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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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SIGNIFICANCE OF TWO-DIMENSIONAL SHEAR WAVE ELASTOGRAPHY IN PREDICTING ESOPHAGEAL VARICOSE VEINS DURING CHRONIC LIVER DISEASE

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Abstract.

Aim: The aim of the study was to reveal diagnostic capabilities of 2D SWE for predicting esophageal varices (EV) in patients with chronic liver diseases. **Materials and Methods:** This case-control study included clinical-laboratory examination results data of 104 patients which were collected retrospectively at the medical center from January 2020 to April 2022. 52 patients who were participated in the examination had got chronic liver disease (case group), and 52 patients were healthy (control group). Based on the obtained data, we compared 2D SWE results with esophagogastroduodenoscopy (EGD) results and evaluated the diagnostic value, sensitivity, specificity, AUROC, positive predictive value (PPV) and negative predictive value (NPV) of 2D SWE in the presence of esophageal varices.

Results: A total of 104 patients were included in the examination. Average hardness of the liver of healthy patients was 3.98 Kpa, the average hardness of the liver in patients with chronic liver disease was 17.51 Kpa. Sensitivity and specificity of liver elastography were 100% and 76%, respectively;(AUROC: 0.973); In addition, positive and negative predictive values were 40% and 100%, respectively.

Conclusion: 2D SWE of the liver, as a non-invasive method of evaluating liver stiffness during chronic liver disease, can also be used to predict the presence of esophageal varices.

Key words. Liver stiffness, liver cirrhosis, esophageal varices, shear wave elastography, endoscopy.

Introduction.

Liver cirrhosis is one of the most common causes of death in the world [1]. Cirrhosis is a result of chronic liver disease with advanced fibrosis, scarring, and regenerative nodules which causes architectural disruption [2,3]. Normal microcirculation and vascular anatomy change as well [4]. This leads to an increase in resistance of portal blood flow, which causes portal hypertension and liver dysfunction [3]. An important and major complication of liver cirrhosis is esophageal varices (EV) and esophagogastric variceal bleeding (EVB), which are associated with high morbidity and mortality [5-10]. Esophageal varices are dilated veins in the esophagus caused by portal hypertension and are a clinically important feature of portal hypertension. Esophageal varices range from 40% to 95% in cirrhotic patients [4]. The risk of variceal bleeding depends on the size of varicose vein [8]. As liver disease progresses, prevalence of varices increases as well. Small varices turn into large varices every year by 10%-12%. Bleeding from esophageal varices is more common than from gastric varices. However, gastric variceal bleeding has a worse prognosis [11]. The risk of bleeding is high if there are large varicose veins of the esophagus (>5 mm) with high wall tension. The cause of additional bleeding in portal hypertension can be gastric varicose veins and portal hypertensive gastropathy. Active variceal bleeding is associated with a 6-week mortality rate greater than 15% [8]. The patient mortality rate is 3.4% per year in individuals with varices who have never had bleeding, while the mortality rate in patients with variceal bleeding is up to 57% per year. Therefore, early diagnosis of varices and prevention of variceal bleeding in patients with liver cirrhosis has got vital importance [1]. Esophageal varices and their stages are usually detected by endoscopic examination. Based on consensus and guideline recommendations, patients with confirmed liver cirrhosis should undergo screening endoscopy to evaluate GEVs [12]. Screening gastroduodenoscopy is recommended in all patients with decompensated cirrhosis and compensated worsened liver disease [13]. Due to the reason that endoscopy has limitations: it is invasive and relatively expensive, requires medical equipment, trained staff [12,7,1]. In addition, it often requires sedation. [14,15]. Therefore, in recent years, non-invasive examination of the prognosis of esophageal varicose veins has become more relevant [7,1]. Several non-invasive methods have been introduced as alternatives of EGD for screening of esophageal varices [15]. According to the updated Baveno VI guidelines, EGD screening can be avoided in patients with compensated advanced chronic liver disease (cACLD) who have liver stiffness <20 kPa and platelet >150,000/Ml [8,15,5]. This data indicates a very low risk of varices. These guidelines have been confirmed by retrospective studies and meta-analysis [15].

