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Case report

Successful liver and kidneys transplant following aortic dissection and subclavian artery rupture: A case report

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ABSTRACT

Introduction and importance: Despite the increasing number of liver and kidney transplants, the number of patients awaiting for a proper donor is still exceeding. Therefore, the preservation of donor organs is critically advocated.
Case presentation: Herein, we presented a successful liver and kidney transplant from a brain-dead donor who was found preoperatively to have simultaneous aortic dissection and intramural hematoma and additionally developed left subclavian artery dissection and perforation, which was noticed following sternotomy.
Clinical discussion: This case experience highlights the key role of cardiac surgeons in preserving visceral organs by rapid repair of the dissection and perforation sites of the aorta and its branches which culminate in lifesaving organ donation.
Conclusion: This case report introduces the first case of a successful; liver and kidneys transplant in a patient with concurrent aortic dissection and subclavian artery rupture which served as a lifesaving donor.

1. Introduction

Organ transplantation has been used as a fairly new treatment method to replace organs from a brain-dead donor to a recipient in need of those organs [1]. The most commonly transplanted organs are kidneys and liver, respectively [2]; 244,000 patients were alive with a viable transplanted kidney in 2019 but 101,337 adult patients were still waiting for kidney transplants at the end of 2019 [3]. In addition, considering the liver transplant, 8425 patients received a liver graft in 2020 nevertheless, 12,261 patients were added to the waiting list [4]. These statistics demonstrated that although the number of these two organs procurement enhanced, the number of patients awaiting kidney and liver donors exceeded yet. Consequently, it is crucial to protect the patients with brain death who are potentially appropriate candidates for organ donation till the process of organ transplantation [5]. In this case report, we presented a novel case of a successful liver and kidneys retrieval from a brain-dead patient who was incidentally found to have an extensive progressive aortic dissection and left subclavian artery rupture and then emphasized the reason for our success in the management of this transplantation with a review of the recent available medical literature. No identifiable information was disclosed in writing this article; however, written consent was obtained from the patient's family. We composed this report in accordance with SCARE guideline 2022 [6].

2. Case report

A 54-year-old Iranian man with a past medical history of hypertension developed brain death following massive intracranial and intraventricular hemorrhage (ICH and IVH) in another hospital. Considering his brain death, a proposition of organ donation was made and after the acquisition of informed consent by the coordinator, he became a potential donor for abdominal solid organ transplantation. Accordingly, he was transferred to our center at Rasool Akram general hospital, Tehran, Iran for organ procurement. Upon admission, his brain death was confirmed with a deep unresponsive comatose state, absent brainstem reflexes, positive apnea test, negative atropine test, and electroencephalography (EEG) findings in favor of electrocerebral inactivity. In the

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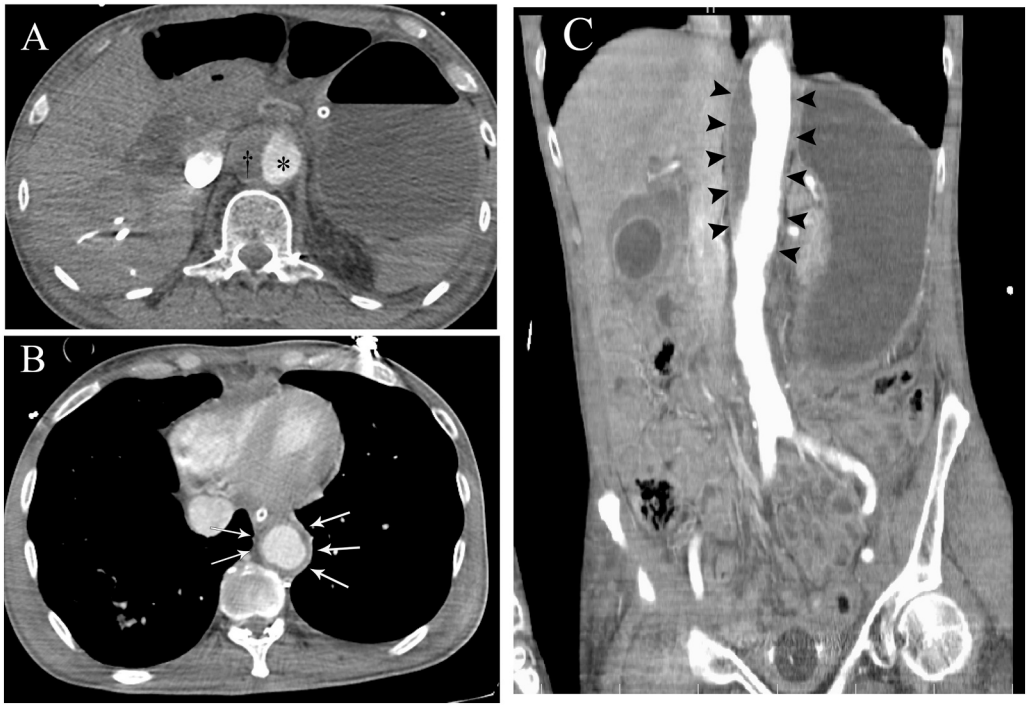

