

Liver Cirrhosis in Forensic Autopsies in Moscow

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Abstract

Introduction: There has been an increase in the number of liver cirrhosis worldwide. Liver cirrhosis in forensic practice is common enough. Medical experts diagnose liver cirrhosis according to morphological data. At the same time this problem in medicolegal analytical reports and publications are still small. The purpose of our research consisted in characteristic of liver cirrhotics by forensic medical examinations for the 12-year period from 2007 to 2018 in the city of Moscow. **Materials and methods.** We studied 3.371 case of death from liver cirrhosis in proportion to the number of non-violent deaths. We analyzed the acts of forensic autopsies and histological studies performed at the Bureau of Forensic Medicine of the Department of Health of Moscow during 2007-2018. We calculated the frequency of occurrence, gender and age, annual changes and the overall trend of mortality from liver cirrhosis. we determined the liver cirrhosis form and liver failure stage. We determined the liver cirrhosis form and liver failure stage by the results of the section and histologic morphological signs. **Results.** We found that forensic examination of corpses diagnosed a significant number of liver cirrhosis. Their annual number averaged 1.15% of total non-violent deaths. During the studied period, the annual incidence of liver cirrhosis changed significantly: it increased in 2009, 2015, 2017, 2018 and decreased in 2013 and 2016. Change difference reached 20.5%. We determined that the highest number of liver cirrhosis were diagnosed between 2009 and 2012, the lowest in 2016. In the last 2 years, the number of liver cirrhosis cases tends to increase. Over a 12-year liver cirrhosis study period we were a steady trend in the decline established. We found that liver cirrhosis during forensic examination of corpses in Moscow were more likely in young and middle-aged men detected. The morphological structure was dominated by small and mixed morphological forms. We found that in histological forensic examination the terminal (48.9%) and decompensated (43.4%) stages of hepatic failure was most often diagnosed. **Conclusion:** According to traditional perceptions liver cirrhosis can rarely be the cause of sudden death and is therefore more likely to be the subject of an autopsy by anatomists rather than forensic experts. On the one hand we established that high (1/100) incidence of liver cirrhosis correlates with the prevalence of this disease among the population of the city of Moscow and on the other indicates a significant number of cases of non-violent death in the total volume of forensic autopsies. We have calculated that the number of annually diagnosed deaths from liver cirrhosis were proportional to the total number of non-violent deaths. During the period 2007-2018 a marked dynamics of decline in the frequency of forensic detection of liver cirrhosis, which is consistent with the general trend of reduction of cirrhosis incidence in Moscow. However, in the last 2 years there was some increase in the number of the liver cirrhosis. The young and middle-aged men in mixed and small-node morphological form at the terminal and decompensated stage of the disease were diagnosed.

Keywords: Liver Cirrhosis; Medicolegal Autopsies; Histologic Researches; Hepatic Acinus; Liver Failure.

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Introduction

Hidden diseases can cause sudden death. Nonviolent sudden death accounts for up to 60 percent of forensic autopsies and is the subject of scientific study of forensic practice. Liver cirrhosis (LC) represents one type of nonviolent death^[1]. In economically developed countries LC is among six main reasons for death at the age of 35–60 years meeting from 14 to 30 cases at 100.000 population. According to literature of five-year prescription the increasing indicators of incidence and mortality from LC are noted.^[2, 3] In Russia the incidence of LC is one of the first places. In 2010 it increased by 73.8%, and in St. Petersburg reached 124.4 cases on 100 thousand people that is 3 times higher, than figures for Russia on average. This problem is linked to the prevalence of drug addiction and chaotic sexual encounters.^[4]

Although LC is often found in forensic practice, analytical materials and scientific publications on this subject are nevertheless very limited.^[5] Since the annual reports of forensic institutions only take into account the types of deaths and the mortality from the LC is combined into a general group of diseases of the digestive system, it is therefore impossible to obtain data on the mortality from LC from these documents. Exhaustive data on the LC are available in primary acts of forensic section and histologic researches. Medicolegal diagnosis of the LC is based, mainly, on results of autopsies and histologic liver researches. Therefore, only forensic documents contain important and exclusive information about the frequency of sudden death from the LC. This information can be used in conjunction with clinical and instrumental laboratory data to substantiate liver failure.