Two-dimensional shear wave elastography is now actively used to measure liver stiffness. 2D-SWE can be freely used as a screening tool for early diagnosis of significant fibrosis [16]. 2D SWE method can also be used to determine liver stiffness to predict liver fibrosis complications. 2D SWE can detect the presence of clinically significant portal hypertension with summary sensitivity and specificity of 0.85 (95% CI: 0.75–0.91) and 0.85 (95% CI: 0.77–0.90), respectively [17]. Our study aims to evaluate the capabilities of shear wave elastography in detecting esophageal varices for patients with chronic liver diseases.

Materials and methods.

This case-control study was conducted in the Medical Center from 2019 to 2023. The protocol was approved by the ethics committee of our clinic. All patient data were used after informed consent was obtained.

The examination included 104 patients, regardless of gender. Their age was 18-77 years. We used data of 52 patients for the examination who were diagnosed with chronic liver disease based on clinical and laboratory tests. We united 52 patients in the control group who had been undergone similar examinations as the case group patients due to various dyspeptic complaints, but pathology was not found in the examinations. Exclusion criteria were insufficient clinical data, acute

hepatitis, hepatocellular carcinoma, encephalopathy, portal vein thrombosis, kidney, heart, lung, and blood diseases. As well as radiotherapy or chemotherapy received by extrahepatic tumors. Patients selected for our examination had been examined laboratory tests within 2-10 days, shear wave elastography to measure liver stiffness, and esophagogastroduodenoscopy (EGD) to detect esophageal varices. The obtained 2D SWE and EGD examination results were compared to determine the role of 2D SWE in the detection of esophageal varices. In addition, we considered other clinical-biochemical data. We compared the obtained results both in case-control patients and in case group patients with and without varicose veins. We studied and made a statistical analysis.

Upper gastrointestinal (UGI) endoscopy:

Endoscopy was performed by a gastroenterologist with 20 years of experience using a EVIS X1: CV-1500 (Olympus Corporation, Tokyo, Japan) gastroscopy machine. The examination was performed on an empty stomach. Sedation was used for 75% of patients. Patients were placed in the left lateral position and a gastroscope was placed in the oral cavity between the incisors. Then it was injected under direct vision into the UGI tract. Data were collected on different sizes of esophageal varices, and varices were graded as grades I, II, and III and IV according to Paquet's (1982) classification, according to which: Grade 0 - Absence of esophageal varices. Grade I - Microcapillars located on esophagogastric transition or distal esophagus. Grade II - 1 or 2 small varices located on distal esophagus. Grade III - Medium esophageal varices. Grade IV - Large varices in any part of the esophagus [18,19]. We divided the variable "esophageal varices" into 3 categories for efficiency of statistical analysis: 1. No; 2. I / II grade; 3. III / IV grade.

Liver stiffness measurements with shear wave elastography:

2D SWE studies were performed by a Canon Aplio i800 ultrasound system (Canon Medical Systems, Tokyo, Japan) with a 3.5 MHz convex probe by a radiologist with 17 years of experience. The patient was required to be on an empty stomach. Liver stiffness (LS) measurements were performed using 2D-SWE on a right intercostal scan with the patient in the supine position. LS is measured by maximal abduction of the right arm. A trapezoidal box (3.5 cm × 2.5 cm) located in the liver parenchyma acquires elasticity signals. The ROI is located in the liver parenchyma, where there are not great vessels or liver nodules, 1–2 cm from the liver capsule. Measured elasticity values are expressed in kilopascals (kPa). For each patient, stiffness was determined as the median of several successful SWE measurements.

Statistical analysis.

Data entry and statistical analysis were performed by SPSS 23.0 statistical software. Statistical testing of the difference according to the qualitative variables was performed by the chi-square method (Pearson's chi-square test). Differences between two continuous independent variables were determined by the independent samples t-test. One-way ANOVA was used to test for differences in continuous variables between more than two groups. A confidence level (p) less than 0.05 ($p<0.05$) was considered statistically significant.

Results.

