GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 3 (372) Март 2026

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

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.

GEORGIAN MEDICAL NEWS
NO 3 (372) 2026

Содержание:

GEORGIAN MEDICAL NEWS
No 3 (372) 2026

GUIDEWIRE-ASSISTED ESOPHAGEAL BOUGIENAGE IN SEVERE CHEMICAL BURNS IN CHILDREN: CLINICAL EFFECTIVENESS OF THE DEVELOPED METHOD

Rakhimov Anvar[1], Khalimov Gulom[1], Khakimova Leyla[2], Shamsiev Jasur[3], Yusupov Shukhrat[1], Khalimova Fariza[4].

[1]*Department of Pediatric Surgery #1 of the Samarkand State Medical University, Uzbekistan.*

[2]*Department of Family and Preventive Medicine, Public Health and Healthcare Management at Samarkand State Medical University, Uzbekistan.*

[3]*Department of Postgraduate Education in Traumatology and Orthopedics, Neurosurgery and Ophthalmology, Samarkand State Medical University, Uzbekistan.*

[4]*Department of Normal and Pathological Physiology, Medico-Social Institute of Tajikistan.*

Abstract.

Background: Corrosive esophageal burns in children remain a clinically important problem because they frequently result in cicatricial strictures, persistent dysphagia, nutritional impairment, and the need for staged treatment. The greatest challenges occur in severe (grade III) injuries, where conventional blind bougienage is performed without visual control and carries a risk of additional esophageal trauma.

Objective: To compare the effectiveness and safety of endoscopically controlled guidewire-assisted bougienage with traditional treatment approaches in children with cicatricial strictures after grade III corrosive esophageal burns.

Materials and Methods: This retrospective single-center cohort study with a historical control included 148 children aged 5-14 years. The main group comprised 102 patients who underwent guidewire-assisted esophageal dilation under endoscopic control during 2019-2023. The control group included 46 patients treated with conventional methods (blind bougienage and/or gastrostomy followed by string-guided bougienage) during 2015-2018. The primary endpoint was defined as the short-term clinical success of dilation - restoration of oral feeding (per os) without gastrostomy during the index hospitalization, i.e., a short-term in-hospital outcome. In addition, the frequency of gastrostomy, length of hospital stay, and complication rates were assessed; infectious complications were defined as documented nosocomial infectious events requiring medical intervention. For the comparative analysis, RR, OR, 95% CI, ARR, and NNT were calculated.

Results: Clinical success was achieved in 94/102 children in the main group (92.2%; 95% CI 85.3-96.0) versus 21/46 in the control group (45.7%; 95% CI 32.2-59.8) (RR 2.02; 95% CI 1.47-2.78; OR 13.99; 95% CI 5.54-35.32; $p < 0.001$). The absolute difference was 46.5% (NNT = 3). The need for gastrostomy was markedly lower with endoscopically controlled dilation: 7.8% vs 54.3% (RR 0.14; 95% CI 0.07-0.30; $p < 0.001$). Median length of stay was 12 [9-16] days in the main group and 19 [14-25] days in the control group ($p < 0.001$). Complications were also less frequent in the main group: 5.9% vs 17.4% (RR 0.34; 95% CI 0.12-0.92; $p = 0.036$).

Conclusion: In children with post-burn cicatricial esophageal strictures after grade III corrosive injury, endoscopically controlled guidewire-assisted bougienage is associated with better short-term in-hospital outcomes than conventional management, including higher dilation success, reduced need for gastrostomy, shorter hospitalization, and fewer complications. Prospective multicenter studies with long-term follow-up are warranted to confirm these findings.

Key words. Corrosive esophageal burn, post-burn cicatricial stricture, children, endoscopic dilation, guidewire-assisted bougienage, gastrostomy, complications.

Introduction.

