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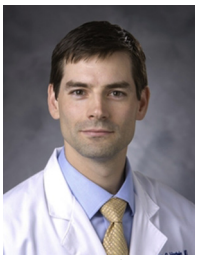
Key Words: lung transplant, lobar lung transplant, size matching

Discussion

Presenter: Dr Jose Luis Campo-Cañaveral de la Cruz



Dr Matthew G. Hartwig *(Durham, NC)*. Thank you, Dr de la Cruz, for providing your paper well in advance, and for an excellent presentation today. I'm very pleased to have the opportunity to discuss the Toronto Lung Transplant experience. With this difficult dilemma for trying to optimize outcomes in our short-statured, diminutively sized chest cavity recipients, I think this is an important question for our community, but it's one that's very challenging to answer from the data, as you showed. This is one of the largest, if not the largest, series, but it still remains challenged by low numbers. For example, you see a loss in the statistical difference in survival in the later era–it's very few patients. Clinically, it seems that those patients struggle much more perioperatively. My first questions are slightly philosophical. Unlike in the setting of single-lung transplantation, where you are actually increasing the use rate, or maximizing the number of transplants done, in this procedure, you are dramatically downsizing a lung for it to fit into a smaller recipient without actually increasing the donor pool or the number of transplants that we perform. Do you think it's ethically appropriate if there's a difference in survival? Or if there's a greater risk to the recipients, is it ethically appropriate to use this strategy to simply redirect a usable organ to a smaller recipient?

Dr Jose Luis Campo-Cañaveral de la Cruz *(Madrid, Spain)*. It is a difficult question, but I do think with these numbers we can go ahead with a lobar transplant even though we don't optimize the donor pool. Especially in our more recent experience, the results are getting better and better. It all depends on where the problem is. If you don't have an important donor shortage, the ethical problem is not that big.

Dr Shaf Keshavjee *(Toronto, Ontario, Canada)*. We're fixing that problem. That's a really important point. I think Matt's point was that if we just take 2 lower lobes and throw away 2 upper lobes, have we disadvantaged 2 single-lung transplant patients? The first problem we are trying to address is that we have kids and small-statured individuals who are waiting a year and a half, while we have everybody else done in 2 weeks, so that's the challenge we are facing. Also, we are starting to be a bit more creative. We are doing 2 lower lobes and 2 upper lobes as 2 separate double-lung transplants from 1 donor. We've done the left-lung split operation with the lower lobe and upper lobe. I think that if you can get your teams together and do it, it is a lot of work and operating rooms going at the same time. You can be creative and do it. But you remember your bad cases, and that's why we started looking at it and said, "We'd better just see if this is still a good thing to be doing."

Dr Hartwig. That's great to maximize the use. Another option could be to think about allocation strategies. For example, in the United States increasing a lung allocation score for someone of small stature might be other ways to address this without having to piecemeal together for the parts. Your choice in lobar combinations in the manuscript, which I don't think you discussed in detail during the presentation, was very heterogeneous and included patients in whom you did a lung and a lobe, patients where you took various and sundry lobes, and there didn't seem to be a lot of method to the selection as described in the manuscript. Based on your experience, is there an optimal technical combination of lobes in this situation?

Dr Campo-Cañaveral de la Cruz. That's a great question. The most frequent combination was right middle and right lower lobe on the right side, and left lower lobe on the left side. I think that the final decision is made when you see the chest cavity of the recipient. If you see that what fits better is the left upper, you go ahead with the

left upper. But I think, after reviewing this experience, that the combination that we used most frequently was the one that fits better with the chest cavity of the recipient. As far as I know, there is no other specific anatomical reason, apart from the fact that sometimes one lobe fits better in one chest cavity.

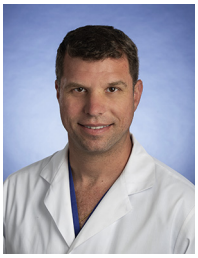
Dr Hartwig. So it's a case-by-case decision.