104 patients were included in the examination, 52 patients of them were suffering from chronic liver disease, 52 patients were healthy. 78 were male patients, 26 were female patients. The age range was from 18 to 77 years old. The etiology of chronic liver disease was as follows: HCV-34; HBV-7; HCV/HBV-5; alcoholic-4; HCV/alcoholic-1; biliary-1 (Figure 1).

According to abdominal ultrasound data, structural changes were not noted in the liver in 52 patients (control patients). Mild structural liver changes were detected in 10 patients, moderate changes in 18 patients, and severe structural changes in 24 patients in the case group. Ascites was detected in 28 patients.

Esophageal varicose veins were detected in 32 patients. Varicose veins of the first grade were detected in 8 patients, varicose veins of the second grade - in 10 patients, varicose veins of the third grade - in 7 patients, and varicose veins of the fourth grade also in 7 patients (Table 1).

Table 1. *Descriptive statistics of categorical variables.*

Feature	N	%
Participant type		
Case	52	50
Conrol	52	50
Age		
≤35	21	20.2
>35	83	79.8
Gender		
Female	26	25.0
Male	78	75.0
Etiology		
Biliary	1	1.9
HCV	34	65.4
HBV	7	13.5
HCV/HBV	5	9.6
Alcohol	4	7.7
Alcohol/HCV	1	1.9
Changes in the liver structure		
Norm	52	50.0
Mild	10	9.6
Moderate	18	17.3
Severe	24	23.1
Ascites		
expressed	28	26.9
Not expressed	76	73.1
Liver stiffness		
<12 kPa	69	66.3
≥12 kPa	35	33.7
Varicose veins of the esophagus		
Not expressed	72	69.2
I Grade	8	7.7
II Grade	10	9.6
III Grade	7	6.7
IV Grade	7	6.7
Among varicose veins of the esophagus cases		
Not expressed	**20**	**38.5**
I **Grade**	**8**	**15.4**
II **Grade**	**10**	**19.2**
III **Grade**	**7**	**13.5**
IV **Grade**	**7**	**13.5**

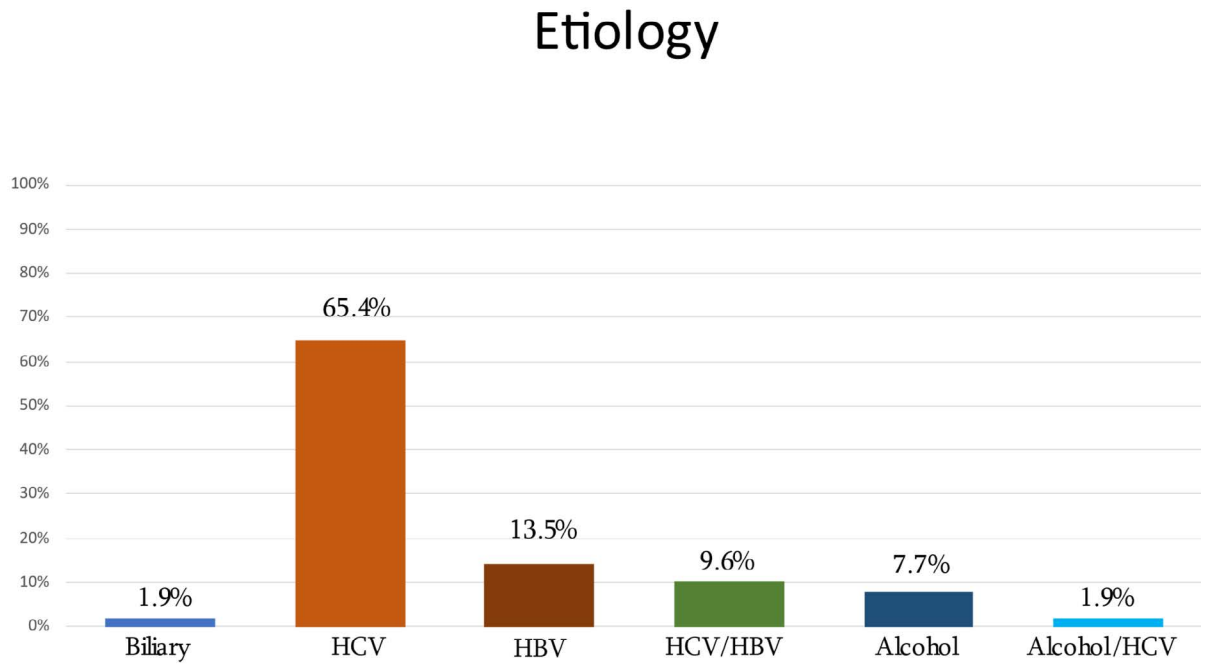

Figure 1. *Etiology of chronic liver damage in the case group, expressed in percentages.*

