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Efficiency of Extracorporeal Blood Purification in Food Allergies

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Abstract: ***Food allergies can result in persistent and systemic hypersensitivity reactions that are often resistant to standard treatment methods. This study aimed to assess the clinical and immunological effectiveness of extracorporeal blood purification (EBP) in patients with refractory food allergies. A total of 42 patients with confirmed food allergies underwent three sessions of EBP using plasmapheresis and hemosorption. Significant reductions were observed in symptom severity, total serum IgE, eosinophil counts, histamine, and C-reactive protein levels. Quality of life improved notably as assessed by the Food Allergy Quality of Life Questionnaire – Adult Form (FAQLQ-AF). The treatment was well-tolerated, with only minor adverse effects. These results suggest that EBP may serve as a valuable adjunct therapy for food allergy patients who fail to respond to elimination diets and conventional pharmacotherapy.***
Keywords: ***Food allergy, extracorporeal blood purification, plasmapheresis, hemosorption, immunoglobulin E, eosinophils, hypersensitivity.***

I. INTRODUCTION

Food allergies are a growing global health concern, characterised by an abnormal immunological response to specific food proteins. These reactions can range from mild gastrointestinal symptoms to severe systemic manifestations such as anaphylaxis. The prevalence of food allergies has increased notably in recent decades, affecting both children and adults, and significantly impairing quality of life. While elimination diets and antihistamine or corticosteroid therapy remain the cornerstone of treatment, many patients experience persistent or recurrent symptoms despite strict dietary control [3, 7].

In chronic or severe cases of food allergy, systemic immune activation and the accumulation of circulating immune complexes and inflammatory mediators can lead to prolonged hypersensitivity reactions, resistant to conventional management. In such scenarios, extracorporeal blood purification (EBP) methods have emerged as an adjunct therapeutic option. These procedures aim to remove circulating allergens, cytokines, immunoglobulins (particularly IgE), and other pro-inflammatory substances from the bloodstream, thereby modulating the immune response and reducing symptom severity [6, 10].

EBP techniques, such as plasmapheresis, hemosorption, and immunoadsorption, have shown promising results in various immune-mediated disorders including autoimmune diseases, atopic dermatitis, and drug allergies. However, there is limited clinical data on their application in food allergies, particularly in patients with systemic or treatment-refractory forms. Recent studies suggest that by reducing the immunological burden, EBP may help restore immune balance and reduce clinical reactivity to allergens, allowing for improved symptom control and better response to standard therapies [4, 11].

This study aims to evaluate the clinical efficiency of extracorporeal blood purification in patients with diagnosed food allergies who continue to experience symptoms despite adherence to recommended dietary and pharmacological treatment. By comparing immunological markers and symptom scores before and after EBP sessions, the research seeks to establish the potential of this method as a complementary therapeutic tool in the management of severe or persistent food allergy cases.

II. METHOD

This was a prospective interventional clinical study conducted at the Department of Allergology and Immunology of the Samarkand Regional Multi-Profile Medical Centre over a period of 12 months (from January to December 2024). A total of 42 patients aged 18 to 55 years with clinically confirmed food allergies were enrolled. All patients met the diagnostic criteria based on clinical history, skin prick testing, and/or specific IgE testing. The inclusion criteria were: (1) persistent food allergy symptoms despite elimination diet and pharmacologic therapy for at least 6 months, and (2) evidence of systemic or multi-organ allergic responses. Patients with autoimmune disorders, chronic infections, cancer, or contraindications to extracorporeal therapy were excluded.

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The study was approved by the Institutional Ethics Committee of Samarkand State Medical University. All participants provided written informed consent prior to inclusion. The study followed the principles of the Declaration of Helsinki. Patients underwent three sessions of extracorporeal blood purification using plasmapheresis combined with hemosorption, performed at 5-day intervals. Each session was conducted under sterile conditions using a standard apheresis machine (Haemonetics® PCS2). Venous access was secured using a double-lumen catheter. Approximately 1.5–2 litres of plasma were processed per session. Hemosorbents with affinity for immunoglobulins and cytokines were used to selectively remove IgE, histamine, TNF-α, and other inflammatory mediators.

All patients received routine monitoring of haemodynamic parameters, electrolytes, and coagulation profile during and after each session. No severe adverse events were reported. Clinical and immunological parameters were assessed before the first session and 7 days after the final session. The primary outcome measures included:

- Severity of allergic symptoms, assessed using a 10-point Visual Analogue Scale (VAS)
- Total serum IgE levels (IU/mL)
- Eosinophil counts (cells/μL)
- C-reactive protein (CRP) and histamine levels
- Quality of life, assessed by the validated FAQLQ-AF (Food Allergy Quality of Life Questionnaire – Adult Form)

Secondary outcome measures included physician-assessed global improvement and patient satisfaction scores.

