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CLINICAL EFFICACY OF SELECTIVE PLASMA FILTRATION (EVACLIO) IN CARDIOVASCULAR COMPLICATIONS: A CASE SERIES FROM THE HEART CENTER KAZAKHSTAN

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Abstract

Background: Cardiovascular surgical patients with sepsis and hepatic dysfunction present significant perioperative management challenges. Selective plasma filtration using the Evaclio system has emerged as a novel extracorporeal therapy for the removal of inflammatory mediators and bilirubin. This is the first case series from Kazakhstan reporting the use of Evaclio in a cardiothoracic setting.

Materials and methods: This retrospective case series describes 15 patients (mean age: 56±3,65 years) who underwent open-heart surgery at the CF UMC "Heart Center" between 2023 and 2024 and subsequently developed sepsis and/or hyperbilirubinemia indicative of acute hepatic dysfunction. All patients received selective plasma filtration using the Evaclio system as part of their post-operative critical care. Statistical data processing was performed using IBM SPSS 29.0. Descriptive statistics, Wilcoxon test and Spearman correlation test were used. Values of $p < 0.05$ were considered statistically significant.

Results: This retrospective cohort study was conducted at the CF UMC "Heart Center" in Astana, Kazakhstan, from January 2023 to December 2024. The study included 15 patients who underwent heart defect correction with cardiopulmonary bypass (CPB). The use of the Evaclio filter was associated with a significant reduction in ALT, AST levels ($p < 0.01$), and platelets ($p < 0.05$), reflecting a decrease in inflammatory response and cytolysis. A positive trend in bilirubin and uremic markers was observed, and in some patients (up to 40%), a reduction in bilirubin of ≥ 30% was achieved, indicating the potential effectiveness of the method as part of comprehensive sepsis therapy.

Conclusion: Evaclio selective plasma filtration demonstrated promising results in managing postoperative sepsis and hepatic dysfunction in pediatric cardiac surgery patients. Its use may offer an effective adjunct to conventional intensive care in similar settings. Further prospective studies are needed to validate these findings.

Keywords: *cardiac surgery, postoperative period, MODS, SIRS.*

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Резюме

КЛИНИЧЕСКАЯ ЭФФЕКТИВНОСТЬ СЕЛЕКТИВНОЙ ПЛАЗМОФИЛЬТРАЦИИ (EVACLIO) ПРИ СЕРДЕЧНО-СОСУДИСТЫХ ОСЛОЖНЕНИЯХ: СЕРИЯ КЛИНИЧЕСКИХ СЛУЧАЕВ ИЗ ЦЕНТРА СЕРДЦА, КАЗАХСТАН

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Введение: Пациенты, перенесшие кардиохирургические операции и страдающие сепсисом и печёночной дисфункцией, представляют собой серьёзную проблему для периоперационного ведения. Селективная плазмофильтрация с использованием системы Evaclio представляет собой новую экстракорпоральную терапию, направленную на удаление воспалительных медиаторов и билирубина. Настоящая работа представляет собой первый в Казахстане клинический случайный ряд, описывающий применение Evaclio в кардиохирургической практике.

Материалы и методы: В данном ретроспективном исследовании описаны 15 пациентов (средний возраст: 56 ± 3,65 лет), перенесших операции на открытом сердце на базе КФ UMC «Центр сердца» в период с 2023 по 2024 год и у которых впоследствии развился сепсис и/или гипербилирубинемия, указывающая на острую печёночную дисфункцию. Все пациенты получили сеансы селективной плазмофильтрации с использованием системы Evaclio в рамках послеоперационного интенсивного лечения. Статистическая обработка данных проводилась с использованием IBM SPSS 29.0. Применялись описательная статистика, критерий Вилкоксона и корреляционный анализ Спирмена. Значения $p < 0,05$ считались статистически значимыми.

Результаты: Исследование проводилось на базе КФ UMC «Центр сердца» в г. Астана, Казахстан, в период с января 2023 по декабрь 2024 года. В него были включены 15 пациентов, которым была выполнена коррекция пороков сердца с использованием искусственного кровообращения. Применение фильтра Evaclio ассоциировалось с достоверным снижением уровней АЛТ, АСТ ($p < 0,01$), а также количества тромбоцитов ($p < 0,05$), что отражает уменьшение воспалительной реакции и цитолиза. Отмечалась положительная динамика по билирубину и уремическим маркёрам, причём у части пациентов (до 40 %) наблюдалось снижение билирубина на ≥ 30 %, что свидетельствует о потенциальной эффективности метода в составе комплексной терапии сепсиса.

