Surgical approach to locally invasive thyroid cancer

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Definition

Locally invasive thyroid cancer (TC) is an ill-defined entity comprising different types of cancer and different extent of longitudinal a/o horizontal extrathyroidal invasion.

According to several recent studies (Ito 2006, Fukushima 2010, Rivera 2010, a. o.) **"massive" but not minimal extrathyroidal invasion represents a significant risk factor for recurrence and survival. It accounts for about one-third of TC specific mortality** (Kitamura 1999).

In contrast to surgery of TC with horizontal invasion (lymph nodes, vessels, soft tissues) longitudinal invasion of the aerodigestive tract (ADT) is not only technically difficult but also associated with significant perioperative morbidity and mortality.

Structures involved by locally advanced TC

Study	N	L (%)	T (%)	E (%)	V (%)	A (%)	M (%)	VN (%)	RLN (%)
Breaux et al, 1980	47	34	60	17	13	6	38	4	47
Fujimoto et al, 1986*	18	6	83	33	39	11	NR	NR	56
McConahey et al, 1986	138	14	48	19	NR	NR	51	NR	38
McCoffrey et al, 1994†	262	11	37	21	NR	NR	53	NR	47
Nishida et al, 1997	117	NR	59	31	38	7	61	8	59
Nakao et al, 2001‡	31	0	100	29	45 (4 studies)	0 (4 studies)	77 (5 studies)	13 (3 studies)	61
Total	613	13	50	23	33	6	54	8	48

*Patients with aerodigestive tract invasion of papillary thyroid carcinoma (PTC) only.

†Patients with PTC only.

‡Patients with trachea resection only.

L = larynx; T = trachea; E = esophagus; V = internal jugular vein; A = carotid artery; M = sternocleidomastoid short strap muscles; VN = vagal nerve; RLN = recurrent laryngeal nerve (unilateral); NR = Not Reported.

Dralle et al. 2005
In: Clark et al. Textbook of Endocrine Surgery, 2nd Edition, 318 - 333

Frequency of ADT invasion by TC

Author	Thyroid Malignancy N	Aerodigestive Invasion n	%
Frazell et al, 1958	383	6	2
Schindel, 1971	225	15	7
Djalilian et al, 1974	2000	18*	1
Breaux et al, 1980	210	47	22
Cody et al, 1981	801†	32	4
Friedman et al, 1982	190	13	7
Nakao et al, 1984	145	18	12
Segal et al, 1984	500	29	6
Tsumori et al, 1985	180	28	16
Shvili et al, 1985	122	7	6
Fujimoto et al, 1986	249	21†	8
McConahey et al, 1986	859‡	138	16
Britto et al, 1990	1925	10	1
Park et al, 1993	432	16	4
Melliere et al, 1993	412	45	11
Nishida et al, 1997	301	69	23
Bayles et al, 1998	536	28	5
Own series, 2002	607	60	10
Total	10,077	600	6

*Patients with intraluminal aerodigestive invasion only.
†Differentiated thyroid carcinoma (DTC) only.
‡Papillary thyroid carcinoma (PTC) only.

Dralle et al. 2005
In: Clark et al. Textbook of Endocrine Surgery, 2nd Edition, 318 - 333

Types of TC with ADT invasion

Study	N	PTC (%)	FTC* (%)	MTC (%)	UTC (%)	Others (%)
Djalilian et al, 1974	18	33	39	6	22	
Breaux and Guillamondegui, 1980	47	63	6	4	23	2
Cody and Shah, 1981†	32	100				
Ishihara et al, 1982	24	92		4	4	
Segal et al, 1984	28	46	18	4	29	4
Shvili et al, 1985	7	71	29			
Tsumori et al, 1985	18	72	6		22	
Fujimoto et al, 1986†	21	100				
Grillo and Zanini, 1986	22	73	14		5	9
Lipton et al, 1988†	48	67	33			
Nomori et al, 1990†	45	87	13			
Ishihara et al, 1991	60	82	10	3	5	
Grillo et al, 1992	52	56	25	2	10	8
Melliere et al, 1993	45	33	31	4	27	4
Park et al, 1993	16	88	12			
Friedman et al, 1994†	34	91	9			
Ozaki et al, 1995	21	86	10	5		
Nishida et al, 1997†	54	89	11			
Bayles et al, 1998	28	43	11	7	39	
Musholt et al, 1999	33	64	24	12		
Kim et al, 2000	22	95			5	
Own series, 2002	60	37	18	23	17	5
Total	735	69	15	4	10	2

*Including Hürthle cell carcinomas.

