Open Access Mini-Review

Journal of Renal Endocrinology

J Ren Endocrinol 2025;11:e25197.
https://www.jrenendo.com
doi: 10.34172/jre.2025.25197

Nickan Research Institute

Harmful effects of liposuction on renal function and structure

Hafez Mohammadhassanzadeh[1], **Abbas Ebrahimi-Kalan**[2*]

Abstract
One of the significant adverse effects of liposuction is the alteration of fluid balance in the body. During the procedure, large volumes of fluids, often referred to as tumescent solution, comprising saline and anesthetic agents, are injected to facilitate fat removal and limit bleeding. This introduction of fluids can lead to fluid overload, causing diuretic strain on the kidneys as they work to maintain homeostasis and excrete excess volume.

Keywords: Liposuction, Acute kidney injury, Ischemia-reperfusion injury, Fluid overload
Citation: Mohammadhassanzadeh H, Ebrahimi-Kalan A. Harmful effects of liposuction on renal function and structure. J Ren Endocrinol. 2025;11:e25197. doi: 10.34172/jre.2025.25197.

Introduction

Liposuction, also referred to as lipoplasty or body contouring, employs a suction technique to eliminate fat from various regions, including the abdomen, thighs, hips, and arms (1). Though, the primarily aimed at cosmetic enhancement, liposuction is not intended for weight loss (2). Instead, it is often sought by individuals who have a stable body weight but struggle with localized fat deposits (1). This aesthetic endeavor entails various techniques, each with its own set of risks and complications. One critical aspect to consider is how the procedure can perturb fluid homeostasis in the body, potentially leading to kidney complications (3).

Search strategy

For this review, we conducted a search in the PubMed, Web of Science, EBSCO, Scopus, Google Scholar, Directory of Open Access Journals (DOAJ) and Embase, using different keywords such as liposuction, acute kidney injury, ischemia-reperfusion injury and fluid overload.

Pathophysiological mechanisms of acute kidney injury following liposuction

Liposuction, as a popular cosmetic procedure intended to remove excess fat, can lead to various postoperative complications, containing acute kidney injury (AKI) (4). This condition is characterized by a rapid decline in renal function and can result from various pathophysiological mechanisms that arise during and after the surgical process (5). A significant aspect of liposuction includes the infiltration of large volumes of tumescent solution, consisted of saline mixed with lidocaine and epinephrine into the subcutaneous tissue prior to fat removal. While these solutions are intended to minimize blood loss during the procedure, they can lead to fluid overload, particularly in cases where large amounts are absorbed back into circulation (5-8). Such overload results in disturbances in fluid balance that eventually pose a risk for AKI due to intravascular depletion (6-8). Meanwhile, the manipulation of body tissues and the introduction of fluids during liposuction can disturb the balance of electrolytes such as hyperkalemia (elevated level of potassium in the blood), or hyponatremia (low sodium levels in the blood) (9). Importantly, the surgical trauma associated with liposuction can initiate an ischemia-reperfusion injury, a tissue damage that occurs when blood supply returns to the tissue after a period of ischemia, or lack of oxygen, in the kidneys (5,10). During surgery, blood supply to certain renal vessels may be temporarily compromised, leading to ischemia. Following the restoration of blood flow, inflammatory mediators and reactive oxygen species can cause further damage to renal tissue, provoking or exacerbating AKI (11). In liposuction procedures, certain anesthetics and medications, particularly those excreted by the kidneys, can pose additional risks (12). Lidocaine, which administered in tumescent anesthesia, is primarily metabolized by the liver but may affect kidney function when used in large volumes or over prolonged

Received: 10 Feb. 2025, Revised: 20 May 2025, Accepted: 1 Jun. 2025, ePublished: 8 Jun. 2025

[1]Tabriz University of Medical Sciences, Tabriz, Iran. [2]Department of Neurosciences and Cognition, Faculty of Advanced Medical Sciences, Tabriz University of Medical Sciences, Tabriz, Iran.
***Corresponding Author:** Abbas Ebrahimi-Kalan, Email: Ebrahimiab@tbzmed.ac.ir, Email: abbasebra@gmail.com

Implication for health policy/practice/research/ medical education

In liposuction, the interplay of fluid overload, electrolyte disturbances, ischemia-reperfusion injury, nephrotoxic agents, and postoperative hypotension contributes significantly to the risk of acute kidney injury.

periods (13). Other agents, such as certain anesthetics or nephrotoxic medications given intra-operatively, can exacerbate kidney injury, especially in patients with pre-existing renal insufficiency (14). Additionally, patients may experience hypotension after liposuction due to fluid shifts, pain, or the effects of anesthesia (15). Meanwhile, during the postoperative phase, monitoring for signs of complications such as rhabdomyolysis becomes critical as it can lead to kidney injury (16). If, AKI not identified and managed promptly, can lead to significant long-term risk of developing chronic kidney disease (17).