Заключение: Селективная плазмофильтрация Evaclio продемонстрировала обнадеживающие результаты в лечении послеоперационного сепсиса и печёночной дисфункции у пациентов, перенесших кардиохирургические вмешательства. Её применение может служить эффективным дополнением к стандартной интенсивной терапии в аналогичных клинических ситуациях. Необходимы дальнейшие проспективные исследования для подтверждения полученных данных.

Ключевые слова: *кардиохирургическая операция, послеоперационный период, синдром полиорганной недостаточности (СПОН), синдром системной воспалительной реакции (ССВР).*

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Түйіндеме

EVACLIO СЕЛЕКТИВТІ ПЛАЗМОФИЛЬТРАЦИЯСЫНЫҢ ЖҮРЕК-ҚАНТАМЫР АСҚЫНУЛАРЫНДАҒЫ КЛИНИКАЛЫҚ ТИІМДІЛІГІ: ҚАЗАҚСТАН ЖҮРЕК ОРТАЛЫҒЫНАН КЛИНИКАЛЫҚ ЖАҒДАЙЛАР ТОПТАМАСЫ

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Кіріспе: Кардиохирургиялық операциялардан кейінгі сепсис және бауыр дисфункциясы бар науқастар периоперациялық кезеңде айтарлықтай қиындық тудырады. Evaclio жүйесін қолданатын селективті плазмофильтрация — қабыну медиаторлары мен билирубинді жоюға бағытталған жаңа экстракорпоральды

терапия әдісі. Бұл жұмыс — Қазақстанда алғаш рет кардиохирургиялық тәжірибеде Evaclio жүйесін қолдану туралы клиникалық жағдайлар топтамасын сипаттайтын зерттеу.

Әдістер: Бұл ретроспективті зерттеуде 2023–2024 жылдар аралығында Қазақстан Республикасы, Астана қаласындағы Ұлттық ғылыми кардиохирургия орталығында ашық жүрекке операция жасалған және кейіннен сепсис пен/немесе жедел бауыр жеткіліксіздігімен (гипербилирубинемия) асқынған 15 науқас (орташа жас: 56 ± 3,65 жас) қамтылды. Барлық науқастарға отадан кейінгі қарқынды терапия аясында Evaclio жүйесін қолдана отырып, селективті плазмофильтрация сеанстары жүргізілді. Деректердің статистикалық өңделуі IBM SPSS 29.0 бағдарламасы арқылы жүзеге асырылды. Сипаттамалық статистика, Вилкоксон критерийі және Спирменнің корреляциялық анализі қолданылды. $p < 0,05$ мәні статистикалық тұрғыдан маңыздылығы ретінде қабылданды.

Нәтижелер: Зерттеу 2023 жылдың қаңтарынан 2024 жылдың желтоқсанына дейінгі аралықта Астана қаласындағы «Ұлттық ғылыми кардиохирургия орталығы» корпоративтік қорында жүргізілді. Жасанды қан айналымын пайдалана отырып жүрек ақауларын түзету операциясы жасалған 15 науқас зерттеуге енгізілді. Evaclio сүзгісін қолдану АЛТ, АСТ деңгейлерінің ($p < 0,01$), сондай-ақ тромбоциттер санының ($p < 0,05$) сенімді төмендеуімен байланысты болды, бұл қабыну реакциясы мен цитолиздің азаюын көрсетеді. Билирубин және уремиялық маркерлер бойынша оң динамика байқалды, кейбір науқастарда (40 %-ға дейін) билирубин деңгейінің ≥ 30 % төмендеуі тіркелді, бұл әдістің сепсисті кешенді емдеудегі әлеуетті тиімділігін көрсетеді.

Қорытынды: Evaclio селективті плазмофильтрациясы жүрекке жасалған операциялардан кейін дамитын сепсис және бауыр дисфункциясын емдеуде үміт күттіретін нәтижелер көрсетті. Бұл әдіс ұқсас клиникалық жағдайларда стандартты қарқынды терапияға тиімді қосымша бола алады. Алынған мәліметтерді растау үшін болашақта проспективті зерттеулер қажет.