†Only differentiated thyroid carcinomas.

PTC = papillary thyroid carcinoma; FTC = follicular thyroid carcinoma; MTC = medullary thyroid carcinoma; UTC = undifferentiated thyroid carcinoma.

Dralle et al. 2005
In: Clark et al. Textbook of Endocrine Surgery, 2nd Edition, 318 - 333

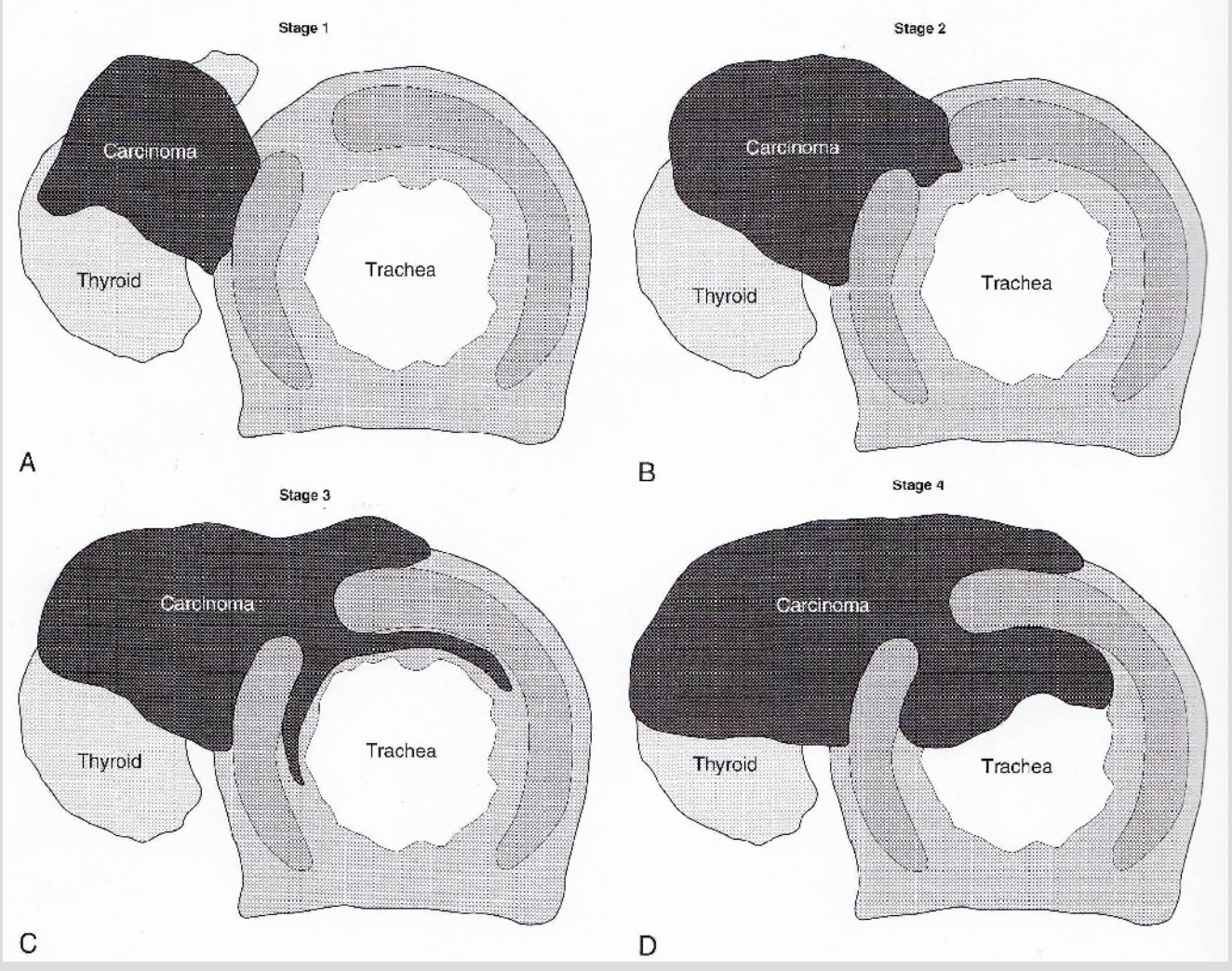
Morbidity and mortality after laryngotracheal resection

