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FEATURED ARTICLE

The use of lung donors older than 55 years: A review of the United Network of Organ Sharing database

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BACKGROUND: Current lung transplantation guidelines stipulate that the ideal donor is aged younger than 55 years, but several institutions have reported that outcomes using donors aged 55 years and older are comparable with those of younger donors.

METHODS: We retrospectively reviewed the United Network for Organ Sharing (UNOS) database to identify all adult lung transplants between 2000 and 2010 in the United States. Patients were stratified by donor age 18 to 34 (reference), 35 to 54, 55 to 64, and ≥ 65 years. Primary outcomes included survival at 30 days and at 1, 3, and 5 years and rates of bronchiolitis obliterans syndrome (BOS). Survival was assessed using the Kaplan-Meier method. Risk factors for mortality were identified by multivariable Cox and logistic regression.

RESULTS: We identified 10,666 recipients with median follow-up of 3 years (range, 0–10 years). Older donors were more likely to have died of cardiovascular or cerebrovascular causes, but there were no differences in recipient diagnosis, lung allocation score, or incidence of BOS as a function of donor age. The use of donors aged 55 to 64 years was not a risk factor for mortality at 1 year (odds ratio, 1.1; $p = 0.304$) or 3 years (odds ratio, 0.923; $p = 0.571$) compared with the reference group; however, use of donors aged > 65 years was associated with increased mortality at both time points (odds ratio, 2.8 and 2.4, $p < 0.02$).

CONCLUSIONS: Outcomes after lung transplantation using donors aged 55 to 64 years were similar to those observed with donors meeting conventional age criteria. Donors aged ≥ 65 years, however, were associated with decreased intermediate-term survival, although there was no increased risk of BOS for this group.

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Lung disease is the fourth leading cause of death in the United States, claiming approximately 200,000 lives every year.[1] Lung transplantation could improve quality of life and survival for many of these individuals but is constrained by an inadequate number of suitable donors (15% of donors offered),[2] a high incidence of primary graft dysfunction (15%–20%),[3] and relatively rapid progression to chronic rejection, also referred to as bronchiolitis obliterans syndrome (BOS). Considering that donor factors are known be important in determining graft function after transplant, guidelines have been established defining acceptable donor parameters.[4] As waiting list mortality continues to rise, there has been a growing trend toward accepting lungs that do not

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meet these criteria. The use of these "marginal" donors has the potential to afford life-saving therapy to many more patients but demands thorough and ongoing assessment of the effect of more liberal acceptance criteria on clinical outcomes.

One of the more controversial guidelines stipulates that the ideal donor is aged younger than 55 years. As the population ages, and as medicine facilitates improved health at advanced ages, several centers have published outcome data suggesting that organs from donors aged older than 55 years may be comparable to those from younger donors.[5–10] Some centers have reported no association between donor age and outcomes, whereas others report decreased long-term survival and decreased time to the development of BOS. Another concern is that these older organs are only being allocated to older or sicker recipients and that recipient characteristics may, in fact, be determining outcomes. We examined the United Network for Organ Sharing (UNOS) database to evaluate the effect of donor age on outcomes after lung transplantation in a large, contemporary patient cohort in the United States.

Methods

The UNOS database was queried for all patients who underwent lung transplantation in the United States between January 2000 and December 2009. In all, 12,633 patients were identified. We excluded 503 pediatric recipients and 1,919 donors aged $<$ 18 years. The remaining 10,666 adults were stratified by donor age 18 to 34 (reference group), 35 to 54, 55 to 64, and $\geq$ 65 years. Donor information included age, sex, smoking history, arterial partial pressure of oxygen, mechanism of death, and lung ischemic time. Recipients were characterized by age, sex, diagnosis, lung allocation score (LAS), and type of transplant. Because the LAS was first routinely recorded in May 2005, analyses involving this variable were limited to transplants after this date (n = 5,986). Primary outcomes included survival at 30 days and at 1, 3, and 5 years, as well as incidence of BOS and time to its development.

