

## COMPARATIVE ASSESSMENT OF RISK-BENEFIT RATIO OF USE OF SILICONE BOUGIE VERSUS ALTERNATIVE METHODS IN POSTOPERATIVE MANAGEMENT OF ESOPHAGEAL ATRESIA

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Esophageal atresia is one of the most common congenital pathologies. More specifically, the survival rate in developed countries is 90%, while in developing ones it varies between 50-80%. Such a low survival rate in less developed countries is due to infection, poor postoperative care, lack of surgical experience and a longer postoperative control of the patients.

There are five types of congenital esophageal pathologies with or without fistula: esophageal atresia with distal tracheoesophageal fistula, esophageal atresia without fistula, esophageal atresia with proximal fistula, esophageal atresia with proximal and distal fistula, tracheoesophageal fistula (H-type) without atresia.

Incidence of esophageal atresia occurs in approximately 1:5000 live births.

Flexible silicone bougie is used for esophageal dilation, as a post-operative care procedure in treatment of esophageal atresia, as a preventive measure against development of strictures. The procedure is known as being highly uncomfortable for patients and parents alike, as well as carrying a high risk of damaging or perforating the esophagus, and causing bleeding from the stricture area. Its successful performance and mitigation of the risks depend on surgical technique, use of postoperative H2 blockers and postoperative care of the esophageal anastomosis.

**Material and methods.** We performed a retrospective study of neonatal patients who were diagnosed and treated for esophageal atresia with or without fistula.

Research was conducted on 28 patients: 12 male and 16 female with the following confirmed diagnoses: esophageal atresia with distal tracheoesophageal fistula – 20 patients, esophageal atresia without fistula (Long-Gap) – 2 patients, esophageal atresia with proximal fistula – 3 patients, esophageal atresia with H-type – 1 patient, esophageal congenital stenosis without fistula or esophageal atresia – 1 patient, and esophageal atresia with distal and proximal tracheoesophageal fistula – 1 patient.

All cases were managed at our clinic from May, 2017 to September, 2020 and were retrospectively analyzed taking into consideration gestation age, birth weight, accompanying anomalies, preoperative preparation, intraoperative technique and postoperative period, use of Bougie in postoperative period, endoscopic balloon dilatation and nutrition type.

**Results and discussion:** Several factors determined the best outcome among patients with esophageal atresia:

1. Non-existence of accompanying pathologies.
2. Adequate pre-operative preparation.
3. Intraoperative intervention by a surgeon.
4. Rational post-operative management.

The strict observance of all above-mentioned conditions without exclusion ensure a positive treatment outcome for the patients.

Application of esophageal Bougie serves as one of the integral components of managing the post operational period, and was performed in all patients with the view of preventing the so-called esophageal stricture within esophageal anastomosis. The first Bougie application was performed on the 14<sup>th</sup> day after the surgery, subsequently repeated in time periods determined by the general condition of the patient, up to the age of 1 y.o. The silicone bougie enabled us to avoid formation of the esopha-

geal stricture. However, the close consideration was given to the beneficial and adverse effects of the procedure while managing the post-operative period in newborns treated for the esophageal atresia. Namely, possible complications caused by conducting it: perforation of the esophagus, esophageal stricture and bleeding in other locations due to mechanical irritation, the stressful condition for the patient and parents. Use of bougie in the adult patients creates complications due to the developments in the oral cavity (teeth), and thus is not recommended without the mouth opening instrument, due to several anatomical, physiological and stress related reasons, since there is a high risk of developing the perforation of the stricture of the esophagus and/or another part of the esophagus, after improperly carrying out the procedure. This is determined by the peculiarity of enlarging the bougie, characteristics of its structure, which serves as the most significant challenge with the patient. It should be mentioned that, in case of the perforation of the esophagus, it's essential to manage the patient in the intensive care setting, which further creates challenges in terms of the positive outcome of the general condition of newborns. The risk of developing the internal hospital infections grows, it becomes necessary to insert the nasogastric tube, which should be carried out with control so that additional injury of the esophagus does not occur.

Inhibitors of H2 receptors should be administered with the view of lowering the acidity in the stomach. It is necessary to place the patient on parenteral feeding (NPO), which continues for 5-7 days (7 days in majority of cases).

Contrast imaging of the esophagus on day 7 after perforation, must be performed for full assessment. If there is no leak of the contrast substance determined, the decision will be made regarding starting an intake of food and liquid.

The aim of our research was to focus on negative aspects of the use of silicone bougie: esophageal bleeding, perforation, irritation of the esophageal anastomosis site, psychological stress of patients and their parents.

Therefore, it is extremely important to provide adequate complex post-operative management of esophageal atresia, which serves as the significant cornerstone for achieving the maximum outcome in terms of treatment and reliable functionality.