	n	Type of resection (n) acc. to Dralle classification (2005)			Morbidity (%)	Mortality (%)
		1 + 2	3 + 4	5 + 6		
Ishihara 1991	60		60		22	1
Grillo 1992	34	1	26	7	21	6
Dralle 1993	24	18		6		8
Ozaki 1995	21		21			0
Nakao 2001	31		31			0
Xu 2004	21	11	8	2		0
Nakao 2004	46		40	6	24	9
Gaissert 2007	82		69	13	28	1
Brauckhoff 2010	82	42	16	24	38	5

Brauckhoff and Dralle, Chirurg 2011; 82: 134 – 140

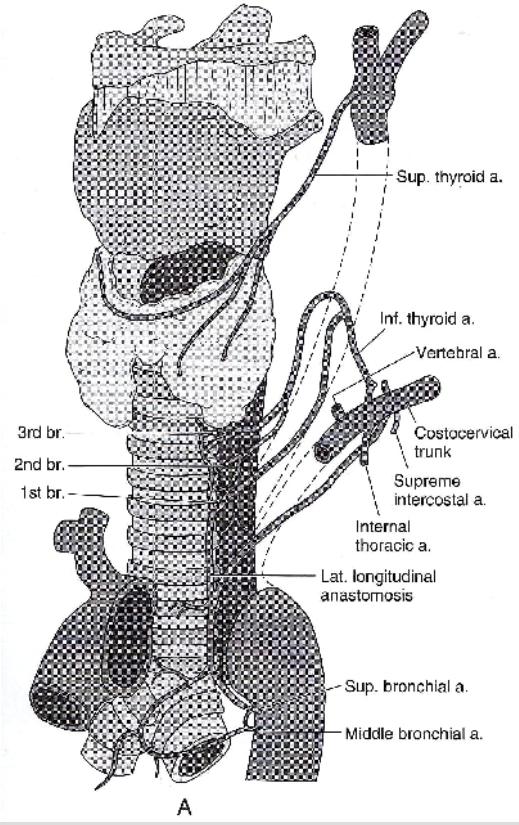
Staging system for TC invading the trachea

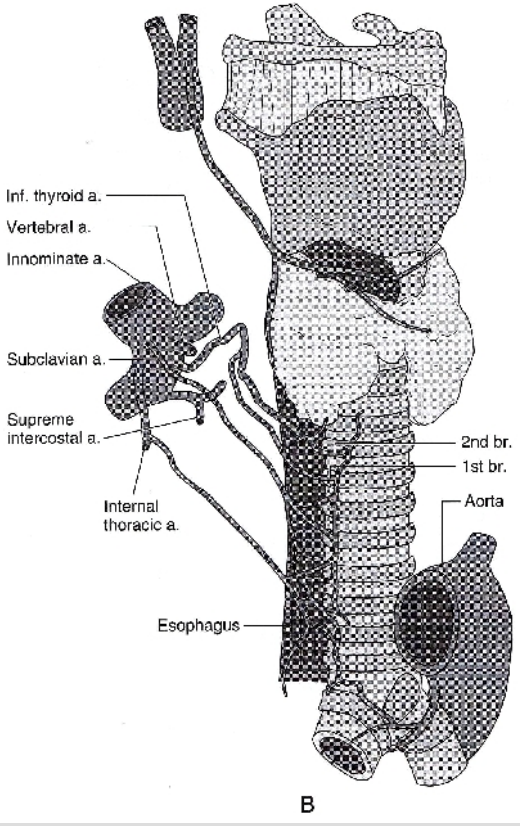
(Shin et al. 1993)