Focus on ischemia-reperfusion injury

Ischemia-reperfusion injury (IRI) represents a significant complication associated with surgical procedures, like liposuction (18). It occurs when blood flow is temporarily interrupted, leading to tissue damage, and is followed by the restoration of perfusion, which can provoke an inflammatory response and further injury to renal tissue (18). Moreover, anti-thrombotic medications can enhance blood circulation and limit thrombus formation, further promoting perfusion during surgical intervention (19). It should remember that some conditions may exacerbate ischemic risks, including obesity, vascular diseases, and diabetes (20). To prevent IRI, effective fluid therapy is critical during liposuction (21). The use of the tumescent technique, which involves infusing large volumes of a saline solution mixed with local anesthetics into the targeted adipose tissue, has been shown to minimize blood loss and reduce the risk of ischemia by maintaining tissue hydration. However, excessive infusion should be avoided, as it can lead to fluid overload and exacerbate IRI (22,23). Appropriate calculations to ensure no more than the recommended volume is infiltrated should be adhered to for optimal safety (24). In addition, adopting a balanced crystalloids strategy during fluid administration may further optimize renal protection and overall tissue perfusion (24,25). Accordingly, postoperative administration of medications such as low-molecular-weight heparin may assist in preventing thromboembolic events that can occur due to vascular stasis following liposuction (26). One of the foremost strategies to mitigate IRI involves the use of pharmacological agents that could protect renal and other ischemic tissues during liposuction (26,27). Medications such as antioxidants and anti-inflammatory drugs are key contenders in reducing oxidative stress that commonly exacerbates IRI (28).

Conclusion

The relationship between liposuction and renal involvement is crucial yet often overlooked in discussions around the procedure's safety and efficacy. Risks such as fluid imbalances, acute kidney injury, and complications linked to specific techniques highlight the crucial need for exact preoperative assessments and postoperative monitoring.

Authors' contribution

Conceptualization: Abbas Ebrahimi-Kalan.
Investigation: Hafez Mohammadhassanzadeh.
Writing–original draft: Hafez Mohammadhassanzadeh.
Writing–review and editing: Abbas Ebrahimi-Kalan.

Conflicts of interest

The authors declare that they have no competing interests.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors utilized Perplexity to refine grammar points and language style in writing. Subsequently, the authors thoroughly reviewed and edited the content as necessary, assuming full responsibility for the publication's content.

Ethical issues

The authors have fully adhered to ethical standards, including those related to plagiarism, data fabrication, and duplicate publication.

Funding/Support

None.

References

1. Bellini E, Grieco MP, Raposio E. A journey through liposuction and liposculture. Ann Med Surg. 2017;24:53-60.
2. Kaoutzanis C, Gupta V, Winocour J, Layliev J, Ramirez R, Grotting JC, Higdon K. Cosmetic liposuction: preoperative risk factors, major complication rates, and safety of combined procedures. Aesthetic surgery journal. 2017;37:680-94.
3. Bartow MJ, Raggio BS. Liposuction. [Updated 2023 Feb 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563135/.
4. Willet JW, Alvaro AI, Ibrahim AK, Javed MU. A systematic review of efficacy and complications of high-definition liposuction. Plastic and Reconstructive Surgery. 2023;152:57-63.
5. Georgiyeva K, Shlyak D, Duarte F, Kumar H, Sciarra J, Duarte FE. Aesthetic Surgery Gone Wrong: A Case Report and Literature Review of Acute Kidney Injury Secondary to Hematoma After Liposuction. Cureus. 2023;15:e39820. doi:10.7759/cureus.39820
6. Venkataram J. Tumescent liposuction: a review. J Cutan Aesthet Surg. 2008;1:49-57. doi: 10.4103/0974-2077.44159.
7. Klein JA, Jeske DR. Estimated Maximal Safe Dosages of Tumescent Lidocaine. Anesth Analg. 2016;122:1350-9. doi: 10.1213/ANE.0000000000001119.
8. Nguyen PV, Merszei J, Patel R, Truong LD, Ramanathan V. Acute renal failure after liposuction. Ren Fail. 2005;27:787-90. doi: 10.1080/08860220500244864.
9. Vivek K, Amiti S, Shivshankar S, Lalit C. Electrolyte and Haemogram changes post large volume liposuction comparing two different tumescent solutions. Indian J Plast Surg. 2014;47:386-93. doi: 10.4103/0970-0358.146604.
10. Bhatta N, Singh R, Sharma S, Sinnha A, Raja S. Acute renal

