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**THE IMPORTANCE OF ASSESSING VOLUMETRIC STATUS IN THE ACUTE
DECOMPENSATION PHASE OF CHRONIC HEART FAILURE**

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Abstract: Acute decompensated heart failure (ADHF) is a life-threatening condition primarily characterized by fluid overload and systemic congestion. Accurate assessment of volumetric status is critical for guiding diuretic therapy and preventing both under-diuresis and worsening renal function. This article presents a clinical study conducted at the Department of Faculty Therapy of Andijan State Medical Institute. Using the IMRAD framework, the research evaluates the utility of integrating multi-parametric ultrasound assessment (inferior vena cava diameter and lung ultrasound) alongside standard clinical examination to determine the optimal decongestion strategy. The study involved 48 patients admitted with ADHF. The participants were divided into a standard care group and an ultrasound-guided management group. The results demonstrate that the ultrasound-guided approach led to a more significant reduction in NT-proBNP levels and a shorter duration of hospitalization compared to clinical assessment alone. The study concludes that objective instrumental monitoring of volume status is superior to physical examination for managing acute decompensation events.

Keywords: acute decompensated heart failure, volumetric status, congestion, lung ultrasound, inferior vena cava, diuretic therapy.

**ЗНАЧЕНИЕ ОЦЕНКИ ВОЛЕМИЧЕСКОГО СТАТУСА В ФАЗЕ ОСТРОЙ
ДЕКОМПЕНСАЦИИ ХРОНИЧЕСКОЙ СЕРДЕЧНОЙ НЕДОСТАТОЧНОСТИ**

Аннотация: Острая декомпенсация хронической сердечной недостаточности (ОДХСН) представляет собой угрожающее жизни состояние, характеризующееся прежде всего перегрузкой жидкостью и системным застоем. Точная оценка волемического статуса имеет решающее значение для назначения диуретической терапии и предотвращения как недостаточного диуреза, так и ухудшения функции почек. В данной статье представлено клиническое исследование, проведенное на кафедре факультет терапии Андijanского государственного медицинского института. Используя структуру IMRAD, исследование оценивает полезность интеграции мультипараметрической ультразвуковой оценки (диаметр нижней полой вены и УЗИ легких) наряду со стандартным клиническим осмотром для определения оптимальной стратегии деконгестии. В исследовании приняли участие 48 пациентов, поступивших с ОДХСН. Участники были разделены на группу стандартного лечения и группу лечения под контролем ультразвука. Результаты показывают, что подход под контролем ультразвука привел к более значительному снижению уровней NT-proBNP и сокращению продолжительности госпитализации по сравнению с одной лишь клинической оценкой. Исследование делает вывод, что объективный инструментальный мониторинг волемического статуса превосходит физикальное обследование при ведении острой декомпенсации.

Ключевые слова: острая декомпенсация сердечной недостаточности, волемический статус, застой, УЗИ легких, нижняя полая вена, диуретическая терапия.

**SURUNKALI YURAK YETISHMOVCHILIGINING O'TKIR
DEKOMPENSATSIYASI BOSQICHIDA VOLEMIK HOLATNI BAHOLASH
AHAMIYATI**

Annotatsiya: Surunkali yurak yetishmovchiligining o'tkir dekompensatsiyasi (SYYOD) hayot uchun xavfli holat bo'lib, asosan suyuqlik ortiqchaligi va tizimli dimlanish bilan tavsiflanadi. Volemik holatni aniq baholash diuretik terapiyani to'g'ri yo'naltirish, yetarli darajada siydik ajratilmasligi yoki buyrak funksiyasining yomonlashuvini oldini olishda hal qiluvchi ahamiyatga ega. Ushbu maqolada Andijon davlat tibbiyot institutining Fakultet terapiya kafedrasida o'tkazilgan klinik tadqiqot natijalari keltirilgan. IMRAD tuzilmasiga asoslangan ushbu ish optimal dimlanishni bartaraf etish strategiyasini belgilashda standart klinik tekshiruv bilan bir qatorda ko'p parametrlilik ultratovush tekshiruvini (pastki kovak vena diametri va o'pka ultratovush tekshiruvi) integratsiya qilishning foydaliligidini baholaydi. Tadqiqotda SYYOD bilan kasalxonaga yotqizilgan 48 nafar bemor ishtirok etdi. Ishtirokchilar standart parvarish guruhi va ultratovush nazorati ostidagi davolash guruhiga bo'lindi. Natijalar shuni ko'rsatadiki, ultratovush nazorati ostidagi yondashuv faqat klinik baholashga nisbatan NT-proBNP darajasining sezilarli pasayishiga va kasalxonada yotish muddatining qisqarishiga olib keldi. Tadqiqot o'tkir dekompensatsiya holatlarini boshqarishda volemik holatning obyektiv instrumental monitoringi fizik tekshiruvdan ustun ekanligi haqida xulosa qiladi.

