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Anatomical Perspective on Kidney Transplantation: A Narrative Review

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Abstract

Context: Chronic Kidney Disease (CKD) is a progressive disorder characterized by irreversible renal damage and gradual loss of function, frequently diagnosed at advanced stages leading to end-stage renal disease (ESRD). Kidney transplantation remains the definitive treatment for ESRD, yet surgical complexity is strongly influenced by recipient anatomy.
Aim and Objectives: To review the impact of anatomical variations on kidney transplantation, highlighting their role in operative planning, technical execution, and long-term graft outcomes.
Methodology: This narrative review synthesizes evidence on anatomical considerations in kidney transplantation, focusing on pelvic vasculature, pelvic structures, and donor-recipient mismatches that affect surgical feasibility, complication risks, and graft survival. Perspectives from retrieval and implanting surgeons highlight the importance of preoperative anatomical assessment. A systematic search of Medline, Web of Science, PubMed, and Google Scholar was conducted using controlled vocabulary and keywords related to Anatomy of the kidney (variations on kidney blood supply, renal blood supply, kidney anomalies, pelvic anatomy) and kidney transplantation (renal transplantation, kidney transplantation, kidney allograft recipients, kidney transplant recipients). Boolean operators, complemented by manual searches were employed to fine-tune the search terms. A total of 164 articles published from 1999 to January 31, 2026, were identified and evaluated for relevance, with 46 ultimately selected for inclusion in narrative analysis.
Results: Anatomical variations in pelvic vessels and structures complicate vascular anastomosis and increase intraoperative risks. Donor-recipient anatomical mismatches affect technical feasibility and long-term graft survival. Anticipation of aberrant vessels by retrieval surgeons reduces implantation emergencies. Careful anatomical planning by implanting surgeons enhances safety and effectiveness of transplantation.
Conclusion: Anatomical perspectives are critical for successful kidney transplantation. Thorough preoperative assessment and anticipation of anatomical variations optimize surgical strategies, reduce complications, and improve both graft and patient survival.

Keywords: chronic kidney disease, kidney transplant, donor kidney, recipient iliac fossa, anatomy

Introduction

Chronic Kidney disease (CKD) is a clinical condition characterized by progressive damage and gradual loss of kidney function leading to failure to filter blood properly. It is often caused by diabetes and high blood pressure, infections, injuries, medications, and genetic factors[1]. Although the condition is not reversible, early detection of the condition is critical for comprehensive medical management and lifestyle modification[2]. Unfortunately, most CKD cases are diagnosed at the advanced stages, leading to end-stage renal disease (ESRD), which requires renal replacement therapy such as dialysis and kidney

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transplantation.

Kidney transplantation is a surgical procedure that replaces a failed kidney with a healthy kidney from a deceased or living person. Kidney transplantation is the most effective treatment for end-stage renal disease[3], offering superior survival and quality-of-life outcomes compared with dialysis. Successful transplantation depends not only on immunological compatibility[4] but also on careful anatomical and surgical considerations. Surgeons must account for the physical aspects of the procedure such as size, shape, and vascular structure of the donor kidney to ensure it can be integrated into the recipient's body.

Although human kidney is classically described as having medial concavity and lateral convexity, receiving a single artery and draining into a single renal vein[5], variations exist in its gross anatomy and neurovascular supply. Anatomical considerations are fundamental to both donor and recipient surgery, influencing technical feasibility, complication rates, and organ graft survival[6,7]. This review explores anatomical perspectives for precise surgical planning and implementation in kidney transplantation for both donor and recipient. Anatomical variations between individuals can present unique challenges, requiring critical planning and execution for long-term success.

Methodology

Search strategy

A systematic literature search was conducted on January 2026 of medical database (Medline, Web of Science, PubMed and Google Scholar) using controlled vocabulary and keywords related to Anatomy of the kidney (variations on kidney blood supply, renal blood supply, kidney anomalies, pelvic anatomy) and kidney transplantation (renal transplantation, kidney transplantation, kidney allograft recipients, kidney transplant recipients). Boolean operators (AND, OR, NOT) were employed to fine-tune the search terms. The automatic search was complemented by a manual search to identify relevant articles. A total of 164 articles published between 1999 and January 31, 2026, were identified and evaluated for relevance.