Materials and methods

In this work we studied acts of the forensic autopsies and histologic researches performed at the Bureau of Forensic medical examination of the Department of Health of the Moscow. These documents containing data on death from the LC for the 12-year period of 2007-2018. We calculated the frequency of LC detection in relative sizes a percentage of total non-violent death autopsies for each calendar year. The LC frequency was calculated according to the formula: $R = n/N \times 100$ where R - Index of frequency LC detection (in %); N-total number of forensic researches of corpses at nonviolent death in a year; n - the number of autopsies with the established medico-

legal diagnosis of the LC. The direction (trend) of changes (growth or decline) was determined by the values of R-index of the frequency of LC detection.

Also the age and sex of the dead from the LC in groups of comparison were studied. By age, all cases were divided into: 1. Young-aged (1.1. 20-29 years; 1.2. 30-39 years); 2. Middle-aged (2.1. 40-49 years; 2.2. 50-59 years); 3. Old-aged (3.1. 60-69 years; 3.2. 70-79 years). From the documents (records) found out the reasons for the development of LC, specified the presence of comorbid diseases. The results of immune blotting obtained from the Moscow City Center for AIDS Prevention and Control were considered to justify HIV infection. The Acts of histological studies were analyzed, in which, when describing the liver, the Knodell index confirming chronic alcoholic intoxication was determined [6, 7]. The incidence of LC complications, which were the cause of death, was recorded. Among the studied observations, the indicators of occurrence of alcohol-viral; alcoholic and viral; tumor and medicinal causes were revealed.

According to the standard classification we have recorded the following morphological forms of LC [8, 9]: 1. The Small Nodular LC (Small Nod LC) with a diameter of knots in limits of 1-3 mm; 2. The Large Nodular LC (Large Nod LC) with knots diameter more than 3 mm; 3. The Mixed Nodular LC (Mix Nod LC) with both small and large knots. To establish liver failure in LC, the microscopic structure of liver parenchyma was examined. Histological changes were determined in the structural-functional departments of the hepatic acinus: portal triads; hepatic beams; central veins. Depending on prevalence of destructive and dystrophic changes in departments of a hepatic acinus allocated three stages of a liver failure [6]:

1. The compensated stage, when initial destructive and dystrophic changes of a hepatic parenchyma only in portal triads departments of acinus were found;
2. The decompensated stage when destructive and dystrophic changes of hepatocytes in both portal triads and hepatic beams departments of acinus were expressed;
3. A terminal stage of a liver failure when destructive and dystrophic changes in hepatocytes in all three departments of hepatic acinus - portal triads, hepatic beams and central veins areas were established.

Results of a research

During the 12-year period 2007-2018 in Moscow,

forensic experts diagnosed 3.371 cases of death from LC. The annual LC count was between tens and hundreds of cases, and the average annual frequency of LC detection was 1.15% of the total of all forensic autopsies in nonviolent death. In different years of the studied period the number of the diagnosed LC's differed significantly. Therefore, for each calendar year, we calculated the R-index of the frequency of LC detection relative to the total number of autopsies in non-violent death. We have found that R-index of the frequency of LC detection have increased in 2009, 2015, 2017, 2018 and decrease in 2013 and 2016. In 2009 the R-index of the frequency of LC detection compared to 2008 is increased by 3.77 times. Throughout 4 years (2009-2012) the sizes of R-index of the frequency of LC detection were high and ranged from 33.98% to 27.03%. Then we have revealed that the highest R-index of the frequency of LC detection in 2009 and the lowest in 2016 were installed. From 2013 to 2018, the dynamics of the number of detected cases of LC changed in a wave-like manner (Chart 1).

