Value of Oral Effervescent Powder Administration for Multidetector CT Evaluation of Esophageal Cancer


PURPOSE

To assess the added value of oral effervescent powder (EP) administration for detection and T-staging of esophageal cancer at contrast-enhanced CT, as compared to studies without EP.

METHOD AND MATERIALS

84 patients without esophageal pathology and 52 patients with histological confirmed diagnosis of esophageal cancer referred for CT were included in this prospective IRB-approved study (99m/37f, mean age 61y). Half of the patients of each group were orally administered 3g effervescent powder (EP) prior to image acquisition. Esophageal distension was assessed (proximal/middle/distal/tumor level) by measurement of the inner (IA) and outer area (OA). Two blinded readers separately evaluated all datasets regarding diagnosis of esophageal cancer (yes/no) and T-staging (T0-T4), if applicable. Distension results were compared (t-Test). In patients with cancer sensitivity, specificity, negative (NPV) and positive (PPV) predictive values were calculated. CT staging results were evaluated (Cohen-k) and compared with histopathology as reference standard, which was obtained within four weeks of imaging.

RESULTS

IA and quotient IA/OA were significantly larger at all levels after EP as compared to the control (p<0.05; mean IA:1.1 vs. 0.42, mean IA/OA:0.34 vs. 0.13). For both readers sensitivity, specificity, NPV and PPV for detection of cancer were as follows: 78%/78%, 98%/98%, 95%/95%, 87%/87% after EP; 60%/68%, 98%/98%, 94%/94%, 80%/83% without EP. T-Staging after EP was good (k=0.838/0.674) and moderate without EP (k=0.576/0.592). Interobserver agreement for detection and staging of tumor was very good (k=0,830) and good (k=0,741) after EP, and good (k=0,774) and moderate (k=0,591) without EP, respectively.

CONCLUSION

Oral administration of effervescent powder at CT results in good distension of the esophagus, and improves detection and T-staging of esophageal cancer, as compared to studies without effervescent powder.

CLINICAL RELEVANCE/APPLICATION

Oral administration of effervescent powder at CT improves detection and T-staging especially of subtle lesions (T1 and T2 tumors) in patients with esophageal cancer.
Pneumo-MDCT is a new technique being offered to patients for the presurgical assessment and characterization of esophageal and GE junction neoplasms (E-GEN). The aims of this study were to prospectively determine the frequency of extraesophago-gastric findings at Pneumo-MDCT, to classify them according to the clinical importance, relationship to E-GEN and to evaluate the consequences of these findings.

**METHOD AND MATERIALS**

300 consecutive patients undergoing study for E-GEN were examined with Pneumo-MDCT. Two independent radiologists reviewed the CT-images for extraesophago-gastric pathology, findings were classified as either clinically important or unimportant and related or not with E-GEN. Clinically important findings were defined as those that necessitated further diagnostic studies, medical or surgical follow-up. Electronic medical records were reviewed to determine the consequences of the workup derived from Pneumo-MDCT.

**RESULTS**

In the 300 patients studied: 287 patients (95%) had a total of 780 extraesophago-gastric findings, 73 (9.3%) were clinically important findings and 707 (90.7%) were unimportant. In the clinically important findings group 38/73 (52%) were lesions not related with E-GEN and 35/73 (48%) were related with E-GEN. In the clinically unimportant findings group 707/707 (100%) were not related with E-GEN. None of the patients with clinically unimportant findings underwent further testing while all important findings required follow-up.

**CONCLUSION**

Pneumo-MDCT identifies a large number of extraesophago-gastric findings. Extraesophago-gastric findings are common, mostly those not related with E-GEN. Only patients with highly clinical significant findings required further diagnostic testing. Additional studies to determine cost-effectiveness and legal implications of detecting extraesophago-gastric findings are warranted.

**CLINICAL RELEVANCE/APPLICATION**

Beyond assessment and characterization of esophageal and GE junction neoplasms, Pneumo-MDCT identifies a large number of extraesophago-gastric findings.

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Comparison between Histogram-derived Apparent Diffusion Coefficient Parameters of Esophageal Squamous Cell Carcinoma and Tumor Regression after Chemoradiotherapy.

Maiko Kozumi (Presenter): Nothing to Disclose, Hideki Ota MD, PhD : Nothing to Disclose, Tomonori Matsuura : Nothing to Disclose, Kei Takase MD, PhD : Nothing to Disclose, Shoki Takahashi MD : Nothing to Disclose, Keiichi Jingu MD : Nothing to Disclose

**PURPOSE**

To evaluate correlation between tumor response to chemoradiotherapy (CRT) in esophageal carcinoma and histogram-derived apparent diffusion coefficient (ADC) parameters obtained from volumetric assessment of the primary lesion on diffusion-weighted MR imaging.

