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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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CORRELATION BETWEEN EJECTION FRACTION (EF) AND CORONARY SINUS BLOOD FLOW (CSBF) DURING OFF-PUMP CORONARY ARTERY BYPASS GRAFTING SURGERY

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Abstract.

Introduction: Many studies have shown that CABG (coronary artery bypass grafting) increases the survival rate of patients, but the effect of bypass grafting on cardiac function is still a matter of debate.

Objective: The objective of our study was to determine:

a. To what extent can the change in coronary sinus flow be used as an intraoperative criterion for the assessment of adequate revascularization.

b. Whether the functional improvement of the revascularized myocardium occurs.

c. The existence of a correlation between the change in coronary sinus flow and changes in myocardial function.

Material and methods: Our study included 435 adult patients of both sexes, aged 55-85 years, ASA -III or less, who underwent coronary artery bypass grafting on a functioning heart. For this part of the study, 70 patients were selected, in whom EF (ejection fraction) and CSBF (coronary sinus blood flow) were determined before and after bypass grafting by TEE (transesophageal echocardiography).

Results: CSBF flow in the CS increases in 74% of cases after bypass surgery, does not change in 9% of cases, and decreases in 17% of cases.

Based on the results obtained, ΔFlow and ΔEF - this distribution is not reliable (Chi2=2.76, p=0.599, NS)

There is no reliable correlation between intraoperative CSBF (coronary sinus blood flow) and EF (ejection fraction).

Conclusions: In off-pump CABG-surgery, coronary sinus flow (CSBF) increases in most cases when assessed shortly after revascularization.

In cases where an increase in ejection fraction (EF) was observed, coronary sinus flow (CSBF) did not increase in most cases and vice versa, meaning that coronary sinus flow (CSBF) and cardiac ejection fraction (EF) did not correlate in the immediate post-revascularization period.

Key words. Coronary Sinus Blood Flow (CSBF), Ejection Fraction (EF), Coronary Artery Bypass Grafting (CABG), Transesophageal Echocardiography (TEE).

Introduction.

Many studies have shown that CABG (coronary artery bypass grafting) increases the survival rate of patients, but the effect of bypass grafting on cardiac function is still a matter of debate [1-6]. There is increasing interest in non-invasive methods for assessing coronary blood flow, both during and after coronary artery bypass grafting. It is clear that TEE (Transesophageal Echocardiography) would be a priority for many reasons, mainly its availability, cost-effectiveness, non-invasiveness, and simplicity. The main task in evaluating a method is to determine its accuracy, error rate, and clinical significance. In addition, the value of the information obtained by this method must be assessed. For this purpose, it is interesting to study the coronary sinus, which blood flow calculation is currently considered the gold standard for positron emission tomography of the myocardium. However, due to the cost and complexity of the method, its intraoperative use is impossible, therefore, it is interesting to evaluate coronary blood flow through changes in the caliber and/or flow of the coronary sinus measured by TEE. The CS (coronary sinus) is a large venous structure located in the posterior part of the left atrium. Its length is 2-3 cm. It drains the venous blood of the coronary circulation into the right atrium. Approximately 70-75% of the entire coronary blood flow flows into the CS (coronary sinus). The anterior cardiac veins drain 15-17%. Approximately 7-10% is drained by small cardiac veins (the so-called veins of Thebes). Coronary artery revascularization also increases flow in the coronary sinus.

Objective.

Therefore, one of our objectives was to determine whether the change in coronary sinus flow can be used as an intraoperative assessment criterion for adequate revascularization. In addition, we were interested in whether the revascularized myocardium improves functionally. The third objective was to determine the correlation between the change in coronary sinus flow and changes in myocardial function.

Materials and Methods.

Our study included 435 adult patients of both sexes, aged 55-85 years, ASA -III or less, who underwent coronary artery bypass grafting on a functioning heart. Patients who refused to participate in the study were not included in the study. Also, those who underwent additional surgical intervention on valves or other cardiac pathology. Those who had contraindications for transesophageal sounding. Those who had severe left ventricular dysfunction <30%. Those who had a history of stroke or had concomitant liver or kidney disease. Our study was approved by ethical review board of Tbilisi 5th clinical hospital in 2022 (#CS04-022). Informed consents were obtained from all individuals. 70 patients were selected for this part of the study, in whom EF (ejection fraction) and CSBF (coronary sinus blood flow) were determined before and after bypass surgery by TEE (transesophageal echocardiography). All patients had intravenous access, anesthesia was induced with midazolam 2 mg/kg, fentanyl 5 μg/kg, and pancuronium 0.1 mg/kg. Tracheal intubation was performed after 5 minutes of manual mask ventilation with FGF 6-8 L/min FiO2 1.0. After intubation and airway prosthesis, we set the FGF to 0.5 L/min and fully opened the sevoflurane vaporizer to 8%. Mechanical ventilation was performed with the anesthesia machine “Drager Primus” in