In our study, independent samples T test was used to analyze the liver stiffness values obtained by 2D-SWE, where it can be seen that average liver stiffness in the case group is 17.51 Kpa, while in the controls it is 3.98 Kpa, and this difference is reliable.

As well as we determined that liver stiffness was higher in patients with oesophageal varices (EV) than in patients without varicose veins. In addition, we found that liver stiffness increases as the degree of EV increases. Patients without EV had 10.87 Kpa less compared to those with EV of the I / II grade, and patients without EV, had 22.14 Kpa less than III / IV Compared to those with EV grade. This difference is statistically significant. It is also important that patients who had EV of the I / II grade had 11.26 Kpa less compared to those with EV of III / IV grade and the mentioned difference is statistically significant (Table 2).

Table 2. *Changes in liver stiffness according to the degree of esophageal varices.*

Esophageal varices grade		**Mean Difference**	**St. Error**	***P***
No	I/II	-10.87	1.18	0.001
	III/IV	-22.14	1.31	
I/II	No	10.87	1.18	0.001
	III/IV	-11.26	1.59	
III/IV	No	22.14	1.31	0.001
	I/II	11.26	1.59	

In our study, we considered a liver stiffness ≥12 Kpa as high according to shear wave elastography. Therefore, according to the data of our study, 2D SWE can predict EV in chronic liver disease. Its sensitivity and specificity were 100% and 76%, respectively; (AUROC: 0.973); Positive and negative predictive values were 40% and 100%, respectively.

We also studied parameters such as patient age, liver size, portal vein diameter, splenic length, splenic vein diameter, direct bilirubin, ALT, AST, GGT, INR, platelet count, hemoglobin, and serum albumin. In case-control groups significant difference was revealed. In case group, there was a pathological change in all data except for age (Table 3).

The above-mentioned parameters were also compared in our case group of patients with and without EV. A significant difference was found in the following data: diameter of the portal vein, spleen length, diameter of the splenic vein, INR, hemoglobin and, as we mentioned, in the stiffness of the liver (Table 4).

And with increase in the grade of EV, only spleen length, diameter of the splenic vein and, of course, liver stiffness increased statistically significantly (Table 5).

Discussion.

Cirrhosis was considered an irreversible process in the past, but recent studies have shown that if it was diagnosed early and treated appropriately, it may improve or even reverse fibrosis [2,8]. The goal of cirrhosis treatment is to stop liver damage and prevent complications [3]. Esophageal varices occur during cirrhosis, both in the decompensation phase (60%) and in compensated cirrhotic patients (30-40%). And in those patients in whom varicose veins were not detected at the time of diagnosis, frequency of new varicose veins is 5-10% annually [20]. That is why routine surveillance of gastroesophageal varices (GEVs) is important for early diagnosis and preventive measures. Upper gastrointestinal endoscopy is considered the gold standard in GEV diagnosis, but it also has some limitations, which led to the study of non-invasive diagnostic methods for GEVs, that includes measurement of liver stiffness [12]. In our