Fig. 1. A: Axial CTA of abdominal cavity revealing false (Double cross sign) and true (Asterisk sign) lumen of descending aorta dissection with contrast enhancement of true lumen.
B: Mediastinal window of the chest CT scan depicts circumferential intramural hematoma of the descending aorta (arrows).
C: Reconstructed coronal view of the CTA in arterial phase demonstrating biluminal aortic contrast pattern (arrowheads), terminating before the aortic bifurcation.

interim, further evaluation with chest CT scan with the aim of exclusion of COVID-19 lung involvement was suspicious of aortic abnormalities. CT angiography of the chest and abdomen exhibited circumferential intramural hematoma (IMH) of the aorta and extensive Stanford type B aortic dissection (TBAD) to the extent of the aortic bifurcation (Fig. 1). Given these findings, the patient was transferred to the operating room (OR) emergently, and cardiac and transplant surgeons were at OR concurrently. During preparation for surgery, the pre-arrest signs were noticed in the patient. The midline sternotomy was performed while the coordination team maintained the hemodynamic stability of the patient. Upon sternotomy, decompensation of aortic dissection with rupture of the left subclavian artery and subsequent left hemithorax hematoma were encountered (Video-1). The aortic arch was exposed and made free from adjacent tissues including innominate vein and areolar fat pads, the subclavian artery perforation site was repaired with prolene sutures rapidly to impede further blood loss and preservation of the patient's blood pressure. Thereafter, the false lumen of dissection was confined via tucking and sewing intima to media to prevent its propagation. In addition, midline laparotomy was done simultaneously by the transplant surgeon, cannulation of the abdominal aorta was performed following systemic heparinization and preservation solution was instilled into the liver and kidneys. Fortunately, visceral organs were perfused by true lumens of the abdominal aorta and its visceral branches. Thus, liver and kidneys harvesting was done and then transplanted to recipients. There were no vascular complications in transplantation and organs were viable in the recipient bodies. In follow-up of the recipients, they were doing well without evidence of organ rejection in 1 year after transplantation.

3. Discussion

Acute aortic syndrome (AAS) comprising aortic dissection and IMH is a commonly misdiagnosed life-threatening circumstance and one of the catastrophic complications of acute TBAD is aortic rupture with massive left hemothorax which is rare and leads to hemodynamic instability and poor outcome [7,8].

In this case presentation, the donor was diagnosed with ongoing TBAD and IMH incidentally. Although the preferred approach for the management of complicated TBAD is thoracic endovascular aortic repair (TEVAR) when it is compared with open surgical repair (OSR) particularly while considering the short-term mortality [9–11]; in our case, classic sternotomy was inevitable due to the transplantation procedure which encompasses cold preservation solution placement in pleural space and the requirement for dissecting diaphragm to release the liver and the inferior vena cava.

Following sternotomy, the dissection and rupture of the subclavian artery and successive left hemothorax were confronted. According to our review of the literature, the perforation of the subclavian artery has mostly iatrogenic or traumatic causes limited to the case reports [12–14]; but in our case, it occurred secondary to retrograde propagation of aortic dissection which led to left subclavian artery dissection and subsequent free wall rupture. Although the subclavian artery rupture gave rise to the patient's hemodynamically instability and increased further risk of organ procurement failure, the perforation site was rapidly repaired.

However, there is another case in the literature of a successful liver retrieval after acute aortic dissection [15]; to the best of our knowledge, this is the first case of thriving liver and kidneys transplant with concomitant aortic dissection and subclavian artery rupture which served as a lifesaving donor.

The experience of this challenging case showed us that cardiac surgeons should be present at OR in similar cases, do sternotomy and prevent the extent of dissection to impede visceral vessels from becoming useless. Moreover, when the abdominal aorta is cannulated and the liver and renal preservation solution is infused by a transplant surgeon, the assistance of a cardiac surgeon can be favorable. Eventually, even though cardiopulmonary bypass was not required for our patient, the cardiac surgeon should be available for possible need of cardiopulmonary bypass. In this case, shifting the circulation to the heart pump was deferred because the process of arterial cannulation in cardiopulmonary bypass could assist the exacerbation of propagating dissection when the arterial cannula is inserted in the false lumen of dissecting aorta and increase blood flow in this lumen.

4. Conclusion

In essence, we reported for the first time a successful hepatic and renal transplantation from a donor with a complex manifestation of a complicated aortic dissection, and this practical experience underscores the prominent role of cardiac surgeons in preserving visceral organs by rapid repair of the dissection and perforation sites of the aorta and its branches which result in lifesaving organ donation.

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Ethical approval

This study did not include participants nor any interventional measure, however ethical approval was obtained from Iran University of medical sciences ethical committee.

Declaration of competing interest

The authors declare no conflict of interest.

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Consent

No identifiable was disclosed in writing this article, nevertheless, a written informed consent was obtained from the patients family members.

