

## Editorial



# Imaging Marker for Acute Kidney Dysfunction in Patients With Heart Failure

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## OPEN ACCESS

**Received:** May 16, 2023  
**Revised:** Jul 11, 2023  
**Accepted:** Jul 14, 2023  
**Published online:** Aug 17, 2023

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Echocardiography

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▶ See the article “Clinical and Imaging Parameters Associated With Impaired Kidney Function in Patients With Acute Decompensated Heart Failure With Reduced Ejection Fraction” in volume 31 on page 169.

The prevalence of heart failure is gradually increasing. Heart failure with reduced ejection fraction (HFrEF) accounts for approximately 50% of all heart failure cases.<sup>1)</sup> Acute decompensated HFrEF (ADHF) has been associated with simple heart dysfunction and dysfunction of systemic organs, including the kidneys, liver, and lungs.<sup>2)</sup> Kidney dysfunction is common in patients with heart failure and is associated with increased mortality. Acute kidney injury is common among patients admitted for ADHF, with its incidence varying from 9.6% to 43%, and it is related to poor prognosis.<sup>3)</sup> Several mechanisms have been proposed for the heart-kidney connection. For HFrEF, increased central venous pressure can decrease renal blood flow and renal perfusion pressure, activate the renin-angiotensin-aldosterone system, and increase intrarenal interstitial pressure, which may lead to renal interstitial fibrosis and reduce the estimated glomerular filtration rate (eGFR).<sup>4)</sup> Kidney dysfunction is more likely to occur in patients with ADHF and diabetes, high baseline creatinine, high B-type natriuretic peptide (BNP) level, and hypoalbuminemia.<sup>3)5)</sup> However, studies on anatomical features predictive of acute kidney dysfunction in patients with ADHF are lacking.

In a recent issue of the *Journal of Cardiovascular Imaging*, Cho and colleagues<sup>6)</sup> published a study titled ‘Clinical and Imaging Parameters Associated With Impaired Kidney Function in Patients With Acute Decompensated Heart Failure with Reduced Ejection Fraction.’ This study was aimed at identifying the clinical and imaging parameters associated with kidney dysfunction in patients with ADHF. The authors reported that perirenal thickness assessed with computed tomography could predict acute kidney dysfunction in patients with ADHF. The measurement of perirenal fat thickness is a simple and reliable method for estimating perirenal fat mass.<sup>7)</sup> This study found that old age, increased N-terminal proBNP, and increased perirenal fat thickness were independently associated with kidney dysfunction in patients with ADHF.<sup>6)</sup> Perirenal fat thicknesses of > 12 mm predicted acute kidney dysfunction with a sensitivity of 55% and specificity of 83%. Subgroup analysis of the patients with ADHF and kidney dysfunction showed that right atrial pressure was significantly higher in patients with recovered kidney function than in those with persistent kidney dysfunction, without differences in perirenal fat thickness.<sup>6)</sup>

Perirenal fat is unique from other connective tissues for its complete blood supply, lymphatic fluid drainage, and innervation.<sup>8)</sup> It includes a non-expandable complete fascia with sympathetic-independent development and is located close to the kidney.<sup>8)</sup>

A high body mass index, which traditionally suggests obesity, is associated with the development of heart, kidney, and metabolic diseases. However, a recent study showed that perirenal fat thickness is negatively correlated with eGFR, while total body fat, subcutaneous adipose tissue, and visceral fat are not.<sup>9)</sup> Other studies have also shown that perirenal fat thickening is independently predictive of kidney dysfunction in patients with diabetes and is associated with hypertension and cardiovascular disease.<sup>10)</sup> Unlike fat in other areas, perirenal fat appears to be a unique marker of kidney dysfunction. Thickened perirenal fat appears to be a potential risk factor for kidney dysfunction, and ADHF may trigger kidney dysfunction above the surface.

This was a cross-sectional, single-center study, and it did not reveal the prognostic value of perirenal fat thickness in patients with ADHF. This study showed no relationship between perirenal fat thickness and improvement in acute kidney dysfunction in ADHF patients.<sup>6)</sup> However, kidney dysfunction is strongly associated with the outcomes of patients with heart failure.<sup>11)</sup> Further longitudinal studies involving larger populations are needed to investigate how perirenal fat thickness affects the prognosis of heart failure and permanent kidney dysfunction. Perirenal fat thickness has been recently associated with various diseases, and its role as an imaging marker is expected to be explored in the future.

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#### Conflict of Interest

The author has no financial conflicts of interest.

## REFERENCES

- Murphy SP, Ibrahim NE, Januzzi JL Jr. Heart failure with reduced ejection fraction: a review. *JAMA* 2020;324:488-504.  
[PUBMED](#) | [CROSSREF](#)
- Harjola VP, Mullens W, Banaszewski M, et al. Organ dysfunction, injury and failure in acute heart failure: from pathophysiology to diagnosis and management. A review on behalf of the Acute Heart Failure Committee of the Heart Failure Association (HFA) of the European Society of Cardiology (ESC). *Eur J Heart Fail* 2017;19:821-36.  
[PUBMED](#) | [CROSSREF](#)
- Chen JJ, Lee TH, Kuo G, et al. Acute kidney disease after acute decompensated heart failure. *Kidney Int Rep* 2022;7:526-36.  
[PUBMED](#) | [CROSSREF](#)
- Scheffold JC, Filippatos G, Hasenfuss G, Anker SD, von Haehling S. Heart failure and kidney dysfunction: epidemiology, mechanisms and management. *Nat Rev Nephrol* 2016;12:610-23.  
[PUBMED](#) | [CROSSREF](#)
- Wang L, Zhao YT. Development and validation of a prediction model for acute kidney injury among patients with acute decompensated heart failure. *Front Cardiovasc Med* 2021;8:719307.  
[PUBMED](#) | [CROSSREF](#)
- Cho JJ, Lee SE, Kim DH, Pyun WB. Clinical and imaging parameters associated with impaired kidney function in patients with acute decompensated heart failure with reduced ejection fraction. *J Cardiovasc Imaging* 2023;31:169-77.  
[CROSSREF](#)
- Favre G, Grangeon-Chapon C, Raffaelli C, François-Chalmin F, Iannelli A, Esnault V. Perirenal fat thickness measured with computed tomography is a reliable estimate of perirenal fat mass. *PLoS One* 2017;12:e0175561.  
[PUBMED](#) | [CROSSREF](#)
- Liu BX, Sun W, Kong XQ. Perirenal fat: a unique fat pad and potential target for cardiovascular disease. *Angiology* 2019;70:584-93.  
[PUBMED](#) | [CROSSREF](#)
- Chen X, Mao Y, Hu J, et al. Perirenal fat thickness is significantly associated with the risk for development of chronic kidney disease in patients with diabetes. *Diabetes* 2021;70:2322-32.  
[PUBMED](#) | [CROSSREF](#)
- Lamacchia O, Nicasastro V, Camarchio D, et al. Para- and perirenal fat thickness is an independent predictor of chronic kidney disease, increased renal resistance index and hyperuricaemia in type-2 diabetic patients. *Nephrol Dial Transplant* 2011;26:892-8.  
[PUBMED](#) | [CROSSREF](#)
- Löfman I, Szummer K, Hagerman I, Dahlström U, Lund LH, Jernberg T. Prevalence and prognostic impact of kidney disease on heart failure patients. *Open Heart* 2016;3:e000324.  
[PUBMED](#) | [CROSSREF](#)