Current status and future aspects of HTx and VAD in Japan

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The world first heart transplantation (HTx) was performed by Dr Barnard in 1967 and the first one in Japan by Dr Wada in 1968. Although organ transplantation including HTx from brain dead persons were increased in USA and European countries and HTx has been established as therapeutic option for end-stage heart failure in the world. However, the Wad's HTx mislead organ donation in Japan, and it took more than 30 years to start HTx in Japan.

The Japanese *Organ Transplant Act* came into effect in October 1997 and the first heart transplantation under this Act was performed in February 1999. However, the Act required a living written consent for brain dead (BD) persons and organ donation and did not allow BD donation from children younger than 15 years. From these reasons, only 81 BD organ donations have been performed in Japan for 13 years since the former Act was issued. The cardiac donation rate per million populations in Japan is only 0.08, while it is 7.3 in USA and 0.97 in South Korea in 2007. A mean waiting time for HTx was extraordinary long in Japan, which was 1,026 days in 2010.

Finally, the Act was revised on 17th July in 2010. By renewal of the Act, organs can be donated after BD with consent from their family, if he or she did not deny organ donation. Although the Act was revised in 2010 and BD organ donation increased from 13 to 84 cases in a year in 2019, the number was still extremely smaller than other developed countries. To maximize heart availability, special transplant management doctors (a medical consultant; MC) have been sent to the procurement hospital since 2002. They assessed donor organ function and identified which organs were useful for transplantation. They also intensively cared the donor, stabilized the donor hemodynamics by giving anti-diuretic hormone and reducing the dose of intravenous catecholamine as much as possible, and improved donor cardiac and lung function by preventing and treating lung infection before procurement teams arrived at the donor hospital. By these efforts, out of 761 consecutive brain-dead organ donation between the beginning and the end of June, 2021, 594 hearts (77.1%) were transplanted and 5, 10 and 20 years of patient survival was 93.5, 90.5 and 75.5%, respectively.

However, the number of HTx procedures remains low in international terms and the mean waiting period exceeded 1,600 days at the end of December 2020 because of a rapid increase in new registered patients on the waiting list. A bridge to transplantation (BTT) using a left ventricular assist device (LVAD) plays a greater role than before in managing the listed patients. Since insurance coverage was extended to the continuous flow-type of implantable LVAD (CF-LVAD) in April 2011, the total number of CF-LVAD implantation patients enrolled in the Japanese registry for Mechanically Assisted Circulatory Support (J-MACS) increased to more than 1600 case at the end of July 2021. In May 2021, Destination therapy (DT) of ineligible candidates for HTx was approved in Japan, and it may change the field of therapeutic therapy for patients with end-stage heart failure in Japan. However, to save patients with severe right heart failure, reluctant lethal arrhythmia and so on, implantable RVAD or total artificial heart should be approved to use in the near future in Japan.

In terms of pediatric HTx and VAD, Berlin Heart EXCOR Pediatric was approved in August 2015. Then small children with end-stage heart failure can be saved in Japan. As pediatric braindead organ donation gradually increased in Japan, children who undergo HTx abroad have been decreasing.