Selection of studies and the eligibility criteria

After eliminating duplicates, the remaining articles were subjected to title and abstract screening. Potentially relevant studies were further evaluated, and those with fully available texts were reviewed based on eligibility requirements.

The inclusion criteria were as follows: (1) articles involving grafts with multiple renal arteries in patients with ESRD; (2) articles comparing various renal vascular anomalies; (3) anastomosis techniques for renal transplantation with multiple renal arteries; (4) studies with ureteral anomalies; (5) articles with donor kidney size; and (6) articles with recipient iliac fossa anatomy.

The exclusion criteria were as follows: (1) studies with irrelevant titles or abstracts;(2) studies with inaccessible full-texts; (3) non-English publications; (4) studies involving non-human subjects;(5); and (6) letters to the editor, poster presentation, brief interviews, or review articles. A total 46 data articles were included in this narrative review, as displayed on the flowchart.

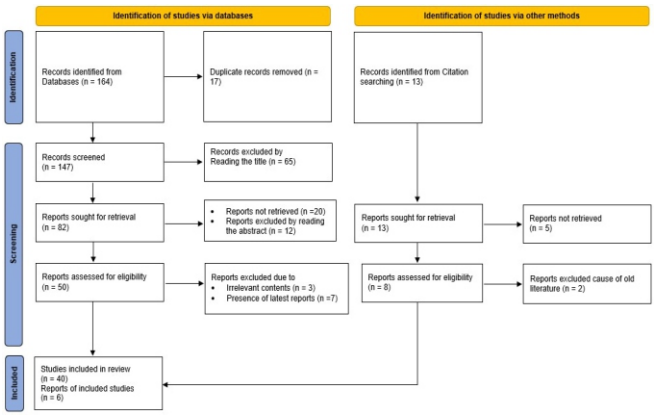

Figure 1: Flow diagram presenting the process of collecting data from databases included in this narrative review.

Review results

Anatomical Structure: Anatomical perspective in kidney transplantation involves consideration of vascular structures supplying and draining the kidney and the ureter anatomy in conjunction with the placement of the donor kidney in the recipient's iliac fossa. Anatomic variations in the renal vasculature occur in approximately 25-40% of patients[8] and plays a crucial role in management of end-stage renal disease. Moreover, anatomical variants such as ureteric status, donor kidney characteristics, and recipient iliac fossa anatomy, are also critical factors.

Vascular anatomy: Classically, a single renal artery originating from the abdominal aorta supplies the kidney through renal hilum. Occasionally renal arteries may originate from atypical sites such as the

common iliac, superior or inferior mesenteric, gonadal (testicular/ovarian), or the contralateral renal artery[9,10]. Multiple renal arteries have been reported in 18-30% cases, and arise due to persistence of foetal vessels[11]. Triple renal arteries have been described in the general population, and instances of four to nine renal arteries have likewise been recorded[12,13,14]. The renal artery may also be duplicated or accompanied by accessory renal arteries[15], each represents a terminal arterial branch that requires preservation during kidney transplantation. The renal artery may give off a suprarenal artery as its first branch before reaching the renal hilum, though some variants do exist[16]. Renal veins follow similar path to arteries, however, the most important variant related to kidney transplantation is the duplication of the renal veins. Kidney transplantation is complicated by the presence of multiple arterial supplies and multiple venous drainage in donor kidney, which predispose the graft to ischemic injury[17]. This risk is primarily associated with prolonged warm ischemia time due to the extended period required for vascular anastomosis. Surgeons are required to anticipate vascular anomalies in order to prevent complications such as thrombosis or suboptimal perfusion during transplantation or post-transplantation.

Donor kidney multiple supply may necessitate the surgeon to sew up into a single patch or establish multiple implantations into the external or internal iliac artery or selected anastomosing artery[18]. Early branching renal arteries have also been reported, which might necessitate bench reconstruction.