28 cases of newborns treated for esophageal atresia were studied through retrospective research. All newborns were investigated according to the protocol defined in a pre-operative manner. Intra-operative details were taken into consideration to creating esophageal anastomosis, which serves as the essential pre-condition in the postoperative management period of the esophageal atresia so that the needed for use of silicone bougie is avoided as much as possible.

Esophageal dilation with bougie has not been performed in these 28 cases. Four patients had a lethal outcome during the first three month after the surgery with the cause of death being several concomitant pathologies such as duodenal atresia, small bowel atresia, anorectal malformations, cardio-vascular anomalies, infection.

The weight of patients under investigation varied between 900-3700 grams, while the gestational age was 31-40 weeks.

Contrast investigation of the esophagus was carried out at the post-operative periods of 7<sup>th</sup> and 14<sup>th</sup> day after the surgery, at the ages of one month, three months, six months, one year, and then annually until the age of five. Research results in the process of investigation were analyzed by surgeon and radiologist, after which decisions were made whether to conduct further steps of investigations, such as:

1. Esophagoscopy – with the aim of ruling out esophageal reflux, as well as the cardia closure and assessing esophagitis.
2. Fibro-bronchoscopy – to rule out the recurrence of tracheo-esophageal fistula.

Based on the contrast imaging results, 14 children were suspected of esophageal stricture. In 10 patients the condition has significantly improved within one month after the surgery. In the remaining 4 patients it improved within three months after the surgery. At the age of one year after the surgery, there were no signs of stricture revealed by the contrast investigation of the esophagus. As a result of contrast investigation, the esophagus was presented within the x-ray boundaries, the diameter of the esophagus corresponded with age norms. The existing contrast was moving freely without delay.

It is noteworthy that by comparison to esophagoscopy, the contrast investigation of the esophagus is more beneficial, in terms of avoiding such complications as mechanical irritation and injury to the esophagus, and mitigating risks of perforation and bleeding from esophagus, especially in presence of reflux esophagitis, which is a frequent adverse effect of dilation with use of bougie. In addition, with improper use and irritation caused by the silicone bougie there are risks of injury to other areas of esophagus, developing esophageal diverticulum, oral cavity irritation, damaging the epiglottis, vocal cords and larynx. Irritation by silicone bougie may result the esophageal stricture.

In the authors' opinion, in comparison to the use of bougie, the contrast imaging of the esophagus has more beneficial aspects. It is by far less stressful and uncomfortable for all involved – the patient, parent and the physician. The risks of the esophagus perforation, injury to the esophagus, its mechanical irritation are kept to the minimum. The procedure enables to simply assess the entire esophagus and its passability. It is carried out by a surgeon at the radiology suite setting. The patient does not require sedation or anesthesia. The patient is placed on the 30-45 degrees inclined fluoroscopy table, in the Trendelenburg supine position. Fluoroscope enables to visualize thoracic cavity on the screen. 5 ml of the contrast Gastrografin is given to the patient orally. The contrast passes the esophagus, the site of the esophageal anastomosis. The entire esophagus, including the anastomosis site can be easily observed.

Only one patient treated for esophageal atresia has developed the esophageal stricture. The patient was born on the 32<sup>nd</sup> gestation week with the weight of 1100 grams. Endoscopic esophageal balloon dilation was performed. After having had recovered from esophageal atresia, the patient underwent the Nissen fundoplication procedure and 17 balloon dilations. Endoscopic balloon dilations were repeated in maximum 1-month periods.

One patient presented with 7 cm gap between the proximal and distal parts of the esophagus. Foker process was applied to stretch the esophagus, with subsequent creation of esophageal anastomosis. Alternatively, endoscopic balloon dilation was needed due to the developed stricture, resulted in by ischemia.

Based on the results obtained by the conducted study, the use of bougie for post-operative management of esophageal atresia has been reconsidered as a procedure of choice, and since, has been completely revoked at our clinic.

Contrast research control proved to be sufficient in the post-operative period to assess the esophagus stricture control. Esophagoscopy was needed with one patient to determine the need for Nissen fundoplication, for visualization of the existing stricture and endoscopic esophageal balloon dilation.

We present that taking into consideration our study outcomes, it can be concluded that in patients with esophageal atresia, namely, during the post-operative management, the use of esophageal bougie is not an essential. However, this does not rule out the possibility of using the silicone bougie, as the supplementary means during the other conditions, such as strictures developed due to burns of the esophagus as well as tumor processes of the esophagus, etc...

Based on all of the above, the contrast imaging of the esophagus in the process of the management and observation of the patient's recovery is valuable and safe method, and mitigates the risk of stricture development. It is less invasive and more comfortable for the patients treated for esophageal atresia with the view of achieving the sound and reliable outcomes.