Chemical (corrosive) esophageal burns in children remain a clinically and socially significant problem due to the frequent development of cicatricial strictures, chronic dysphagia, nutritional impairment, and the need for staged therapy. Contemporary pediatric case series and reviews indicate that severe caustic injuries of the upper gastrointestinal tract are still associated with a substantial rate of late stricture formation and prolonged treatment in specialized centers [1-5]. The most severe injuries have traditionally been linked to alkali exposure, which causes liquefactive necrosis, deep transmural damage to the esophageal wall, and pronounced scarring, whereas acidic agents often produce a different injury profile; importantly, clinical severity is determined not only by the type of substance but also by its concentration, volume, and contact time [1,3,6-9].

The key therapeutic goal is to restore esophageal patency while minimizing the risk of perforation and infectious complications, as dilation-related adverse events and progressive fibrosis largely drive the need for repeat interventions, prolonged hospitalization, and surgical treatment stages [5,10,11]. In clinical practice, endoscopic dilation (balloon dilation or bougienage) is commonly used, and when safe passage is not feasible, gastrostomy with subsequent bougienage may be required; in modern reviews and clinical series, endoscopic dilation is regarded as the cornerstone treatment for benign post-corrosive esophageal strictures in children, although the optimal technique and frequency of procedures may vary [2-4,7].

The absence of visual guidance during blind bougienage limits procedural safety and may reduce efficacy in high-grade stenoses, particularly in children with severe dysphagia, long-segment, or dense strictures, where the risk of esophageal wall injury and technical failure is higher [6,11]. Guidewire-assisted dilation under endoscopic control may help standardize traversal of the stricture segment, reduce trauma, and improve treatment outcomes; conceptually, this approach aligns with the current trend toward controlled and reproducible endoscopic techniques in the management of benign esophageal strictures in children [4,6,10].

Materials and Methods.

A retrospective comparative single-center cohort study with a historical control was conducted at a specialized tertiary

care hospital (Pediatric Surgery Clinic No. 1). The control group included patients treated before the introduction of endoscopically guided bougienage over a guidewire during 2015-2018, whereas the main group consisted of patients treated after this approach had been adopted into the center's routine clinical practice during 2019-2023. Data sources included medical records and instrumental examination reports (esophagoscopy and contrast radiographic examination of the esophagus) collected during the observation period.

A total of 148 children aged 5-14 years were included (mean age 10.6 ± 2.4 years), including 86 boys (58.1%) and 62 girls (41.9%).

Eligibility criteria.

Inclusion criteria: age 5-14 years; grade III chemical esophageal burn; clinical and instrumental evidence of cicatricial stenosis (dysphagia of varying severity and endoscopic findings and/or contrast radiography confirming an esophageal stricture). Burn severity and the extent of mucosal injury were interpreted according to endoscopic approaches and classifications used for caustic esophageal injuries.

Exclusion criteria: absence of endoscopic and/or radiographic confirmation of stricture; severe comorbid conditions limiting dilation (decompensated systemic diseases, significant hemostatic disorders, etc.); incomplete clinical or instrumental data preventing assessment of treatment dynamics and outcomes.

Group allocation:

Patients were assigned to two groups according to the treatment strategy:

Intervention group: 102 children treated using the developed protocol of guidewire-assisted dilation under endoscopic control.

Control group: 46 children who received standard (traditional) management used in the clinic prior to implementation of the new technique.

Stricture assessment:

The severity of cicatricial deformity and the degree of luminal narrowing were assessed using the clinic's standard grading scale based on the available medical documentation. Stricture characteristics included localization, length, severity of narrowing, and the clinical grade of dysphagia (when recorded in the medical charts).

Treatment protocol in the intervention group:

In the early period after admission, esophagoscopy was performed with visual assessment of the injured segment and cicatricial changes. Under endoscopic guidance, a guidewire was advanced across the stenotic segment. Dilation was then carried out using sequential bougienage over the guidewire with stepwise increases in bougie diameter (wire-guided bougienage, Savary-Gilliard type), consistent with generally accepted approaches to the dilation of benign esophageal strictures.

The starting diameter, incremental up-sizing, and frequency of sessions were determined by the clinical presentation, severity of stenosis, and procedural tolerance. After each session, patients underwent clinical monitoring (changes in dysphagia, pain, and signs of complications); additional endoscopic and/or radiographic assessment was performed when indicated.