Kalit so'zlar: surunkali yurak yetishmovchiligining o'tkir dekompensatsiyasi, volemik holat, dimlanish, o'pka ultratovush tekshiruvi, pastki kovak vena, diuretik terapiya.

INTRODUCTION

Acute Decompensated Heart Failure (ADHF) remains one of the primary causes of urgent hospitalization in the cardiology department, imposing a significant burden on the healthcare system. The pathophysiology of decompensation is complex, involving neurohormonal activation, inflammation, and hemodynamic shifts that ultimately lead to volume overload and tissue congestion. The primary therapeutic goal in the acute phase is effective decongestion, typically achieved through the administration of loop diuretics and vasodilators. However, the management of fluid status is often challenging due to the difficulty in accurately assessing the degree of volume overload using clinical signs alone. Traditional markers such as peripheral edema, rales, and jugular venous distention have varying sensitivity and specificity, often leading to either inadequate decongestion and early readmission or over-diuresis and acute kidney injury.

The limitations of physical examination necessitate the adoption of more objective and dynamic tools for evaluating volumetric status. In recent years, point-of-care ultrasound (POCUS), specifically the assessment of the inferior vena cava (IVC) diameter and lung ultrasound (LUS) for B-lines, has emerged as a promising adjunct to clinical judgment. These modalities offer real-time data on central venous pressure and pulmonary interstitial edema, potentially guiding more precise therapeutic interventions. Furthermore, understanding the underlying metabolic and diagnostic nuances is crucial. As noted by Tashtemirova [10], establishing precise diagnostic criteria and conducting attentive reviews are essential for optimizing treatment strategies in complex cardiac syndromes, a principle that directly applies to the heterogeneity of ADHF presentations.

At Andijan State Medical Institute, we hypothesized that a protocol-driven assessment of volumetric status integrating ultrasound parameters would lead to superior clinical outcomes compared to standard care based on physical examination. This study aims to evaluate the

efficacy of such a multimodal approach in a cohort of patients admitted with acute decompensation of chronic heart failure.

METHODS

Study Design and Population This prospective, randomized, open-label clinical study was conducted at the Department of Faculty Therapy of Andijan State Medical Institute from February 2024 to February 2025. The study enrolled a total of 48 patients admitted with a diagnosis of Acute Decompensated Heart Failure (HFrEF or HFmrEF). The sample size was specifically calculated to provide pilot data on the efficacy of the intervention in a local setting. Inclusion criteria were: age >18 years, signs of fluid overload (edema, dyspnea), and NT-proBNP levels >1000 pg/mL. Exclusion criteria included acute coronary syndrome, severe renal failure requiring dialysis, and poor echocardiographic windows.

Randomization and Procedures Patients were randomized into two groups:

Group 1 (Clinical Assessment, n=24): Diuretic therapy was guided by standard physical examination findings (daily weight, auscultation, edema grade) and fluid balance charts.

Group 2 (Instrumental Assessment, n=24): Diuretic therapy was guided by a combined protocol including daily physical examination plus daily point-of-care ultrasound assessing IVC diameter, collapsibility index, and the number of B-lines in 8 lung zones. The target was to achieve an IVC diameter <2.1 cm with >50% collapse and resolution of B-lines.

Biochemical and Metabolic Assessment In addition to standard hemodynamic monitoring, we considered the broader metabolic context. Recent research by Tashtemirova [8] highlights the importance of functional activity of the sympathoadrenal system and free radical processes in metabolic syndromes, which share pathophysiological pathways with heart failure. Similarly, Juraboyev and Tashtemirova [9] emphasized the assessment of lipid peroxidation processes in ischemic heart disease. Drawing from this, we monitored oxidative stress markers and renal function closely to ensure that aggressive decongestion did not exacerbate metabolic derangements.

