The Comparative Healthcare Cost Between Robotic Esophagectomy and Video Assisted Esophagectomy for Esophageal Cancer in Japan

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OBJECTIVE

- Since the introduction of minimally invasive esophagectomy, there have been improvements in post-operative outcomes, functional recovery and short-term quality of life.
- However, its economic impact has been less addressed
- We examined the costs of minimally invasive esophagectomy and how surgical approaches influenced these costs in Japan.

METHODS

- A nationwide Japanese claim database (Medial Data Vision Data) which represents approx. 23% of acute general hospitals in Japan was used.
- Adult patients who underwent Robotic Assisted Esophagectomy (RAE) or Video-Assisted Esophagectomy (VAE) between April 2018 and June 2022 were identified
- Healthcare costs include hospitalization cost, cumulative medical cost from admission to 30, 60, 90 days after post discharge. We also further analyzed hospitalization cost by items
- 1:1 Propensity Score Matching (PSM) was used to balance the covariates of studied population. Matching covariates include sex, age, smoking, CCI, BMI, TNM cancer stage, ICU admission and the hospital bed size.

RESULTS

- A total of 4407 esophagectomy patients were identified (LAP: 3,960, RAS: 447). 447 VAE and 447 RAE patients are matched
- After matched analyses, the Length of Stay (LOS) stay was 28.06±13.45 in VAE and 24.25±9.40 in RAE (p = 0.001), the post operative length of stay was respectively. RAE showed higher ICU admission than VAE (RAE: 373 (83.4%), VAE: 329 (73.6%), p<0.001)
- Index hospitalization mean costs were lower in RAE than VAE (VAE $ 31,723±4742.89; RAE $ 30,573±4576.35; p<0.001) and cumulative cost from admission to 90 days after post-discharge (VAE $ 35,665 ±7701.55; RAE $ 34,551±7877.20; p<0.001) as well .
- Cost of RAE was lower in injection (VAE $ 901±719.69; RAE $ 681±629.8; p<0.001), treatment (VAE $ 314±231.05; RAE $ 249±190.04; p<0.001), examination (VAE $ 1819±632; RAE $ 1777±600.2; p<0.001), hospitalization services ((VAE $ 9232±2969.58; RAE $ 8132±2815.31; p<0.001), and medical management (VAE $ 176±104.95; RAE $ 152±96.45; p<0.001) than VAE during the index hospitalization.

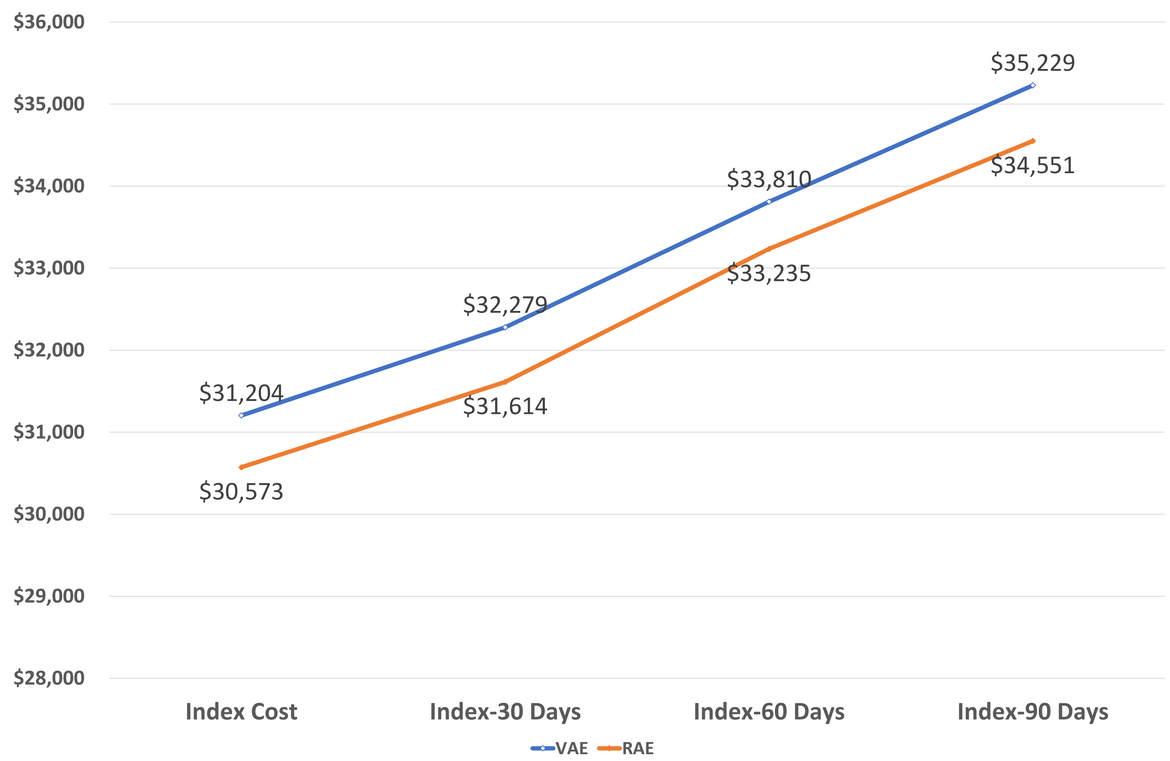
Table1. Patients baseline characteristics