Treatment protocol in the control group:

The control group received conventional management: direct (blind) esophageal bougienage; when indicated (inability to maintain adequate oral intake, severe dysphagia, or the need for prolonged staged bougienage), gastrostomy was performed followed by bougienage over a thread. Thus, "traditional treatment" in this study referred to non-endoscopically guided dilation (primarily blind bougienage) and a surgical strategy involving gastrostomy when safe direct bougienage was not feasible.

Criteria for gastrostomy:

Gastrostomy was considered in the presence of predefined clinical conditions: inability to maintain adequate oral nutrition, severe dysphagia associated with clinically significant nutritional deficiency or a risk of its development, technical inability to safely traverse the stricture during direct dilation, as well as an anticipated need for prolonged staged treatment requiring secure enteral access. The same predefined clinical indications were applied as decision guidance in both groups; however, given the retrospective design and the use of a historical control, temporal changes in the institutional threshold for gastrostomy decision-making cannot be completely excluded.

Clinical success of dilation:

Clinical success of dilation was defined as restoration of esophageal patency sufficient to allow oral feeding (per os) without the need for gastrostomy during the inpatient stage. This endpoint was interpreted as a short-term in-hospital outcome and was not considered evidence of a sustained long-term result.

Primary endpoint:

Clinical success of dilation: short-term restoration of esophageal patency sufficient to allow oral feeding without the need for gastrostomy during the inpatient stage.

Secondary endpoints:

1. Need for gastrostomy.
2. Length of hospital stay.
3. Complications recorded in the medical documentation (perforation, bleeding, infectious complications, and other adverse events). Infectious complications were defined as clinically documented in-hospital infectious events requiring therapeutic intervention, including aspiration pneumonia, mediastinal or paraesophageal infection in cases of suspected microperforation, catheter-associated infection, as well as other systemic infections if they were explicitly documented in the medical records.

Statistical analysis:

Statistical analyses were performed using SPSS version 13.0. Continuous variables are presented as mean ± standard deviation (M ± SD) for normally distributed data and as median with interquartile range (Me [IQR]) for non-normally distributed data. Categorical variables are presented as n (%).

Categorical variables were compared using the chi-square test or Fisher's exact test (when expected cell counts were <5). Between-group comparisons of continuous variables were performed using the independent-samples t test or the Mann-Whitney U test, depending on data distribution. For proportions,

95% confidence intervals (95% CI) were calculated using the Wilson method.

To quantify the intervention effect, we calculated the relative risk (RR) with 95% confidence intervals (95% CI), the odds ratio (OR) with 95% CI, the absolute risk reduction (ARR), and the number needed to treat (NNT - the number of patients who need to be treated using the developed technique instead of the conventional approach to achieve one additional successful outcome). Differences were considered statistically significant at $p < 0.05$.

Ethical considerations:

The study was conducted in accordance with the Declaration of Helsinki (2013) and the current regulations of the Ministry of Health of the Republic of Uzbekistan. The study protocol was approved by the Local Ethics Committee of Samarkand State Medical University (Protocol No. 1 dated 12 September 2022). Analyses were performed using anonymized medical record data.

Results.

Cohort characteristics and baseline comparability:

Baseline characteristics of the enrolled children are summarized in Table 1. Alkali exposure predominated, accounting for 92 cases (62.2%), whereas acid burns were recorded in 48 patients (32.4%); in 8 cases (5.4%), the causative agent was not specified. The median time from injury to admission was 2.0 [1.0-4.0] days.

Regarding baseline dysphagia severity (0-3 scale), grade 2 dysphagia was most common (69 cases, 46.6%), followed by grade 3 (57 children, 38.5%) and grade 1 (22 children, 14.9%). The most frequent location of cicatricial esophageal stricture was the middle third of the esophagus (66 cases, 44.6%); strictures were less commonly located in the upper (45, 30.4%) and lower (37, 25.0%) thirds. In terms of stricture length, 2-5 cm strictures predominated (79, 53.4%), whereas strictures <2 cm were identified in 31 children (20.9%) and strictures >5 cm in 38 (25.7%).