Ureteral anatomy: Anatomically, the ureter is a fibromuscular tube, measured 25 – 30cm long, responsible for transporting urine from the kidney in the abdomen to the urinary bladder in the pelvis. Occasionally, anatomical databases, report single kidneys drained by double, triple, and quadruple ureters[19,20]. Double ureters are commonly linked to duplication of the renal pelvis, which may be present in either a solitary kidney or in cases of renal duplication[21]. Partial duplication has also been reported to be ureter fissus proximalis and ureter fissus distalis[21,22]. Each of these variants' ureters do receive independent arterial supply.

Ureter arterial supply may derive from branches of the renal artery, the abdominal aorta, and the superior and inferior vesical arteries, as well as from the gonadal, middle rectal, and uterine arteries[23,24,25]. Comprehensive knowledge of both the normal and variant patterns of the donor ureter, together with its relationship to the arterial supply, is essential and constitutes a prerequisite for accurate anatomical understanding and safe kidney transplantation procedures. Complex donor ureter anatomy or variant arterial patterns significantly raise the risk of recipient postoperative ureter complications, including leaks and strictures.

Donor-Recipient Size Mismatch: Renal size has a critical role in the clinical management of renal disorders, including kidney transplant, given its strong association with kidney function[26,27,28]. Normal human kidney size is estimated to vary from 9 -12cm in length, 4 – 8cm in width, and 3 – 5cm in thickness, however, it varies with age, sex, ethnic and racial diversity[27]. Kidney is larger in males than in females, while larger in adults than children, and decreases in size during nephrosenescence[29,30]. The size of the transplant donor (length, weight, or volume) is commonly recognized as a predictive factor for recipient allograft performance, while also potentially influencing donor outcomes such as residual kidney function[27,31,32,33,34].

Donor–recipient size mismatch can be classified into two principal categories. The first occurs when a relatively small kidney is transplanted into a large recipient, potentially leading to functional strain as the graft must meet higher metabolic demands. Here, the risk of graft loss is high because of hyper filtration injury[35]. The second arises when a large kidney is transplanted into a small recipient, which may pose anatomical challenges related to space constraints and vascular adaptation, including hemodynamic imbalance and, low perfusion into the transplant kidney[36]. Both scenarios emphasize the importance of considering donor–recipient size compatibility in transplantation outcomes.

Although, there is no standardized 'normal' size for a transplanted kidney, as allograft volume is determined by donor characteristics, the larger donor kidney has been linked to better recipient outcomes and post-transplant graft function than vice versa[37]. However, most transplant plans generally consider donor–recipient size and functional asymmetry below 10% to be clinically insignificant, allowing either kidney to be utilized. Conversely, asymmetry greater than 20% is widely regarded as an exclusion threshold[38], reflecting concerns that the smaller kidney may lack adequate functional reserve for safe donation.

Recipient Pelvic Anatomical Variations: Kidney transplantation typically involves graft implantation in the iliac fossa with vascular anastomosis to the iliac vessels and ureteral re-implantation into the bladder. Variations in vascular and urinary techniques are common and should be recognized during planning for transplant procedures. Recipient pelvic variations, such as anatomical abnormalities or pelvic organ prolapse, can complicate kidney transplantation and often require individualized strategies for vascular and urinary anastomosis[39].

Damage to aberrant vessels has been linked to poorer graft and patient survival. Awareness of common vascular variants is critical for retrieval surgeons to avoid injury[40], while implanting surgeons must anticipate both typical and atypical variants to ensure a well-considered surgical plan[39].

The presence of corona mortis, a vascular variant that indicates the presence of both the normal and variant obturator artery and venous communication (external iliac or inferior epigastric and obturator), poses a high risk of severe hemorrhage during pelvic surgery, including kidney transplantation, as it lies within the iliac fossa where graft vessels are anastomosed[41]. Injured corona mortis is difficult to manage because it usually retracted into the pelvis, leading to massive and life-threatening pelvis haemorrhage. Other reported variants in this area include an obturator–inferior epigastric arterial trunk arising from the external iliac artery, from which the left obturator artery originated as a branch[42].

Iliolumbar artery variants also may complicate the kidney transplant due to its position and origin. In normal anatomy, it originates from the posterior division of internal iliac artery and coursing on the superior medial portion of the iliac fossa, however, may arise from the main internal iliac, or common iliac or external iliac artery[43], or may have two separate branches from the internal iliac artery. Transplant recipient vessel preparation entails dissection of the external iliac artery and vein for anastomosis. Variants involving iliolumbar artery may cross the operative field and necessitate surgical intervention such as ligation, while unrecognized iliolumbar branches can lead to significant hemorrhage during transplantation.