Table 3. *Bivariate analysis (T test of independent variables).*

Feature	Average	Mean difference	Static deflection	*p*
Age				
Case	49.62	1.32	13.0	<0.05
Conrol	48.29		15.9	
Liver size				
Case	155.56	13.21	22.6	<0.001
Conrol	142.35		9.9	
Portal vein				
Case	14.17	4.08	2.2	<0.01
Conrol	10.09		1.4	
Spleen length				
Case	156.71	48.75	28.1	<0.001
Conrol	107.96		11.8	
Splenic vein				
Case	9.92	4.41	3.1	<0.001
Conrol	5.51		1.3	
LSM_kPa				
Case	17.52	13.53	8.6	<0.001
Conrol	3.98		0.5	
Direct bilirubin				
Case	31.65	28.95	55.8	<0.001
Conrol	2.69		1.0	
ALT				
Case	68.74	48.14	42.9	<0.001
Conrol	20.59		8.6	
AST				
Case	91.09	71.08	66.2	<0.001
Conrol	20.01		8.9	
GGT				
Case	172.79	143.43	230.5	<0.001
Conrol	29.35		13.6	
INR				
Case	1.43	0.32	0.3	<0.001
Conrol	1.11		0.1	
Platelets				
Case	196.42	83.50	126.5	<0.001
Conrol	279.92		67.3	
Hemoglobin				
Case	37.51	117.75	52.1	<0.001
Conrol	155.27		12.7	
Albumin				
Case	188.21	-	179.6	
Conrol	0		0	

examination, we measured liver stiffness in patients and control groups by real-time shear wave elastography and compared the results with upper gastrointestinal endoscopy results. Patients with chronic liver disease had a higher mean liver stiffness (17.51 Kpa) than control patients (3.98 Kpa). Our results were similar to those of Mohamed et al at 3.1 Kpa in healthy patients and 12.6 Kpa in patients with advanced fibrosis [21] and of Hashim et al results, where LS mean value in controls was 5.8±1.3 and in case group was 23.8±10.1 [22]. Among the patients included in our examination, 32 patients had esophageal varices, 8 patients had I Grade varicosities, 10 patients had II Grade varicosities, 7 patients had III Grade varicosities, and 7 patients had IV Grade varicosities. We found a significant difference in LS between patients with EV and patients without EV in chronic liver disease. Our opinion has been confirmed by other studies [14,23,22]. Our study showed that a liver 2D SWE cut-off value ≥12 Kpa can predict esophageal varices with sensitivity and specificity of 100% and 76%, respectively; (AUROC: 0.973); Positive and negative predictive values were 40% and 100%, respectively. A similar result was obtained in the study by Hashim et al, a cut-off value of 16.2 kPa for LS showed 89.8% sensitivity, 57.6% specificity, 79.1% PPV and 76% NPV for predicting the presence of EV AUROC:0.775 [22]. As well as Tag-Adeen et al showed that an LSM cut-off value ≥17 kPa was a good predictor for the presence of EV with 93.6% sensitivity, 95% specificity, 95.1% PPV, and

Table 4. *Bivariate analysis (T test of independent variables) between cases by esophageal varices.*

Feature	Average	Mean difference	Static deflection	p
Age				
No	48.00	2.62	15.30	0.51
Yes	50.63		11.48	
Liver size				
No	153.50	3.34	18.34	0.58
Yes	156.48		25.09	
Portal vein				
No	13.22	1.54	2.17	<0.05
Yes	14.76		2.04	
Spleen length				
No	134.55	36.01	26.99	<0.001
Yes	170.56		18.27	
Splenic vein				
No	8.10	2.95	2.60	<0.001
Yes	11.05		2.78	
LSM_kPa				
No	10.84	10.85	3.36	<0.001
Yes	21.69		8.28	
Direct bilirubin				
No	32.93	2.08	73.36	0.90
Yes	30.85		42.76	
ALT				
No	66.53	3.58	40.24	0.76
Yes	70.11		45.03	
AST				
No	78.50	20.46	55.90	0.25
Yes	98.96		71.66	
GGT				
No	155.70	27.22	285.51	0.71
Yes	182.93		195.04	
INR				
No	1.31	0.19	0.24	<0.05
Yes	1.50		0.38	
Platelets				
No	232.45	58.54	96.36	0.07
Yes	173.90		138.91	
Hemoglobin				
No	68.69	50.66	66.19	<0.01
Yes	18.03		27.47	
Albumin				
No	240.00	84.16	195.55	0.11
Yes	155.84		163.67	

** Yes - has esophageal varices*
** No – does not have esophageal varices*

Table 5. *Bivariate analysis (T test of independent variables) between cases according to grade of esophageal varices.*