Dr Campo-Cañaveral de la Cruz. Yes, also using the total lung capacity donor–recipient combination.

Dr Keshavjee. For the analysis and the matching, we left out the ones who got a whole lung and half a lung, since that's really one and a half single-lung transplants. We really, in the survival and outcomes, are comparing 2 lobes, to double lungs.

Dr Hartwig. It wouldn't seem right not to ask you a question around ex vivo lung perfusion (EVLP) for the Toronto program. Now you talk about the advent of EVLP, and that's sort of helped determine some of your era delineation. Did you do any downsizing while on the EVLP, and if so was this technically easier that doing it on the back table or after implantation? If you did do any downsizing on the EVLP device, did it impact the assessment of the lung, the assessment period, or were there other implications for this strategy when combining the EVLP with pneumo-reduction?

Dr Campo-Cañaveral de la Cruz. Reviewing the database, there are no data that address that matter.



Dr Marcelo Cypel *(Toronto, Ontario, Canada)*. We always perform the anatomical down-sizing on the back table.

Dr Campo-Cañaveral de la Cruz. The assessment of EVLP is for the full-size lung, or the 2 lungs, and we go ahead on the back table with the lobar partition.

Dr Hartwig. This is wonderful work and a great presentation, thank you.

Dr Kenneth R. McCurry *(Cleveland, Ohio)*. I'll just ask you one technical question. How do you handle the bronchus?

Dr Campo-Cañaveral de la Cruz. The bronchus is one of the critical parts in the lobar transplantation, and all of the complications that can be avoided for that particular anatomical part are extremely important. You know that Toronto General has extensive experience in lung transplants, so the technical issues for the bronchial anastomosis have been exactly the same for many, many years, and the complications are very low. I have to say that the only technical thing is to manipulate as least as you can the bronchus on the back table during the dissection, giving the stump as much tissue as you can, and then a gentle manipulation during the anastomosis. You can cover the anastomosis or not. Another technical point is to address the discrepancy between the donor and the recipient. Sometimes it's not easy, and the anastomosis telescopes itself. I would say that perfect technical manipulation of the bronchus is one of the key parts.

Dr Thomas Egan *(Chapel Hill, NC)*. Technical question, but when you are splitting and using upper lobes and lower lobes, did you have trouble with either the middle lobe artery being too low or lingular branches being too low so that you had to sacrifice the lingula or middle lobe?

Dr Campo-Cañaveral de la Cruz. Again, looking at the database, I didn't see the reason why the middle lobe is preserved or sacrifice, but I would say that sometimes yes.

Dr Keshavjee. I can answer that, actually, because that's one of the things you lose in the database. The answer is yes and yes, so sometimes it just doesn't work. We want to keep as much lung as possible and sometimes you just end up having to sacrifice it, depending on where the artery comes off, so it's a challenge. I think Jose was asked a question from probably one of the most experienced lung transplant surgeons in the world, but the question that you asked, Ken, was the bronchus issue. I know most of the Japanese surgeons who do live donor transplants have experience in this, but if you're going to split and use both lobes, then you want to kind of keep that carina between the 2 lobes. If you actually split it, sometimes you lose structure because you don't have the spur. If you're only doing one lobe and are trying to preserve the spur at the lobar carina, it gives it a much better structure when you're putting a small bronchus into the main bronchus. When you are splitting it the other way, you just do what you can. Sometimes you end up sewing something that seems like membranous bronchus all the way around, and again I think it's important to correct on every bite and kind of splay it out. The other thing that is pleasantly surprising but predictable from the anatomy is the blood supply to the bronchus at that level is predominately (80% or 90%) pulmonary so it's less vulnerable than an anastomosis than a main bronchus.

Dr Campo-Cañaveral de la Cruz. Just a quick addition to that, when you're doing upper-lobe implantations, we always do the anastomosis in the upper-lobe bronchus, and not in the main bronchi avoiding leaving a stump, so it's always possible to anastomose directly the upper lobe orifice.