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Physician Assistant Model for Lung Procurements: A Paradigm Worth Considering

Joseph Costa, DHSc., PA-C, **Frank D'Ovidio, MD, PhD**, **Matthew Bacchetta, MD, MBA, MA**, **Matthew LaVelle**, **Gopal Singh, MD**, and **Joshua R. Sonett, MD**

[1]Thoracic Surgery, Columbia University Medical Center, New York, NY, United States

Abstract

Background—Thoracic procurements have traditionally been performed by surgical fellows or attending cardiothoracic surgeons. Donor lung procurement protocols are well established and fairly standardized; however, specific procurement training and judgment are essential to optimizing donor utilization. Although the predicted future deficits of cardiothoracic surgeons are based on a variety of analytical models and scenarios, it appears evident that there will not be a sufficient number of trained cardiothoracic surgeons over the next two decades. Over the past five years in our institution, lung procurements have been performed by a specifically trained physician assistant; as the lead donor surgeon. This model may serve as a cost effective, reproducible and safe alternative to using surgical fellows and attending surgeons, assuring continuity, ongoing technical expertise, and teaching, while addressing future workforce issues as related to transplant.

Methods—This is a single institution review of 287 consecutive lung procurements performed by either a physician assistant or fellow over five years. This study was approved by the Institutional Review Board of Columbia University, which waived the need for informed consent (IRB#AAAL7107).

Results—From 2008 to 2012, fellows served as senior surgeon in 90 cases (31.4%) vs. 197 cases (68.6%) by the physician assistant, including 12 Donations after Cardiac Death and 6 re-operative donors. Injury rate was significantly lower for the physician assistant compared to the resident cohort (1/197 (0.5%) vs. 22/90 (24%) respectively. (Rates for pulmonary graft dysfunction grade 2&3 were found to be significantly lower in cases where the physician assistant served as senior surgeon (combined rates of 32.2% (29/90) vs. 9.6% (19/197) in physician assistant group) ($p<0.01$).

Conclusions—Use of experienced physician assistants in donor lung procurements is a safe and viable alternative offering continuity of technical expertise and evaluation of lung allografts.

Corresponding Author: Joshua R. Sonett, MD, Chief Section of Thoracic Surgery, Columbia University Medical Center, The Herbert Irving Pavilion, Suite 301, 161 Fort Washington Avenue, New York, NY 10032, 212-305-3408, Js2106@columbia.edu.

Introduction

Although lung transplantation continues to be the established treatment for end-stage pulmonary failure refractory to medical management, only 15% of lung allografts are currently utilized for transplant. The critical shortage of donors and scarcity of suitable lung allografts has resulted in a growing number of candidates awaiting lung transplant and an increase in deaths among patients on waiting lists. Significant advances in donor management, use of what were considered marginal donors and Donation after Cardiac Death (DCD) donors, and organ preservation, have increased the complexity and volume of lung donors. Given the expanded use of marginal and DCD donor lung allografts, transplant centers must always be assured by the level of assessment and technical skill of their procurement surgeons going and evaluating these lung allografts, which may be higher potential for pulmonary graft dysfunction (PGD). Additionally, as preservation technology continues to advance, a sustainable model for the training of donor surgeons and safe procurement of lung allografts that provides technical expertise, training, oversight and quality assurance, will be essential for the continued growth of the field.

Currently half of the cardiothoracic active workforce is >55 years of age and nearing retirement [1]. In the literature, an overall consensus has been reached about there being a shortage of surgeons in the future. Given the growing concern about the future supply of cardiothoracic surgeons, rising transplant volume, and residency work hour limitations, an alternative source of procurement surgeons should be entertained. In this study, we examined efficacy of our current model and looked at the results of donor lung procurements performed by a physician assistant (PA) and cardiothoracic surgery lab fellows and compared procurement results between the two groups.