failure following multiple wasp stings. Pediatr Nephrol. 2005;20:1809-10. doi: 10.1007/s00467-005-2044-0.
11. Basile DP, Anderson MD, Sutton TA. Pathophysiology of acute kidney injury. Compr Physiol. 2012;2:1303-53. doi: 10.1002/cphy.c110041.
12. Nath SS, Roy D, Ansari F, Pawar ST. Anaesthetic complications in plastic surgery. Indian J Plast Surg. 2013;46:445-52. doi: 10.4103/0970-0358.118626.
13. Torp KD, Metheny E, Simon LV. Lidocaine Toxicity. [Updated 2022 Dec 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482479/
14. Yu X, Feng Z. Analysis of Risk Factors for Perioperative Acute Kidney Injury and Management Strategies. Front Med (Lausanne). 2021;8:751793. doi: 10.3389/fmed.2021.751793.
15. Sood J, Jayaraman L, Sethi N. Liposuction: Anaesthesia challenges. Indian J Anaesth. 2011;55:220-7. doi: 10.4103/0019-5049.82652.
16. Petejova N, Martinek A. Acute kidney injury due to rhabdomyolysis and renal replacement therapy: a critical review. Crit Care. 2014;18:224. doi: 10.1186/cc13897.
17. Goyal A, Daneshpajouhnejad P, Hashmi MF, et al. Acute Kidney Injury. [Updated 2023 Nov 25]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK441896/
18. Cowled P, Fitridge R. Pathophysiology of Reperfusion Injury. In: Fitridge R, Thompson M, editors. Mechanisms of Vascular Disease: A Reference Book for Vascular Specialists [Internet]. Adelaide (AU): University of Adelaide Press; 2011. 18. Available from: https://www.ncbi.nlm.nih.gov/books/NBK534267/.
19. Sim MMS, Shiferawe S, Wood JP. Novel strategies in antithrombotic therapy: targeting thrombosis while preserving hemostasis. Front Cardiovasc Med. 2023;10:1272971. doi: 10.3389/fcvm.2023.1272971.
20. Lecube A. Impacto de la obesidad y la diabetes en la salud y en la enfermedad cardiovascular [Impact of obesity and diabetes on health and cardiovascular disease]. Aten Primaria. 2024;56:103045. doi: 10.1016/j.aprim.2024.103045.
21. Trott SA, Beran SJ, Rohrich RJ, Kenkel JM, Adams WP Jr, Klein KW. Safety considerations and fluid resuscitation in liposuction: an analysis of 53 consecutive patients. Plast Reconstr Surg. 1998;102:2220-9. doi: 10.1097/00006534-199811000-00063.
22. Uttamani RR, Venkataram A, Venkataram J, Mysore V. Tumescent Anesthesia for Dermatosurgical Procedures Other Than Liposuction. J Cutan Aesthet Surg. 2020;13(4):275-282. doi: 10.4103/JCAS.JCAS_192_19.
23. Venkataram J. Tumescent liposuction: a review. J Cutan Aesthet Surg. 2008;1:49-57. doi: 10.4103/0974-2077.44159.
24. Cueva Galárraga IM. Liposuction infiltration: The Quito formula - a new approach based on an old concept. Can J Plast Surg. 2011;19:17-21. doi: 10.1177/229255031101900105.
25. Semler MW, Kellum JA. Balanced Crystalloid Solutions. Am J Respir Crit Care Med. 2019;199:952-960. doi: 10.1164/rccm.201809-1677CI.
26. Patel P, Varacallo MA. Low-Molecular-Weight Heparin (LMWH) [Updated 2025 Mar 28]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK525957/.
27. Brignone J, Assersen KB, Jensen M, Jensen BL, Kloster B, Jønler M, Lund L. Protection of kidney function and tissue integrity by pharmacologic use of natriuretic peptides and neprilysin inhibitors. Pflugers Arch. 2021;473:595-610. doi: 10.1007/s00424-021-02555-w.
28. Fang X, Zhao H, Xu T, Wu H, Sheng G. Anti-Inflammatory and Antioxidant Effects of Irigenen Alleviate Osteoarthritis Progression through Nrf2/HO-1 Pathway. Pharmaceuticals (Basel). 2024;17:1268. doi:10.3390/ph17101268