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## SUMMARY

### COMPARATIVE ASSESSMENT OF RISK-BENEFIT RATIO OF USE OF SILICONE BOUGIE VERSUS ALTERNATIVE METHODS IN POSTOPERATIVE MANAGEMENT OF ESOPHAGEAL ATRESIA

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The aim of the present research is to assess the beneficial and adverse effects of silicone bougie use in comparison to alternative methods of post-operative management of esophageal atresia.

The study was carried on 28 patients treated at our healthcare institution for esophageal atresia during the period from May, 2017 to September, 2020. As an alternative to the use of esophageal bougie these patients were managed postoperatively, by utilizing the contrast imaging of the esophagus on the 7<sup>th</sup> and 14<sup>th</sup> days after surgery, and at the age of 1, 3, 6 months and one year. Unless the esophageal stricture has developed, the procedures are repeated annually until the age of 5.

The aim of utilizing the contrast imaging technique is to prevent the stricture of the esophagus and recurrence of trachea esophageal fistula.

**Keywords:** esophageal atresia with or without fistula, esophageal bouging, esophageal balloon dilatation, esophageal contrast imaging, tracheoesophageal fistula, silicon bougie.

## РЕЗЮМЕ

### СРАВНИТЕЛЬНАЯ ОЦЕНКА "ПОЛЬЗА-РИСК" БУЖИРОВАНИЯ И ДРУГИХ МЕТОДОВ ПОСЛЕОПЕРАЦИОННОГО ЛЕЧЕНИЯ ПАЦИЕНТОВ С АТРЕЗИЕЙ ПИЩЕВОДА

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Целью настоящего исследования явилась оценка положительных и отрицательных эффектов использования силиконовых бужей в сравнении с альтернативными методами послеоперационного лечения атрезии пищевода.

Исследование проводилось на 28 пациентах, пролеченных в нашем лечебном учреждении по поводу атрезии пищевода в период с мая 2017 года по сентябрь 2020 года. В качестве альтернативы использовано пищеводного бужа эти пациенты получали лечение в послеоперационном периоде с использованием контрастной визуализации пищевода на 7-е и 14-е сутки после операции и в возрасте 1, 3, 6 мес и 1 год. В случае, если не разовьется стриктура пищевода процедуры повторяли ежегодно до 5 лет.

Принимая во внимание результаты проведенного исследования, следует заключить, что у пациентов с атрезией пищевода в послеоперационном периоде использование бужа пищевода не является необходимым.

Исходя из вышеизложенного, контрастная визуализация пищевода в процессе лечения и наблюдения за выздоровлением пациента является эффективным и безопасным методом, снижающим риск развития стриктуры. Он менее инвазивен и более удобен для пациентов, пролеченных по поводу атрезии пищевода, с целью достижения надежных результатов.

## რეზიუმე

სილიკონის ბუჯის მნიშვნელობა საყლაპავის ატრეზიის პოსტოპერაციული პერიოდის მართვაში

ზ.ძიძავა, მ.გიორგობიანი, ი.წულეისკირი,  
ბ.ზენაიშვილი, ე.მოსიძე

*პედიატრიული პრივატ კლინიკა, თბილისი, საქართველო*

კვლევის მიზანს წარმოადგენს სილიკონის ბუჯის გამოყენების დადებითი და უარყოფითი ასპექტების შედარება საყლაპავის ატრეზიის პოსტოპერაციული მკურნალობის სხვა ალტერნატიულ მეთოდთან მიმართებაში.

კვლევა ჩატარდა 28 პაციენტზე, რომლებიც მკურნალობდნენ ჩვენს კლინიკაში საყლაპავის ატრეზიით 2017 წლის მაისიდან -2020 წლის სექტემბრამდე. საყლაპავის კონტრასტული გამოკვლევა ამ

პაციენტებს ჩაუტარდა პოსტოპერაციულ პერიოდში მე-7, მე-14 დღეს, 1, 3, 6 თვის და 1 წლის ასაკში. პაციენტებს, რომლებსაც არ განუვითარდათ საყლაპავის სტრიქტურა პროცედურები ჩაუტარდა წელიწადში ერთხელ 5 წლის ასაკამდე.

არსებული კვლევის შედეგების გათვალისწინებით, შესაძლებელია დავასკვნათ, რომ პოსტოპერაციულ პერიოდში საყლაპავის ატრეზიის მქონე პაციენტებში საყლაპავის ბუჯის გამოყენება არ წარმოადგენს აუცილებელ პირობას, თუმცა, ეს არ გამორიცხავს სილიკონის ბუჯის დამატებით გამოყენების შესაძ-

ლებლობას, ისეთი პათოლოგიების დროს, როგორცაა საყლაპავის დამწვრობის შედეგად გამოწვეული სტრიქტურა, ასევე საყლაპავის სიმსივნური პროცესები.