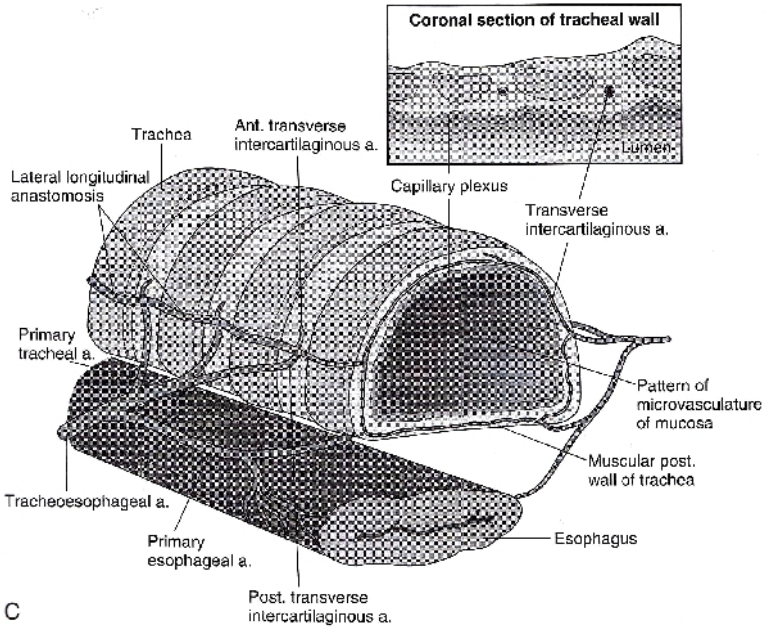


Shin et al. Hum Pathol 1993; 24: 866 – 870

Arterial blood supply of the ADT







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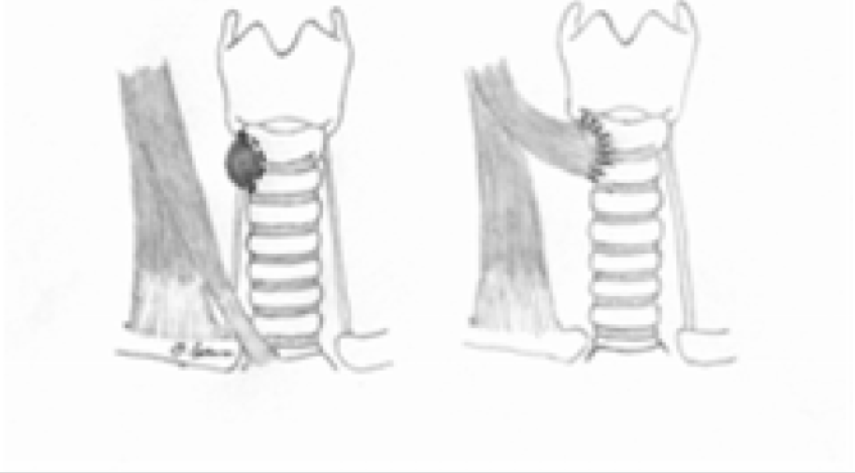
Types of resection and reconstruction acc. to level and extent of ADT invasion by TC