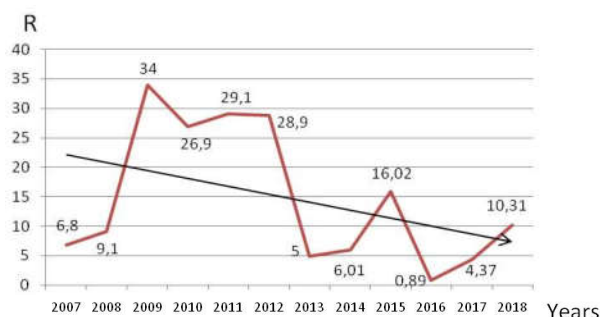


Chart 1. Frequency of occurrence of LC during 2007-2018
R - Index of frequency LC detection (concerning at non-violent death, in %) Trend (direction of LC frequency dynamics).

The largest distinctions R-index of the frequency of LC detection (falling by 17.9 times) between 16.01% (2015) to 0.89% (2016) were established. We found that R-index of the frequency of LC detection annual changes were proportional to the number of non-violent deaths. We revealed that for the 12-year period baseline trend shows steady dynamics decrease frequency of LC occurrence. The last 2 years R-index of the frequency of LC detection have increased by 79.6 and 57.7% respectively.

We have established a percentage distribution of the age groups studied relative to the total number of installed LC: 20-29 years - 3.1%; 30-39 years - 44.6%; 40-49 years - 28.9%; 50-59 years - 9.7%; 60-69 years - 7.3%; 70-79 years - 6.4%. It turned out that men's death from LC prevailed over women. The male was assigned in 78.6%. We have identified the causes of the LC: Virus-Alcoholic (41.2%); Alcoholic (35.0%); Tumoral (12.0%); Virus (8.9%); Medicinal (2.9%). In all years the quantity of mixed and

small nodular forms LC were prevailed. However, since 2012 the quantity the large nodular LC forms got a tendency to increase The frequency of morphological forms of LC is presented on chart 2.

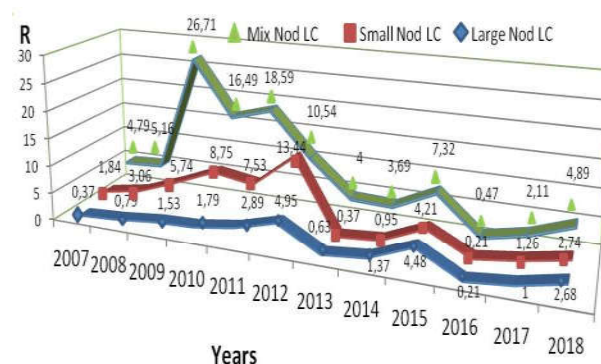


Chart 2. Morphological forms of LC.
R-Index of frequency of detection of morphological forms of LC (relative to the number of non-violent deaths).

Years	Stades of a Liver Failure Frequency, concerning LC autopsies, in %		
	Compensated	Decompensated	Terminal
2007	1.6	43.6	54.8
2008	0.0	56.4	43.6
2009	1.9	52.4	45.7
2010	4.6	49.5	45.9
2011	1.9	44.9	53.2
2012	2.3	44.2	53.5
2013	2.6	26.3	71.1
2014	8.8	35.3	55.9
2015	3.4	43.2	53.4
2016	0.0	46.2	53.8
2017	7.7	38.5	53.8
2018	3.4	40.7	55.9

We established that by histological forensic examination the terminal (48.9%) and decompensated (43.4%) stages of hepatic failure was most often detected.

Discussion of the results

It is thought that LC can rarely be the cause of sudden death, because in the case of severe decompensated LC patients are usually treated in clinics. Autopsies about death from LC are performed, as a rule, by doctors pathologists, rather than forensic experts. We have found that in Moscow LC occupies a significant place. In the total number of forensic autopsies in 2007-2018 LC with an average frequency of 1/100 from cases of non-violent deaths were detected. According to literary data a marked increase in the number of deaths from LC in Russia was observed between 2009 and 2012, which was associated with excessive use of alcohol and drugs [10]. The highest LC mortality rates characterized by an increase in drug addiction

occurred in 2009. Since 2013 there has been a decrease in the number of deaths from this disease.