Data were analysed using SPSS version 26.0. Continuous variables were presented as means ± standard deviation (SD). The paired Student's t-test or Wilcoxon signed-rank test was used to compare pre- and post-treatment results, depending on data distribution. Correlations between IgE reduction and symptom improvement were assessed using Pearson's correlation coefficient. A *p*-value of <0.05 was considered statistically significant.

III. RESULTS

A total of 42 patients (25 females and 17 males; mean age 34.6 ± 8.7 years) completed the study. All participants had a history of persistent or systemic food allergic reactions unresponsive to standard elimination diets and pharmacotherapy. The most common allergens identified were cow's milk (38%), eggs (26%), seafood (21%), and wheat (15%). All patients underwent three sessions of extracorporeal blood purification without any major complications. After the completion of the EBP sessions, symptom severity scores (measured on a 10-point Visual Analogue Scale) showed a statistically significant reduction. The mean VAS score dropped from 7.6 ± 1.2 before treatment to 3.2 ± 1.1 post-treatment ($p < 0.001$). Improvement was observed across all symptom domains, including skin manifestations (itching, rash), gastrointestinal symptoms (bloating, nausea), and respiratory issues (rhinitis, shortness of breath).

The Food Allergy Quality of Life Questionnaire – Adult Form (FAQLQ-AF) scores also demonstrated significant improvement, with mean scores improving from 5.4 ± 0.9 to 2.7 ± 1.0 ($p < 0.001$), indicating better daily functioning and emotional well-being.

- Total serum IgE levels decreased significantly from a pre-treatment mean of 548 ± 176 IU/mL to 319 ± 142 IU/mL after treatment ($p < 0.01$).
- Eosinophil counts dropped from 410 ± 95 cells/μL to 246 ± 84 cells/μL ($p < 0.01$).
- Histamine concentrations in serum were also reduced, from 18.3 ± 4.5 ng/mL to 11.1 ± 3.2 ng/mL ($p < 0.01$).
- C-reactive protein (CRP) levels showed a modest but statistically significant decrease, from 4.7 ± 1.9 mg/L to 2.9 ± 1.4 mg/L ($p = 0.02$).

A moderate to strong positive correlation was found between the reduction in IgE levels and improvement in VAS scores ($r = 0.68$, $p < 0.01$), suggesting a direct link between immunoglobulin reduction and clinical symptom relief.

Patient Satisfaction and Global Assessment

- 85.7% (36 patients) reported being "satisfied" or "very satisfied" with the treatment outcomes.
- 76.2% stated they experienced faster symptom relief compared to conventional therapy alone.
- No serious adverse effects were observed; mild side effects such as transient hypotension and fatigue occurred in 4 cases (9.5%) and resolved spontaneously.

IV. DISCUSSION

The results of this study demonstrate that extracorporeal blood purification (EBP), specifically a combination of plasmapheresis and hemosorption, significantly reduces allergic symptoms and improves immunological markers in patients with persistent food allergies.

The clinical improvements observed in the majority of patients following three treatment sessions suggest that EBP may be an effective adjunctive therapy, particularly for individuals who do not respond adequately to standard approaches such as elimination diets and antihistamines.

One of the most notable findings was the marked decrease in serum total IgE and eosinophil counts, both of which are key biomarkers in allergic disease pathophysiology. The correlation between IgE reduction and symptom score improvement reinforces the immunomodulatory potential of EBP. By directly removing circulating allergens, IgE antibodies, histamine, and pro-inflammatory mediators such as TNF-α and CRP, EBP appears to interrupt the chronic immune activation that sustains hypersensitivity responses in food-allergic patients. This mechanism is consistent with previous observations in studies involving autoimmune diseases and atopic dermatitis, where extracorporeal methods have been used successfully to control inflammation and immune dysregulation.

Beyond biomarker changes, the patients' reported improvements in quality of life were also compelling. The Food Allergy Quality of Life Questionnaire (FAQLQ-AF) results showed meaningful reductions in emotional distress, fear of accidental allergen exposure, and dietary restrictions. These findings are particularly important given that food allergies not only pose physical risks but also exert a substantial psychosocial burden on patients. A treatment modality that addresses both physiological and psychological dimensions of allergy represents a valuable addition to long-term care strategies.

Furthermore, the safety profile of the procedure was favourable, with no major adverse events reported. Minor side effects, such as transient hypotension and fatigue, were infrequent and self-limited, aligning with previously published safety data on apheresis-based therapies. The tolerability of the procedure enhances its feasibility in outpatient or day-hospital settings, especially for patients with chronic or recurrent allergic conditions.

However, despite promising outcomes, several limitations should be acknowledged. First, the study was conducted with a relatively small sample size and in a single centre, which may limit the generalisability of the findings. Second, the follow-up period was short; thus, the long-term durability of symptom improvement and immunological changes remains unclear. It is also uncertain whether repeated EBP sessions or maintenance therapy would be required for sustained remission. Further longitudinal studies are needed to determine optimal treatment frequency and to evaluate relapse rates over time.