		VAE	RAE	p-value	VAE	RAE	p-value
N (%)		3960	447		447	447	
Sex	Male	3118 (78.7)	338 (75.6)	0.144	339 (75.8)	338 (75.6)	1.000
	Female	842(21.3)	109(24.4)		108 (24.2)	109 (24.4)	
Age	18 ~ 55	371 (9.4)	45 (10.1)	0.027	42 (9.4)	45 (10.1)	0.593
	55 ~ 75	2676 (67.6)	324 (72.5)		337 (75.4)	324 (72.5)	
	75 ~	913 (23.1)	78 (17.4)		68 (15.2)	78 (17.4)	
CCI	0 ~ 1	2 (0.1)	1 (0.2)	0.379	1 (0.2)	1 (0.2)	0.790
	2	1540 (38.9)	178 (39.8)		168 (37.6)	178 (39.8)	
	3 ~	2418 (61.1)	268 (60.0)		278 (62.2)	268 (60.0)	
BMI	Normal	3409 (86.1)	373 (83.4)	0.148	383 (85.7)	373 (83.4)	0.405
	Overweight	551 (13.9)	74 (16.6)		64 (14.3)	74 (16.6)	
Cancer Stage	T0 ~ T1	1263 (31.9)	144 (32.2)	0.273	162 (36.2)	154 (34.5)	0.943
	T2	651 (16.4)	68 (15.2)		65 (14.5)	68 (15.2)	
	T3	1686 (42.6)	203 (45.4)		200 (44.7)	203 (45.4)	
	T4	192 (4.8)	22 (4.9)		20 (4.5)	22 (4.9)	
Preoperative Neoadjuvant Therapy	Yes	1590 (40.2)	188 (42.1)	0.467	246 (55.0)	259 (57.9)	0.418
	No	2370 (59.8)	259 (57.9)		201 (45.0)	188 (42.1)	
Hospital Scale	200-499 beds	1279 (32.3)	123 (27.5)	0.045	121 (27.1)	123 (27.5)	0.433
	>=500 beds	2681 (67.7)	324 (72.5)		326 (72.9)	324 (72.5)	
Smoking Status	Nonsmoker	1010 (25.5)	99 (22.1)	0.169	105 (23.5)	99 (22.1)	0.796
	<400	620 (15.7)	65 (14.5)		65 (14.5)	65 (14.5)	
	400-799	974 (24.6)	129 (28.9)		116 (26.0)	129 (28.9)	
	>=800	1356 (34.2)	154 (34.5)		161 (36.0)	154 (34.5)	
Hospital Type	University	906 (22.9)	110 (24.6)	0.445	103 (23.0)	110 (24.6)	0.966
	Others	3054 (77.1)	337 (75.4)		344 (77.0)	337 (75.4)	
Year of Surgery	2018	579 (13.2)	7 (1.4)	<0.001	5 (1.1)	6 (1.3)	0.878
	2019	821 (18.7)	7 (1.4)		8 (1.8)	7 (1.6)	
	2020	951 (21.6)	98 (20.2)		100 (22.4)	89 (19.9)	
	2021	1041 (23.7)	170 (35.1)		160 (35.8)	159 (35.6)	
	2022	1004 (22.8)	203 (41.9)		174 (38.9)	186 (41.6)	

