



# Tracheostomy Post Liver Transplant: Indications, Complications and Outcomes

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## ABSTRACT

### Objective

This study reviews a large number of liver transplant (LT) recipients at a single center, describes indications for tracheostomy within 6-months of transplant, and analyzes post-tracheostomy complications and outcomes.

### Study Design

Retrospective review and case-control

### Methods

The records for all LT patients over a 15-year period were reviewed. A case-control subgroup analysis was conducted in which 80 tracheostomy patients were matched with 80 non-tracheostomy liver transplant patients based on age, gender, and body mass index.

### Results

Among 1786 patients undergoing Liver Transplantation, 80 required tracheostomy (4%). Tracheostomy patients had a higher MELD score, were older and had a lower BMI. Tracheostomy patients had longer stay (39 versus 10 days,  $p < 0.001$ ) and worse 1-year survival (63% versus 90%,  $p < 0.001$ ). Median days between transplant and tracheostomy was 20 days, with a median of 48 days from tracheostomy to decannulation. Pre-transplant pulmonary function among tracheostomy patients included FVC of 79%, FEV1 of 75%, FEV1/FVC of 80%. In the case-control analysis, tracheostomy patients had a muscle mass deficit of -45% when compared to matched LT controls ( $p < 0.05$ ). The most common complications post tracheostomy included bleeding (5%), tracheocutaneous fistula (4%), operative revision (3%), and leak with subcutaneous or mediastinal air (3%) (overall 15% complication rate).

### Conclusions

Tracheostomy was required in 4% of liver transplant patients, with a 15% complication rate. Respiratory failure, requiring tracheostomy, was associated with worse liver disease, older age, deconditioning and lower pulmonary function testing. It was not associated with body mass index or history of tobacco use.

## INTRODUCTION

Each year in the U.S., over 6,500 patients undergo liver transplantation. This is an expensive and high risk procedure. Inclusion or exclusion of a patient for liver transplant is a complex, multidisciplinary process. Being able to predict patients that will have a poor outcome is critical to achieving optimal utilization of a limited number of donor organs.

Respiratory complications are associated with worse clinical outcomes, longer hospital stay and increase costs. Previous studies have identified the incidence of post-transplant respiratory complications to be approximately 59-87 percent. [1,2,] When severe respiratory complications require prolonged mechanical ventilation, a tracheostomy is performed to protect the larynx and glottis from mucosal damage and to aid in weaning. Current indications for post liver transplant tracheostomy are 14 consecutive days of required mechanical ventilation. [3] In this study, we reviewed a large number of liver transplant recipients to determine clinical predictors of liver transplant patients requiring tracheostomy.

Additionally, liver transplant patients are often deconditioned, chronically ill, and suffer from coagulopathic disease, making tracheostomy a higher risk procedure. We performed a retrospective review of all LT patients, requiring a tracheostomy, to identify risks and complications of performing a tracheostomy post liver transplant.