Material and Methods

This study was approved by the Institutional Review Board of Columbia University, which waived the need for informed consent (IRB#AAAL7107). Columbia lung procurement team began integrating PA's on lung procurement runs in 2001. The PA was initially charged with assuring constant quality and oversight for lung assessments and coordinating the transplant runs. With rising demands of increasing donor runs and lung transplants, as well as limitations in residency hours, PA support was further developed to include primary surgical procurement responsibilities. This paper reviews this experience commencing in 2008, where a single PA has served as the primary procurement surgeon in conjunction with a licensed physician as an assistant.

The PA began his training on lung procurements in 2008. Our model then consisted of sending a fully trained and credentialed third year resident as lead surgeon. Combined with his ongoing cardiothoracic surgery experience, the PA was trained in donor assessments and the operative phase of procurement surgery. Having gone on 81 lung procurements starting in 2008 and having demonstrated excellent assessment skills and technical abilities, the PA was tasked with taking on an instructor and quality assurance role for incoming residents going out on procurements in 2009. As residents were trained in donor assessment and operative skills, the PA functioned as the main oversight and final authority on site, when

present. Residents on average were signed off and credentialed to procure organs on their own after approximately 15 supervised organ procurements. When the resident/PA team was sent, cases would be divided where the PA and resident would alternate functioning as lead surgeon. All organs were initially evaluated off site by the attending surgeon prior to committing a procurement team. Communicating pertinent information to the implanting surgeon was part of resident training, however, final conversations regarding whether the organ was suitable for transplant was based on the PA's presentation of the operative phase and communicating his assessment. The PA performed intraoperative repair of all injuries.

Our PA completed 402 total lung assessments and procurements as assistant, overseeing the entire assessment and technical phase of the procurement, prior to assuming his current status as lead procurement surgeon. The procurement team has always consisted of a PA and resident or cardiothoracic fellow. A physician acting as assistant surgeon and coordinator has always accompanied the PA on procurement runs, as required by the New York Organ Donor Network (NYODN) bylaws. The level of training of the accompanying physician could be an intern or even a pulmonologist, or for specific credentialing training purposes, a cardiothoracic fellow being trained by the PA.

All statistical analysis was performed using Stata (College Station, TX). Categorical variables were compared using the Pearson Chi-squared test for adequately large sample sizes, and Fischer's exact test as necessary for small subgroups. Comparison of ordinal variables in group and subgroup analysis was done using the Wilcoxon-Mann-Whitney rank sum test. P-values of 0.05 or less were considered statistically significant. Pulmonary graft dysfunction grade was determined using the International Society for Heart and Lung Transplantation Primary Graft Dysfunction Grading System. Lung Allocation Scores (LAS) were calculated as per standard criteria.

Results

- From 2008 to 2012, fellows served as senior surgeon in 90 cases (31.4%) vs. 197 cases (68.6%) by the PA, including 12 DCD donors and 6 re-operative donors. All retrievable organs procured by the PA were harvested without loss or significant injury. The PA cohort did include one non-significant injury (0.5%) vs. 22 (24%) overall injuries (in the fellow cohort ($p<0.01$). A significant difference was seen in the number of injuries done during the procurements, with the PA having 1 per 197 (0.5%) and the fellows having 22 per 90 (24%) ($p<0.01$) (Table 1).

Overall Thirty-day and one-year graft survival rates were 97% and 87%, with no difference in the cohorts. Rates for PGD grade 2&3 were found to be significantly lower in cases where the PA served as senior surgeon (combined rates of 32.2% (29/90) vs. 9.6% (19/197) in PA group) ($p<0.01$) (Table 2).

Pulmonary graft dysfunction grade was used as a measure for comparison of the two groups.

- A significant difference ($p<0.01$) in the distribution of PGD grades between the PA and the fellows was seen, which is at least partially due to the large

discrepancy in number of transplants done by the two groups, however, a trend showing generally lower PGD grades for the PA as compared to the resident can be noted (Table 2).

- Grouping PGD Grade 0&1 versus 2&3, shows the lab fellows had a significantly higher proportion of grade 2&3 (32.2% (29/90) vs. 9.6% (19/197) in PA group) ($p<0.01$) (Table 2).
- A significant difference ($p<0.01$) was seen between the LAS of transplant patients with a PGD grade of 2, as well as the group of PGD grades 2 and 3 combined.
- The PA showed a higher median LAS for both, with the 2&3 group for the PA being 55.0 (43.1–69.6) n=19 versus lab fellows at 43.3 (36.0–49.9) n=29.