Characteristics of interventions and treatment process:

The characteristics of interventions and key treatment-process parameters in the compared groups are presented in Table 2.

In the intervention group (endoscopically guided dilation, n = 102), treatment was initiated early after hospitalization: the median time from admission to the first procedure was 2.0 [1.0-3.0] days, and the median time from the burn event was 4.0 [2.0-7.0] days. The number of endoscopically guided dilation sessions per patient was 4.0 [3.0-6.0]. The maximum achieved bougie diameter (when documented in procedural records) was 30 [27-33] Fr, corresponding to 10.0 [9.0-11.0] mm. Additional instrumental assessment (repeat esophagoscopy and/or contrast esophagography) was required in 28 children (27.5%; 95% CI 19.7-36.8).

In the control group (conventional management, n = 46), the number of blind bougienage sessions per patient was 6.0 [4.0-8.0], which was significantly higher than in the intervention group ($p < 0.001$). Additional instrumental assessment was required in 19 patients (41.3%; 95% CI 28.3-55.7). Gastrostomy was performed in 25 children (54.3%; 95% CI 40.2-67.9). Among those who underwent gastrostomy, the median time from admission to gastrostomy placement was 3.0 [2.0-5.0] days. The duration of staged bougienage (when documented and when stepwise treatment was required) was 28 [21-42] days.

Clinical success of dilation was defined as restoration of esophageal patency sufficient to allow oral feeding (per os) without the need for gastrostomy during the inpatient stage.

Table 1. *Baseline clinical, anamnestic, and morphological characteristics of children with post-burn cicatricial esophageal strictures (n = 148).*

Variable	Intervention group (n = 102)	Control group (n = 46)	p
Age, years (M ± SD)	10.7 ± 2.3	10.4 ± 2.5	0.48*
Boys, n (%) [95% CI]	60 (58.8) [48.6-68.4]	26 (56.5) [41.1-71.1]	0.79**
Girls, n (%) [95% CI]	42 (41.2) [31.6-51.4]	20 (43.5) [28.9-58.9]	0.79**
Caustic agent, n (%)	-	-	0.87**
- Alkali	63 (61.8)	29 (63.0)	
- Acid	34 (33.3)	14 (30.4)	
- Not specified	5 (4.9)	3 (6.5)	
Time to admission, days, median [IQR]	2.0 [1.0-4.0]	2.0 [1.0-5.0]	0.61***
Dysphagia grade (1-3), n (%)	-	-	0.56**
- Grade 1	14 (13.7)	8 (17.4)	
- Grade 2	50 (49.0)	19 (41.3)	
- Grade 3	38 (37.3)	19 (41.3)	
Stricture location, n (%)	-	-	0.84**
- Upper third	32 (31.4)	13 (28.3)	
- Middle third	44 (43.1)	22 (47.8)	
- Lower third	26 (25.5)	11 (23.9)	
Stricture length, n (%)	-	-	0.73**
- <2 cm	22 (21.6)	9 (19.6)	
- 2-5 cm	53 (52.0)	26 (56.5)	
- >5 cm	27 (26.5)	11 (23.9)	

Notes: ** independent-samples t test; ** chi-square test; *** Mann-Whitney U test. 95% confidence intervals (95% CI) for proportions were calculated using the Wilson method.*

Table 2. *Characteristics of interventions and the treatment process in the intervention and control groups.*

Variable	Intervention group (n = 102)	Control group (n = 46)	p
Time from admission to first procedure, days, median [IQR]	2.0 [1.0-3.0]	2.0 [1.0-4.0]	0.18*
Time from burn to first procedure, days, median [IQR]	4.0 [2.0-7.0]	5.0 [3.0-8.0]	0.22*
Procedures per patient, median [IQR]	4.0 [3.0-6.0]	6.0 [4.0-8.0]	<0.001*
Maximum diameter, Fr, median [IQR]	30 [27-33]	27 [24-30]	0.003*
Maximum diameter, mm, median [IQR]	10.0 [9.0-11.0]	9.0 [8.0-10.0]	0.003*
Additional assessment (repeat endoscopy and/or contrast study), n (%) [95% CI]	28 (27.5) [19.7-36.8]	19 (41.3) [28.3-55.7]	0.10**
Gastrostomy, n (%) [95% CI]	8 (7.8) [4.0-14.7]	25 (54.3) [40.2-67.9]	<0.001**
Time to gastrostomy after admission, days, Me [IQR] (among patients with gastrostomy)	2.0 [1.0-3.0]	3.0 [2.0-5.0]	0.04*
Duration of staged bougienage, days, Me [IQR] (when staged treatment was applied)	14 [10-21]	28 [21-42]	<0.001*