## MATERIALS and METHODS

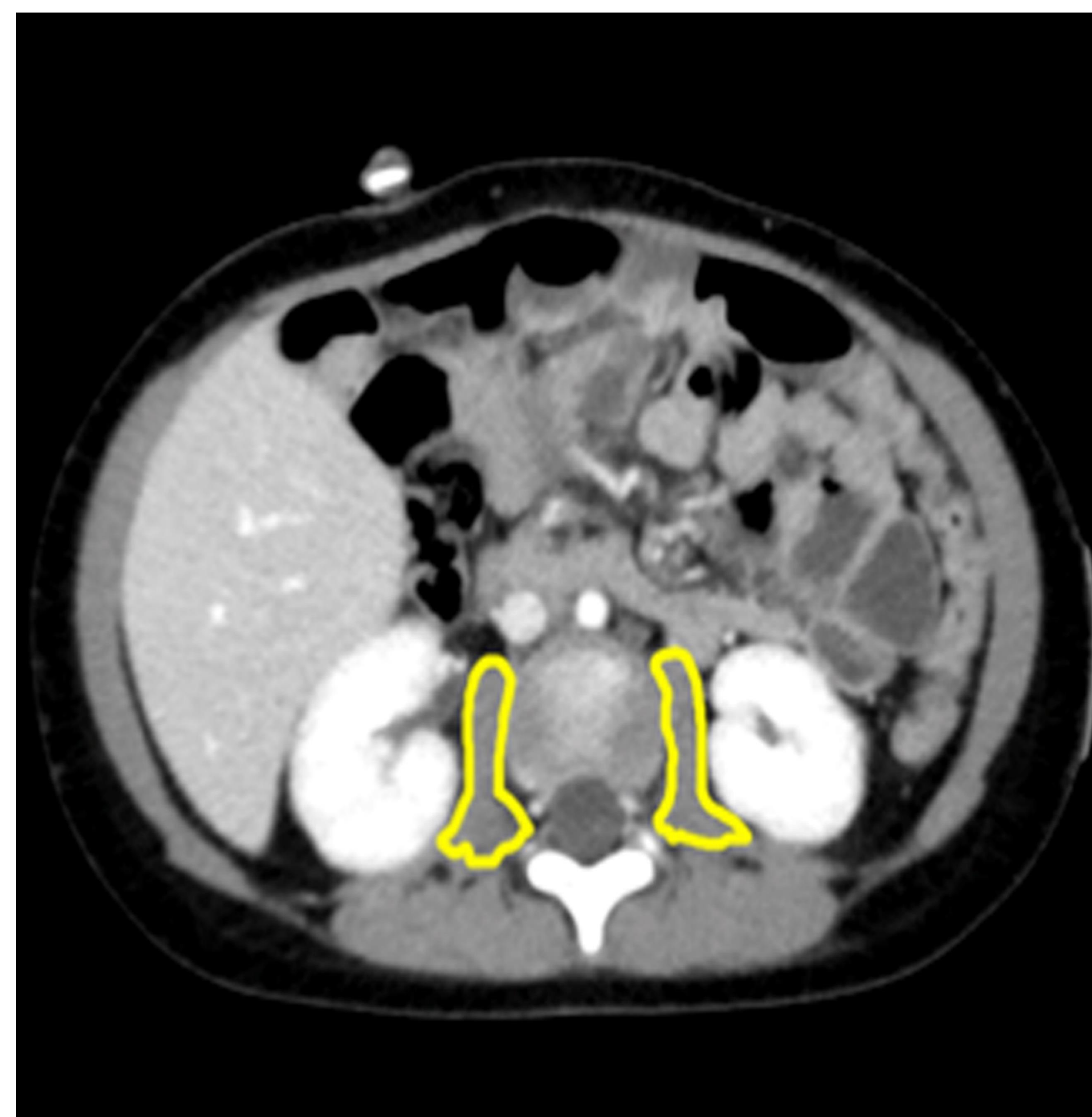
The records for all liver transplantation patients over a 15-year period at a single institution were reviewed. 80 patients were identified that required tracheostomy post liver transplantation. Preoperative and post-operative notes were reviewed using Cerner and Otter EMR systems. Data collected included MELD score, age, BMI, pre-operative pulmonary function tests, smoking status, length of stay in the hospital, complications of tracheostomy, total days of tracheostomy tube before decannulation, and 1-year survival.

Preoperative muscle mass was also assessed using preoperative CT scans. CT measurements were taken at the level of the L2/L3 intervertebral disc space which has been determined to be an accurate approximation of total body composition[4]. Total psoas muscle area was obtained by outlining both the right and left psoas muscles [Figure] and summing these measurements. In order to account for variations due to differing heights, all measurements were scaled for height. The sarcopenic index was obtained by dividing the total psoas area by the height squared. CT measurements were taken using Synapse PACS Software.

A case-control subgroup analysis was conducted in which the 80 tracheostomy patients were matched with 80 non-tracheostomy liver transplant patients based on age, gender, and body mass index. Each patient was matched to a control patient that was the same gender and same age. The scaled measurements of the transplant patients were compared to the scaled measurements of age-matched controls. The difference was calculated by subtracting the control measure from the transplant patient measure and a percent difference was calculated.