VCV mode: Vt 8 ml/kg, f 10-12/min, I:E 1:2, PEEP 2-3 mbar. As soon as the sevoflurane concentration reached 1.2 MAC, the vaporizer parameters were adjusted so that its concentration during the operation was 1.1-1.2 MAC. Mechanical ventilation parameters were also adjusted to maintain normocapnia (EtCO2 34-35 mmHg). We used fentanyl infusion at 2 μg/kg/h for analgesia and its intermittent boluses at 1 μg/kg as needed. After induction, we added pancuronium 0.01 μg/kg every hour for muscle relaxation. Hemodynamic stability was ensured by α- and β-mimetic and blocking agents. We used dobutamine and norepinephrine by infusion, and metoprolol and urapidil by boluses as needed. Heart rate, invasive blood pressure, and central venous pressure were recorded continuously. TEE transducer was placed in the esophagus in a 4-chamber view. We then focused on the inferior aspect of the atrial septum to visualize the tricuspid valve, followed by 10-15 degrees of rotation and maximum retroflexion of the transducer (Retro-Flex), which revealed the CS (coronary sinus) and its opening in the right atrium. After this, we briefly stopped ventilation, turned on the Pulse Wave Modes, focused on the CS (coronary sinus), and measured blood flow in the coronary sinus. (When turning on the Pulse Wave Modes, it is important to focus on the coronary sinus and not on the tricuspid valve, which is located nearby) (Figures 1 and 2).

The aim of this part of our study was to determine the relationship between ejection fraction and changes in CS (coronary sinus) flow. We used the chi-square test for statistical calculations (software SPSS 23.0).

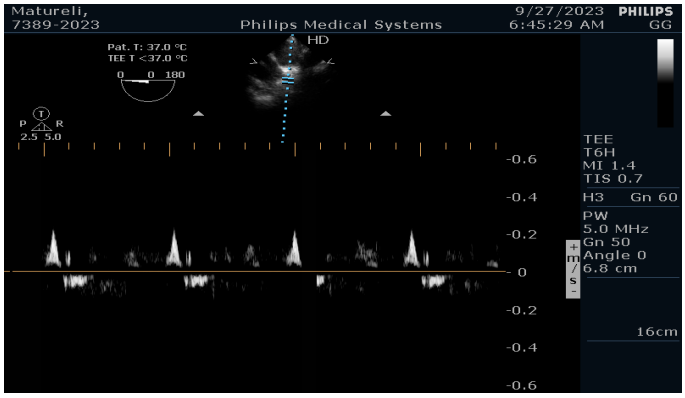

Figure 1. *CSBF(coronary sinus blood flow) view with Puls Wave Mode by TEE (Transesophageal Echocardiography).*

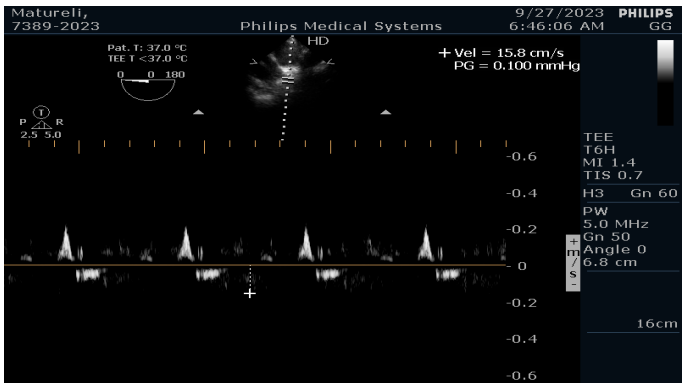

Figure 2. *CSBF(coronary sinus blood flow)intraoperative measurement by TEE (Transesophageal Echocardiography).*

Results.

Our study (70 selected patients) showed that: EF at the end of surgery increases in 39% of cases, does not change in 37% of cases, and decreases in 34% of cases (Table1).

Table 1. *Results of ΔEF.*

Positive changes ΔEF > 0	**No changes ΔEF = 0**	**Negative changes ΔEF < 0**
39%	37%	24%

Our study also showed that: CSBF flow in CS increases in 74% of cases after shunting, does not change in 9% of cases and decreases in 17% of cases (Table2).

Table 2. *Results of Δ CSBF.*

Positive changes Δ Flow> 0	**No changes ΔFlow = 0**	**Negative Changes ΔFlow < 0**
74%	9%	17%

Based on the results obtained, ΔFlow and ΔEF were as follows (Table 3).