Түйінді сөздер: *кардиохирургиялық операция, операциядан кейінгі кезең, көпмүшелі жетіспеушілік синдромы (КМЖС), жүйелі қабыну реакциясы синдромы (ЖҚРС)*

Дәйексөз үшін:

Аманжолова А.К., Койчубаева Д.К., Зупаров Е.Н., Серикова А.А., Абильбаева А.А., Бекишев Б.Е. Evaclio селективті плазмофильтрациясының жүрек-қантамыр асқынуларындағы клиникалық тиімділігі: Қазақстан кардиологиялық орталығынан клиникалық жағдайлар топтамасы // Ғылым және Денсаулық сақтау. 2025. Vol.27 (6), Б. 38-45. *doi 10.34689/SH.2025.27.6.005*

Introduction

Postoperative sepsis and liver dysfunction are among the most common and serious complications following open-heart surgery, significantly contributing to both short- and long-term morbidity and mortality. These adverse outcomes are often the result of a complex interplay between systemic inflammatory response, ischemia-reperfusion injury, and the effects of cardiopulmonary bypass, all of which can precipitate multiorgan dysfunction, particularly hepatic impairment characterized by elevated serum bilirubin levels.

Evaclio, a novel selective plasma filtration technology developed in Japan, offers an extracorporeal method for the removal of medium-molecular-weight substances, including pro-inflammatory cytokines and albumin-bound bilirubin. Although Evaclio has demonstrated effectiveness in treating adult patients with septic shock and liver failure, there is currently limited evidence regarding its application in cardiac surgery patients, particularly in settings with complex postoperative comorbidities.

This study presents the first case series from Kazakhstan describing the use of Evaclio therapy in 15 adult patients who underwent open-heart surgery and subsequently developed postoperative sepsis and hepatic dysfunction. The study aims to address a critical gap in clinical practice by evaluating the therapeutic potential of selective plasma filtration in complex postoperative scenarios.

The relevance of this research lies in the high incidence of postoperative complications, the serious impact of multiple organ dysfunction syndrome (MODS) on patient outcomes, and the current lack of standardized protocols for early diagnosis and management in such cases. Improved understanding of associated risk factors may enhance preventive strategies and reduce morbidity and mortality in adult patients undergoing cardiac surgery.

Study Objectives

The primary aim of this study is to evaluate the clinical efficacy of Evaclio selective plasma filtration in managing sepsis and hepatic dysfunction in adult patients after cardiac surgery. The specific objectives are as follows:

1. **To compare key laboratory and clinical parameters before and after Evaclio therapy**, including serum bilirubin levels, inflammatory markers (CRP, procalcitonin), and hemodynamic status.
2. **To analyze the distribution of patients** by age, sex, and intensive care unit (ICU) location.
3. **To assess the relationship between surgical characteristics** (e.g., duration of cardiopulmonary bypass, total operation time) and treatment outcomes.
4. **To classify the success rate of therapy**, with a reduction of ≥30% in total bilirubin considered a marker of therapeutic efficacy.

The findings of this study are expected to contribute to the development of unified clinical protocols for early recognition and intervention in postoperative complications following cardiac surgery.

Methods

Study Design and Setting:

This retrospective case series was conducted at the CF UMC “Heart Center” between January 2023 and February 2024.

Ethical Considerations

Ethical approval was obtained, and informed consent was waived due to the retrospective nature of the study.

The study adhered to the principles outlined in the Declaration of Helsinki and was approved by the Local Committee on Bioethics of the Corporate Fund "University Medical Center" (Protocol No. 4/2024/PE dated April 15, 2024. Assigned number 2024/02-008). Compliance with international Good Clinical Practice (GCP) standards, Joint Commission International (JCI) requirements, and Order No. 248 of the Ministry of Health of the Republic of Kazakhstan (dated December 11, 2020) was ensured. All participants' legal representatives provided informed consent.

Patient selection:

Fifteen adult patients who underwent open-heart surgery and developed clinical signs of sepsis and/or hepatic dysfunction were included. All patients received Evaclio therapy postoperatively.

Inclusion Criteria:

1. Adult patients (≥18 years) who underwent open-heart surgery with cardiopulmonary bypass.
2. Development of clinical signs of hepatic dysfunction (e.g., hyperbilirubinemia) and/or sepsis within the early postoperative period (≤7 days post-surgery).
3. Written informed consent obtained from the patient or their legal representative.