Feature	Average	Mean difference	Static deflection	*p*
Spleen length				
I/II Grade	162.94	17.41	13.82	<0.01
III/IV Grade	180.36		19.03	
LSM_kPa				
I/II Grade	16.77	11.26	5.34	<0.001
III/IV Grade	28.03		7.02	
Portal vein				
I/II Grade	14.17	1.33	2.22	0.06
III/IV Grade	15.51		1.54	
Splenic vein				
I/II Grade	9.96	2.51	2.27	<0.05
III/IV Grade	12.4		2.82	
INR				
I/II Grade	1.56	0.12	0.43	0.35
III/IV Grade	1.43		0.29	
Hemoglobin				
I/II Grade	18.59	1.28	32.67	0.89
III/IV Grade	17.31		20.07	

** I/II Grade - I/II grade varicose veins of esophageal tube*
** III/IV Grade - III/IV grade varicose veins of esophageal tube*

93.4% NPV [24]. However, other studies have found different cut-off values: According to Zaki et al, SWE can differentiate between cirrhotic patients with and without gastroesophageal varices with a value of 26.5 kPa and a sensitivity of 88% and a specificity of 85% [14]. In the Danish et al study, liver stiffness on real-time shear wave elastography was greater than 25 kPa in patients with varicose veins. The sensitivity and specificity of liver elastography were 44.90% and 51.90%, respectively [23]. And Kim et al reported that the optimal cut-off value for predicting presence of esophageal varices is 13.9 [25]. Quantitative differences in kilopascals are likely due to the machine used, as different manufacturers have different values [14]. We have also found out that liver stiffness increases with increasing grade of varices and in patients with chronic liver disease compared to patients without varices. Liver stiffness was 10.87 Kpa units higher in patients with I/II grade varicose veins and 22.14 Kpa higher in patients with III/IV grade. A similar result was shown by Tag-Adeen et al in study, where the mean LSM was 21.22±3, 25.72±6, 33.82±8 and 46.11±15 kPa for I, II III / IV grade varicose veins respectively (P<.0001). All these indicates that LSM is effective not only in predicting the presence of EV, but also in differentiating between its various grades [24]. A significant correlation between increased liver stiffness and pathological laboratory data was established in our study, as well as data of other authors [14,23]. In addition, liver size, its structure with varying grades, diameter of the portal vein, diameter of the splenic vein and length of the spleen were changed. There are other studies that show a significant correlation between the grade of splenomegaly and increased stiffness of the liver on real-time shear wave elastography [14,23,24]. We also compared the above parameters in the case group patients with and without EV and statistically significant changes were obtained in the following data: LSM ($p<0.001$), portal vein ($p<0.05$), splenic length ($p<0.001$), splenic vein ($p<0.001$), INR ($p<0.05$) hemoglobin ($p<0.01$). Then we statistically analyzed these data in I / II and III / IV grade varicosities, respectively and it was found that only: LSM ($p<0.001$), spleen length ($p<0.01$), splenic vein ($p<0.05$) changed significantly with the increase in the grade of esophageal varices. Although Tag-Adeen et al found in their study that splenic diameter is a significant additional tool for predicting esophageal varices ($p<0.0001$) reports statistically insignificant differences when esophageal varices grade increases ($p=0.01$) [24]. Unlike us, Hashim et al in the study noted that there was a significant difference between patients with and without EVs regarding LS, spleen diameter, serum albumin and bilirubin levels [22]. Compared to transient elastography (TE), 2D SWE has the advantage that it can be successfully used both in ascites [26,27] and overweight patients [27]. Elkrief et al found that in patients with advanced cirrhosis in whom hepatic venous pressure gradient (HVPG) was measured, LS measurements obtained by the SWE method had a higher success rate and better diagnostic value than TE for clinically significant portal hypertension (PH) [28]. The limitation of our examination is small number of patients. In the future, it is necessary to conduct study on a large scale of patients, as well as clinical-laboratory studies. Study with TE will also be interesting.

Conclusion.

Shear wave elastography as a new, non-invasive, and easily available method can be used in the prediction of esophageal varices. The results of the current study are reliable and of high importance. However, future studies will further strengthen capabilities of this method.

