Chapter 18
Esophageal Cancer

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PEARLS

- Esophageal cancer accounts for 5% of all GI cancers. There are 16,470 new cases and 14,280 deaths from esophageal cancer each year in the US. It is the sixth leading cause of death from cancer worldwide.
- Incidence increases with age, peaks at sixth to seventh decade.
- Male:female = 3.5:1.
- African-American males:White males = 5:1.
- Most common in China, Iran, South Africa, India, and the former Soviet Union.
- Risk factors: tobacco, EtOH, nitrosamines, Tylosis (congenital hyperkeratosis), Plummer Vinson syndrome, achalasia, GERD, and Barrett's esophagus.
- Four regions of the esophagus: Cervical = cricoid cartilage to thoracic inlet (15–18 cm from the incisor). Upper thoracic = thoracic inlet to tracheal bifurcation (18–24 cm). Midthoracic = tracheal bifurcation to just above the GE junction (24–32 cm). Lower thoracic = GE junction (32–40 cm).
- Barrett's esophagus: metaplasia of the esophageal epithelial lining. The squamous epithelium is replaced by columnar epithelium, with 0.5% annual rate of neoplastic transformation.
- Adenocarcinoma: rapid rise in incidence. Comprises 60–80% of all new cases compared to 10–15% 10 years ago. Predominately white men. Associated with Barrett's, GERD, and hiatal hernia. Locations: 75% in the distal esophagus and 25% in the upper and midesophagus.
- Squamous cell carcinoma: Associated with tobacco, alcohol, or prior history of H&N cancers. Locations: 50% midesophagus and 50% distal esophagus.

WORKUP

- H&P: Dysphagia, odynophagia, cough, hoarseness (laryngeal nerve involvement), weight loss, use of EtOH, tobacco, nitrosamines, history of GERD. Examine for cervical or supraclavicular adenopathy.
- Labs: CBC, chemistries, LFTs.
- EGD: allow direct visualization and biopsy.
- EUS: assess the depth of penetration and LN involvement. Limited by the degree of obstruction.
- Barium swallow: can delineate proximal and distal margins.
- CT chest and abdomen: assess adenopathy and metastasis.
- PET scan: can detect up to 15–20% of metastases not seen on CT and EUS.
- Bronchoscopy: rule-out fistula in midesophageal lesions.
- Bone scan: recommended if elevated alkaline phosphatase or bone pain.
- Pulmonary function test: to evaluate whether medically operable and serve as baseline lung function for chemo-RT.
- Nutritional assessment.

STAGING: ESOPHAGEAL CANCER

Editors' note: All TNM stage and stage groups referred to elsewhere in this chapter reflect the 2002 AJCC staging nomenclature unless otherwise noted as the new system below was published after this chapter was written.

(AJCC 6TH ED., 2002)

Primary tumor (T)
TX: Primary tumor cannot be assessed
T0: No evidence of primary tumor
Tis: Carcinoma in situ
T1: Tumor invades lamina propria or submucosa
T2: Tumor invades muscularis propria
T3: Tumor invades adventitia
T4: Tumor invades adjacent structures

Regional lymph nodes (N)
NX: Regional lymph node metastasis cannot be assessed
N0: No regional lymph node metastasis
N1: Regional lymph node metastasis

Distant metastasis (M)
MX: Distant metastasis cannot be assessed
M0: No distant metastasis
M1: Distant metastasis
Tumors of the lower thoracic esophagus:
M1a: Metastasis in celiac lymph nodes
M1b: Other distant metastasis
Tumors of the midthoracic esophagus:
M1a: Not applicable
M1b: Nonregional lymph nodes and/or other distant metastasis
Tumors of the upper thoracic esophagus:
M1a: Metastasis in cervical nodes
M1b: Other distant metastasis

(AJCC 7TH ED., 2010)

Primary tumor (T)*
TX: Primary tumor cannot be assessed
T0: No evidence of primary tumor
Tis: High-grade dysplasia**
T1: Tumor invades lamina propria, muscularis mucosae, or submucosa
T1a: Tumor invades lamina propria or muscularis mucosae
T1b: Tumor invades submucosa
T2: Tumor invades muscularis propria
T3: Tumor invades adventitia
T4: Tumor invades adjacent structures
T4a: Resectable tumor invading pleura, pericardium, or diaphragm
T4b: Unresectable tumor invading other adjacent structures, such as aorta, vertebral body, trachea, etc.

