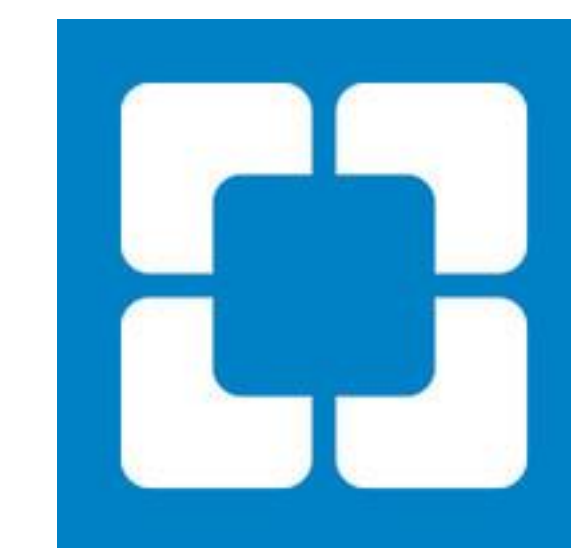




Prognostic Value of Computed Tomography Scan Detection of Cartilage Invasion in Advanced Laryngeal Cancer Treated with Primary Total Laryngectomy

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INTRODUCTION

Cartilage invasion (CI) is central to staging and treatment of advanced laryngeal cancer; tests that can accurately diagnose CI are needed.¹ Patients without cartilage invasion are often able to undergo organ preserving treatment with chemoradiotherapy while those with extensive cartilage invasion often undergo surgery. Many studies have analyzed the sensitivity and specificity of computed tomography scans (CT) for CI but few have associated these measures with oncologic outcomes.^{2,3} We sought to determine whether CT detection of CI predicts oncologic outcomes in patients receiving primary total laryngectomy.

METHODS

This was a retrospective cohort study at a single tertiary care institution from 2000-2018. Data was extracted from patient charts and placed in an IRB-approved head and neck cancer registry. All patients receiving primary total laryngectomy for laryngeal cancer and had available imaging were included. All CT scans were reviewed by one of two neuroradiologists. Survival analysis was performed with Kaplan Meier analysis. Multivariable Cox proportional hazards models were used to model disease free survival (DFS) and were presented as hazard ratios (HR) with 95% confidence intervals. Chi-squared test was used to compare counts. Analyses were performed using R statistical software

Results

	n	%
Age (mean and SD)	63.65	9.68
Ethnicity		
Asian	1	1.10%
African American	22	24.20%
White	67	1.10%
Unknown	1	73.60%
Sex: Male	71	78%
Smoking History		
Use during or after treatment	57	62.60%
Never smoker	3	3.30%
Former smoker	31	34.10%
Heavy alcohol use	36	39.60%