Author contribution

Sam Zeraatian Nejad, Yazdan Shafikhani and Milad Gholizadeh Mesgarha were responsible for patients' initial admission, surgery planning and management of organ procurement. Milad Gholizadeh Mesgarha, Ali Saberi Shahrbabaki and Aisa Talebi were accountable for composing the initial draft and literature review; Arash Pour Mohammad, made final revisions and prepared the figures and videos.

Registration of research studies

Not applicable.

Guarantor

The authors confirm Dr. Milad Gholizadeh Mesgarha as guarantor of this study.

References

[1] I.R.F. da Silva, J.A. Frontera, Worldwide barriers to organ donation, JAMA Neurol. 72 (1) (2015) 112, https://doi.org/10.1001/jamaneurol.2014.3083.
[2] Key Facts | Overview | Transplant Safety | CDC, Centers for Disease Control and Prevention (CDC), Retrieved February 24, 2022, from, https://www.cdc.gov/transplantsafety/overview/keyfacts.html#:%7E:text=In%20the%20United%20States%2C%20the,providing%20on%20average%203.5%20organs, 2019.
[3] A. Hart, K.L. Lentine, J.M. Smith, J.M. Miller, M.A. Skeans, M. Prentice, A. Robinson, J. Foutz, S.E. Booker, A.K. Israni, R. Hirose, J.J. Snyder, OPTN/SRTR 2019 annual data report: kidney, Am. J. Transplant. 21 (S2) (2021) 21–137, https://doi.org/10.1111/ajt.16502.
[4] UNOS Data and Transplant Statistics | Organ Donation Data. United Network for Organ Sharing (UNOS). Retrieved February 5, 2022, from https://unos.org/data/.
[5] I. Martin-Loeches, A. Sandiumenge, J. Charpentier, J.A. Kellum, A.M. Gaffney, F. Procaccio, G.A. Westphal, Management of donation after brain death (DBD) in the ICU: the potential donor is identified, what's next? Intensive Care Med. 45 (3) (2019) 322–330, https://doi.org/10.1007/s00134-019-05574-5.
[6] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group, The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines, International Journal of Surgery 84 (2020) 226–230.
[7] I. Vilacosta, J.A. San Román, R. di Bartolomeo, K. Eagle, A.L. Estrera, C. Ferrera, S. Kaji, C.A. Nienaber, V. Riambau, H.J. Schäfers, F.J. Serrano, J.K. Song, L. Maroto, Acute aortic syndrome revisited, J. Am. Coll. Cardiol. 78 (21) (2021) 2106–2125, https://doi.org/10.1016/j.jacc.2021.09.022.
[8] S. Trimarchi, S. Segreti, V. Grassi, C. Lomazzi, C. de Vincentiis, V. Rampoldi, Emergent treatment of aortic rupture in acute type B dissection, Ann. Cardiothorac. Surg. 3 (3) (2014) 319–324, https://doi.org/10.3978/j.issn.2225-319X.2014.05.05. PMID: 24967173; PMCID: PMC4052411.
[9] J. Liu, J. Xia, G. Yan, Y. Zhang, J. Ge, L. Cao, Thoracic endovascular aortic repair versus open chest surgical repair for patients with type B aortic dissection: a systematic review and meta-analysis, Ann. Med. 51 (7–8) (2019) 360–370, https://doi.org/10.1080/07853890.2019.1679874.
[10] D. Liu, H. Luo, S. Lin, L. Zhao, C. Qiao, Comparison of the efficacy and safety of thoracic endovascular aortic repair with open surgical repair and optimal medical therapy for acute type B aortic dissection: a systematic review and meta-analysis, Int. J. Surg. 83 (2020) 53–61, https://doi.org/10.1016/j.ijsu.2020.08.051.
[11] D. Sheeran, L. Wilkins, P.K. Koyada, J.F. Angle, Management of acute, complicated type B aortic dissection, Tech. Vasc. Interv. Radiol. 24 (2) (2021), 100750, https://doi.org/10.1016/j.tvir.2021.100750.
[12] T. Rizk, D. Patel, E. Young, V. Ramakrishnan, K. Mansour, Multidisciplinary management of subclavian artery perforation and complications, Cureus (2020), https://doi.org/10.7759/cureus.8009.
[13] H. Kawashima, Y. Watanabe, A. Kataoka, K. Kozuma, Unexpected massive pleural effusion leading to discovery of left subclavian artery rupture during transcatheter aortic valve implantation, J. Cardiol. Cases 19 (4) (2019) 136–139, https://doi.org/10.1016/j.jccase.2018.12.016.
[14] N.G. Baikoussis, S.N. Siminelakis, M. Matsagas, L.K. Michalis, Massive haemothorax due to subclavian artery rupture: emergency thoracotomy or primary stent-grafting? Heart Lung Circ. 19 (7) (2010) 431, https://doi.org/10.1016/j.hlc.2009.08.002.
[15] S. Abu-Gazala, P.L. Abt, M.H. Levine, Successful liver retrieval after acute aortic dissection involving the celiac artery origin, Am. J. Transplant. 16 (1) (2015) 365–367, https://doi.org/10.1111/ajt.13548.