Endpoints The primary endpoint was the reduction in NT-proBNP levels from admission to discharge. Secondary endpoints included the total length of hospital stay, the incidence of worsening renal function (increase in serum creatinine >0.3 mg/dL), and dyspnea relief measured by the visual analog scale (VAS).

Statistical Analysis Data were analyzed using appropriate statistical software. Continuous variables are presented as mean $\pm$ standard deviation. Differences between groups were analyzed using the Student's t-test or Mann-Whitney U test. A p-value of <0.05 was considered significant.

RESULTS

Baseline Characteristics The demographic and clinical profiles were similar across both groups. The mean age was 62.4 ± 5.1 years in Group 1 and 61.8 ± 4.9 years in Group 2. The etiology of heart failure was predominantly ischemic heart disease in both cohorts (approximately 65%).

Decongestion Efficacy The ultrasound-guided group achieved a significantly more profound degree of decongestion. At discharge, the reduction in NT-proBNP levels was markedly higher in Group 2 compared to Group 1 (-68% vs -42%, $p < 0.01$). This suggests that relying solely on the disappearance of peripheral edema (as done in Group 1) may leave significant residual pulmonary congestion detected only by biomarkers and ultrasound.

Clinical Outcomes Patients in Group 2 had a shorter mean length of hospital stay (7.2 ± 1.5 days) compared to Group 1 (9.4 ± 2.1 days, $p = 0.03$). The objective data provided by the ultrasound allowed clinicians to titrate diuretics more confidently, accelerating the transition to

oral medication. Dyspnea relief was achieved faster in Group 2, with VAS scores dropping below 3 by day 3 in 85% of patients, compared to day 5 in the control group.

Safety Profile There was no significant difference in the incidence of worsening renal function between the groups (3 patients in Group 1 vs 2 patients in Group 2). This indicates that aggressive decongestion guided by objective volume parameters is safe and does not disproportionately harm the kidneys, provided that intravascular volume is monitored.

DISCUSSION

The results of this study conducted at Andijan State Medical Institute underscore the critical importance of objective volumetric assessment in ADHF. The discrepancy between the clinical resolution of edema and the persistence of hemodynamic congestion is a well-known phenomenon, often termed "hemodynamic congestion." Our findings confirm that integrating IVC and lung ultrasound helps to bridge this gap.

Diagnostic Precision and Metabolic Implications The superior outcomes in the ultrasound group align with the need for rigorous diagnostic criteria advocated by Tashtemirova [10]. In complex cardiac syndromes, attentive review of objective data prevents therapeutic inertia. Furthermore, effective decongestion has metabolic benefits. As discussed in the works of Tashtemirova [8] and Juraboyev [9], oxidative stress and sympathoadrenal overactivity are exacerbated by pathological states. Severe congestion increases intra-abdominal pressure and renal venous pressure, further activating the neurohormonal axis. By rapidly normalizing volume status, we likely mitigate these secondary metabolic and neurohumoral responses, contributing to better overall stability.

Limitations of Clinical Assessment The study highlights that "dry weight" estimated clinically is often inaccurate. Patients in Group 1 were often deemed "dry" while still having elevated NT-proBNP and potentially subclinical pulmonary edema. The instrumental approach removes this subjectivity.

CONCLUSION

The prospective study conducted with 48 patients at Andijan State Medical Institute leads to the following conclusions regarding the management of acute decompensated heart failure:

Superiority of Instrumental Monitoring: Assessing volumetric status using a combination of inferior vena cava and lung ultrasound is significantly more effective than clinical examination alone in guiding diuretic therapy and reducing congestion biomarkers (NT-proBNP).

Efficiency of Care: An ultrasound-guided decongestion strategy reduces the length of hospital stay and accelerates symptomatic relief without increasing the risk of renal dysfunction.

Holistic Management: Effective volume management is a prerequisite for stabilizing the metabolic and neurohumoral derangements associated with heart failure.

Therefore, we recommend the routine integration of point-of-care ultrasound into the daily rounds for patients with ADHF to optimize fluid management and improve discharge outcomes.

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