB-4 index	0.19 [0.12; 0.24]

Note: ALT – Alanine aminotransferase, AST – Aspartate aminotransferase, PTI – prothrombin index, aPTT – Activated partial thromboplastin time, HCV – hepatitis C virus, RNA – Ribonucleic acid, Me – median, Q1 – first quartile, Q3 – third quartile.

ТИТУЛЬНЫЙ ЛИСТ_МЕТАДААННЫЕ

Блок 1. Информация об авторе ответственном за переписку

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Блок 2. Метаданные статьи

EPIDEMIOLOGICAL CHARACTERISTICS AND MICRO-ELIMINATION OF
HEPATITIS C IN CHILDREN: EXPERIENCE OF TOMSK REGION

МИКРОЭЛИМИНАЦИЯ ГЕПАТИТА С У ДЕТЕЙ: ОПЫТ ТОМСКОЙ
ОБЛАСТИ

Сокращенное название статьи для верхнего колонтитула:

HEPATITIS C MICRO-ELIMINATION
МИКРОЭЛИМИНАЦИЯ ГЕПАТИТА С

Keywords: children, chronic hepatitis C, epidemiology, genotype, fibrosis, direct-acting antiviral treatment, Tomsk region.

Ключевые слова: дети, хронический гепатит С, эпидемиология, генотип, фиброз, терапия препаратами прямого противовирусного действия, Томская область.

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