Exclusion Criteria:

1. Pre-existing end-stage renal disease requiring dialysis.
2. Diagnosed chronic liver failure or cirrhosis prior to surgery.
3. Hemodynamic instability incompatible with extracorporeal therapy.
4. Refusal to participate in the study.
5. Inability to perform cardiac surgery due to absolute medical contraindications.

Evaclio Procedure:

The Evaclio system was applied according to clinical indications. Each session lasted approximately 6 hours. Depending on the clinical response, each patient received between 1 to 3 sessions.

Priming and rinsing of circuits were performed using 0.9% sodium chloride solution, 500 mL × 3.

The procedure was conducted using a Dialog+ machine with a plasma fractionator Evaclio EC–2C20 (1 unit).

Sodium profile: 14.5–14.0

Blood flow rate: stepwise progression from 50 → 100 → 150 → 180 → 200 mL/min

Replacement solutions included:

- Duasol, 5000 mL (1 unit)
- Sterofundin, 1000 mL (1 unit)

Substitution flow rate: 666 mL/hour

An additional replacement fluid was ABO-compatible fresh frozen plasma (FFP) — 3000 mL, with a flow rate of 333 mL/hour.

Total substitution volume: 6000 + 3000 mL

Anticoagulation was achieved with Arixtra 2.5 μg / 0.5 mL (1 dose).

Activated clotting time (ACT) values during the procedure ranged between: 172 – 158 – 150 – 152 – 144 – 142 seconds.

Vascular access was provided via ECMO circuit and double-lumen central venous catheter.

Data Collection:

Laboratory parameters, including serum bilirubin (direct and total), ALT, AST, albumin, creatinine, urea, hemoglobin, hematocrit, platelet count, as well as systolic and diastolic blood pressure, were measured before and after each Evaclio session. To assess and classify acute kidney injury (AKI) in this patient population, several scoring systems were employed, including the adapted KDIGO (Kidney Disease: Improving Global Outcomes) criteria.

The diagnosis of AKI was primarily based on serial measurements of serum creatinine and urine output over time, allowing for accurate staging of AKI severity. This dual-parameter approach enabled timely identification and stratification of renal dysfunction, which is critical in the context of postoperative care following cardiac surgery.

The prevention and management of AKI focused on several intraoperative and postoperative strategies. These included careful optimization of hemodynamics during cardiopulmonary bypass, maintenance of appropriate fluid balance, judicious use of nephrotoxic medications, and continuous monitoring of renal function during the postoperative period.

To evaluate hepatic dysfunction, standard laboratory parameters were used, including serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), total bilirubin, and direct bilirubin levels. Elevations in these markers—particularly in conjunction with clinical features—were considered indicative of hepatic impairment, commonly observed in the setting of low cardiac output or systemic inflammatory response.

The diagnosis of sepsis and systemic inflammatory response syndrome (SIRS) was established using established clinical and laboratory criteria. These included abnormal core temperature, leukocytosis or leukopenia, elevated C-reactive protein (CRP) and procalcitonin (PCT) levels, as well as hemodynamic instability requiring vasopressor support. Blood culture results and clinical course were used to further substantiate sepsis diagnosis when applicable.

Patient Demographics and Clinical Characteristics

The study cohort was characterized by a range of demographic and clinical variables. Key demographic parameters included age, sex, weight and height. Clinical metrics comprised duration of hospitalization, total ICU stay (in days), preoperative diagnosis, type of cardiac defect, and the complexity of the surgical procedure performed.

Statistical analysis

The collected data were processed using the IBM SPSS 29.0 statistical program. The study used descriptive statistics methods, including calculation of percentages, determination of medians and percentiles. Since the data were not normally distributed, the Wilcoxon signed-rank test was employed to assess the dynamics of the parameters before and after therapy using the Evaclio system. Values of $p < 0.05$ were considered statistically significant. Spearman's correlation coefficient was used to determine the correlation between the duration of surgical intervention and laboratory parameters.

Results

Patients who received therapy using the Evaclio system were included in the study. The mean age of the patients

was 56 ± 3.65 years. Distribution across hospital departments showed a predominance of patients from cardiac surgery and intensive care units (Table 1).