In the CS (coronary sinus), blood flow increased in 52 patients, but the ejection fraction increased by 40%, did not change at all in 38.5%, and decreased by 21.1% (Table 3 and Figure 3).

In the CS (coronary sinus), blood flow did not change at all in 6 patients, in whom the ejection fraction increased by 50%, did not change at all in 33.3%, and decreased by 16.7%. (Table 3 and Figure 3).

Table 3. *Results of Δ CSBF and Δ EF.*

	Positive ΔEF > 0	**No dynamics Δ EF = 0**	**Negative Δ EF < 0**
Positive ΔFlow > 0 (n=52)	21 (40.4%)	20 (38.5%)	11 (21.1%)
No dynamics Δ Flow = 0 (n=6)	3 (50.0%)	2 (33.3%)	1 (16.7%)
Negative Δ Flow < 0 (n=12)	3 (25.0%)	4 (33.3%)	5 (41.7%)

This distribution is not reliable (Chi2=2.76, p=0.599, NS).

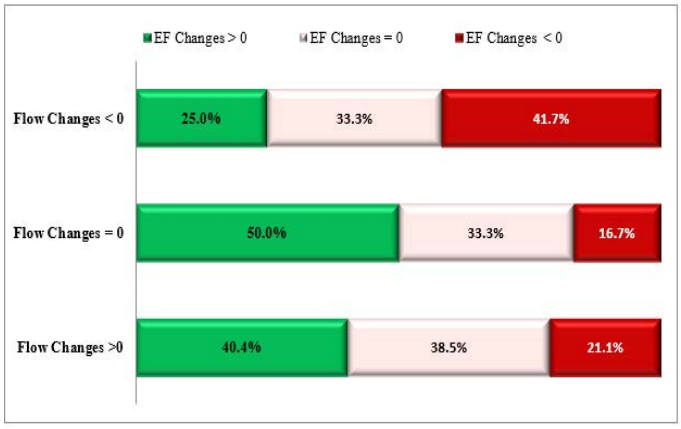

Figure 3. *Results of ΔFlow and ΔEF%.*

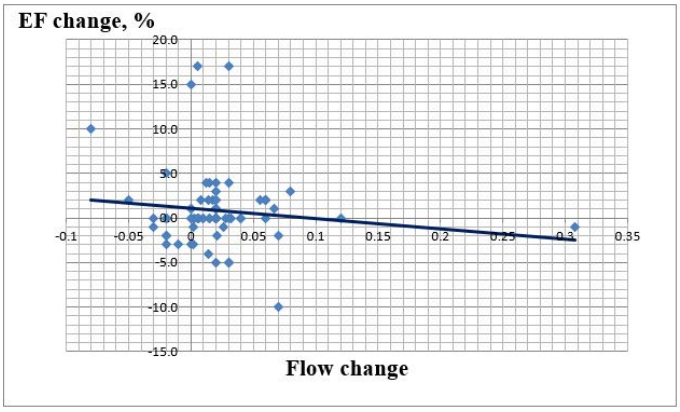

Figure 4. *Correlation between EF(ejection fraction) and Flow (CSBF -coronary sinus blood flow) parameters changes (ΔEF vs. Δ Flow).*

In the CS (coronary sinus), blood flow decreased in 12 patients, of whom the ejection fraction increased by 25%, did not change at all in 33.7%, and decreased by 41.7%. (Table 3 and Figure 3).

Accordingly, as a result of the conducted study, we came to the conclusion that

There is no reliable correlation between intraoperative CSBF (coronary sinus blood flow) and EF (ejection fraction).

No reliable correlation was established between changes in EF (ejection fraction) and Flow (CSBF -coronary sinus blood flow) parameters (ΔEF vs. ΔFlow).

r = - 0.126773, p = 0.295 (NS – non-significant) (Figure 4).

Discussion.

It is known from the literature that EF is often associated with mortality after coronary artery bypass grafting, but there is little information about how it changes during the postoperative period after revascularization [7-10]. Our study data showed that ejection fraction increases in only 39% of cases, does not change in 37% of cases, and even decreases in 24% (Table1). These data are based only on intraoperative studies. Ejection fraction was measured before the patient's chest was opened (i.e., before coronary artery bypass grafting) and after the chest was closed (i.e., after coronary artery bypass grafting). Unfortunately, we do not have studies conducted in the immediate and long-term postoperative period, which would be interesting in terms of whether the ejection fraction changes in the postoperative period and, if it does, whether there is a correlation with the data we obtained directly during the operation. As for the blood flow in the coronary sinus, according to the world literature, in most cases it increases in the period after coronary bypass grafting (immediately after the grafting), which is logical, because in 95% of cases of coronary bypass grafting, revascularization of the branches of the left coronary artery necessarily occurs, which should reliably increase the blood flow in the coronary sinus and, accordingly, this plays a certain role in the assessment of revascularization [11,12]. In our cases, revascularization of the left coronary arteries was also performed during all operations, but in a number of cases (26%) the blood flow in the coronary sinus did not increase, and in 17% of cases it decreased (Table 2). The decrease in flow in CS was an unexpected finding for us. The interpretation of this requires additional studies, in particular, it would be interesting to examine the same patients after some time to assess long-term results.