- The median LAS of the PA was higher than that of the fellows for all PGD grades (0–3), however the only groups of this trend to reach statistical significance were PGD grade 2 and PGD grade 2/3 combined.

Comment

Traditionally, donor surgeons are trained by going out with a senior fellow or junior attending. Following a short period of oversight and training, junior fellows are sent out on their own, often lacking the requisite experience required to effectively evaluate lung allografts for transplant. The potential for surgical injuries or lack of experience in evaluating lung allografts may greatly impact the current and increasing shortage of lungs for transplant. Retrospective study by Shigemura et al [2] concluded donor lung procurements performed by trainees with limited transplant experience, frequently included technical errors with regards to graft preservation, which may have had an effect on transplant outcome, despite the study showing no significant difference in PGD, between the trainee and the attending surgeon groups at 72 hours post-transplant, as defined by the International Society for Heart and Lung Transplantation [3–5].

The future of the cardiothoracic workforce in staffing the demands of increased lung transplants looms as a significant issue. Currently half of the cardiothoracic active workforce is >55 years of age and nearing retirement [6]. Assuming a cardiothoracic surgeon ratio of 1.42 physicians per 100,000 population, by 2030, the population in the United States will be 364,000,000 with 5169 cardiothoracic surgeons needed, leaving this goal short by 2000 surgeons [7]. Concurrently, there has been a decline in the number of well-qualified applicants to cardiothoracic residencies in 2004, 2005, and 2006; there were more available positions than applicants applying [8]Within the past decade, cardiothoracic surgery has witnessed a notable drop in applicants. These predicted shortages of cardiothoracic surgeons are not new. In the early 90’s, thoracic surgery was enjoying a surplus of applicants. Today, thoracic surgery is less popular due to many reasons, such as perceived poor job outlook, excessive length of training, and personal time and life balance concerns, which are major deterrents for potential applicants, leaving more positions available [9,10].

Conservatively speaking, the predicted deficit of 30% of thoracic surgeons over the next 20 years will potentially result in residency programs being unable to completely fill their program slots, a critical issue worsened by limitations in individual work hours. A deficit of cardiothoracic surgery trainees will have a direct impact on transplant center donor teams, tasked with going out to evaluate and explant thoracic organs for transplantation. Lack of manpower coupled with the potential issue of not having adequately trained and qualified personnel, places a burden on transplant centers and awaiting transplant recipients. Instituting a procurement surgeon PA model, may help provide a sustainable and predictable oversight and expertise of procurement teams, while assuring skilled manpower coverage for transplant center donor teams, and aiding as an ongoing source of teaching for transplant trainees.

Within the past year, the NYODN revisited their current bylaws, and made changes, which called for only attending thoracic surgeons or cardiothoracic fellows to procure thoracic organs. Given the magnitude of experience, technical expertise and surgical judgment presented on behalf of the PA, the medical advisory committee of the NYODN, unanimously voted to grandfather in the first PA, as a credentialed thoracic donor surgeon.

Our model has come from the mindset that although professional credentials are important, the real proven factor rests on an individuals unique abilities and level of proven and demonstrable experience. This by no means is suggesting that all PA’s are capable of this model. It is note worthy to mention, that other institutions send out highly experienced non-licensed individuals, such as technicians or a research scientist, signifying they too have embraced the fact that a well trained and experienced individual, who has proven technical and judgment abilities, can augment the pool of surgeons tasked with performing organ procurements acting as an invaluable resource for training and quality oversight.

Our institutional experience of sending a PA as the lead procurement surgeon with a licensed physician, has proven to be a reliable model, both in the PA’s ability in evaluating lung allografts, and technical ability in performing the operation, this to include DCD and re-operative donors.