Size discrepancies between donor kidneys and recipient pelvic cavities can complicate implantation, particularly when asymmetry thresholds are exceeded. This anatomical observation is encountered when the donor kidney is unusually large or the recipient's pelvis is small (common in paediatric or petite adult patients). Donor-recipient size mismatch involving an oversized kidney can cause pelvic crowding and structural compression, increasing compartmental pressure and risk of post-operative complications.

Recipient pelvic congenital anomalies also have influence on the kidney transplantation outcomes[44]. Pelvic malformations can alter vessels or urinary bladder position, morphology and orientation, reducing space in the iliac fossa and complicating graft placement and vascular anastomosis (Figure 2).

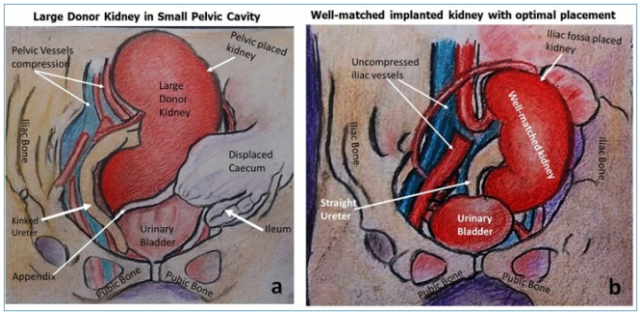

Figure 2: Illustration on Kidney transplant size discrepancies. Note (a) the pelvic organs compression when donor kidney exceeding the asymmetry threshold, and (b) when the donor kidney matches with the recipient iliac fossa.

In contemporary kidney transplantation, the donor kidney is placed into the recipient's iliac fossa. To facilitate an optimal angle for vascular anastomosis, the graft is positioned using laparotomy pads, rolled gauze, or manual adjustment[45]. Maintaining stable allograft positioning in this space is often difficult, as the graft may rotate posteriorly, settle too low, or adopt an unstable orientation due to the anatomy of the iliac fossa which is more vertical and shallower in female, while more rugged and more medial inclination[5]. These positional challenges are associated with recipient iliac fossa anatomy and structures/organs, henceforth, heighten the risk of graft torsion, vascular tension, and impaired venous drainage. Advances in technology have facilitated the growing adoption of robotic-assisted kidney transplantation[46]. Henceforth, a comprehensive knowledge of the documented anatomical variations of the iliac fossa anatomy is essential to retrieval surgeons and implanting surgeons during surgical planning, as it mitigates intraoperative risks and reduces post-transplant complications

Conclusion

Kidney transplantation remains the definitive treatment for end-stage renal disease, nevertheless surgical complexity is often dictated by implant recipient anatomy. Anatomical variations of the recipient pelvic vessels, pelvic anatomy, donor-recipient mismatch, can significantly influence kidney implant operative planning, technical execution, and ultimately graft and patient outcomes. Awareness of these anatomical variants is critical for both retrieval and implanting surgeons. Retrieval surgeons must anticipate aberrant vessels and associated pelvic organs anomalies to avoid injury, while implanting surgeons should plan for potential variations to ensure safe and effective anastomosis. Anatomical perspectives on the donor kidney and implant recipient anatomy is crucial for kidney transplantation.