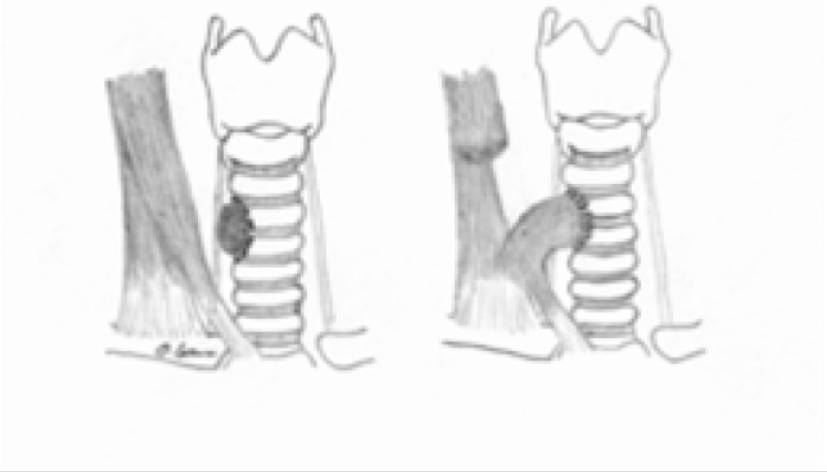
Type 1

Laryngocricoid, unilateral, ≤ 2 cm longitudinally,
≤ ¼ of circumference: window resection, SCM flap



Type 2

Trachea, unilateral, ≤ 2 cm longitudinally,
≤ ¼ of circumference: window resection, SCM flap



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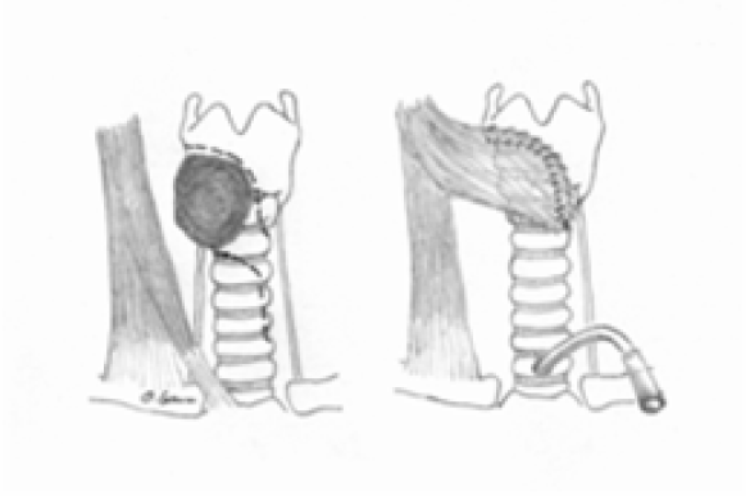
Dralle et al. 2011; In: Oertli, Udelsman, Surgery of the thyroid and parathyroid glands, 2nd Edition (in prep.)

Types of resection and reconstruction acc. to level and extent of ADT invasion by TC

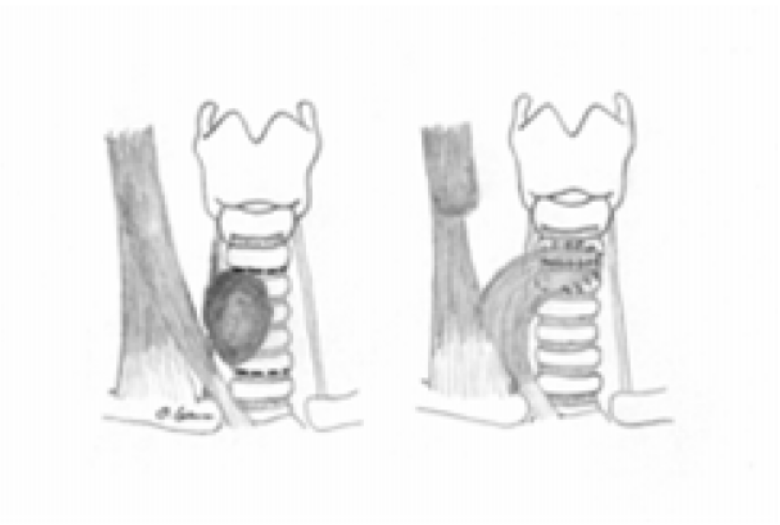
Type 3

Laryngocricoid, unilateral, > 2 cm longitudinally, > ¼ of circumference: oblique sleeve resection, primary anastomosis, SCM flap