There are currently 170 accredited PA programs and eight surgical PA post-graduate residencies in the United States. Physician assistants are recognized to practice in all fifty states and scope of practice varies by state. Healthcare in the United States has changed considerably and continues to do so. As cost-effective, versatile, highly trained clinicians, the roles of PAs have greatly expanded over the years. Over the past two decades, the supply of PAs has increased considerably. The current supply of clinically active PAs is projected to grow to 127,821 by 2015, increasing by almost 72% by 2025 [11]. Post-graduate surgical residencies may serve as a potential source for training uniquely qualified PAs in thoracic procurements. Currently, none of the PA post-graduate surgical residency programs offer this type of training in their curriculum; however, this could be easily implemented for those interested in pursuing this specialty. This model is not a substitute for sending surgical fellows, however, having a highly trained individual will be an invaluable asset in a cardiothoracic fellow-PA procurement team, allowing for training, oversight and quality assurance of rotating surgical fellows tasked with procuring thoracic organs for transplant.

A few transplant centers in the United States do not follow the current standard model of sending out attending surgeons or cardiac fellows to procure thoracic organs. Our center along with Stanford and Wisconsin, send out both licensed and non-licensed, highly experienced individuals to perform thoracic and abdominal organ procurements (Table 3). Having an attending surgeon or surgical fellow going out on procurements may not be sustainable in the future, in light of the predicted manpower shortages and less surgical trainees going into cardiothoracic surgery, and rules limiting work hours. Integrated cardiothoracic residencies will also pose a challenge due to the lack of surgical skill and judgment these resident's poses early in their program years. The technical aspects of procurement surgery can be taught in less time, however, the judgment ability of trainees and the handling of intraoperative surgical complications is not easily taught or assessed in that timeframe. The models reviewed have proven reliable for all three centers. One out of three centers utilizes an unlicensed non-clinician, who is highly experienced and has performed a multitude of procurements since the early 80's. The common denominator between these three models is the level of experience each of these individuals brings to the table and not their medical credentials. Experience is clearly the predominating principle, which continues to grow exponentially as time goes on and serves as an invaluable source for teaching, oversight and quality assurance for transplant centers. Another important concept to note in these models is the fact that talented individuals were identified and appropriately trained by cardiothoracic surgeons and in one case a liver transplant surgeon. This paper is by no means implying, that these individuals tasked to procure organs for transplant are superior to attending cardiothoracic or abdominal surgeons, however, it does imply that having the right individual, who undergoes a rigorous training program and is appropriately mentored can and will function as good as any resident or fellow in procuring organs for transplantation. Importantly, the PA model may provide consistent bedrock of experience to the procurement team. This should aid in educating tomorrow's surgeons and assuring quality oversight measures, but it also builds long term relationships and trust with multiple organ procurement organizations and hospitals based on a robust working relationships.

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Table 1

Surgical Injuries during Procurement

Surgical Injuries	Types of Injuries	
Total: 23/287 (8%)	SVC:	4/23 (17%)
PA: 1/197 (0.5%)	Innominate Vein:	5/23 (22%)
Fellow: 22/90 (24%)	Aortic:	5/23 (22%)
	Pulmonary Artery:	3/23 (13%)
	Right Atrium:	2/23 (9%)
	Epicardium:	1/23 (4%)
	IMA:	1/23 (4%)
	Left Bronchus:	1/23 (4%)

Table 2

PGD grade distribution comparison. (Fisher exact test P<0.01)

PGD Grade	PA	Fellow	Total
0 & 1	178 (90.4%)	61 (67.8%)	239 (83.3%)
2 & 3	19 (9.6%)	29 (32.2%)	48 (16.7%)

Table 3

Procurement Team Models

Institution/OPO	Model
Columbia University Medical Center, New York, NY	Physician Assistant – Lead Surgeon Surgical Resident – First Assistant/Coordinator
Stanford Hospital, Stanford, Ca.	Senior Scientist – Lead Surgeon Surgical Resident – First Assistant
University of Wisconsin Hospital, Madison, WI	Surgical Fellow – Lead Surgeon Physician Assistant – Trainer
Life Center Northwest, Bellevue, WA	Technician – Lead Surgeon