*(1) At least maximal dimension of the tumor must be recorded and (2) multiple tumors require the T(m) suffix
**High-grade dysplasia includes all noninvasive neoplastic epithelia that was formerly called carcinoma in situ, a diagnosis that is no longer used for columnar mucosae anywhere in the gastrointestinal tract.

Regional lymph nodes (N)*
NX: Regional lymph nodes cannot be assessed
N0: No regional lymph node metastasis
N1: Metastasis in 1–2 regional lymph nodes
N2: Metastasis in 3–6 regional lymph nodes
N3: Metastasis in seven or more regional lymph nodes

continued

Stage grouping
0: TisN0M0
I : T1N0M0
IIA: T2N0M0, T3N0M0
IIB: T1N1M0, T2N1M0
III: T3N1M0, T4 Any N M0
IV: Any T, Any N, M1
IVA: Any T, Any N, M1a
IVB: Any T, Any N, M1b

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*Number must be recorded for total number of regional nodes sampled and total number of reported nodes with metastasis

Distant metastasis (M)
M0: No distant metastasis
M1: Distant metastasis

Anatomic stage/prognostic groups
Squamous cell carcinoma (Fig. 18.1)*

Stage	T	N	M	Grade	Tumor location**
0:	Tis (HGD)	N0	M0	1, X	Any
IA:	T1	N0	M0	1, X	Any
IB:	T1	N0	M0	2–3	Any
	T2–3	N0	M0	1, X	Lower, X
IIA:	T2–3	N0	M0	1, X	Upper, middle
	T2–3	N0	M0	2–3	Lower, X
IIB:	T2–3	N0	M0	2–3	Upper, middle
	T1–2	N1	M0	Any	Any
IIIA:	T1–2	N2	M0	Any	Any
	T3	N1	M0	Any	Any
	T4a	N0	M0	Any	Any
IIIB:	T3	N2	M0	Any	Any
IIIC:	T4a	N1–2	M0	Any	Any
	T4b	Any	M0	Any	Any
	Any	N3	M0	Any	Any
IV:	Any	Any	M1	Any	Any

*Or mixed histology including a squamous component or NOS**Location of the primary cancer site is defined by the position of the upper (proximal) edge of the tumor in the esophagus.
Adenocarcinoma (Fig. 18.2)

Stage	T	N	M	Grade
0:	Tis (HGD)	N0	M0	1, X
IA:	T1	N0	M0	1–2, X
IB:	T1	N0	M0	3
	T2	N0	M0	1–2, X
IIA:	T2	N0	M0	3

continued

IIB:	T3	N0	M0	Any
	T1–2	N1	M0	Any
IIIA:	T1–2	N2	M0	Any
	T3	N1	M0	Any
	T4a	N0	M0	Any
IIIB:	T3	N2	M0	Any
IIIC:	T4a	N1–2	M0	Any
	T4b	Any	M0	Any
	Any	N3	M0	Any
IV:	Any	Any	M1	Any