A comparative analysis of laboratory parameters before and after therapy revealed a statistically significant decrease in liver enzyme levels (ALT and AST) as well as platelet count:

- ALT: p = 0.003
- AST: p = 0.003
- Platelets: p = 0.031

A marked reduction in transaminases during therapy suggests a decrease in hepatocellular injury and indicates a potential anti-inflammatory effect of the filtration procedure.

The observed decline in platelet count (p = 0.031) may also reflect a reduction in systemic inflammatory response.

Table 1.

Descriptive statistics.

Indicators	Before treatment			After treatment		
	Me	25th percentile	75th percentile	Me	25th percentile	75th percentile
Systolic blood pressure	113	100	122	115	98	125
Diastolic blood pressure	62	42	68	61	45	66
Total bilirubin	3,63	3	5,41	2,65	1,267	4,68
Direct bilirubin	2,36	1,48	4,63	1,77	0,87	3,39
ALT	47,5	15,78	717,85	32,4	15,3	188,3
AST	84,7	30,35	1375,5	41,3	30,8	345,2
Platelets	107	72,25	166,75	92	59	129
Creatinine	1,63	1,07	2,65	1,06	0,77	2,25
Urea	72,8	33,7	105,3	31,2	20,5	83,02
Hemoglobin	90	83,75	97	90	80	93
Hematocrit	26,7	24,78	29,75	26,6	23,9	28
Albumin	3,18	2,99	3,77	3,08	2,81	3,6

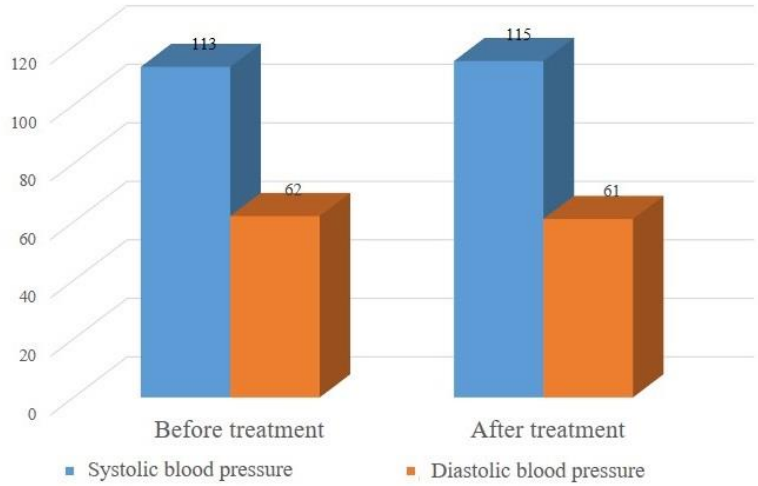

Figure 1. Changes in systolic and diastolic blood pressure before and after therapy

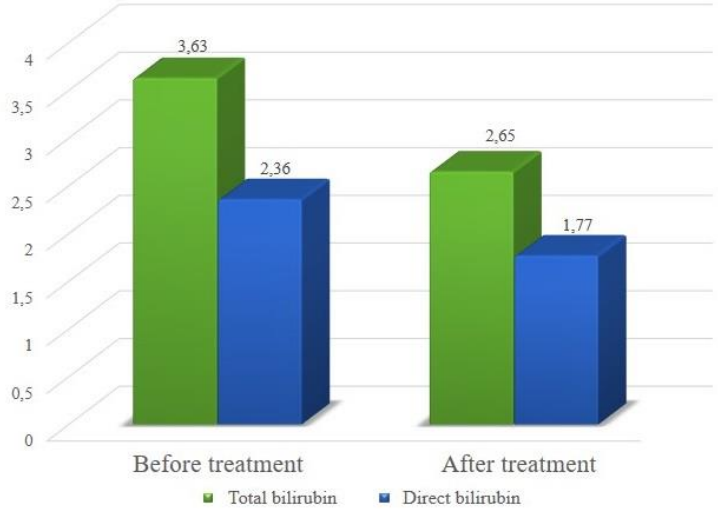

Figure 2. Changes in total and direct bilirubin levels before and after therapy.

Changes in other parameters — including bilirubin, creatinine, urea, hemoglobin, hematocrit, albumin, and blood pressure — did not reach statistical significance ($p > 0.05$) (Figure 1, 2), although a trend toward reduction in total and direct bilirubin levels was observed.

