


Unexpected cardio-circulatory arrest during a brain-dead donor organ retrieval

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Keywords

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Abstract

According to the Maastricht classification category of donation after circulatory death (DCD), type IV DCD refers to brain-dead donors who are re-categorized after unexpected circulatory arrest before donor organ retrieval. Clinical management is challenging, even in intensive care units, where most of this type of organ donation occurs. We report a case of the first successful lung transplantation (LTx) using type IV DCD organ in Taiwan. The recipient's recovery was satisfactory, without acute or chronic organ dysfunction. When unexpected events made the brain-dead donors suffer from sudden onset of cardiac arrest before or during organ donation surgery, immediately switching the retrieval protocol from donation after brain death (DBD) to DCD could expand the donor pool and increase organ supply. The well-prepared and experienced transplant team and prompt protocol switch made this transplant surgery possible.

Introduction

With the increasing demand for organ transplant and advances in transplant management, the utilization of donors after circulatory death has increased. According to the modified Maastricht classification of donation after circulatory death (DCD), unexpected circulatory arrest in brain-dead donors is classified as type IV DCD and mostly occur in the intensive care units (ICUs) [1]. However, there has been a limited discussion on sudden unexpected circulatory arrest for cadaveric donors after the declaration of brain death was completed, especially when the event happened during the harvest procedure. In this report, we present how to switch the donation protocols from the donation after brain death (DBD) to DCD in the operation theatre. This was the first case of successful lung transplantation (LTx) from a type IV DCD donor in Taiwan.

Case Report

A 55-year-old man with interstitial lung disease was admitted to our hospital for LTx. He had dyspnoea and

cough since 2016, and pulmonary function test (PFT) and chest computed tomography (CT) findings led to the diagnosis of idiopathic pulmonary fibrosis. However, the symptoms exacerbated in March 2019. Therefore, he underwent an LTx evaluation. The PFT showed that the forced vital capacity and the forced expiratory volume in 1 second deteriorated to 32.0% and 38.8%, respectively (Fig. 1A). The recipient was placed on the waiting list for LTx and received the cadaveric organ donation in April 2020. The donor was a 37-year-old man diagnosed with left basal ganglia haemorrhage and was determined to be brain-dead after confirming brain stem dysfunction. The donor was evaluated as a potential brain-dead donor. The coronary angiography demonstrated coronary artery disease with one-vessel stenosis, but he was still considered to be a suitable donor for multiple organ donation, including the heart. After declaring brain dead, the organ retrieval operation was arranged according to DBD protocol. However, sudden-onset ventricular tachycardia was noted during the control of the inferior vena cava. Although defibrillation-cardioversion was conducted,

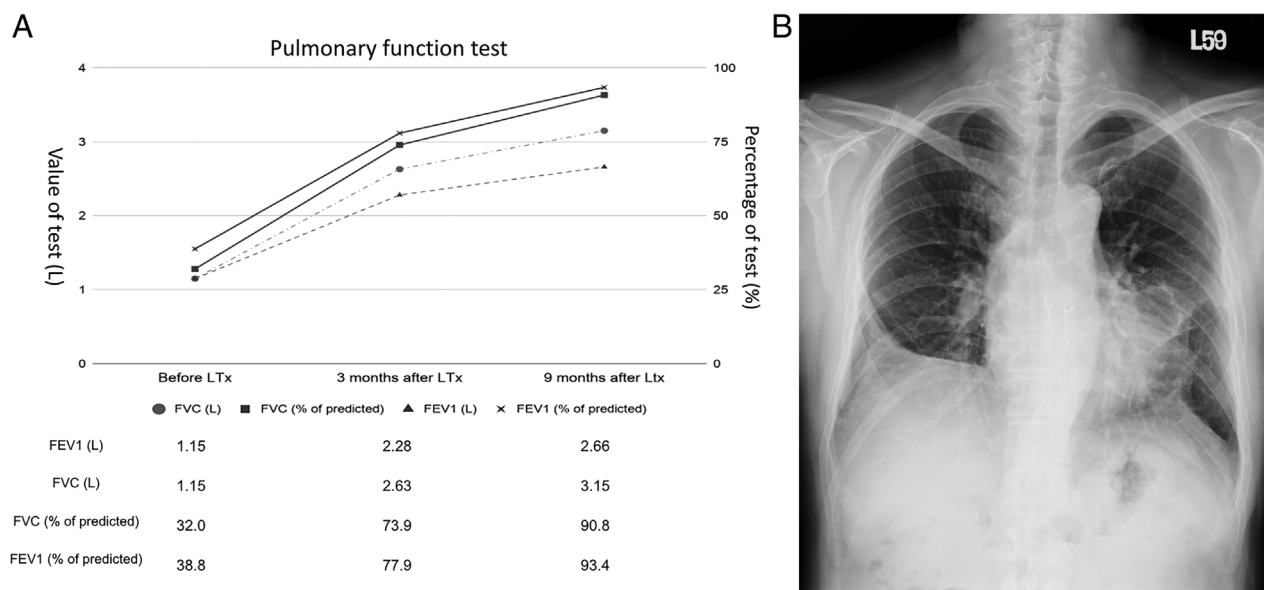


Figure 1. (A) Pulmonary function test result. (B) Chest radiograph after five months of operation. FEV₁, forced expiratory volume in 1 sec; FVC, forced vital capacity; LTx, lung transplantation.

circulation was still arrested after 11 min of cardiopulmonary resuscitation. To preserve the donor organ’s function, the retrieval protocol was immediately switched from DBD to DCD. After systemic heparinization, the organ retrieval was begun followed by administration of organ preservation solutions. The warm ischaemia time

was 15 min. The donor lungs and liver were retrieved successfully. The donor liver was allocated to another medical centre for organ transplant, and the donor lungs were implanted to our recipient simultaneously. The cold ischaemia time for each lung was 285 and 487 min (Fig. 2).