Notes: ** Mann-Whitney U test; ** chi-square test. 95% confidence intervals (95% CI) for proportions were calculated using the Wilson method.*

Table 3. *Clinical success of dilation in the intervention and control groups.*

Variable	Intervention group (n = 102)	Control group (n = 46)	Effect estimates / p
Clinically successful dilation, n (%)	94 (92.2)	21 (45.7)	RR = 2.02 (95% CI 1.47-2.78); OR = 13.99 (95% CI 5.54-35.32); p < 0.001
95% CI for the proportion of successful outcomes	85.3-96.0	32.2-59.8	ARR = 46.5%; NNT =3

Notes: *95% confidence intervals (95% CI) for proportions were calculated using the Wilson method. ARR - absolute risk reduction; NNT - number needed to treat.*

Table 4. *Comparative analysis of secondary treatment outcomes (gastrostomy rate, length of hospital stay, and complications) by treatment strategy.*

Variable	Intervention group (n = 102)	Control group (n = 46)	Effect (RR, OR)	p
Gastrostomy, n (%) [95% CI]	8 (7.8) [4.0-14.7]	25 (54.3) [40.2-67.9]	RR 0.14 (0.07-0.30); OR 0.07 (0.03-0.18)	<0.001
Length of hospital stay, days, median [IQR]	12 [9-16]	19 [14-25]	-	<0.001
Complications (any), n (%) [95% CI]	6 (5.9) [2.7-12.2]	8 (17.4) [9.1-30.7]	RR 0.34 (0.12-0.92); OR 0.30 (0.10-0.91)	0.036
Perforation, n (%)	1 (1.0)	3 (6.5)	-	0.08
Bleeding, n (%)	2 (2.0)	2 (4.3)	-	0.59
Infectious complications, n (%)	3 (2.9)	3 (6.5)	-	0.36

Notes: *95% confidence intervals (95% CI) for proportions were calculated using the Wilson method. RR and OR were calculated from a 2 × 2 contingency table. Categorical outcomes were compared using Fisher's exact test; length of hospital stay was compared using the Mann-Whitney U test.*

Thus, the primary endpoint specifically reflected a short-term in-hospital outcome rather than the long-term durability of the effect.

Clinical success of dilation.

Short-term clinical success was defined as restoration of esophageal patency sufficient to allow oral feeding without the need for gastrostomy during the inpatient stage. A successful outcome was achieved in 94 of 102 patients in the intervention group (92.2%; 95% CI 85.3-96.0) and in 21 of 46 patients in the control group (45.7%; 95% CI 32.2-59.8).

Comparative analysis demonstrated a statistically significant advantage of the developed strategy over conventional treatment: RR 2.02 (95% CI 1.47-2.78), OR 13.99 (95% CI 5.54-35.32), p < 0.001. The absolute risk reduction (ARR) was 46.5%, corresponding to an NNT of 3. In other words, treating 3 patients with the developed technique instead of the conventional approach yields one additional clinically successful outcome.

Data on clinical success are presented in Table 3. In the intervention group, the rate of successful short-term restoration of esophageal patency with the ability to feed orally without gastrostomy during the inpatient stage was substantially higher than in the control group (92.2% vs 45.7%). The estimated effect measures (RR, OR, ARR, NNT) indicate a marked clinical benefit of endoscopically guided, guidewire-assisted bougienage.

Secondary treatment outcomes.