Correlation analysis did not reveal any statistically significant associations between surgery duration and the main laboratory parameters. A comparative analysis of clinical and laboratory parameters before and after therapy is presented in Table 2. The strongest, though not statistically significant, correlations were observed between:

Duration of surgery and diastolic blood pressure ($r = 0.327$; $p = 0.217$)

Duration and AST levels ($r = 0.264$; $p = 0.342$)

Duration and hemoglobin levels ($r = 0.263$; $p = 0.344$)

The criterion for treatment success was defined as a ≥ 30% reduction in total or direct bilirubin levels from baseline.

According to this criterion, the success rate of therapy was: 27% for total bilirubin (4 out of 15 patients); 40% for direct bilirubin (6 out of 15 patients).

Table 2.

Comparative analysis of indicators before and after Evaclio therapy.

Indicators	T	Z	p
Systolic blood pressure	46	-0,796	0,426
Diastolic blood pressure	37,5	-0,560	0,575
Total bilirubin	36	-1,363	0,173
Direct bilirubin	39	-1,193	0,233
ALT	8,5	-2,926	0,003
AST	7	-3,010	0,003
Platelets	22	-2,159	0,031
Creatinine	38	-1,250	0,211
Urea	26	-1,931	0,053
Hemoglobin	28	-1,822	0,068
Hematocrit	34,5	-1,449	0,147
Albumin	41,5	-1,051	0,293

Despite the lack of statistical significance in several parameters, Evaclio-based therapy demonstrated a consistent downward trend in total and direct bilirubin, urea, and creatinine levels, indicating a clinically relevant detoxification effect.

The study also analyzed the relationship between the duration of extracorporeal hemocorrection procedures and various clinical and laboratory parameters, as well as the success of therapy, defined as a ≥ 30% reduction in total bilirubin (Table 3).

Correlation analysis between the duration of the procedure and various clinical and laboratory parameters revealed no statistically significant associations ($p > 0.05$ for all variables). The strongest, though still non-significant, positive correlations were observed between procedure duration and diastolic blood pressure ($r = 0.327$, $p = 0.217$), as well as with aspartate aminotransferase (AST) levels ($r = 0.264$, $p = 0.342$). A negative correlation with systolic blood pressure (SBP) was also noted ($r = –0.32$, $p = 0.907$), but did not reach statistical significance.

Table 3.

Classification of therapy success

Indicator	Success of therapy (bilirubin reduction ≥ 30%)	
	Success	Failure
Total bilirubin	4 (27%)	11 (73%)
Direct bilirubin	6 (40%)	9 (60%)

To assess the clinical effectiveness of the therapy, a ≥ 30% reduction in total bilirubin level was used as the primary criterion. Based on this criterion, a successful therapeutic response was observed in 4 patients (27%), while 11 patients (73%) were classified as having an unsuccessful response. When analyzing direct bilirubin reduction, a favorable response was noted in 6 patients (40%), whereas in 9 patients (60%), the effect was considered insufficient.

Discussion

To our knowledge, this study represents the first reported clinical experience with selective plasma filtration using the Evaclio system in Kazakhstan and Central Asia, and the first application in postoperative cardiac surgery patients with sepsis and hepatic dysfunction. The findings suggest that Evaclio may serve as a valuable adjunctive extracorporeal therapy in critically ill cardiovascular patients, particularly in the context of systemic inflammation and hyperbilirubinemia liver injury following cardiopulmonary bypass (CPB).

Cardiac surgery with CPB is well known to trigger a systemic inflammatory response syndrome (SIRS) due to blood-surface interaction, ischemia-reperfusion injury, endotoxemia, and cytokine activation. This inflammatory cascade plays a central role in the development of sepsis-associated liver dysfunction, hyperbilirubinemia, and multiorgan failure [1-3]. Elevated levels of bilirubin and transaminases after cardiac surgery are independently associated with increased mortality and prolonged ICU stay [4].

Selective plasma filtration using Evaclio is designed to remove middle-to-large molecular weight substances, including bilirubin bound to albumin, inflammatory cytokines (IL-6, TNF-α), and other hepatotoxic mediators, while preserving essential plasma proteins, coagulation factors, and immunoglobulins [5, 6]. This selective mechanism differentiates Evaclio from conventional plasma exchange, which is associated with higher risks of bleeding, immunosuppression, and volume shifts.

