

Robotic Versus Laparoscopic Esophagectomy for Cancer: A Comparative Analysis of Outcomes

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BACKGROUND

- Esophagectomy is a cornerstone in the management of esophageal cancer, but the optimal minimally invasive technique remains debated.
- Robotic-assisted minimally invasive esophagectomy (RAMIE) offers improved dexterity and visualization, while thoracoscopic-laparoscopic transthoracic esophagectomy (TLE) remains widely used.
- This study compares perioperative and short-term oncologic outcomes between RAMIE and TLE.

METHODS

- A retrospective review was conducted of patients undergoing minimally invasive esophagectomy by a single surgeon for cancer.
- Patients were stratified by operative approach:
 - Robotic-assisted minimally invasive esophagectomy (RAMIE)
 - Thoracoscopic-laparoscopic transthoracic esophagectomy (TLE)
- Patient demographics, operative outcomes and postoperative complications were compared.
- All statistical tests were two-sided and a P-value of <0.05 was considered statistically significant.

Table 1: Patient Characteristics

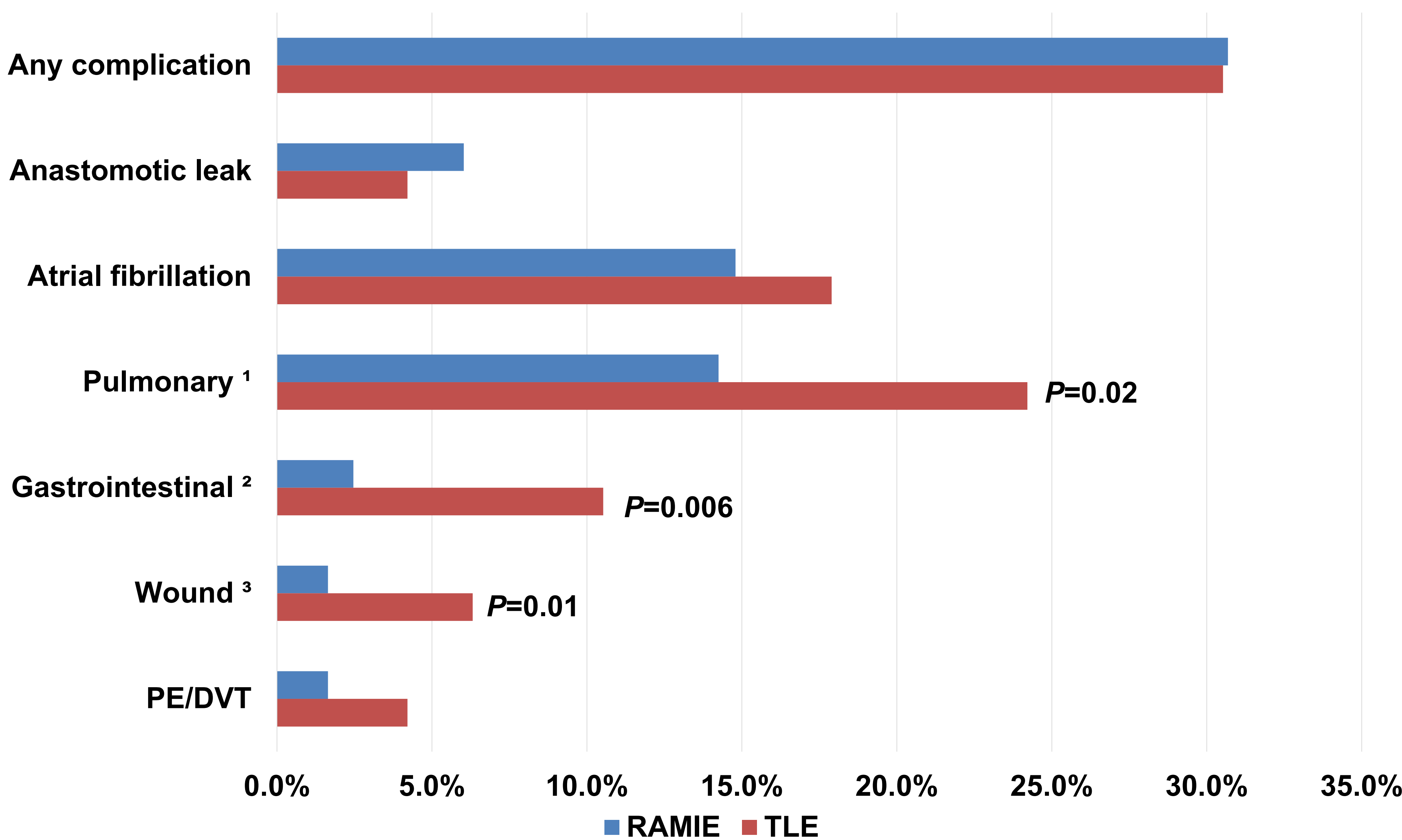
Variable	All N = 460	RAMIE N = 365	TLE N = 95	<i>P</i> value
Age, year	67 (30 – 91)	69 (30 – 91)	63 (42 – 79)	<0.001
Sex				
Male	372 (80.9)	291 (79.7)	81 (85.3)	0.22
Female	88 (19.1)	74 (20.3)	14 (14.7)	
Race				
White	442 (96.1)	349 (95.6)	93 (97.9)	0.76
Black	10 (2.2)	9 (2.5)	1 (1.1)	
Hispanic	7 (1.5)	6 (1.6)	1 (1.1)	
Other	1 (0.2)	1 (0.3)	0	
BMI, kg/m ²	27.1 ± 6.1	27 ± 6.3	27.4 ± 5.4	0.59
ASA score	2.8 ± 0.6	2.9 ± 0.6	2.4 ± 0.5	<0.001
Histology				
Adenocarcinoma	385 (83.7)	302 (82.7)	83 (87.4)	0.55
Squamous	57 (12.4)	48 (13.2)	9 (9.5)	
Other	18 (3.9)	15 (4.1)	3 (3.2)	

Table 2: Operative Outcomes

Variable	All N = 460	RAMIE N = 365	TLE N = 95	<i>P</i> value
R0 resection	451 (98)	362 (99.2)	89 (93.7)	<0.001
Operative time, min	324 (267 – 390)	331 (275 – 401)	277 (234 – 360)	<0.001
Blood loss, mL	100 (50 – 150)	100 (50 – 150)	150 (100 – 212)	<0.001
Lymph nodes removed	17 (13 – 22)	18 (14 – 23)	14 (9 – 18)	<0.001
Length of stay, day	9 (7 – 12)	9 (7 – 11)	10 (8 – 14)	0.05
30-day mortality	12 (2.6)	9 (2.5)	3 (3.2)	0.71
90-day mortality	23 (5)	17 (4.7)	6 (6.3)	0.51

RESULTS

Figure 1: Postoperative Complications



Any complication defined as the presence of one or more complication(s) in a single patient
¹ Pneumonia, pleural effusions, pneumothorax, respiratory failure
² Delayed gastric emptying, ileus, partial bowel obstruction
³ Infection, dehiscence

CONCLUSIONS

- Compared with thoracoscopic-laparoscopic transthoracic esophagectomy, robotic esophagectomy was associated with superior oncologic outcomes, including higher R0 resection rates and increased lymph node harvest, along with reduced pulmonary, gastrointestinal, and wound complications.
- Despite longer operative times, overall morbidity and mortality were comparable.
- These findings support RAMIE as a safe and oncologically sound alternative to conventional laparoscopic esophagectomy, offering perioperative advantages in appropriately selected patients.