According to the comparative analysis (Table 4), the need for gastrostomy occurred significantly less often in patients of the main group than in the control group: 8 of 102 (7.8%; 95% CI 4.0-14.7) versus 25 of 46 (54.3%; 95% CI 40.2-67.9). The differences were statistically significant and were associated with a marked risk reduction with the use of the proposed treatment strategy (RR 0.14; 95% CI 0.07-0.30; OR 0.07; 95% CI 0.03-0.18; p < 0.001). The duration of hospitalization was also shorter in the main group: the median was 12 [9-16] days versus 19 [14-25] days in the control group (p < 0.001). The overall complication rate was lower in patients who underwent endoscopically guided dilation: 6 of 102 (5.9%; 95% CI 2.7-12.2) compared with 8 of 46 (17.4%; 95% CI 9.1-30.7) in the conventional treatment group. In the present analysis, infectious complications were defined as clinically documented in-hospital infectious events requiring treatment. The differences reached statistical significance (RR 0.34; 95% CI 0.12-0.92; OR 0.30; 95% CI 0.10-0.91; p = 0.036).

Within the complication profile, perforation remained the most clinically relevant event (1.0% in the intervention group and 6.5% in the control group). However, no statistically significant differences were observed for individual complication types ($p > 0.05$), likely due to the small number of recorded events.

Exploratory subgroup analysis of clinical success of dilation.

According to an exploratory subgroup analysis, the advantage of endoscopically guided dilation was maintained across the main clinically relevant subgroups (Table 5).

By type of caustic agent:

In children with alkali burns, clinical success of dilation in the intervention group was 58/63 (92.1%) versus 13/29 (44.8%) in the control group ($p < 0.001$). A similar pattern was observed for acid burns: a successful outcome was recorded in 32/34 (94.1%) patients in the intervention group and in 7/14 (50.0%) patients in the control group ($p = 0.003$).

By baseline dysphagia severity:

The advantage of the developed strategy was maintained in patients with both grade 2 and grade 3 dysphagia; however, the absolute difference in successful outcomes was more pronounced in those with more severe baseline dysphagia

For grade 2 dysphagia, clinical success was achieved in 47/50 (94.0%) children in the intervention group and in 10/19 (52.6%) children in the control group ($p = 0.001$). For grade 3 dysphagia, dilation success was 34/38 (89.5%) in the intervention group versus 7/19 (36.8%) in the control group ($p < 0.001$).

The marked imbalance in group size (102 patients in the main group and 46 in the control group) is most likely explained by the retrospective study design with a historical control, the longer accrual period for the intervention cohort (2019-2023 vs 2015-2018), and the gradual incorporation of the new technique into routine clinical practice. After the center transitioned to endoscopically guided bougienage over a guidewire, an increasing number of children were treated with this approach, whereas the number of patients managed exclusively with the conventional strategy naturally declined. At the same time, this design feature does not exclude the influence of calendar-time confounders, including possible changes in intensive care, antibiotic therapy, nutritional support, and endoscopic management, which should be taken into account when interpreting the results.

Thus, the use of endoscopically guided, guidewire-assisted esophageal bougienage in children with cicatricial strictures after grade III caustic esophageal burns was associated with higher clinical dilation success, a lower need for gastrostomy, shorter hospital stay, and a reduced overall complication rate compared with conventional management.

Table 5. *Exploratory subgroup analysis of clinical dilation success by caustic agent type and baseline dysphagia severity.*

Subgroup	Intervention group, n/N (%)	Control group, n/N (%)	RR (95% CI)	p
Caustic agent type				
Alkali	58/63 (92.1)	13/29 (44.8)	2.06 (1.36-3.13)	<0.001
Acid	32/34 (94.1)	7/14 (50.0)	1.88 (1.08-3.28)	0.003
Baseline dysphagia				
Grade 2	47/50 (94.0)	10/19 (52.6)	1.79 (1.17-2.75)	0.001
Grade 3	34/38 (89.5)	7/19 (36.8)	2.43 (1.30-4.55)	<0,001

Notes: *RR - relative risk; 95% confidence interval (95% CI). p values were obtained using Fisher's exact test. Subgroup analyses are exploratory.*

Discussion.