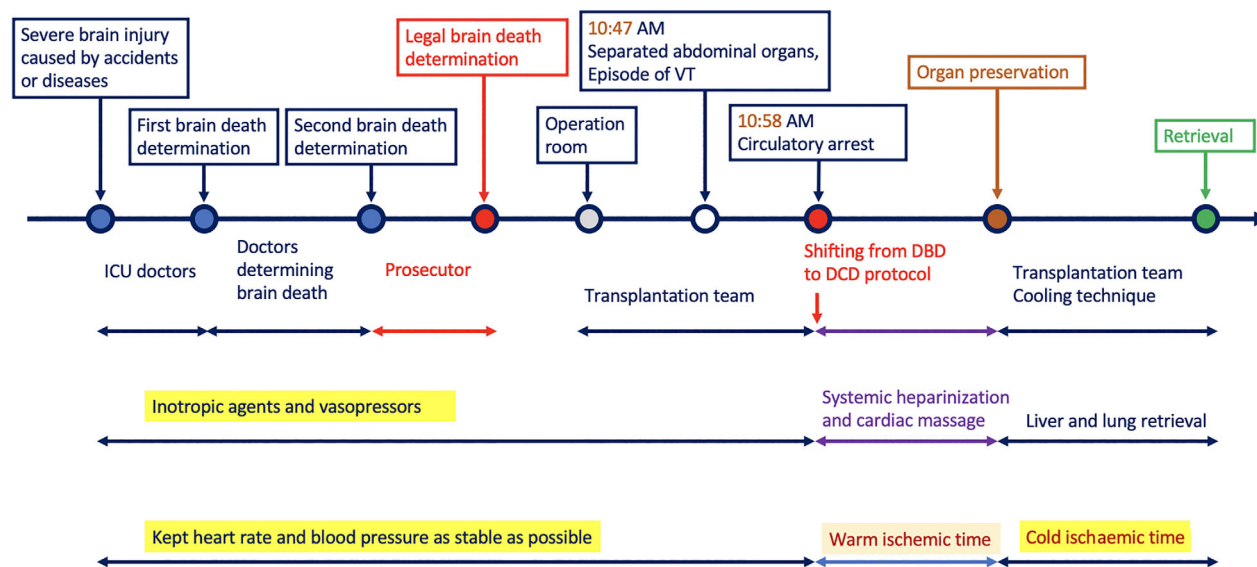


Figure 2. Uncontrolled DCD process. DBD, donation after brain death; DCD, donation after circulatory death; ICU, intensive care unit; VT, ventricular tachycardia.

After LTx, the recipient's condition continued to improve, and there were no episodes of acute or chronic organ rejection. Due to the prolonged cachexia before LTx, the recipient was scheduled for in-hospital rehabilitation. The total ICU stay was 74 days and hospital stay was 82 days. The recipient's remaining post-operative course was satisfactory and is periodically followed up at an out-patient clinic for more than 10 months with uneventful course and improved pulmonary function (Fig. 1B).

Discussion

The persisting shortfall in the available organ donor has promoted to develop the DCD schemes. However, prolonged warm ischaemia would injure the donor organ and limit the utility of DCD donors. Furthermore, especially under uncontrolled DCD setting, it was hard to arrange the transplant when the donor's blood pressure decreased abruptly and unexpectedly. In contrast, DBD was conducted when the donor was under stable blood pressure, and therefore the warm ischaemic time was shorter, causing less injuries to the organs. With better management, the percentage of organ transplantation increased by approximately 20% [2].

The clinical management of circulatory shock in DBD donors required delicate adjustment of ventilator, fluid control, and timely arrangement of transplant [3]. This is challenging even in the ICU setting and nearly inevitably leads to transplant failure if the scenario happened during operation. In this case, the protocol for DCD LTx was followed immediately after failed resuscitation of brain-dead donor during organ retrieval [4]. But still, the effect of acute inflammatory lung injury which related to neuro-hormonal homeostatic unbalance and cardiac arrest is inevitable.

The decision was made to prevent the prolonged warm ischaemic time and thrombosis formation, which may lead to organ dysfunction and lower functionality rate of organ retrieval. Immediate intravenous heparin administration and cardiac massage help to preserve the organ function from the damages that may be caused by the original DBD protocol. In this condition, extracorporeal membrane oxygenation is another option for organ perfusion preservation. However, facility and faculty availability may be a limitation [5].

To the best of our knowledge, this is the first report of DCD LTx in Taiwan and the initial outcome is promising. In summary, the well-prepared and experienced transplant team and prompt protocol switch made the transplant surgery feasible in this condition. Expanding the donor pool to include DCD donors is important to increase organ

supply, which gives hope to the patients on the waiting lists.

Disclosure Statement

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

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Author Contribution Statement

Conception or design of the work, acquisition, analysis or interpretation of data for the work: Pei-Hsing Chen, Ching-Tang Chiu, Shu-Chien Huang, Hsao-Hsun Hsu. Drafting the work or revising it critically for important intellectual content: Pei-Hsing Chen, Yu-Shan Shih. Final approval of the version to be published: Pei-Hsing Chen, Yu-Shan Shih, Ching-Tang Chiu, Shu-Chien Huang, Hsao-Hsun Hsu.

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