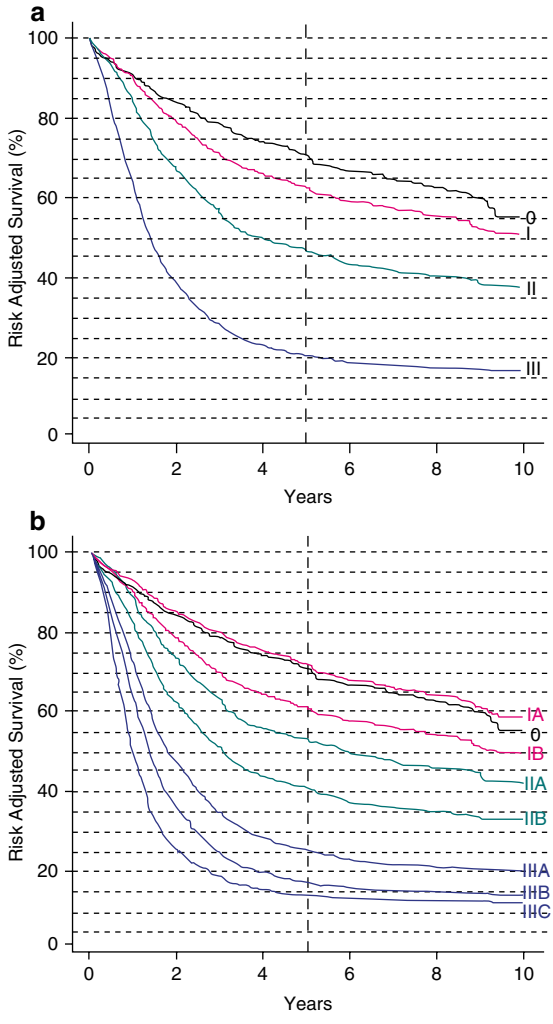

Fig. 18.1 (**a**) Survival after esophagectomy only for squamous cell carcinoma stratified by stage groupings, based on worldwide esophageal cancer collaboration (WECC) data. Condensed stage groupings. (**b**) Survival after esophagectomy only for squamous cell carcinoma stratified by stage groupings, based on worldwide esophageal cancer collaboration (WECC) data. Expanded stage groupings. (Used with permission from the American Joint Committee on Cancer (AJCC), Chicago, IL. The original source for this material is the AJCC Cancer Staging Manual, Seventh Edition (2010), published by Springer Science+Business Media)

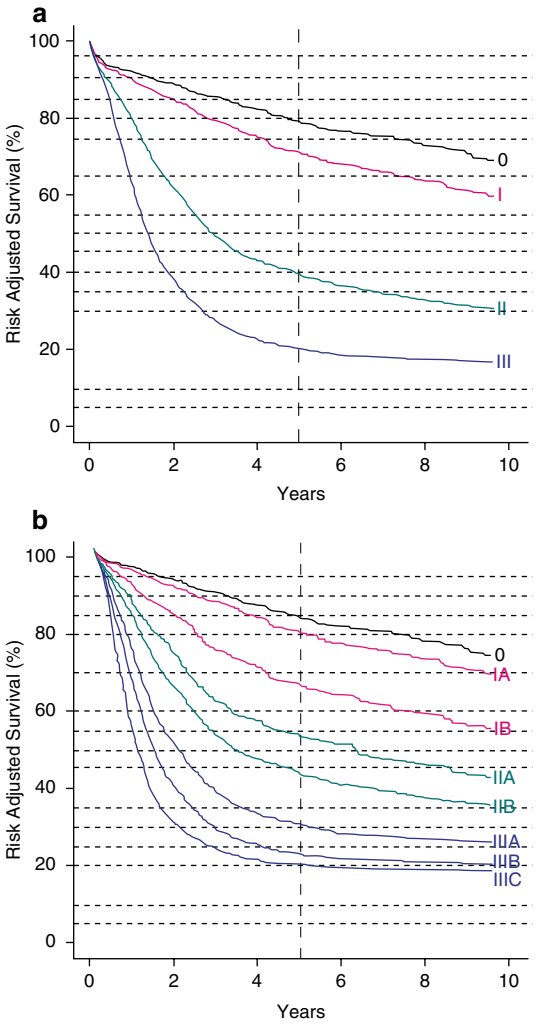

Fig. 18.2 (**a**) Survival after esophagectomy only for adenocarcinoma stratified by stage groupings, based on worldwide esophageal cancer collaboration (WECC) data. Condensed stage groupings. (**b**) Survival after esophagectomy only for adenocarcinoma stratifi ed by stage groupings, based on worldwide esophageal cancer collaboration (WECC) data. Expanded stage groupings. (Used with permission from the American Joint Committee on Cancer (AJCC), Chicago, IL. The original source for this material is the AJCC Cancer Staging Manual, Seventh Edition (2010), published by Springer Science+Business Media)

SURGICAL TECHNIQUES

- Transhiatal esophagectomy: for tumors anywhere in esophagus or gastric cardia. No thoracotomy. Blunt dissection of the thoracic esophagus. Left with cervical anastomosis. Limitations are lack of exposure of midesophagus and direct visualization and dissection of the subcarinal LN cannot be performed.
- Right thoracotomy (Ivor-Lewis procedure): good for exposure of mid to upper esophageal lesions. Left with thoracic or cervical anastomosis.
- Left thoracotomy: appropriate for lower third of esophagus and gastric cardia. Left with low-to-midthoracic anastomosis.
- Radical (en block) resection: for tumor anywhere in esophagus or gastric cardia. Left with cervical or thoracic anastomosis. Benefit is more extensive lymphadenectomy and potentially better survival, but increased operative risk.