**METHOD AND MATERIALS**

Consecutive 22 patients (20 men; mean age 70.0 years, range 51-88 years) with esophageal squamous cell carcinoma (clinical T3, 17, T4, 5) were included in this prospective study. All the patients underwent radiotherapy with a total dose of 59.6-62.4 Gy and concurrent chemotherapy (cisplatin and 5-fluorouracil [5-FU], 14, nedaplatin and 5-FU, 6, docetaxel, cisplatin and 5-FU, 2). MR examination at 3 Tesla was performed 1-3 days prior to CRT. Readout-segmented echo-planar diffusion imaging (RESOLVE, b=50, 800 s/mm²) was used to acquire ADC maps. Two radiologists evaluated MR images by consensus reading. Regions of interests were placed on all slices of the ADC maps where the tumor was visualized. Histogram parameters (the mean, 10th, 25th, 50th, 75th, 90th percentiles, skewness and kurtosis) of ADCs were compared with post-treatment disease status based on Response Evaluation Criteria In Solid Tumors criteria (complete response [CR], partial response [PR] or stable disease [SD]) and tumor regression ratio in diameter on pre- and post-treatment CT scans.

**RESULTS**

The mean of the largest tumor diameter on pretreatment CT was 33.5 ± 9.1 mm. Post-treatment status were CR in one, PR in nine and SD in 12, respectively. Mean tumor regression ratio was 33.1 ± 22.4%. The mean 50th percentile ADC values were (1.39 ± 0.27) ×10-3 mm²/s in patients with CR or PR and (1.35 ± 0.18) ×10-3 mm²/s in those with SD (P = 0.61). None of the ADC parameters was significantly correlated with post-treatment status (Spearman's ρ = 0.09 - 0.26, P = 0.29 - 0.99) or tumor regression ratio (Pearson's r = -0.13 - 0.26, P = 0.25 - 0.99).

**CONCLUSION**

Histogram-derived pretreatment ADC parameter was not a predictive imaging biomarker for tumor response by CRT in esophageal squamous cell carcinoma. Further investigation that includes long-term follow-up is warranted to evaluate association between tumor characteristics determined by ADC and patients' prognoses.

**CLINICAL RELEVANCE/APPLICATION**

ADC parameters obtained from readout-segmented echo-planar diffusion imaging are not correlated with tumor response to CRT in esophageal squamous cell carcinoma and are not recommended for its prediction.
SSM09-04  Prognostic Utility of Pre-treatment Apparent Diffusion Coefficient in Esophageal Cancer: A Pilot Study

Francesco Giganti MD (Presenter): Nothing to Disclose, Annalaura Salerno MD: Nothing to Disclose, Elena Orsenigo: Nothing to Disclose, Damiano Chiari: Nothing to Disclose, Alessandro Del Maschio MD: Nothing to Disclose, Francesco Aldo De Cobelli MD: Nothing to Disclose

PURPOSE

Treatment options for esophageal cancer (EC) vary from endoscopic to surgical resection, with or without neo-adjuvant therapy (NT), but prognosis still remains poor. This pilot study was designated to evaluate the role of apparent diffusion coefficient (ADC) as a potential prognostic biomarker in the management of EC.

METHOD AND MATERIALS

Ethics approval was obtained from our research committee and informed, written consent was obtained from each patient. Over a period of 4 years, 23 Patients (18 men-5 women; mean age 64 ± 11 years) with biopsy-confirmed esophageal tumor (16 esophageal and 7 Siewert I) prospectively underwent 1.5T MR system including T1, T2 and DWI (b values: 0-600 s/mm²) sequences and ADC measurements were calculated. Specifically, 14/23 patients (61%) were directly treated with radical surgery whereas 9/23 patients (39%) were submitted to NT before undergoing surgical resection, with histopathological evaluation. All participants were followed up for a median of 19 months. Pathological ADC, tumor location, pT (T1-2 vs T3-4), pN and histotype were investigated by univariate and multivariate analysis using Cox regression and Kaplan-Meier curves.

RESULTS

At the end of the follow up, 19 (83%) patients were alive and 4 (17%) had died. Median overall survival was superior to 24 months. In the univariate analysis, assuming an ADC cut off of 1.4 x 10⁻³ mm²/s, our results showed significant results in detecting patients with a better (>1.4) or worse (<1.4) ADC.

CONCLUSION

This preliminary study suggests the innovative role of ADC as a diagnostic tool able to predict the aggressiveness of EC. DW-MRI might be added in the staging of EC and, although further studies are needed, ADC could be considered a non-invasive prognostic parameter capable of distinguishing between patients with better or worse prognosis with important implications in therapeutic regimens.

CLINICAL RELEVANCE/APPLICATION

ADC could be considered a non-invasive prognostic parameter able to distinguish between patients with better or worse prognosis in esophageal cancer, with important implications in therapeutic regimens.