The present findings indicate that endoscopically guided, guidewire-assisted bougienage in children with cicatricial strictures following grade III caustic esophageal burns is associated with substantially higher short-term clinical success than the traditional approach. The primary endpoint (oral feeding without gastrostomy during the inpatient stage) was achieved in 92.2% of patients in the intervention group versus 45.7% in the control group, corresponding to a twofold higher probability of a successful outcome (RR 2.02) and a marked difference in the odds of achieving the effect (OR 13.99). The clinical relevance of this effect is further supported by an ARR of 46.5% and an NNT of 3, meaning that treating three patients with the developed technique instead of conventional management yields one additional successful outcome. Importantly, this outcome should be interpreted strictly as an in-hospital indicator and not as proof of durable long-term stricture resolution after discharge.

A plausible explanation for this advantage is the greater controllability of the procedure afforded by guidewire assistance and endoscopic visualization. Unlike blind bougienage, the endoscopically guided technique enables more precise traversal of the stenotic segment, reduces the risk of creating a false passage, and minimizes trauma to the esophageal wall, particularly in severe and long-segment cicatricial changes. In addition, stepwise bougie upsizing over the guidewire makes dilation more predictable and technically reproducible.

A key practical benefit was the significant reduction in gastrostomy use in the intervention group (7.8% vs 54.3%). Clinically, this is highly relevant because gastrostomy in children with post-burn esophageal strictures is associated not only with additional surgical burden but also with prolonged staged treatment, more complex nutritional support, and increased caregiving requirements. The reduced need for gastrostomy, together with the high rate of restored oral feeding, indicates a meaningful improvement in immediate treatment outcomes and represents a strong argument for implementing the developed strategy in routine practice; however, it cannot by itself establish a lower long-term restenosis risk.

Another important finding was the shorter length of hospital stay (median 12 [9-16] days vs 19 [14-25] days). This effect likely reflects multiple mechanisms, including faster restoration of esophageal patency, fewer surgical procedures (gastrostomy), reduced need for prolonged staged bougienage, and a more favourable post-procedural course. From a health-system perspective, these improvements may translate into reduced inpatient bed utilization and lower treatment-related costs in this patient population. The lower overall complication rate (5.9% vs 17.4%) further supports the safety profile of endoscopically guided, guidewire-assisted dilation. Although differences in individual complication types (perforation, bleeding, infectious events) did not reach statistical significance, the direction of effect consistently favored the intervention group. The absence

of statistically significant differences for specific complications is likely explained by the small number of events, limiting statistical power for rare outcomes.

The subgroup analyses are also clinically informative. The advantage of the developed strategy persisted in both alkali and acid injuries and across different baseline dysphagia severities. This suggests that the method's effectiveness is not confined to a narrow patient subset and may be applicable across a broad range of clinical scenarios. However, because the subgroup analyses were exploratory, these findings should be interpreted cautiously.

Overall, the presented data align well with the rationale of contemporary approaches to benign esophageal stricture management, which prioritize controlled dilation techniques to minimize tissue trauma and enhance procedural safety. This is particularly important in pediatric practice given the smaller luminal diameter, the risk of rapid nutritional deterioration, and the high vulnerability to complications from invasive interventions.

Study Limitation.

The present study has several limitations that should be taken into account when interpreting the findings. First, the retrospective single-center design with a historical control is inherently associated with a potential risk of selection bias and the influence of temporal changes in treatment organization. Second, some treatment-related parameters and stricture characteristics were assessed from medical records, which may have resulted in incomplete capture of certain variables. Third, the analysis of complications by individual event type was limited by the small number of observations, thereby reducing the statistical power of the corresponding comparisons. Fourth, the subgroup analysis was exploratory in nature and should therefore be interpreted with caution. Fifth, even with formalized criteria for gastrostomy, it is not possible to completely exclude temporal changes in the institutional threshold for deciding on gastrostomy placement. Finally, the study focused on in-hospital outcomes and did not include a standardized long-term assessment of stricture recurrence, the need for repeated dilation courses, functional quality of life, or outcomes at 6-12 months and beyond. Accordingly, the outcome termed clinical success in this manuscript should be interpreted only as an exceedingly short-term inpatient indicator.