TREATMENT RECOMMENDATIONS

2002 Stage	Recommended treatment
Stage I–III and IVA resectable* medically-fit	■ Pre-op chemo-RT (5-FU + cisplatin, 50 Gy) → surgery. Surgery preferred for adenocarcinoma regardless of response to chemo-RT. Three-year OS 20–30% (up to 50% if pCR). LF ~35% ■ Or, definitive chemo-RT (5-FU + cisplatin, 50 Gy). Chemo-RT is preferred for cervical esophagus lesions. Three-year OS 20–30%. LF ~45% ■ Or, surgery. Preferred upfront for noncervical T1N0 and young T2N0 patients with primaries of lower esophagus or gastroesophageal junction without high-risk features (poorly differentiated, LVSI). Perioperative chemo given for >T1N0 disease. Indications for post-op chemo-RT include: unfavorable T2N0, T3/4, LN+, and/or close/+ margin. Three-year OS 20–30%, LF ~40% *Resectable T4: involvement of pleura, pericardium or diaphragm only *Resectable stage IVA: resectable celiac nodes and no involvement of celiac artery, aorta, or other organs
Stage I–III inoperable	■ Definitive chemo-RT (5-FU + cisplatin, 50 Gy) (RTOG 85–01, RTOG 94–05, INT0123)

Stage IV palliative	■ Concurrent chemo-RT (5-FU + cisplatin, 50 Gy) or RT alone (e.g., 2.5 Gy × 14 fx) or chemo alone or best supportive care. RT palliates dysphagia in ~70% for average of ~6 months ■ Obstruction: stenting, laser, RT, chemo, or dilatation ■ Pain: medications ± RT ■ Bleeding: endoscopic therapy, surgery, or RT

STUDIES

SURGERY ALONE

- Three-year OS 6–35% (~20%). See control arms in Kelsen, Medical Research Council, and EORTC trials below.

RT ALONE

- Three-year OS 0%. See control arm in RTOG 85–01.

PRE-OP AND POST-OP RT

- Five randomized trials of pre-op RT vs. surgery alone demonstrate no difference in LF and OS.
- Phase III data from outside the US demonstrate decreased LF, but no difference in OS or DM with post-op RT.

PRE-OP CHEMO

- *Metaanalysis* (Gebski et al. 2007). Ten randomized trials with 1,209 patients evaluating pre-op chemo-RT vs. surgery alone in resectable esophageal cancer. Conclusion was that concurrent pre-op chemo-RT improves OS in SCC and adenocarcinoma. Eight randomized studies with 1,724 patients evaluating chemo + surgey vs. surgery alone. Chemo alone improved survival in adenocarcinoma, but not SCC. Caveats: suboptimal RT, sequential chemo-RT included, older studies.
- *RTOG 8911/INT 133* (Kelsen et al. 1998; 2007). Phase III: 467 patients with resectable T1-2NxM0 SCC and adenocarcinoma randomized to surgery alone vs. pre-op chemo × 3c (cisplatin, 5-FU) → surgery. Pre-op chemo did not improve MS (16 vs. 15 months) or OS at 4 years (26 vs. 23%). 12% cCR and 2.5% pCR. No difference between histologies. Update 2007: only R0 resection resulted in significant long-term survival advantage. Five-year OS R0 32%, R1 5%.

- *Medical Research Council Oesophageal Cancer Working Group* (2002); (Allum et al. 2008). Phase III: 802 patients with resectable SCC and adenocarcinoma randomized to surgery alone vs. pre-op chemo × 2c (5-FU, cisplatin) → surgery. Nine percent of patients from each arm received pre-op RT. Pre-op chemo improved 5-year OS (17→23%) and complete resection rate (54 → 60%). Survival advantage was seen in adenocarcinoma (17 vs. 24%) and SCC (18 vs. 23%).

PERI-OP CHEMO

- *MAGIC trial* (Cunningham et al. 2006). Phase III: 503 patients, T1-3N0-1M0, with resectable adenocarcinoma of the stomach, GE junction, or lower esophagus randomized to perioperative chemo vs. surgery alone. Chemo was epirubicin, cisplatin, and 5-FU × 3 cycles pre-op and same regimen × three cycles post-op. Peri-op chemo improved 5-year OS 23 → 36% (HR 0.75).