Data are expressed as mean ± standard error of the mean or number (%), unless otherwise specified. The Student's t-test was used to test continuous variables with normal distributions, and the Mann-Whitney U test was used for non-normal continuous variables. Categoric variables were analyzed using the chi-square test or Fisher's exact test. Survival data were analyzed using the Kaplan-Meier method, and survival curves were compared using the log-rank test. A multivariable Cox regression was performed to identify risk factors for death and then repeated on data segregated into pre-LAS and post-LAS eras, using as the dividing point the official inclusion of the LAS in the UNOS database on May 3, 2005. Further comparison of older donors and their recipients was conducted, followed by Cox regression assessing the effect of transplantation era on outcomes while controlling for known risk factors and other differences between donor and recipient groups. Finally, multivariable logistic regression was used to assess the effect of donor age at specific time points. All variables included in these calculations were found to be significant in Cox regression or univariate analyses (LAS, not shown). The results are presented as odds ratio (OR) ± standard error of the mean. Stata 9.2 software (StataCorp LP, College Station, TX) was used for all analyses.

Results

The number of transplants performed in each donor age group is shown in Figure 1. Almost all lung transplants continue to use lungs from donors who meet ideal age criteria, but an increasing number of organs are being procured from donors of advanced age. In 2000, donors aged $\geq$ 55 years represented only 5.8% of the total, whereas in 2009, this increased to 10.0%.

Donor characteristics are presented in Table 1. Older donors were more likely to be female and less likely to have had a significant tobacco smoking history ($\geq$ 20 pack-years, $p < 0.004$). The most striking difference between younger and older donors is in the mechanism of death. Younger donors were more likely to die from gunshots and blunt trauma. As donor age increases, donors are more likely to have died from stroke and cardiovascular disease. Very few non-heart-beating donors were found in the database (n = 80), and the partial pressure of arterial oxygen (Pao_2) did not vary significantly among groups.

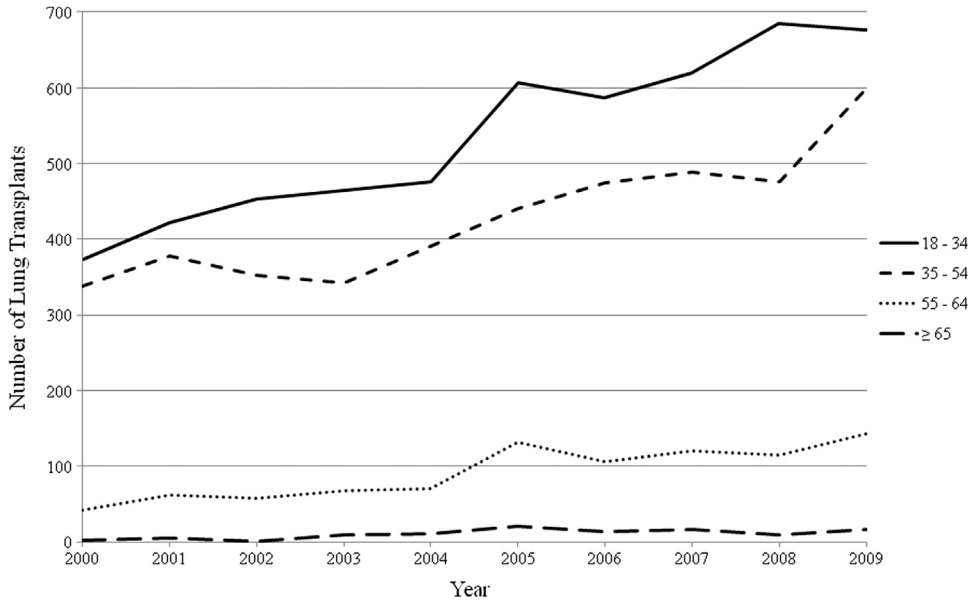

Figure 1 Number of lung transplants in the United States by donor age.