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Цель: целью исследования было выявление диагностических возможностей 2D SWE с целью прогнозирования варикоза пищевода (EV) среди пациентов, страдающих хроническими заболеваниями печени.

Матариал и методы: указанное исследование случаев и контроля включало в себя данные клинико-лабораторных исследований 104 пациентов, которые были отобраны ретроспективно в медицинском центре в период с января 2020 года по апрель 2022 года. В исследование были вовлечены 52 пациента с хроническими заболеваниями печени (группа случая), а 52 пациента были здоровыми (группа контроля). На основании полученных данных, результаты двумерной эластографии сдвиговой волны (2D SWE) сравнили с результатами эзофагогастродуоденоскопии (EGD) и оценили диагностическое значение двумерной эластографии сдвиговой волны при наличии варикоза пищевода, чувствительность, специфику, AUROC, положительное прогнозируемое значение (PPV) и отрицательное прогнозируемое значение (NPV).

Результаты: всего в исследование было вовлечено 104 пациента. Средняя плотность печени здоровых пациентов составила 3.98 Kpa, среди пациентов с хроническими заболеваниями печени - 17.51 Kpa. Чувствительность и специфика эластографии печени составила 100% и 76%, соответственно; (AUROC: 0.973); кроме того, положительное и отрицательное прогнозируемые значения составили 40% и 100% соответственно.

Заключение: 2D SWE печени, как неинвазивный метод оценки плотности печени во время хронических заболеваний печени, может также быть использован для прогнозирования наличия варикозных вен пищевода.

მიზანი: კვლევის მიზანი იყო 2D SWE დიაგნოსტიკური შესაძლებლობების გამოვლენა საყლაპავის ვარიკოზების (EV) პროგნოზირებისთვის ღვიძლის ქრონიკული დაავადებების მქონე პაციენტებში.

მასალადამეთოდები:ესშემთხვევა-კონტროლისკვლევა მოიცავდა 104 პაციენტის კლინიკურ-ლაბორატორიული გამოკვლევის შედეგების მონაცემებს,რომელიც შეგროვდა რეტროსპექტრულად სამედიცინო ცენტრში 2020 წლის იანვრიდან 2022 წლის აპრილამდე. კვლევაში ჩართული 52 პაციენტი იყო ღვიძლის ქრონიკული დაავადებით (შემთხვევის ჯგუფი),ხოლო 52 პაციენტი იყო ჯანმრთელი(კონტროლის ჯგუფი).მიღებული მონაცემების საფუძველზე ორგანზომილებიანი წანაცვლებითი ტალღის ელასტოგრაფიის (2D SWE) შედეგები შევადარეთ ეზოფაგოგასტროდუოდენოსკოპიის (EGD) შდეგებს და შევაფასეთ საყლაპავის ვარიკოზის არსებობისას ორგანზომილებიანი წანაცვლებითი ტალღის ელასტოგრაფიის დიაგნოსტიკური მნიშვნელობ ა,მგრძნობელობა,სპეციფიკა, AUROC, დადებითი პროგნოზირებადი მნიშვნელობა (PPV) და უარყოფითი პროგნოზირებადი მნიშვნელობა (NPV).

შედეგები: კვლევაში სულ 104 პაციენტი იყო ჩართული. ჯანმრთლი პაციენტების ღვიძლის საშუალო სიმტკიცე იყო 3.98 Kpa,ღვიძლის ქრონიკული დაავადების მქონე პაციენტებში ღვიძლის საშუალო სიმტკიცე აღმოჩნდა 17.51 Kpa. ღვიძლის ელასტოგრაფიის მგრძნობელობა და სპეციფიკა იყო 100 % და 76 %, შესაბამისად); (AUROC: 0.973); გარდა ამისა, დადებითი და უარყოფითი პროგნოზირებადი მნიშვნელობები იყო შესაბამისად 40 % და 100 %. დასკვნა: ღვიძლის 2D SWE ,როგორც ღვიძლის ქრონიკული დაავადებების დროს ღვიძლის სიმკვრივის შესაფასების არაინვაზიური მეთოდი, შესაძლებელია ასევე გამოყენებულ იქნას საყლაპავის ვარიკოზული ვენების არსებობის პროგნოზირებისთვის.