PRE-OP CHEMO-RT

- See Gebski metaanalysis above.
- Walsh et al. (1996). Phase III: 113 patients, adenocarcinoma only, randomized to surgery alone vs. pre-op chemo-RT → surgery. RT was 40 Gy/15 fx. Chemo was 5-FU and cisplatin × 2c. Pre-op chemo-RT improved OS at 1 year (52 vs. 44%) and 3 years (32 vs. 6%) and MS (16 vs. 11 months). Twenty-five percent pCR rate in chemo-RT arm. Positive LN or mets at surgery: 42% Chemo-RT, 82% surgery alone. Caveats: small patient number, adenocarcinoma only, poor outcome of surgery alone arm, nonconventional fractionation, and short follow-up (only 11 months).
- *EORTC* (Bosset et al. 1997). Phase III: 282 patients, T1-3N0 and T1-2N1M0, SCC only, randomized to surgery alone vs. pre-op chemo-RT → surgery. Chemo was cisplatin × 2c. RT was 37 Gy/10 fx in two 1-week courses separated by 2 weeks. Surgery was one-stage en bloc esophagectomy and proximal gastrectomy. pCR 26%. No difference in OS and MS (18.6 months). Pre-op chemo-RT improved DFS ($p = 0.003$), had a higher rate of curative resection ($p = 0.017$), a lower rate of death from cancer ($p = 0.002$), and a higher rate of post-op death ($p = 0.012$). RT was split course, nonconventional fractionation, no 5-FU.
- Urba et al. (2001). Phase III: 100 patients, localized CA, 75% adenocarcinoma, 25% SCC randomized to pre-op chemo-RT

→ surgery vs. surgery alone. Chemo was cisplatin, vinblastine, and 5-FU. RT was 1.5 Gy b.i.d. to 45 Gy. Surgery was transhiatal esophagectomy. Pre-op chemo-RT significantly decreased LR (19 vs. 42%). Improved 3-year OS (30 vs. 15%) did not reach statistical significance ($p = 0.07$).

- Bates et al. (1996) Phase II: 35 patients, localized CA, 80% SCC, 20% adenocarcinoma treated with pre-op chemo-RT → surgery. Chemo was 5-FU + cisplatin. RT was 1.8/45 Gy. Surgery was Ivor-Lewis esophagectomy. pCR 51%, MS 25.8 months (all patients) with 36.8 months for pCR and 12.9 months for no pCR. Three-year DFS 43% (80% with CR, 13% with residual). Three-year OS 41% (61% with CR, 25% with residual). However, after chemo-RT, 41% of patients with negative repeat EGD still had residual tumor at surgery, indicating that preresection EGD alone is not reliable for detecting residual disease.
- Stahl et al. (2009) Phase III trial: 126 patients with locally advanced (uT3/4NxM0) but resectable adenocarcinoma of the lower esophagus or gastric cardia randomized to induction chemo (cisplatin, 5-FU, and leucovorin (PLF) × 2.5 cycles) + surgery vs. induction chemo (PLF × two cycles) + chemo-RT (30 Gy with cisplatin and etoposide) + surgery. Study prematurely closed but showed trend toward improved 3-year survival 47.4% in RT group vs. 27.7% in no RT group ($P = 0.07$). Chemo-RT group had increase in pCR (15.6 vs. 2%).
- *CALGB 9781* (Tepper et al. 2008). Phase III: 56 patients with resectable SCC and adenoCA (T1-3N1M0) randomized to surgery alone vs. concurrent chemo-RT (cisplatin, 5-FU × 2 cycles + 50.4 Gy in 28 fx)→ surgery. Trimodality therapy improved 5-year survival (16→ 39%), median survival (1.8→ 4.5 years), 40% pCR in patients with pre-op chemo-RT.
- Burmeister et al. (2005): 256 patie nts with T1-3N0-1 SCC or adenoCA (61%) randomized to pre-op concurrent chemo-RT vs. surgery alone. Chemo-RT = cisplatin and 5-FU with 35 Gy in 15 fx. No difference in 3-year DFS (~30–35%) or OS (~35%), but chemo-RT improved R0 resection rate (60 → 80%). Subgroup analysis showed SCC had improved DFS and OS with chemo-RT. No difference in patterns of failure. Thirteen percent of patients with pCR had 3-year OS 49%.