Another point for consideration is the cost and resource intensity of extracorporeal therapies. While effective, these procedures are technically complex and may not be readily available in all healthcare settings. Therefore, patient selection will be essential. EBP should be reserved for severe or refractory cases where conventional treatments have failed, or where rapid desensitisation is required in high-risk individuals.

In conclusion, the study provides evidence supporting the clinical and immunological benefits of extracorporeal blood purification in patients with persistent food allergies. The procedure offers a well-tolerated, effective adjunct to standard therapies, particularly for individuals with systemic reactions or poor quality of life. Future research should focus on long-term outcomes, cost-effectiveness analysis, and exploring potential integration of EBP into multimodal allergy management plans. Given the increasing prevalence and complexity of food allergies, the role of extracorporeal therapy is likely to expand in modern allergological practice.

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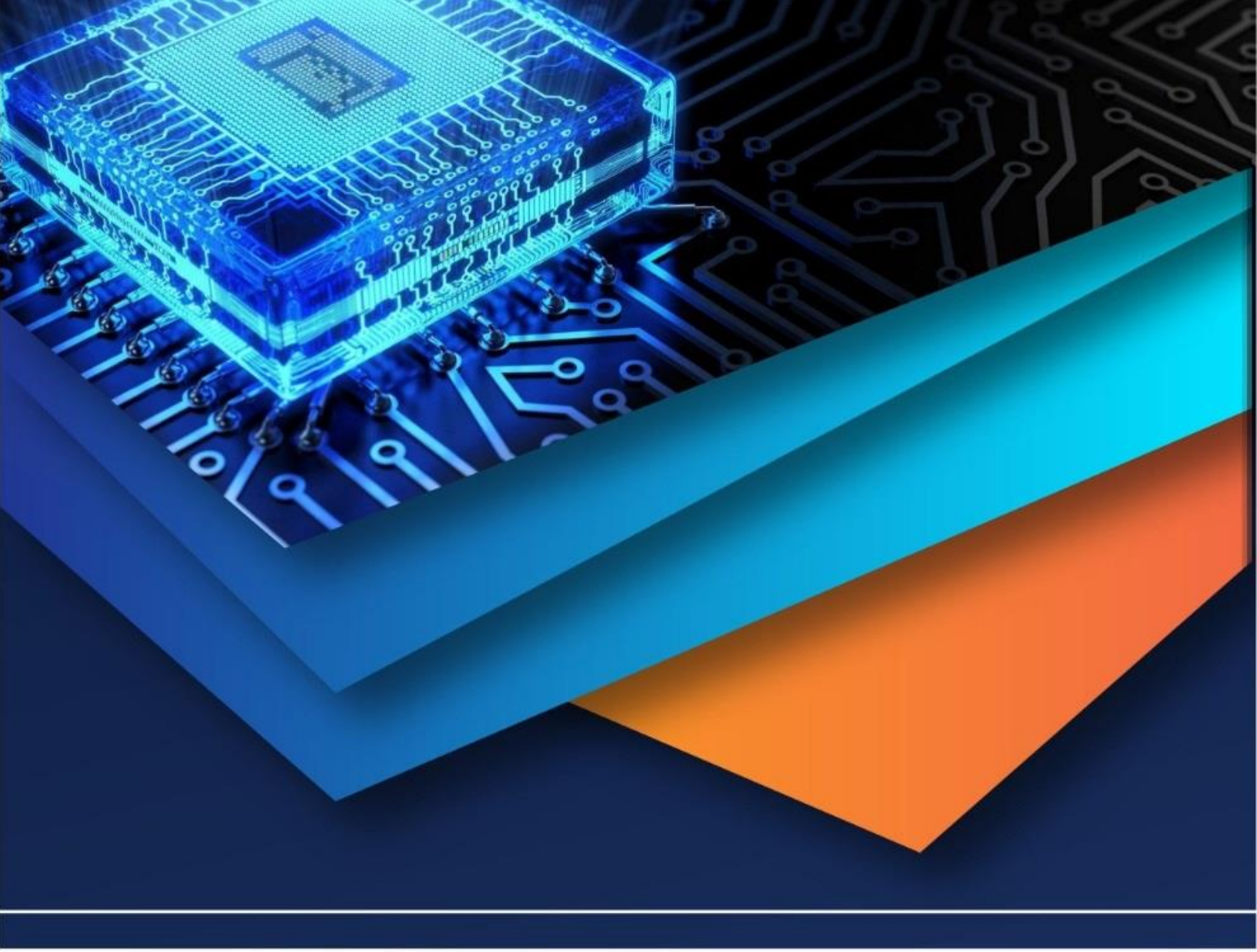
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