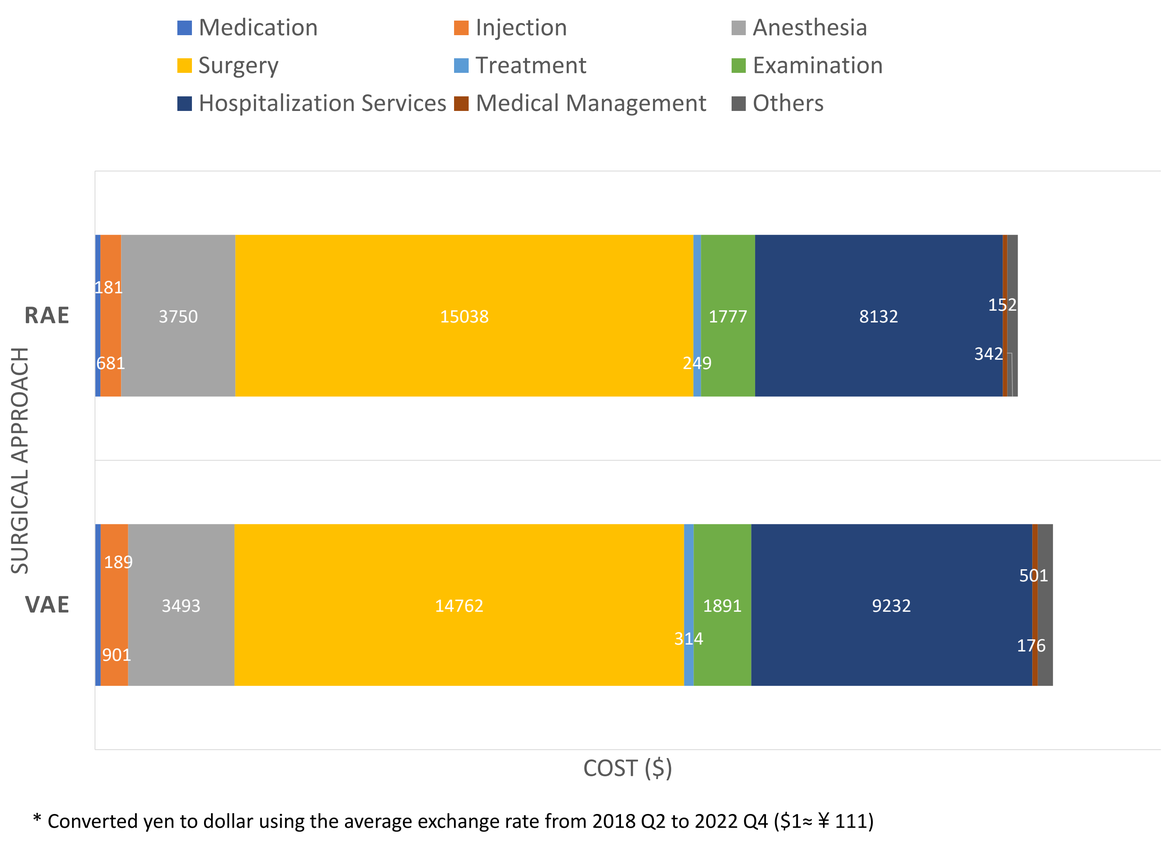
Table 2. Post operative Outcomes

		VAE	RAE	p-value	VAE	RAE	p-value
Length of stay (days)		29.09 (13.82)	24.25 (9.40)	<0.001	28.06 (13.45)	24.25 (9.40)	<0.001
Post operative length of stay (days)		25.28 (12.90)	21.05 (9.01)	<0.001	24.15 (12.27)	21.05 (9.01)	<0.001
ICU admission rate (N/%)	Yes	1785 (45.1)	74 (16.6)	<0.001	329 (73.6)	373 (83.4)	<0.001
	No	2175 (54.9)	373 (83.4)		118 (26.4)	74 (16.6)	

Graph 1. Cumulative cost from admission



Graph 2. Hospitalization cost by category



* Converted yen to dollar using the average exchange rate from 2018 Q2 to 2022 Q4 ($1≈ ¥ 111)

CONCLUSIONS

- Overall, among the Japanese population studied, RAE demonstrated favorable cost outcomes when compared to VAE. Specifically, RAE showed cost-saving effects both during hospitalization and after discharge.
- RAE showed 3 days shorter LOS compared to VAE, but higher ICU admission rate. Further analysis revealed that the cost advantages of RAE extended to lower expenses in injection, treatment, examination, hospitalization services and medical management costs during the hospitalization. These findings underscore the potential economic benefits and efficiency gains associated with implementing RAE for esophageal cancer patients in Japanese healthcare settings

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