Definitive chemo-RT

- *RTOG 85-01* (Herskovic and Martz 1992; al-Sarraf M et al. 1997; Cooper et al. 1999). Phase III: 121 patients, T1-3N0-1M0,

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adenocarcinoma and SCC, randomized to RT alone vs. chemo-RT. Chemo was 5-FU and cisplatin on weeks 1, 5, 8, 11. RT alone arm was 50 + 14 Gy boost at 2 Gy/fx. Concurrent chemo-RT dose was 50 Gy. Interim analysis showed improved OS with chemo-RT. Additional 69 patients were treated according to the chemo-RT protocol and followed prospectively. Five-year OS for RT alone was 0%, for chemo-RT (randomized) 27% and for chemo-RT (nonrandomized) 14%. No differences in OS based on histology.

- *RTOG 94-05, INT0123* (Minsky 2002). Phase III: 236 patients, T1-4N0-1M0, SCC and adenocarcinoma, randomized to chemo-RT to 50 Gy vs. chemo-RT to 65 Gy. Chemo was 5-FU + cisplatin × 4c. Trial was stopped after an interim analysis. High-dose arm had higher treatment-related death (10 vs. 2%). Of the 11 deaths in high-dose arm, 7 occurred at ≤50.4 Gy. No differences in MS (13 vs. 18 months), 2-year OS (31 vs. 40%), or LRF (56 vs. 52%) between high-dose vs. low-dose arms.

Chemo-RT with and without surgery in high-risk patients

- Stahl et al. (2005, 2008). Phase III: 172 patients, T3-4N0-1M0, SCC, treated with chemo × 3c and then randomized to chemo-RT (2/40 Gy) → surgery (arm 1) vs. definitive chemo-RT (64–65 Gy, arm 2). Chemo was 5-FU, leucovorin, etoposide, and cisplatin when given alone, and cisplatin/etoposide when given with RT. RT in arm 2 was 2/50 + 1.5 Gy b.i.d./15 Gy boost (total 65 Gy) or 2/60 + 4 Gy HDR boost (total 64 Gy). Sixty-six percent of patients in arm 1 and 88% of patients in arm 2 completed treatment. pCR was 35% at surgery. No difference in MS (16 vs. 15 months) or 5-year/10-year OS (28/19 vs. 17/12%). Surgery improved 2-year freedom from local progression (64 vs. 41%), but definitive chemo-RT had less treatment-related mortality (13 vs. 4%) and preserved the esophagus. Patients with response to induction chemo had improved prognosis regardless of treatment group (3-year OS ~50%).
- *FFCD 9102* (Bedenne et al. 2007; Crehange et al. 2007): 259 patients with potentially resectable T3-4N0-1 SCC (90%) or adenoCA (10%) with ≥PR to chemo-RT (5-FU/cisplatin × 2c; concurrent RT (2/46 Gy or split-course 3/30 Gy)) randomized to surgery vs. three more cycles of 5-FU/cisplatin with RT boost during first cycle (2/20 Gy or split course 3/15 Gy). Two-third patients had split-course RT. Total RT doses were 2/66 or 3/45 Gy (split-course). *No difference* in 2-year OS (34–40%)

or MS (18–19 months). Worse QOL in post-op period and increased treatment-related mortality with surgery (1 → 9%). *Surgery reduced LF* (43 → 34%) and need for stents (32 → 5%). No change in DM. Split-course RT had worse local RFS (57 vs. 77%).

Brachytherapy

- *RTOG 9207 phaseI/II* (Gaspar et al. 2000): 49 patients T1-2N0-1M0, 92% SCC, 8% adenocarcinoma treated with concurrent chemo (5-FU, cisplatin) + RT (EBRT 50 Gy/25 fx + HDR 5 Gy × 3 or LDR 20 Gy × 1). Twenty-four percent Grade 4 toxicity, 12% fistula, 10% treatment-related deaths with MS 11 months. Three-year OS 29% and LF 63%. Brachytherapy not recommended due to high toxicity.