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References

1. Walker CS, Gadegbeku CA. Addressing kidney health disparities with new national policy: the time is now. Cardiovasc Diagn Ther. 2023 Feb 28;13(1):115-121. 10.21037/cdt-22-566 Epub 2023 Feb 13. PMID: 36864968; PMCID: PMC9971295.
2. Khalid F, Alsadoun L, Khilji F. Predicting the Progression of Chronic Kidney Disease: A Systematic Review of Artificial Intelligence and Machine Learning Approaches. Cureus. 2024 May 12;16(5):e60145. 10.7759/cureus.60145 . PMID: 38864072; PMCID: PMC11166249.
3. Tonelli M, Wiebe N, Knoll G, Bello A, Browne S, Jadhav D, Klarenbach S, Gill J. Systematic Review: Kidney Transplantation Compared With Dialysis in Clinically Relevant Outcomes. Am J Transplant. 2011 Oct;11(10):2093-109. Available from: https://doi.org/10.1111/j.1600-6143.2011.03686.x Epub 2011 Aug 30. PMID: 21883901.
4. Güell-Alonso R, Cabrera-Pérez R, Vives J. Immunocompatibility in transplantation: adapting to a changing therapeutic landscape. Front Immunol. 2025 Sep 9;16:1648534. 10.3389/fimmu.2025.1648534. PMID: 40995364; PMCID: PMC12454034.
5. Standring S. Philadelphia: Churchill Livingstone Elsevier. Philadelphia: Elsevier; 2016. Gray's Anatomy: The Anatomical Basis of Clinical Practice. [Google Scholar]
6. Novacescu D, Latcu SC, Raica M, Baderca F, Dumitru CS, Daminescu L, Bardan R, Dema V, Croitor A, Cut TG, Cumpanas AA. Surgical Strategies for Renal Transplantation: A Pictorial Essay. J Clin Med. 2024 Jul 17;13(14):4188. 10.3390/jcm13144188. PMID: 39064228; PMCID: PMC11278135.
7. Vistoli F, Romano L, Lancione L, Giuliani A, Clementi M, Iacobelli E, et al. Kidney Transplant Surgery. In: Santangelo M, Vistoli F, editors. Surgery in Uremic Patients. Cham: Springer; 2026. p. 111–126. 10.1007/978-3-031-92716-4_15
8. Wein AJ, Kavoussi LR, Novick AC, et al. Campbell-Walsh Urology. 9th ed. Saunders; 2007. Vol I: p 24.
9. Mchonde, GJ. Variant Right Renal and Adrenal Arterial Supply with Associated Clinical and Embryological Perspectives. Cureus. 2025 Dec 18;17(12):e99558. 10.7759/cureus.99558. PMID: 41552258; PMCID: PMC12812030
10. Pradhay G, Gopidas G, Karumathil Pullara S et al. Prevalence and Relevance of Multiple Renal Arteries: A Radioanatomical Perspective. Cureus. 2021;13(10):e18957. 10.7759/cureus.18957 – Pubmed
11. Watson CJ, Harper SJ. Anatomical variation and