Type 4

Trachea, uni- or bilateral, > 2 cm longitudinally, > ¼ of circumference: sleeve resection, primary anastomosis, SCM flap



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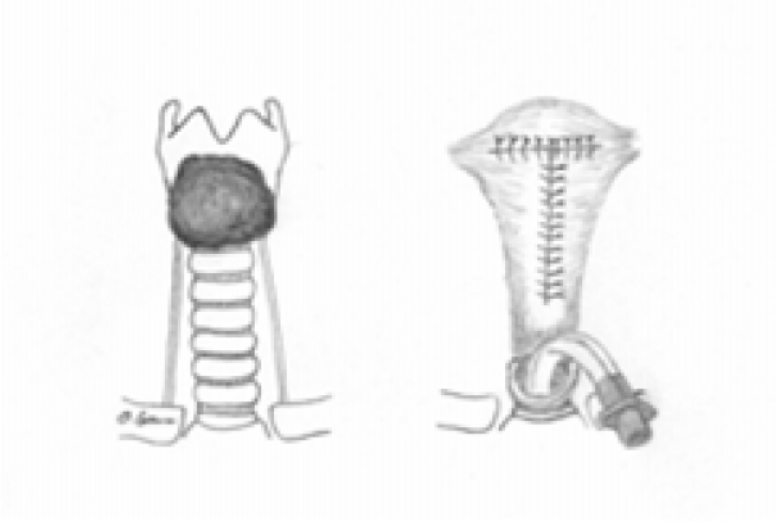
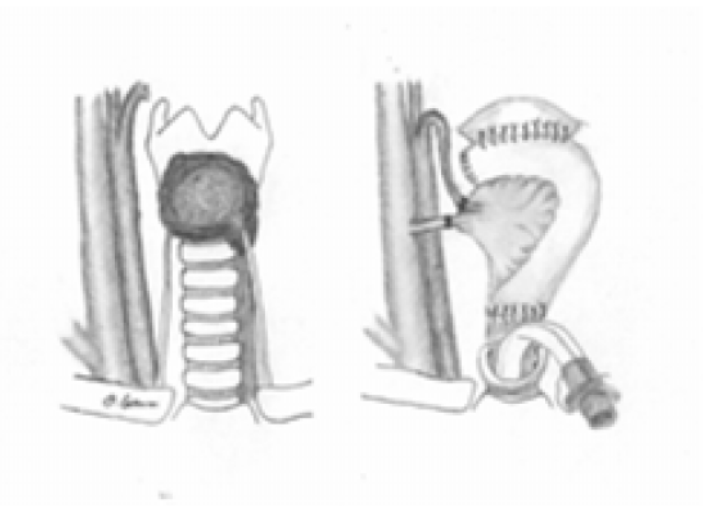
Types of resection and reconstruction acc. to level and extent of ADT invasion by TC

Type 5
Laryngocricoid, bilateral: laryngectomy

Type 6
Laryngocricoid, bilateral plus hypopharynx/ esophagus: cervical evisceration, tracheostomy, free jejunal graft