In the present series, Evaclio therapy was associated with a statistically significant reduction in ALT and AST levels, reflecting attenuation of hepatocellular injury and cytolysis. Similar reductions in transaminases and bilirubin have been reported in patients with acute liver dysfunction treated with selective plasma filtration or albumin-permeable membranes [7–9]. Although a decrease in platelet count was observed, this finding is consistent with prior reports on extracorporeal blood purification techniques and may reflect platelet activation and adsorption on the membrane surface rather than clinically significant thrombocytopenia [10]. Importantly, no major bleeding events or therapy-limiting complications were observed in our cohort, supporting the acceptable safety profile of Evaclio in a postoperative cardiac population.

Up to 40% of patients achieved a ≥30% reduction in bilirubin levels, which is clinically meaningful, as early bilirubin clearance has been associated with improved

outcomes in septic patients with liver dysfunction [11]. The observed positive trends in uremic markers further suggest a multiorgan modulatory effect, likely mediated by systemic inflammation reduction.

Previous studies investigating extracorporeal liver support systems such as Molecular Adsorbent Recirculating System (MARS) or Coupled Plasma Filtration and Adsorption (CPFA) have demonstrated mixed results, often limited by complexity, cost, and hemodynamic instability [12, 13]. In contrast, Evaclio offers a technically simpler and more hemodynamically tolerable approach, making it particularly attractive for use in cardiac ICUs, where patients frequently require combined renal and hepatic support.

The introduction of Evaclio therapy at the CF University Medical Center “Heart Center” reflects the growing integration of advanced extracorporeal blood purification technologies into critical care practice in Kazakhstan. This experience may serve as a foundation for regional protocols, multicenter collaborations, and future prospective studies evaluating standardized indications, timing, and treatment intensity.

In addition, increasing evidence supports the role of extracorporeal blood purification as an immunomodulatory rather than purely detoxifying strategy in critically ill patients with sepsis and postoperative systemic inflammation. Excessive cytokine release, endothelial dysfunction, and dysregulated host response have been identified as key drivers of organ failure following CPB and septic shock, providing a mechanistic rationale for early extracorporeal intervention [14–16]. Selective plasma filtration may contribute to restoration of immune homeostasis by reducing circulating inflammatory mediators while preserving protective plasma components, thereby potentially avoiding the immune paralysis associated with non-selective plasma exchange [17].

Furthermore, integration of selective plasma filtration into multimodal extracorporeal support strategies, including continuous renal replacement therapy and mechanical circulatory support, has been increasingly reported in contemporary critical care practice [18, 19]. Such combined approaches may be particularly relevant in cardiac ICUs, where patients frequently present with overlapping cardiac, renal, and hepatic dysfunction. Although current evidence remains largely observational, expert consensus and international guidelines acknowledge extracorporeal blood purification as a promising adjunctive therapy in selected septic patients with organ failure, warranting further prospective evaluation [20, 21].

Limitations of the Study

One of the main limitations of this study is the small sample size, which may affect the generalizability of the findings to broader patient populations. Additionally, long-term outcomes related to the development of acute kidney injury (AKI) were not assessed, and the influence of other potential factors, such as genetic predisposition or comorbid conditions, was not considered.

Another limitation is the lack of control over other concurrent interventions and pharmacological treatments, which may have influenced the progression of multiple organ dysfunction syndrome (MODS). The inability to obtain data on certain variables, such as individual drug responses, may also limit the completeness of the conclusions.

Conclusion

As a result of therapy using the Evaclio filter, a marked improvement in cytolysis markers (ALT, AST; $p < 0.01$) was observed, along with a consistent trend toward reduction in bilirubin, creatinine, and urea levels. In several patients, bilirubin levels decreased by more than 30%, which is considered a clinically meaningful effect.

These findings suggest that the use of Evaclio may have a beneficial impact on markers of systemic inflammatory response and liver function, particularly in the context of severe septic conditions.

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Conceptualization – Amanzholova A.

Methodology – Amanzholova A.; Bekishev B.

Verification – Zuparov Y.

Formal analysis – Koichubayeva D.; Serikova A.

Writing (original draft preparation) – Amanzholova A.; Koichubayeva D.

Writing (review and editing) – Abilbayeva A.; Bekishev B.

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