SSM09-05  Markers of Sarcopenia Predict Adverse Long-term Outcome in Patients Undergoing Resection of Esophageal or Gastro-esophageal Junction Cancer

Dietmar Tamandl MD (Presenter): Nothing to Disclose, Matthias Paireder: Nothing to Disclose, Reza Asari: Nothing to Disclose, Sebastian Schopppmann MD: Nothing to Disclose, Ahmed Ba-Ssalamah MD: Speaker, Bayer AG Speaker, Siemens AG

PURPOSE

To evaluate the predictive value of sarcopenia as a potential biomarker for survival in patients undergoing potentially curative resection of esophageal or esophagogastrectomy cancer.

METHOD AND MATERIALS

After IRB approval, 202 patients (49F/153M) were selected from the institutional database who underwent resection for esophageal cancer (EC) or cancer of the gastroesophageal junction (GEJ) between 2006 and 2013. Besides demographic and tumor-specific parameters, preoperative CT scans were used to assess established markers of sarcopenia and body composition (psoas muscle area, PMA; [lean] psoas muscle density, [L]PMD; lumbar skeletal muscle, LSM; intraabdominal fat, IAF; subcutaneous fat, SCF and retrorenal fat, RRF). Cox regression along with Kaplan Meier analysis was performed to assess the primary outcome parameter overall (OS) and recurrence free survival (RFS) after surgery. Median and interquartile range (IQR) was used for continuous variables.

RESULTS

202 patients underwent surgery in the observed time period, 28 had transhiatal extended gastrectomy and 174 had Ivor Lewis esophagectomy. The time period between preoperative CT scan and surgery was 15 days (7-34). Median age was 63.9 years (IQR, 56.4-70.0). 5-year OS and median OS was 39.8% and 41.4 months (95% confidence interval [CI] 21.4-61.4). Patients who were sarcopenic based on PMD (CONCLUSION

Patients who show signs of sarcopenia on preoperative CT images have impaired long-term outcome after surgery for esophageal or GEJ cancer.

CLINICAL RELEVANCE/APPLICATION

Based on CT data, this readily available information can help to identify patients who might benefit from intense nutritional support before and probably after surgery for esophageal or GE-Junction cancer.

SSM09-06  Perforated Intrathoracic Viscus: Are Two Tests Better than One?

Martha Terrazas MD (Presenter): Nothing to Disclose, Ane Lauren McCullough MD: Nothing to Disclose, William Moreau Thompson MD: Nothing to Disclose, Jess Schwartz MD: Nothing to Disclose, Loren Howard Ketai MD: Nothing to Disclose

PURPOSE

SSM09-07

SSM09-08

SSM09-09

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SSM09-11

SSM09-12
Determine the relative accuracy of Fluoroscopic Esophagography (FE) and CT in the detection of perforation of intrathoracic viscus (esophagus or neo-esophagus).

METHOD AND MATERIALS

A university hospital Radiology Information System was searched for patients who had undergone both FE and CT within three days. Those patients who had received both exams to evaluate suspected perforation of an intrathoracic viscus were included for study. FEs and CTs were evaluated by independent readers, each blinded to the results of the other exam and to the clinical outcome. FE and CT were scored separately using a 1-5 Likert scale, a score > 3 designated positive. A composite score (CS) was also created, designating cases as positive if Likert score was > 3 on FE or CT. Cases were considered true positive if 1) free perforation was surgically repaired 2) contained perforation was confirmed by evolution on subsequent diagnostic imaging or 3) by post image evaluation consensus of both readers and an attending thoracic surgeon. Accuracy of FE, CT and CS were compared using McNemar’s test.

RESULTS

Seventy-nine patients met the inclusion criteria, 19 of whom had free (12) or contained (7) viscus perforations. Perforations were postsurgical (6), or related to endoscopy (5), penetrating trauma (4), Boerhaave's (3) or blunt trauma (1). CT was 69% sensitive and 88% specific, with 5 of the 6 false negatives (FNs) occurring in CTs performed without positive GI contrast. Two FNs involved penetrating trauma and two were related to endoscopy. FE was 42% sensitive and 98% specific for perforation, 5 of the FNs occurring in postsurgical perforations. Sensitivity of the composite score was 95% and specificity was 88%. Both CT and CS were significantly better than FE alone (P < .05).

CONCLUSION

CT is superior to FE in the detection of perforated intrathoracic viscus, particularly in the post-surgical setting but is not sufficiently sensitive to stand alone in all settings. Diagnostic accuracy may be improved by combining CT with FE, particularly in the diagnosis of perforations caused by penetrating or endoscopic trauma or if CT is performed without administration of positive GI contrast.

CLINICAL RELEVANCE/APPLICATION

In a large cohort of patients undergoing evaluation for perforated intrathoracic viscus the relative efficacy of FE and CT was dependent upon the clinical setting. Results suggest that combination of both tests is often warranted.