Practical recommendations and future directions:

1. In children with post-burn cicatricial esophageal strictures after grade III caustic burns, endoscopically guided, guidewire-assisted bougienage should be considered the preferred dilation method when technically feasible and performed by trained personnel.

2. Prior to dilation, endoscopic assessment of the injury site and cicatricial changes is recommended to clarify stricture characteristics, plan safe traversal of the narrowed segment, and select the initial bougie diameter.

3. Dilation should be performed in a stepwise manner, with individualized selection of upsizing increments and session frequency based on stenosis severity, clinical symptoms (including dysphagia grade), and procedural tolerance.

4. After each session, clinical monitoring is required (dysphagia dynamics, pain, and signs of complications); additional endoscopic and/or radiographic assessment is recommended when clinically indicated.

5. If safe passage across the stricture is not feasible, in the presence of significant nutritional compromise, or when staged dilation fails, gastrostomy should be considered in a timely manner as part of the treatment strategy to avoid delaying nutritional support.

6. To improve comparability of outcomes, medical documentation should be standardized with mandatory recording of stricture location and length, number of dilation sessions, achieved dilation diameter, complications, and clinical outcomes.

A promising direction is the implementation of prospective monitoring with assessment of long-term outcomes, including stricture recurrence, the need for repeat dilation procedures, nutritional status, and quality of life.

Conclusion.

These findings support the broader use of endoscopically guided technologies in the management of this patient population; however, they do not eliminate the need for further prospective multicenter studies with 6-12-month and longer follow-up to evaluate the long-term effectiveness of the method.

Conflict of interest.

The authors declare no conflict of interest.

REFERENCES

1. Ateş U, Göllü G, Ergün E, et al. Corrosive Substance Ingestion: When to Perform Endoscopy? J. Paediatr. Child Health. 2025;61:967-973.

2. Ben Youssef S, Messaoud M, Samia B, et al. Outcomes of pneumatic dilation in pediatric caustic esophageal strictures: a descriptive and analytic study from a developing country. Surg. Endosc. 2023;37:9291-9298.

3. Di Nardo G, Betalli P, Illiceto M.T, et al. Caustic Ingestion in Children: 1 Year Experience in 3 Italian Referral Centers. J. Pediatr. Gastroenterol. Nutr. 2020;71:19-22.

4. Irlayıcı F.I, Elmas A, Akcam M. Corrosive substance ingestion in children: clinical features, management and outcomes in a tertiary care setting. Eur. J. Pediatr. 2025;184:549.

5. Oprita B, Diaconu A.E, Dinu B, et al. Post-Caustic Esophagitis: Updated Clinical Insights and Practical Lessons from Case Illustrations. J. Clin. Med. 2025;14:23.

6. Radhakrishna V, Kumar N, Gadgade B.D, et al. Sequelae of Corrosive Injury in Children: An Observational Study. J. Indian Assoc. Pediatr. Surg. 2022;27:435-440.

7. Rashid R, Arfin S, Rukunuzzaman, et al. Retrospective analysis of endoscopic dilatation for pediatric patients with esophageal stricture: Bangladesh perspective. Gastroenterology and Functional Medicine. 2023;1.

8. Sarma M.S, Tripathi P.R, Arora S. Corrosive upper gastrointestinal strictures in children: Difficulties and dilemmas. World J. Clin. Pediatr. 2021;10:124-136.

9. Sengul O.K, Cicek M, Sayar E, et al. Caustic Ingestion in the Paediatric Age: Single Centre Experience. HK J. Paediatr. (New Series). 2024;29:225-229.

10. Shah J, Jena A, Shweta S, et al. Corrosive induced esophageal and gastric injury: Histopathological evaluation of surgically resected specimens over a decade in a tertiary care center. Indian J. Pathol. Microbiol. 2024;67:379-384.

11. Sutherland J, Bowen L. Ingestion of foreign bodies and caustic substances in children. BJA Educ. 2023;23:2-7.