Our research supports these literary data. We established that in 2009 the number of deaths from LC in Moscow were increased by 3.77 times as compared to 2008 and remained so high until 2012. From 2013 to 2018 the LC level was reduced and then changed in a wave-like manner. During the whole studied period from 2007 to 2018 in Moscow a steady trend of decrease of mortality from LC were revealed. We have established a marked dynamics of decline in the frequency of forensic detection of LC, which is consistent with the general trend of reduction of cirrhosis incidence in Moscow. Annual changes of LC were proportional to the number of non-violent deaths. The reduction of LC proportional to non-violent death is new information not reflected in recent publications.^[11]

The prevalence of alcohol-viral LC in recent years is mentioned in available sources of literature.^[5] Our research has confirmed that alcohol-viral (41.2%) and alcohol (35.0%) LC were most often detected by their etiological affiliation. Tumor (12.0%), viral (8.9%) and medicinal (2.9%) LC etiology were less common. In men (78%) LC more often than in women were detected. The majority (73.5%) young and medium age were deceased, which is consistent with the data previously obtained.^[12]

Hepatocyte necrosis at the LC due to the direct toxic action of ethanol is an important feature of alcoholic genesis. LC formation occurs for many months or years in combination with autoimmune processes. During this time, the gene apparatus changes and new generations of pathologically altered liver cells appear [6]. In order to evaluate morphological changes of liver parenchyma at LC used a new approach to analyse the structural-functional departments of hepatic acinus are histologically examined. The prevalence of destructive-dystrophic hepatocyte changes is a morphological component of hepatic insufficiency. It is considered that in LC destructive changes of hepatocytes first appear in portal triads, then in beams and in the area of central veins, characterizing successive stages of severity of hepatic insufficiency [7]. Destructive hepatocyte changes found in all three structural regions of the acinar tract indicate the onset of the terminal stage of hepatic insufficiency.^[12]

We executed histological examination of liver parenchyma changes to study LC pathogenesis. A new approach for evaluating hepatocytes in the structural functional departments of hepatic acinus was used. We have found that when dying from

LC, decompensated and terminal stages of hepatic failure are recorded more frequently. We found that in cases of death from LC decompensated and terminal stages of hepatic failure were more often recorded.

It is noteworthy that in the terminal stage of hepatic insufficiency we were revealed the patho-morphological changes and separate clinical-laboratory indicators from different sides characterize the same condition - the liver coma.^[12] Between 2013 and 2018, there was a significant decrease, an average of 5.93 times (by 20.5%) histologically confirmed cases of hepatic failure. These changes require further reflection to clarify their causes. It is possible that at this time the falling in the number of detected cases of liver failure is due to the decrease in the frequency of alcoholic excesses accompanying sudden death.^[1,3] The main scientific significance of the study is the possibility to estimate the dynamics of mortality and pathogenesis of LC by morphological characteristics of developing liver failure.

Conclusions

Mortality from liver cirrhosis in Moscow according to forensic autopsy data for 2007-2018, averaged 1.15% of non-violent deaths. The highest figure was in 2009. After 2013, the number of liver cirrhosis began to decrease. The lowest frequency of detection of liver cirrhosis was established in 2016. Over a 12-year period, there was a steady trend towards a decrease in liver cirrhosis mortality. The number of diagnosed liver cirrhosis was proportional to the number of autopsies in nonviolent death.

Among the causes of liver cirrhosis were viral-alcoholic (41.2%) and alcoholic (35.0%) etiological forms. Mixed and small-node morphological forms of the disease were more common in young and middle-aged men. We found that histological forensic examination was more likely to detect terminal (48.9%) and decompensated (43.4%) stages of hepatic failure.

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