ზემოაღნიშნულიდან გამომდინარე, საყლაპავის ატრეზიის მქონე პაციენტების პოსტოპერაციული მეთვალყურეობის დროს, საყლაპავის კონტრასტული გამოკვლევა ეფექტური და უსაფრთხო მეთოდია, რომელიც საყლაპავის ბუჯირებისგან განსხვავებით, ამცირებს საყლაპავის სტრიქტურის განვითარების რისკს და ზრდის დაავადების კეთილსაიმედო გამოსავალს.

## ЭНДОСКОПИЧЕСКИЙ НЕВРОЛИЗ ПЛЕЧЕВОГО СПЛЕТЕНИЯ У ПАЦИЕНТА С ПОВРЕЖДЕНИЕМ ВРАЩАТЕЛЬНОЙ МАНЖЕТЫ ПЛЕЧА И ПОСТТРАВМАТИЧЕСКОЙ ПЛЕКСОПАТИЕЙ (СЛУЧАЙ ИЗ ПРАКТИКИ)

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Плечевое сплетение формируется передними ветвями 4 нижних шейных и 1 грудного спинномозговых нервов (C5–C8, Th1). Повреждения плечевого сплетения – частая проблема, особенно после высокоэнергетических травм (экстремальные виды спорта, вождение мотоцикла), что нередко сопровождается вывихом головки плечевой кости и сопутствующим повреждением в плечевом суставе [1,2]. В последнее время наметился рост подобных повреждений. [3,4] Существуют различные классификации повреждения плечевого сплетения, самой полной и широко применяемой является классификация R.D. Leffert, учитывающая механизм и уровень повреждения, и согласно которой выделяют открытые, закрытые, надключичные и подключичные повреждения. [5]. В зависимости от клинических проявлений тяжелые повреждения плечевого сплетения делят на 2 группы: верхний паралич (Дюшена–Эрба) и нижний паралич (Дежерин–Клюмпке). Легкие повреждения проявляют себя в виде болевого синдрома, онемения, слабости в области руки. Консервативное лечение включает в себя медикаментозную терапию, ЛФК, физиотерапию, кинезиотерапию, электромиостимуляцию. Открытое хирургическое лечение включает в себя невролиз, шов нервов «конец-в-конец», перемещение нервов [6,7]. Альтернативой открытому невролизу являются миниинвазивные технологии [8,9]. Разработка техники эндоскопического невролиза, совместно с выполнением артроскопии плечевого сустава и устранением внутрисуставной патологии, позволит ускорить и минимизировать объем вмешательства и уменьшить вероятность развития послеоперационного фиброза. Эндоскопическая техника и дополнительная гидропрепаровка тканей, за счёт которой создаётся рабочее пространство для манипуляций, позволяют проводить операцию в более щадящем режиме. Огromным преимуществом является также качественное и четкое, даже при большом увеличении, изображение (вплоть до васкуляризации фасцикул), которое создаётся за счёт современных оптических систем. Выше-

изложенное, являя научной новизной, послужило причиной проведения данного исследования.

*Случай из практики.* Пациент 3., 60 лет, мужчина, получил травму в результате падения на левую руку, при этом не произошло перелома плечевой кости и вывиха головки плеча. После травмы появился болевой синдром в области плеча и верхней конечности. Затем пациент отметил появление онемения, болевого синдрома в области плечевого сустава и постепенное прогрессирование слабости в кисти. Обращался за помощью к специалистам разного профиля: терапевт, невролог, травматолог-ортопед. Проходил курсы комплексного консервативного лечения, однако без эффекта. Спустя 10 мес. после травмы обратился в Городскую клиническую больницу им. Буянова В.М. за помощью. Клинически выявлена гипотрофия мышц в области левой верхней конечности и левого плечевого сустава (Рис. 1).

Пациент предъявлял жалобы на боль в области левого плечевого сустава и, в меньшей степени, в области левой верхней конечности, на гипестезию в области левой кисти. Он отмечал «болезненную дугу» отведения, Jobe-test был положительным. Активный объем движений: сгибание 160°, отведение 100°, наружная ротация 30°, внутренняя ротация – до уровня ягодицы. Пассивный объем движений – полный. По шкале ВАШ (визуальная аналоговая шкала) интенсивность болевого синдрома у пациента оценена в 9 баллов. Степень пареза в левой верхней конечности оценена в 3 балла по шкале Brad-dora. Нейропатический характер боли подтверждён шкалой PainDetect, составил 30 баллов. Пациент обследован: МРТ плечевого сустава, выявило признаки теносиновита сухожилия длинной головки бицепса, отрыв сухожилия надостной мышцы; МРТ шейного отдела позвоночника патологии не выявило; стимуляционная электронейромиография нервов левой верхней конечности показала первично-аксональное поражение подкрыльцового и мышечно-кожного нервов, с начальными признаками вторичной демиелинизации, снижение амплитуды до 70%;