Living by numbers

Dirk Van Raemdonck, MD, PhD,^a Arne Neyrinck, MD, PhD,^b Robin Vos, MD, PhD,^c and Geert M. Verleden, MD, PhD^c

From the Departments of ^aThoracic Surgery, ^bAnesthesiology, and ^cPneumology, University Hospitals Leuven, Leuven, Belgium.

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Address for reprints: Dirk Van Raemdonck, MD, PhD, Department of Thoracic Surgery, University Hospital Gasthuisberg, Herestraat 49, Leuven B-3000, Belgium (E-mail: dirk.vanraemdonck@uzleuven.be).

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Fifteen hundred likes for the lung transplant group at Washington University in St Louis.

Central Message

Lung transplant outcome is related to center volume. More aggressive selection of higher-risk donors and recipients can lead to increased transplant volume without a negative impact on survival.

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“Living by Numbers” is a song performed by the English synthpop group New Musik.¹ It was the band’s biggest hit worldwide in 1980, before the first reports on successful lung transplantation (LTx). The expression “living by numbers” asks the question of whether a problem might best be approached qualitatively or quantitatively.

According to the 2017 Registry Report of the International Society for Heart and Lung Transplantation,² center volume is an independent risk factor for 1-year mortality among recipients undergoing LTx for chronic obstructive pulmonary disease and idiopathic interstitial pneumonia. In a study published in 2009 on more than 10,000 cases in the United Network for Organ Sharing database, Weiss and associates³ analyzed the impact of center volume on posttransplant outcome. Low-volume centers had double the risk of 30-day censored 1-year mortality. High-volume centers (>20 LTx procedures/year) had the lowest 30-day mortality (4.1%). Weiss and associates³ concluded that low center volume was associated with increased short-term and cumulative mortalities despite fewer patients with idiopathic pulmonary fibrosis and younger patients. As for many other complex thoracic surgical procedures with high risk of mortality, center volume and surgeon specialty are important determinants of outcome, but evidence-based minimum-volume standards are lacking.⁴⁻⁶

In this issue of the *Journal*, Balsara and coworkers⁷ report their review of 1500 adult LTx procedures performed between 1998 and 2016 at Washington University in St Louis, comparing recipient outcomes before and after the introduction of the lung allocation score in 2005. When comparing demographic characteristics between the study groups (April 1988-April 2005, n = 792; May 2005-September 2016; n = 708), the average age at transplant increased from 48 ± 13 years to 50 ± 14 years, the percentage of male patients increased from 51% to 59%, and the number of double-lung transplants increased from 77.7% to 96.2%. The percentage of recipients with emphysema decreased from 52% to 25.8%, whereas the percentage of

recipients with pulmonary fibrosis increased from 16.1% to 46% as a result of prioritization with higher lung allocation score. Overall incidence of grade 3 primary graft dysfunction was significantly lower in the first cohort at 22.1%, compared with 31.6% in the second ($P < .001$). Nonetheless, overall in-hospital mortality did not differ (4.4% vs 3.5%). A significant improvement in 1-year survival was noted, from 81.6% to 91.4% ($P < .02$). Balsara and coworkers⁷ concluded that more aggressive selection of higher-risk donors and recipients can lead to increased transplant volume without a negative impact on survival. Although their improved survival though the years is likely to be multifactorial, better understanding and management of early (primary graft dysfunction) and long-term (chronic lung allograft dysfunction) dysfunction are certainly key elements in their success.

This is the largest single-center report to date on outcome in lung recipients undergoing LTx over the span of 3 decades. The St Louis LTx group is to be applauded for these improved survival results in the post-lung allocation score era. Other LTx centers have learned many aspects from this pioneering group. We are grateful to their initial surgical leaders, Joel D. Cooper and G. Alexander Patterson, who moved from Toronto to St Louis, for showing the way forward in isolated LTx.

In our series of 1036 patients who underwent LTx at the University Hospitals Leuven, Belgium, between 1991 and

FIGURE 1. A, Evolution in annual number and transplant type of more than 1000 lung transplants performed at the University Hospitals Leuven, Belgium between July 14, 1991, and December 31, 2017. B, Overall lung transplant (LTx) graft survival (censored at redo lung transplantation). UZ Leuven, Universitaire Ziekenhuizen Leuven (University Hospitals Leuven). C, Graft survival in the first 1000 lung transplant patients stratified per quartile. Results improved significantly with growing experience over time: quartile 1 versus quartile 4 ($P < .0001$; hazard ratio, 2.311; 95% confidence interval, 1.583-3.375); quartile 2 versus quartile 4 ($P = .013$; hazard ratio, 1.627; 95% confidence interval, 1.105-2.395); quartile 3 versus quartile 4 ($P = .50$; hazard ratio, 1.154; 95% confidence interval, 0.763-1.745). HL, Heart-lung transplant; DL, double-lung transplant; SL, single-lung transplant.

2017, a gradual shift was noticed from single-lung transplantation in the first half of our program toward double-lung transplantation in most patients in the second half and to the exclusive use of both lungs for a single recipient since 2012 (Figure 1, A). Median survival was 11 years, and overall graft survivals censored at redo-LTx were 90.3%, 80.7%, 74.6%, 55.5%, and 25.5% at 1, 3, 5, 10, and 20 years (Figure 1, B). Survival improved significantly with growing numbers and total experience of the transplant team (Figure 1, C). Undoubtedly, improved surgical techniques, better immunosuppression and infection prophylaxis, and earlier recognition and better management of both primary graft dysfunction and chronic lung allograft dysfunction have largely influenced our results over time. The use of lungs from extended-criteria donors,⁸ lungs from donors after circulatory death,⁹ and cadaveric lobar LTx,¹⁰ did not negatively affect survival in our cohort. Much as in the report of Balsara and coworkers,⁷ these donors helped us to increase our transplant volume in Leuven with better survival over time.

This article from St Louis⁷ nicely demonstrates that quality and quantity go hand in hand in LTx. It takes years and years, and a high level of expertise, to come even close to perfection.

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