The authors have no conflicts of interest to report.

## FIGURE



## TABLE 1

Table 1. Demographic data for liver transplant patients who did or did not require tracheostomy for respiratory failure in the first 6-months post transplant.

	No tracheostomy 1706 (96%)	Tracheostomy 80 (4%)	p-value
<b>OVERALL</b>			
<b>Recipient characteristics</b>			
MELD (mean)	18	22	<0.001
Gender			0.94
Male	96%	4%	
Female	96%	4%	
Race			0.67
White	95%	5%	
Black	97%	3%	
Other	96%	4%	
Age (years)			
Median (range)	54	57	0.08
Body mass index			
Median	28.2	26.2	0.06
Retransplant	97.0	3.0	0.82
Tobacco use			0.38
Never smoker	96%	4%	
Former smoker	95%	5%	
Current smoker at transplant	96%	4%	
Pack-years smoking* (years)			0.01
Zero	96%	4%	
1 to 20	92%	8%	
20 to 40	96%	4%	
> 40	97%	3%	
<b>Outcomes</b>			
Length of hospital stay (days, median)	10	39	<0.001
1-year survival	90%	63%	<0.001

\* Pack-years is the number of years of smoking multiplied by the average number of packs of cigarettes per day

## TABLE 2

Table 2. Subgroup analysis of 80 liver transplant patients with respiratory failure who required tracheostomy in the first 6-months post liver transplant.

	Number
<b>Overall</b>	80
<b>Clinical outcomes</b>	
Days to tracheostomy post transplant (mean/median)	34 / 20
Surgeon*	
Transplant surgeon	98%
Other	2%
Decannulation	
Days from tracheostomy to decannulation (mean/median)	135 / 48
Died with tracheostomy	15 (19%)
Second tracheostomy required	11 (14%)
Transplant surgeon	5 (45%)
Other surgeon	6 (54%)
<b>Pulmonary function tests</b>	
Forced vital capacity (FVC, % of predicted)	79%
Forced expiratory volume in 1 second (FEV1, % of predicted)	75%
FEV1 / FVC (% of predicted)	80%
<b>Complications</b>	
Any complication related to tracheostomy	12 (15%)
Operative revision	2
Tracheocutaneous fistula	3
Bleeding requiring operative intervention	4
Subcutaneous emphysema/pneumomediastinum	2
Intraoperative unstable atrial fibrillation (cardioverted)	1

\* 2 tracheostomies were performed percutaneously

## RESULTS

Demographics for the case-control analysis can be seen in **Table 1**. Among 1786 patients undergoing Liver Transplantation, 80 required tracheostomy (4%). Tracheostomy patients had a higher MELD score, were older and had a lower BMI. Tracheostomy patients had longer stay (39 versus 10 days,  $p < 0.001$ ) and worse 1-year survival (63% versus 90%,  $p < 0.001$ ). Median days between transplant and tracheostomy was 20 days, with a median of 48 days from tracheostomy to decannulation. Pre-transplant pulmonary function among tracheostomy patients included FVC of 79%, FEV1 of 75%, FEV1/FVC of 80%. Tracheostomy patients had a muscle mass deficit of -45% when compared to matched LT controls ( $p < 0.05$ ).

Data for the retrospective review can be seen in **Table 2**. The most common complications post tracheostomy included bleeding (5%), tracheocutaneous fistula (4%), operative revision (3%), and leak with subcutaneous or mediastinal air (3%) (overall 15% complication rate).

## CONCLUSIONS

In conclusion, the incidence of tracheostomy post liver transplant was 4%, with a 15% complication rate. This complication rate is similar to those reported in recent studies of elective tracheostomy. [5] The requirement for tracheostomy was associated with worse liver disease, older age, deconditioning and lower pulmonary function testing, but was not associated with body mass index or history of tobacco use.

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