its management in transplantation. Am J Transplant. 2015 Jun;15(6):1459-71. 10.1111/ajt.13310. Epub 2015 May 15. PMID: 25981150.
12. Damaskos C, Georgakopoulou VE, Garmpis N, Garmpi A, Dimitroulis D. Triple Renal Arteries in a Cadaveric Kidney Donor: A Case Report. Cureus. 2020 Nov 23;12(11):e11639. 10.7759/cureus.11639 PMCID: PMC7755657; PMID: 33376651
13. Rossi UG, Romano M, Ferro C. Seven renal arteries. Clin Anat. 2006; 19:632–633. 10.1002/ca.20264. [PubMed] [Google Scholar]
14. Hirai S, Honma S, Naito M, Terayama H, Kawata S, Itoh M. Nine renal arteries in a Japanese female cadaver. Anat Sci Int. 2013; 88:118–121. 10.1007/s12565-012-0161-y. [PubMed] [Google Scholar]
15. Garza FA, Leslie SW. Anatomy, Abdomen and Pelvis: Kidneys. 2025 Sep 15. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan–. PMID: 29494007. Anatomy, Abdomen and Pelvis: Kidneys - StatPearls - NCBI Bookshelf
16. Priya A, Narayan RK, Ghosh SK. Prevalence and clinical relevance of the anatomical variations of suprarenal arteries: a review. Anat Cell Biol. 2022 Mar 31;55(1):28-39. doi: 10.5115/acb.21.211. Erratum in: Anat Cell Biol. 2022 Dec 31;55(4):525-528. 10.5115/acb.21.211E. PMID: 35046145; PMCID: PMC8968230. [PMC free article] [PubMed]
17. Oceguera IN, Thaher O, Bausch D, Pouwels S. Vascular and Anatomical Challenges in Renal Transplant Surgery; What a Urologist Needs to know. Curr Urol Rep 26, 55 (2025). 10.1007/s11934-025-01281-5
18. Muharia BHR, Situmorang GR, Rasyid N, Rodjani A, Birowo P. Comparing anastomosis techniques on ischemia time in multi-arterial kidney grafts: a systematic review and meta-analysis. Med J Indones. 2025;34:30–6 10.13181/mji.oa.257527
19. Choudhary U, Kumar S, Jee K, et al. A cadaveric study on anatomical variations of kidney and ureter in India. Int J Res Med Sci 2017; 5:2358-61 DOI: 10.18203/2320-6012.ijrms20172094
20. Tuteja SY, Forgacs B. Multiple renal arteries. N Engl J Med. 2019; 381:862. 10.1056/NEJMicm1902894 . [PubMed] [Google Scholar]
21. Arumugam S, Subbiah NK, Mariappan Senthiappan A. Double Ureter: Incidence, Types, and Its Applied Significance-A Cadaveric Study. Cureus. 2020 Apr 21;12(4):e7760. 10.7759/cureus.7760 . PMID: 32455077; PMCID: PMC7243094.
22. Dorko F, Tokarčík J, Výborná E. Congenital malformations of the ureter: anatomical studies. Anat Sci Int. 2016 Jun;91(3):290-4. 10.1007/s12565-015-0296-8 . Epub 2015 Aug 19. PMID: 26286110.
23. Lescay HA, Jiang J, Leslie SW, et al. Anatomy, Abdomen and Pelvis Ureter. [Updated 2024 May 5]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532980/
24. Reisner DC, Elgethun MT, Heller MT, Klepchick PR, Hartman MS. Congenital and Acquired Disorders of Ureteral Course. Curr Probl Diagn Radiol. 2017 Mar-Apr;46(2):151-160. 10.1067/j.cpradiol.2016.04.002. Epub 2016 Apr 14. PMID: 27207823.
25. Chakravarthi KK. Unilateral multiple variations of renal, phrenic, suprarenal, inferior mesenteric and gonadal arteries. J Nat Sci Biol Med. 2014;5:173–5. 10.4103/0976-9668.127320. [PMC free article] [PubMed] [Google Scholar]
26. Sutton D. Textbook of radiology and imaging. 7th ed. London: Churchill Livingstone; 2003. pp. 885–988. [Google Scholar]
27. Narasimhamurthy M, Smith LM, Machan JT, et al. Does size matter? Kidney transplant donor size determines kidney function among living donors. Clin Kidney J. 2017 Feb;10(1):116-123. 10.1093/ckj/sfw097. Epub 2016 Oct 4. PMID: 28638611; PMCID: PMC5469570.
28. Pezeshki RM, Abbasi B, Valizadeh N et al. Evaluation of Normal Renal Size and its Influencing Factors: A Cross-Sectional Study on the Adult Population of Mashhad. Caspian J Intern Med. 2022 Summer;13(3):623-633. 10.22088/cjim.13.3.623. PMID: 35974941; PMCID: PMC9348224.
29. Glassock RJ, Rule AD. The implications of anatomical and functional changes of the aging kidney: with an emphasis on the glomeruli. Kidney Int. 2012 Aug;82(3):270-7. 10.1038/ki.2012.65. Epub 2012 Mar 21. PMID: 22437416; PMCID: PMC3513938.
30. Pani A, Pilia MG., Ferreli, LP, et al. Kidney size in

relation to ageing, gender, renal function, birthweight and chronic kidney disease risk factors in a general population. Nephrology Dialysis Transplantation, 35(4), 640–647. 10.1093/ndt/gfy270