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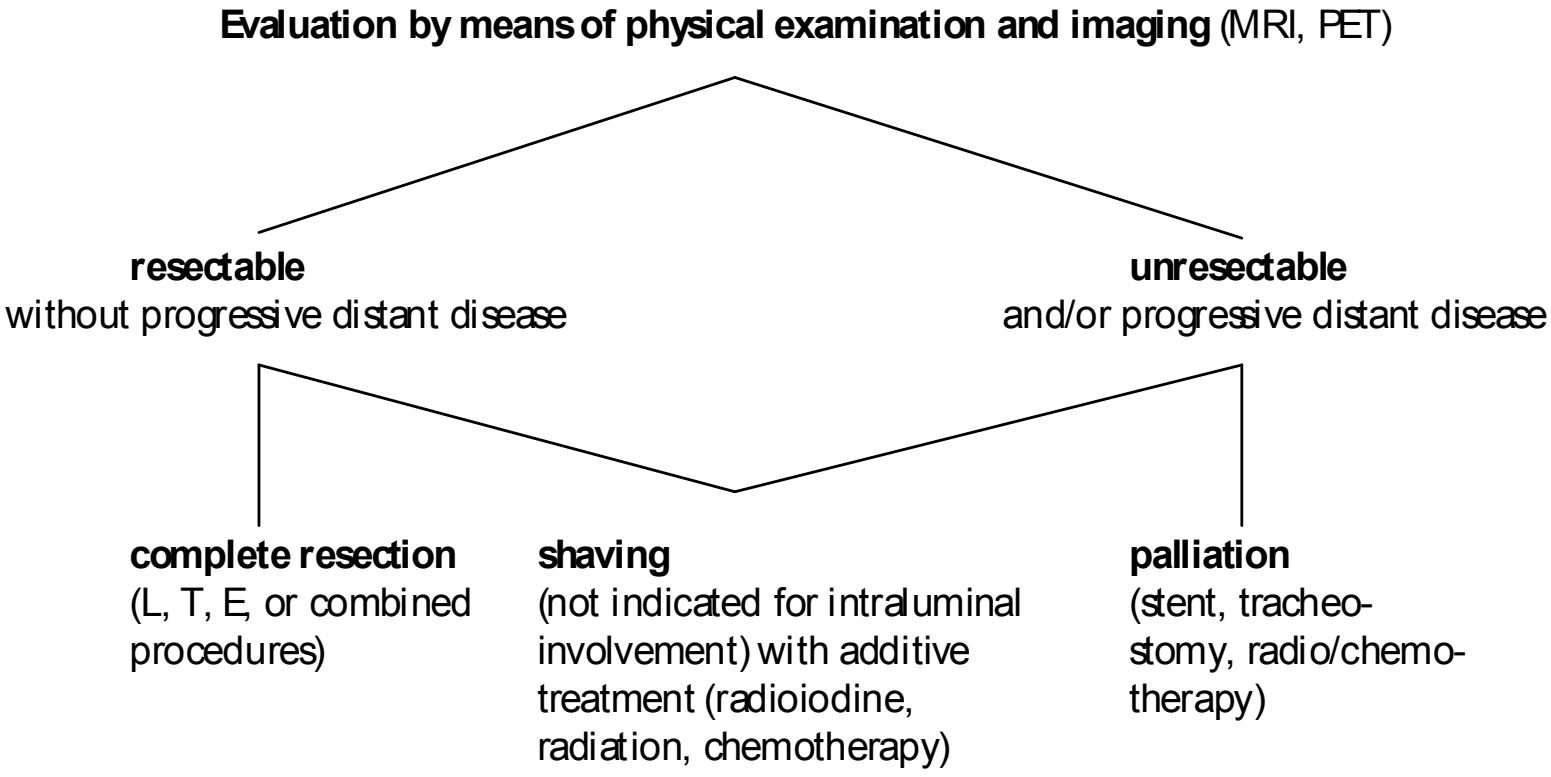
Definition of resectability and preferred strategy

Resectable	ADT invasion confined to the central compartment, with trachea invasion ≤ 4 cm in length	Complete resection
Unresectable	ADT invasion extending to or beyond the carotid sheath or infrabrachiocephalic mediastinum	Shaving (extraluminal ADT invasion only), intraluminal stenting (intraluminal ADT invasion), or palliative procedures

Terminology and types of treatment

Complete resection	Complete resection (R0) of extra/intraluminar ADT invasion	Patient with resectable tumor without distant met, who is in good physical shape and prepared to undergo resection
Shaving	Incomplete resection (R1/2) leaving small tumor remnants at outer circumference of L, T, or E; not indicated for pts. with intraluminal ADT invasion	Patients with unresectable tumor or progressive distant met, who are unsuitable for, or not preopared to undergo transmural resection
Palliation	Non-surgical intraluminal stenting, tracheostomy, external beam radiation, or chemotherapy	Patients with unresectable tumor or progressive distant met, or pts. unsuitable for, or not prepared to undergo resection