It should be noted that we performed the last coronary flow measurement after chest closure, when we applied more aggressive artificial ventilation (increased PEEP), and this may have had some effect on the total blood flow in the coronary sinus. Here too, it would have been interesting to determine the blood flow in the coronary sinus in the postoperative period, namely a few days after surgery, which was not technically possible, since transthoracic echo data may differ from transesophageal echo data.

Conclusion.

Based on the results of our study, we can draw the following conclusions:

1. During off-pump CABG-surgery, when assessing the ejection fraction (EF) of the heart muscle in the short term after revascularization, an increase in the percentage of cases was not observed (Table3).

2. During off-pump CABG-surgery, when assessing the flow in the coronary sinus (CSBF) in the short term after revascularization, the flow in the coronary sinus (CSBF) increased in most cases.

(However, a small percentage of cases were also observed where the flow decreased) (Table3 and Figure 3).

3. In cases where there was an increase in ejection fraction (EF), coronary sinus flow (CSBF) did not increase in most cases and vice versa, which means that coronary sinus flow (CSBF) and cardiac ejection fraction (EF) did not correlate in the immediate post-revascularization period (Figure 4).

4. Detection of increased sinus flow by TEE (transesophageal echocardiography) may be used as one of the criteria for intraoperative assessment of revascularization.

Ethics approval.

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of these Images. Board institutional approval was not required.

Declaration of competing interest.

The authors declare no competing interests.

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REFERENCES

1. Yusuf S, Zucker D, Peduzzi P, et al. Effect of coronary artery bypass graft surgery on survival: overview of 10-year results from randomised trials by the Coronary Artery Bypass Graft Surgery Trialists Collaboration. Lancet. 1994;344:563-570.

2. van Domburg RT, Kappetein AP, Bogers AJJC. The clinical outcome after coronary bypass surgery: a 30-year follow-up study. European Heart Journal. 2009;30:453-458.

3. Momin A, Ranjan R, Valencia O, et al. Long Term Survival Benefits of Different Conduits Used in Coronary Artery Bypass Graft Surgery - A Single Institutional Practice Over 20 Years. J Multidiscip Healthc. 2024;17:1505-1512.

4. Nuru A, Weltzien J.A.H, Sandvik L, et al. Short- and long -term survival after isolated coronary artery bypass grafting, the impact of gender and age. 2019:342-347.
5. Newman JS, Jarral OA, Kim MC, et al. Ten-year outcomes of hybrid coronary revascularization at a single center. Ann Cardiothorac Surg. 2024;13:425-435.
6. Windecker S, Stortecky S, Stefanini GG, et al. Revascularisation versus medical treatment in patients with stable coronary artery disease: network meta-analysis. BMJ. 2014;348:g3859.
7. Topkara VK, Cheema FH, Kesavaramanujam S, et al. Coronary artery bypass grafting in patients with low ejection fraction. Circulation. 2005;112:I344-50.
8. Koene RJ, Kealhofer JV, Adabag S, et al. Effect of coronary artery bypass graft surgery on left ventricular systolic function. J Thorac Dis. 2017;9:262-270.
9. Awan NI, Jan A, Rehman MU, et al. The effect of ejection fraction on mortality in Coronary Artery Bypass Grafting (CABG) patients. J Med Sci. 2020;36:1454-1459.
10. Masuda S, Serruys PW, Ninomiya K, et al. Impact of left ventricular ejection fraction on 10-year mortality in the SYNTAX trial, on behalf of the SYNTAX Extended Survival Investigators. Cardiovascular Revascularization Medicine. 2024;58:7-15.
11. Parajuli SS, Adhikari RB, Gangalal S. Transesophageal echocardiographic measurement of coronary sinus blood flow to estimate the adequacy of revascularization in patients undergoing coronary artery bypass graft: a prospective observational study. Nepalese Heart Journal. 2024;21.
12. Choudhury A, Joshi S, Magoon R, et al. Coronary sinus blood flow estimated by transesophageal echocardiography correlates well with transit time flowmetry after coronary artery bypass grafting. SESSION: ECHOCARDIOGRAPHY ANNO 2019. 2019;33:S85-S86.