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Researches Classified – Panel Awards – Surgical

CT-based diagnosis of bronchial stenosis after lung transplantation

Academic author: **Yuri Tebelskis Nunes Dias, Guilherme Carvalhal Gnipper Cirillo**

Academic advisors: **João Madison Nogueira Filho, Rodrigo Caruso Chate, Marcos Naoyuki Samano**

Faculdade de Medicina da Universidade de São Paulo - FMUSP

Introduction: Among all types of transplant complications, that related to airway anastomosis, such as stenosis is still uncertain[12]. Starting by the difficulty in diagnosis,such as the low precision of bronchoscopy, high cost and invasive test. This article purpose a precise and non-invasive diagnostic method of bronchial stenosis after lung transplantation based on three measures got from a reconstruction of thorax computerized tomography (CT) using a software called TeraRecon.

Objective: The anastomosis index (AI), ratio of the area of the bronchial cross-section at the site of the anastomosis to the arithmetic mean of the cross-sectional areas 5 mm upstream and 5 mm downstream, obtained from reconstruction of a thorax CT has direct correlation with the bronchoscopic and clinical diagnosis of bronchial stenosis.

Methods: Were obtained all cases of clinical and bronchoscopic diagnosed bronchial stenosis after lung transplantation at Heart Institute of University of São Paulo, between 2003 and 2016 (n=8). Another 8 patients, without any signs of stenosis, were selected to the control group. After that, the closest CT from the diagnostic was obtained and reconstructed using the software Terarecon, which is capable to find the exact area of any point of a cylindrical structure chosen by the operator. Then, three areas were obtained: 5mm before, at the anastomosis and 5mm after. Were calculated the Anastomosis Index (AI), which is the ratio between the area of anastomosis, and the arithmetic average of the areas 5mm before and 5mm after the anastomosis. After that, the data was confronted to variation of best FEV1 from transplantation to chosen CT and the FEV1 closest to the chosen CT.

Results: As expected, in patients without bronchial stenosis, the area of the bronchi cross- section decreases linearly as it moves from proximal to distal in the bronchial tree, the AI in these cases tends to 1. Whereas, when there is no decay linear, that is, there is bronchial stenosis at the anastomosis, the AI was less than 1. There was a significant difference between AI in stenosis group (n=8, M = 0.387, SD = 0.151) and control group (n=8, M = 0.850, SD = 0.091). $t(16) = -7.893$ $p < 0.001$. This findings were supported by mean reduction of FEV1 in 17.71% and median 19.81% on stenosis group and mean

reduction of 5.45%, and median 5.35% on control group. Besides that, the values undergone in a t-test, which returned a t-value = 2.879 with a p-value = 0.0129. The result is significant at $p < 0.05$.

Conclusion: The Anastomosis Index can be useful in diagnosis of bronchial stenosis after lung transplantation, it is harmless and subsequently may help as a basis for new studies involving treatments. It is worth mentioning that is also a rational use of resources, since lower costs are generated by the CT analysis than performing a bronchoscopy, besides not requiring hospitalization and sedation, taking into account that these patients presents greater risks by the immunosuppression and other comorbidities.

Keywords: Anastomosis; Bronchial stenosis; Lung transplantation; Computerized tomography.

Supplemental Material

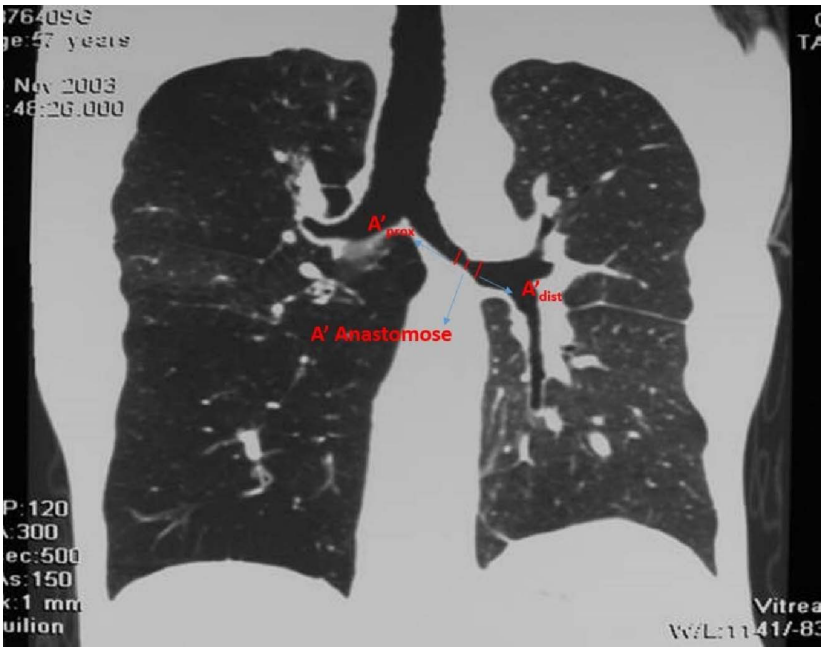

Figure 1: Shown in red, the three points of measure used to calculate the Anastomosis Index