RTOG trials

- *RTOG 0246* (Swisher et al. 2007): Phase II study of resectable locoregionally advanced CA treated with induction chemo (5-FU, cisplatin, paclitaxel) → chemo-RT (50 Gy, 5-FU, cisplatin) → salvage surgery. Trial closed 3/17/2006. Preliminary results showed increased toxicity compared to historical controls, no significant improvement in outcomes, and study arm not suitable for phase III trial.
- *RTOG 0113*(Ajani et al. 2008): Randomized phase II study of inoperable localregional esophageal CA treated with 5-FU based vs. non-5-FU based induction chemo → chemo-RT. Trial closed 4/2005. Both arms associated with high morbidity (Grade 3 or 4). Study did not meet 1-year survival endpoint of ≥77.5% (5-FU based arm 1-year survival was 75.7%).
- *RTOG 0436*: Phase III trial evaluating the addition of cetuximab to paclitaxel, cisplatin, and RT for patients with esophageal cancer who are treated without surgery (50.4 Gy in 28 fractions). Trial activated 6/30/08.

RADIATION TECHNIQUES

GENERAL PRINCIPLES

- Simulate patient supine with arms up so that lateral fiducials are possible.
- Immobilize with wing board or alpha cradle with arms above head.
- Use esophotrast to outline the esophagus and barium (2%, ReadiCat) to outline the stomach and small bowel.

FIELD DESIGN

- AP/PA fields deliver higher dose to the heart and lower dose to the lungs, whereas obliques and laterals deliver higher dose to the lungs and lower dose to the heart.
- At UCSF, we consider using a 3DCRT or IMRT plan throughout treatment, so that normal tissues such as the lungs receive a lower total integral dose. We generally weight AP/PA > obliques.
- Wedges and/or compensators may be needed.
- Tumors above the carina: treat SCV and mediastinal LN.
- GTV = primary lesion and involved LN; CTV = GTV + subclinical disease (regional LN and submucosal), 4 cm proximal/distal and 1 cm radial; PTV = CTV + 1–2 cm.
- Two options for field design:
  - SCV and primary tumor treated in one field. Consider AP 6 MV and PA 18 MV with off-cord boost to primary (after cord dose reaches 45 Gy). This technique might not be suitable if tumor volume includes excessive heart.
  - SCV field matched to primary tumor fields. Isocenter is placed at the matchline. SCV field is AP 6 MV to 50 Gy with half-beam block at clavicle and block placed over spinal cord. Primary tumor fields are beam split from above and use AP/PA and obliques. AP/PA fields are weighted » obliques and laterals.
- Tumors at or below the carina: treat mediastinal LN, and include celiac LN for lower 1/3 and gastroesophageal junction tumors.
  - Use a multifield technique including AP/PA and obliques or laterals. Weigh AP/PA » obliques and laterals.
- IMRT now being used more frequently, particularly cervical lesions; consider 4DCT and respiratory gating, especially for lower esophageal tumors.

DOSE PRESCRIPTIONS

- 1.8 Gy/fx to 50.4 Gy.
- If the stomach is in the field, consider reducing lower border to block stomach at 45 Gy if clinically possible.

DOSE LIMITATIONS

- Spinal cord D_{max} ≤45 Gy at 1.8 Gy/fx
- Lung: Limit 70% of both lungs <20 Gy
- Heart: Limit 50% of ventricles <25 Gy

COMPLICATIONS

- Acute side effects: esophagitis, weight loss, fatigue, and anorexia.
- Esophageal perforation may present with substernal chest pain, increased heart rate, fever and hemorrhage.
- Pneumonitis: subacute, occurs ~6 weeks after RT. Presents with cough, dyspnea, hypoxia, and fever. Depending on severity, treat with NSAIDs or steroids.
- Late strictures possible, half are due to LR. For benign strictures, dilation results in palliation in the majority of patients. For malignant strictures, dilation does not work as well.
- Pericarditis, coronary artery disease.
- With brachytherapy and/or EBRT, tumor involvement of the trachea can lead to fistula formation during RT (5–10%), secondary to tumor necrosis or natural progression of the disease.

FOLLOW-UP

- H&P every 4 months for 1 year, then every 6 months for 5 years, then annually thereafter. CBC, metabolic panel, CXR, endoscopy, CT chest, and PET should be considered when clinically indicated.
- For locally advanced esophageal cancers undergoing combined chemo-RT, metabolic response as determined by FDG-PET imaging before and after treatment is a strong predictor of OS (MS 6–7 months for non-PET responders vs. 16–23 months for PET responders) (Downey et al. 2003; Wieder et al. 2004).

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