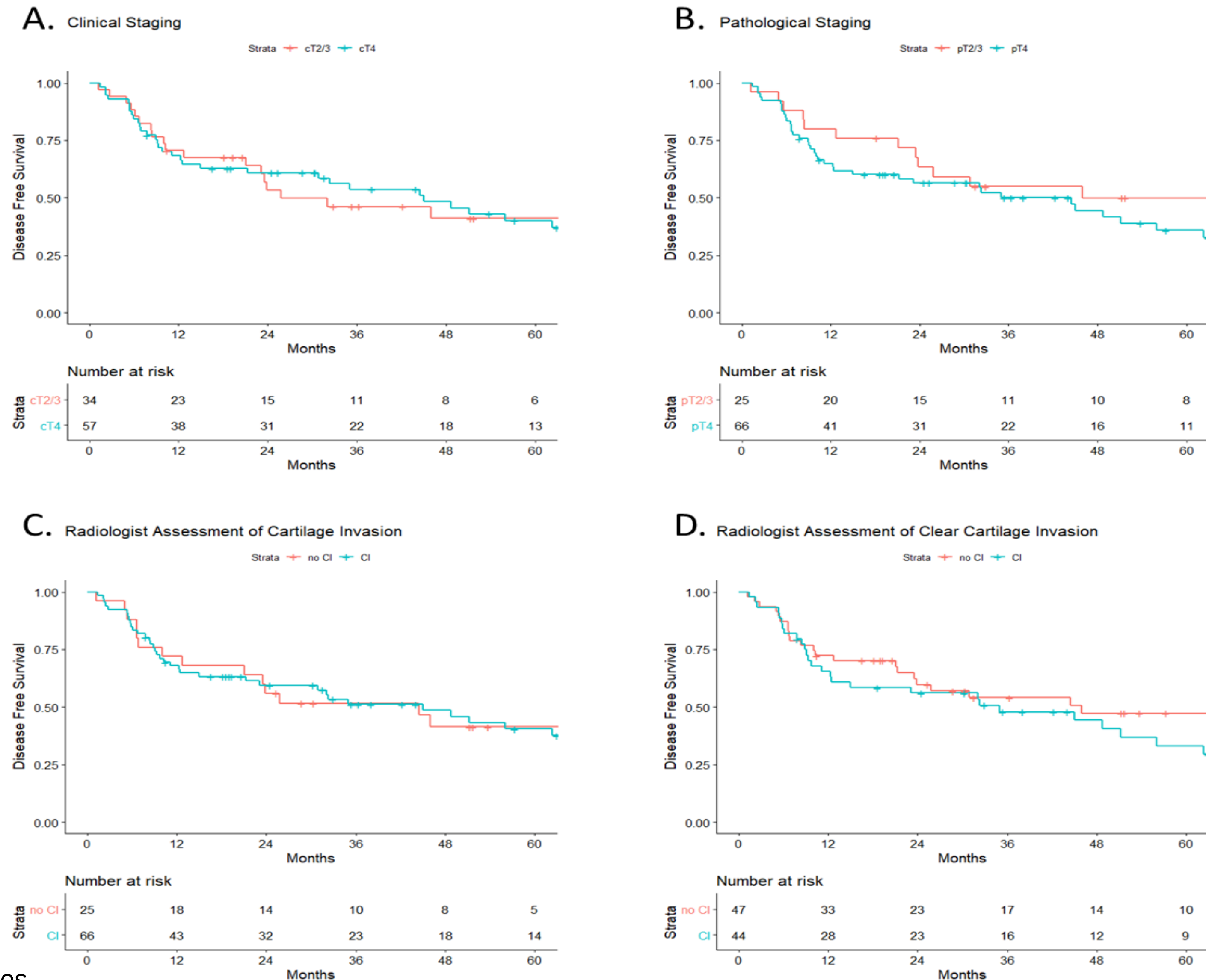
Table 1: Demographics

91 patients were included; median follow up was 23 months (range 2.5-118.6). Clinically, 57 (62.6%) were T4a (cT4a), 31 (34.1%) cT3, 3 (3.3%) cT2. Pathologically, 67 (73.6%) T4a (pT4a), 23 pT3 (25.3%), one pT2 (1.1%). Adjuvant treatment in pT4a was radiation 39 (58.2%), chemoradiation 17 (25.4%), none 11 (16.4%); in pT3/pT2 radiation 8 (33.3%), chemoradiation 7 (29.2%), none 9 (37.5%). DFS was similar between cT4a and cT3/cT2 (five-year p=0.98). One-year DFS in pT3/pT2 was 80% versus 64.9% in pT4a (p=0.17). Five-year DFS was 49.9% in pT3/pT2 versus 35.9% in pT4a (p=0.18). DFS was similar among patients with gestalt CI versus no CI. One-year DFS was 72% in gestalt non-CI patients and 67.9% in CI (p=0.72). Five-year DFS was 41.4% in gestalt non-CI patients and 40.5% among CI patients (p=0.94). Local recurrence occurred in 9 (9.9%), regional 9 (9.9%), distant 18 (19.8%).

Figure 1: Disease Free Survival curves

Radiologist: gestalt of any cartilage invasion						
Radiologist	Pathology	No	Yes	Total	Sensitivity	0.80
	No	12	13	25	Specificity	0.48
	Yes	13	53	66	PPV	0.80
	Total	25	66	91	NPV	0.48
Radiologist: clear invasion of any cartilage						
Radiologist	Pathology	No	Yes	Total	Sensitivity	0.60
	No	21	26	47	Specificity	0.84
	Yes	4	40	44	PPV	0.90
	Total	25	66	91	NPV	0.44
Radiologist: tumor abutting any sclerosing cartilage						
Radiologist	Pathology	No	Yes	Total	Sensitivity	0.78
	No	8	14	22	Specificity	0.32
	Yes	17	52	69	PPV	0.75
	Total	25	66	91	NPV	0.36
Radiologist: invasion and/or sclerosis of cartilage						
Radiologist	Pathology	No	Yes	Total	Sensitivity	0.93
	No	5	4	9	Specificity	0.20
	Yes	20	62	82	PPV	0.75
	Total	25	66	91	NPV	0.55

Table 2: Sensitivity and specificity for prediction of cartilage invasion



When adjusted for age and sex, histology confirmed CI was associated with HR of 1.43 (0.74-2.74), gestalt CI had HR of 1.03 (0.56-1.89), and clear CI had HR of 1.27 (0.71-2.27) for DFS.

	Hazard Ratio	2.5% CI	97.5% CI
Pathology confirmed cartilage invasion*	1.42	0.74	2.74
Radiologist gestalt cartilage invasion*	1.03	0.56	1.89
Radiologist clear cartilage invasion*	1.27	0.71	2.28

Table 3: Adjusted multivariable Cox proportional hazards analysis for disease free survival.

CONCLUSION

Our study is the first to study the relationship between radiologic CI and oncologic outcome in patients receiving primary total laryngectomy for advanced laryngeal cancer. Gestalt determination of CI results in higher sensitivity but lower specificity, while clear CI results in lower sensitivity and higher specificity. Neither histologic, gestalt, nor clear CI was significantly associated with inferior DFS. Studies with larger samples are warranted.

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