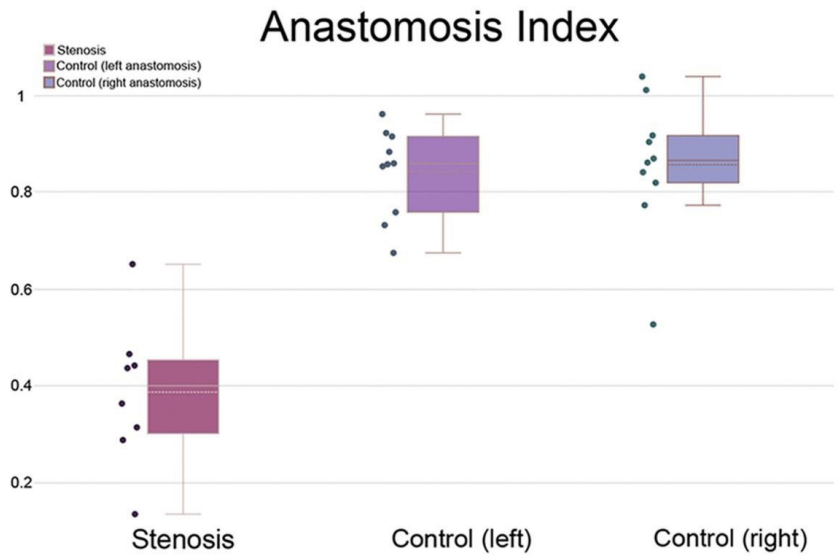

Figure 2: Boxplot showing distribuition of Anastomosis Index in control and stenosis group

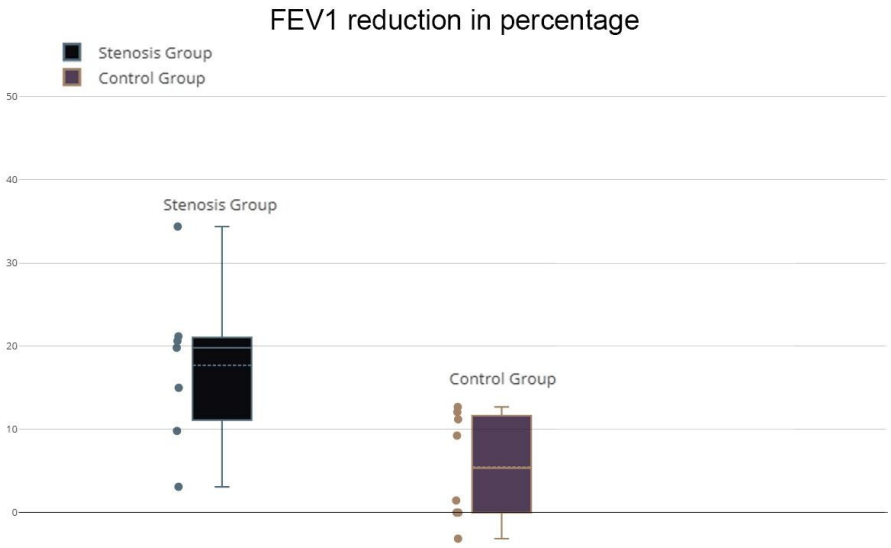

Figure 3: Boxplot showing the diferences in percentages between FEV1 in stenosis and control group

Table 1: Measures of the patients in stenosis group (mm²) and correspondly AI

Patient	Area 5 mm proximal	Area at anastomosis	Area 5 mm distal	AI
Patient 1	85.6	13.6	115	0.135
Patient 2	29.9	18.6	55.2	0.437
Patient 3	68	18	30.9	0.364
Patient 4	29.7	20	56.1	0.466
Patient 5	43.7	11.6	36.7	0.288
Patient 6	76.1	29	55	0.442
Patient 7	16.5	7.88	33.6	0.314
Patient 8	47.9	27.7	37.1	0.651
N = 8	Mean AI = 0.387	Median AI = 0.400	SD = 0.15	

Table 2: Measures of the patients in control group (mm²) and correspondly AI

Patient	Area 5 mm proximal	Area at anastomosis	Area 5 mm distal	AI
Patient 1	171	143	139	0.922
Patient 2	96.1	91.2	116	0.859
Patient 3	115	126	147	0.961
Patient 4	128	89.2	107	0.759
Patient 5	83.2	60.5	96	0.675
Patient 6	124	103	101	0.915
Patient 7	160	124	129	0.858
Patient 8	177	146	165	0.853
N = 8	Mean AI = 0.850	Median AI = 0.859	SD = 0.093	

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