Algorithm of patient selection for surgical vs. non-surgical treatment



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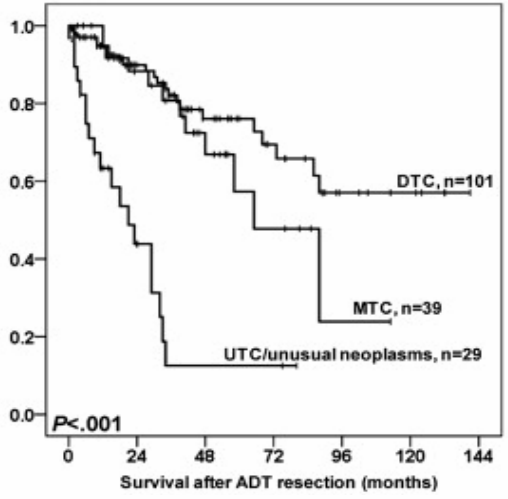
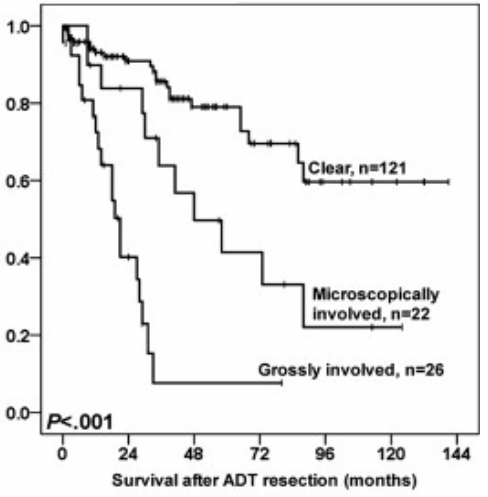
CSS after resection of ADT invasion in TC

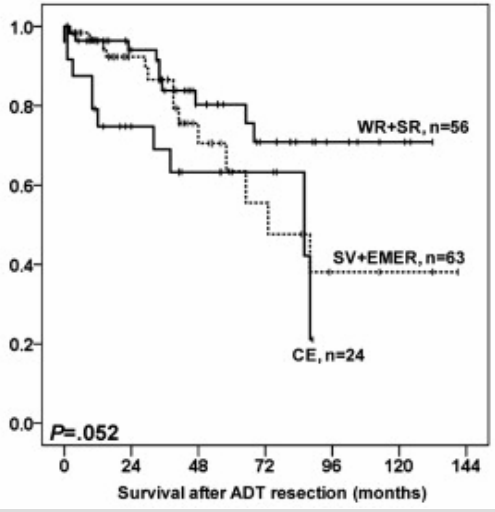
Tumor type



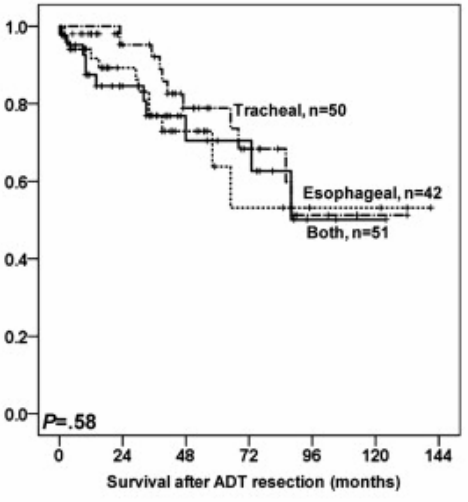
Surgical margins



Extent of surgery
(excluding grossly incomplete resections)



Type of organ invasion
(excluding grossly incomplete resections)



n = 190 including 16 (8.4 %) with unresectable lesions, Halle, 1995 – 2009 - Brauckhoff et al., Surgery 2010; 148: 1257 – 1266