Successful bilateral lung transplantation from a deceased donor with a ruptured main bronchus

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 Received 18 March 2015; received in revised form 20 May 2015; accepted 27 May 2015

Abstract

Major tracheobronchial trauma may lead to underestimation of the potential for lung donation due to insufficient alveolar ventilation and resulting poor oxygenation, bronchosscopic findings and radiographic findings (e.g. atelectasis). Here, we report a case of successful bilateral lung transplantation from a deceased donor whose right bronchus was ruptured by a trauma from the main bronchus to the bronchus intermedius. Although poor oxygenation and a collapsed right lung detected by computed tomography scanning precluded the use of the donor lungs by multiple transplant centres, careful bronchoscopic evaluation and intraoperative assessment convinced us that the parenchyma of the donor lungs was preserved sufficiently well for transplantation. Upon transplantation, the donor right bronchus was anastomosed at two levels, the upper lobe bronchus and the bronchus intermedius, and the lacerated portion was removed. The recipient's postoperative course was uneventful and the bronchial anastomoses healed excellently. Careful preoperative evaluation and appropriate surgical techniques might enable successful lung transplantation, using seemingly suboptimal donor lungs with major airway trauma.

Keywords: Lung transplantation • Post-traumatic donor • Ruptured main bronchus

INTRODUCTION

Potential donors with a significant chest trauma have been regarded as ineligible for lung donation. Conservative medical management for tracheobronchial injuries has been developed recently, resulting in favourable outcomes [1]. Although the effect of such medical approaches in traumatized organ donors is largely unknown, potential donors with airway trauma might become valid for lung transplantation, changing the conventional perception. Here, we present a successful case of bilateral lung transplantation from a brain-dead donor with a ruptured right main bronchus.

CASE

The recipient was a 55-year old man diagnosed with emphysema. The donor was diagnosed with traumatic brain death. Chest computed tomography (CT) showed bilateral atelectasis and pleural effusion, as well as pneumomediastinum (Fig. 1A). Bronchoscopy revealed that the membranous portion of the right bronchus was lacerated raggedly across the main bronchus and bronchus intermedius. The CT findings did not improve despite days of continuous chest drainage and mechanical ventilation. Preoperative blood gas analysis showed a suboptimal arterial oxygen pressure of 166 mmHg (inspiratory oxygen fraction, 1.0). These negative findings led several other institutions to decline the donor lungs. However, we thought that the bronchial injury might have been the cause of insufficient ventilation, leading to deteriorating oxygenation levels and CT findings, and that the actual condition of the right lung may have been far better than it appeared. We hypothesized that if this was the case, surgical management of the ruptured airway could salvage the donor lungs.

During our assessment, although the right lung remained collapsed, bronchoscopy revealed that all of the right lobar bronchi were intact, without any evidence of purulent secretions or positive gram staining of the airway secretions. During the donor operation, we could fully inflate the whole lung by manually holding the ruptured bronchus at the hilum. Arterial blood gas analysis revealed a partial pressure of oxygen of 466 mmHg (inspiratory oxygen fraction, 1.0). We extracted the entire lung by clamping the trachea and the left main bronchus after temporarily repairing the laceration site in order to maintain lung inflation during transportation.

On the back table of the operating room, the right bronchus of the donor (Fig. 1B) was truncated at the upper lobe bronchus and the orifice of the lower and middle lobar bronchi, removing the lacerated portion of the bronchus (Fig. 1C). During the recipient operation, the right bronchus was prepared by truncating the upper bronchus and the bronchus intermedius separately (Fig. 1D). Then, the donor and recipient bronchi were anastomosed at two levels with 4-0 monofilament sutures. Anastomosis of the left atrial cuff and the pulmonary artery as well as left lung transplantation was conducted in a regular manner.

There were no significant complications during the postoperative course. Bronchoscopy confirmed excellent healing of all...
DISCUSSION

Tracheobronchial trauma may occur in close proximity to the tracheal bifurcation [2]. In the previous report, the calculated incidence of such airway trauma was ≏1–2% in all high-speed crashes [1]. Severe airway trauma is often a major obstacle of respiratory care as it can cause hypoxia, massive atelectasis and/or pulmonary/mediastinal infections, which are usually impermissible for lung donation [3]. Indeed, in the current case, several negative findings such as protracted lung collapse and insufficient oxygenation precluded the use of the donor lungs by multiple transplant centres. However, in reality, the arterial oxygen pressure after whole lung inflation in the surgical field was good enough to convince us that the donor lung parenchyma was preserved adequately for lung donation. With a careful preoperative management and evaluation, seemingly suboptimal donor lungs with severe airway trauma could indeed be acceptable for transplantation.

Another key factor contributing to the successful transplantation was the separate anastomosis of the right upper lobe bronchus and the bronchus intermedius without using the injured bronchus. A similar approach has been taken when using donor lungs with a right tracheal bronchus [4, 5].

In conclusion, we experienced a case of successful bilateral lung transplantation from a brain-dead donor with a ruptured right main bronchus. Careful preoperative evaluation and appropriate surgical techniques might enable successful lung transplantation using apparently suboptimal donor lungs with major airway trauma.
Conflict of interest: none declared.

REFERENCES


eComment. Tracheobronchial trauma in lung transplantation: ethical considerations

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doi: 10.1093/icvts/ivv199

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I was interested to read Miyamoto et al’s case report on successful bilateral lung transplantation from a deceased donor with a ruptured main bronchus, and to read how their hypothesis was put directly into practice to allow transplantation with seemingly suboptimal donor lungs [1]. During the UK financial year 2013–2014, 39% of patients listed for a lung transplant were transplanted within 6 months, and of 374 lungs retrieved, 347 organs were used [2]. Where demand outweighs resource, the potential for lung transplantation in cases of donor tracheobronchial trauma arguably unlocks a potentially valuable resource.

The ethical dimensions to organ donation are vast - societal attitudes and health inequalities to name two examples [3]. If transplantation in the context of tracheobronchial trauma in the donor was shown to be effective on a larger scale, this might reduce the gap between resource and demand. However, it is also important to consider the lack of long-term follow-up data on such cases and the potential implications for this.

I would be interested to know how Miyamoto et al defined the absence of significant complications during the postoperative period, and also whether there will be any further follow-up on this patient in terms of outcome after six months. Following the success of this case where bronchoscopic evaluation and careful intraoperative assessment allowed utilization of a resource deemed unsuitable by computed tomography scan, I also wondered whether there has been any change to the assessment of organ suitability in Miyamoto et al’s department?

Conflict of interest: none declared.

References


eReply. Re: Tracheobronchial trauma in lung transplantation: ethical considerations

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doi: 10.1093/icvts/ivv208

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Thank you very much for your encouraging comment and constructive feedback on our article [1,2]. During the immediate postoperative period, we carefully examined the airway anastomoses by repeated periodical bronchoscopy until discharge to find no problem at these anastomoses. In the long term, at the latest one and a half years after transplantation, there was no airway trouble. We do continue further follow-up. As you mentioned, severe donor shortage was the very reason why we tried to utilize this donor with tracheobronchial injury. Although this was a rare case, we would assess donor lungs, considering the possibility of using the donor lungs with airway trauma without any damage or infection in the lung parenchyma.

Conflict of interest: none declared.

References