31. Paleologo G, Abdelkawy H, Barsotti M et al. Kidney dimensions at sonography are correlated with glomerular filtration rate in renal transplant recipients and in kidney donors. Transplant Proc 2007; 39: 1779–1781. 10.1016/j.transproceed.2007.05.003. [PubMed] [Google Scholar]
32. Buturovic-Ponikvar J, Cerne S, Arnol M, Kandus A, Ponikvar R, Bren A. Early kidney graft size and Doppler parameters are associated with kidney graft function 1 year after transplantation. Transplant Proc. 2010 Dec;42(10):4026-9. 10.1016/j.transproceed.2010.09.053. PMID: 21168617.
33. Herts BR, Sharma N, Lieber M, Freire M, Goldfarb DA, Poggio ED. Estimating glomerular filtration rate in kidney donors: a model constructed with renal volume measurements from donor CT scans. Radiology. 2009 Jul;252(1):109-16. 10.1148/radiol.2521081873. Epub 2009 May 12. PMID: 19435940.
34. Hugen CM, Polcari AJ, Farooq AV, Fitzgerald MP, Holt DR, Milner JE. Size does matter: donor renal volume predicts recipient function following live donor renal transplantation. J Urol. 2011 Feb;185(2):605-9. 10.1016/j.juro.2010.09.098. Epub 2010 Dec 18. PMID: 21168871.
35. Giral M, Foucher Y, Karam G, et al. Kidney and recipient weight incompatibility reduces long-term graft survival. J Am Soc Nephrol. 2010 Jun;21(6):1022-9. 10.1681/ASN.2009121296. Epub 2010 May 20. PMID: 20488949; PMCID: PMC2900958.
36. Donati-Bourne J, Roberts HW, Coleman RA. Donor-recipient size mismatch in paediatric renal transplantation. J Transplant. 2014; 2014:317574. 10.1155/2014/317574. Epub 2014 Feb 13. PMID: 24688785; PMCID: PMC3943255.
37. Poggio ED, Hila S, Stephany B, et al. Kidney Volume and Outcomes Following Live Donor Kidney Transplantation, American Journal of Transplantation, Volume 6, Issue 3, 2006, Pages 616-624, ISSN 1600-6135, 10.1111/j.1600-6143.2005.01225.x.
38. Sabaa A, Rampersad C, Ani Orchanian-Cheff, et al. Impact of donor-recipient size mismatch on post-transplant outcomes in kidney transplant recipients: A systematic review. Transplantation Reviews, Volume 39, Issue 4, 2025,100965, ISSN 0955-470X, 10.1016/j.trre.2025.100965.
39. Watson CJ, Harper SJ. Anatomical variation and its management in transplantation. Am J Transplant. 2015 Jun;15(6):1459-71. 10.1111/ajt.13310. Epub 2015 May 15. PMID: 25981150.
40. Wigmore SJ, Seeney FM, Pleass HC, et al. Kidney damage during organ retrieval: data from UK National Transplant Database. Kidney Advisory Group. Lancet. 1999 Oct 2;354(9185):1143-6. 10.1016/s0140-6736(98)09409-4. PMID: 10513706.
41. Cardoso GI, Chinelatto LA, Hojaij F, et al. Corona Mortis: A Systematic Review of Literature. Clinics (Sao Paulo). 2021;76:e2182. 10.6061/clinics/2021/e2182.
42. Mchonde GJ, Nondoli HG, Mwashambwa MY, Fabian FM. Unilateral Variation on Origin, Position and Course of Pubic Artery Associated with a Variant Obturator Artery and Vein. Int J Anatomical Variations 2015. 10.16965/ijar.2015.135
43. Hajdyła, P., Plutecki, D., Nasser, A., et al. 2024. The complete anatomy of the iliolumbar artery: a meta-analysis with clinical implications. Folia Morphologica, 83(4), 771–778. 10.5603/fm.99720
44. McKay AM, Kim S, Kennedy SE. Long-term outcome of kidney transplantation in patients with congenital anomalies of the kidney and urinary tract. Pediatric Nephrology (Berlin, Germany) 2019;34(11):2409–2415. 10.1007/s00467-019-04300-z.[PubMed] [Google Scholar]
45. Kiani, A.Z., Hill, A.L., Vachharajani, N. et al. Robotic kidney transplant has superior outcomes compared to open kidney transplant: results of a propensity match analysis. Surg Endosc 39, 448–458 (2025). 10.1007/s00464-024-11301-z
46. Tzvetanov IG, Tulla KA, Di Cocco P et al. Robotic Kidney Transplant: The Modern Era Technical Revolution. Transplantation 106(3):p 479-488, March 2022. 10.1097/TP.0000000000003881