Published in final edited form as:

Dis Esophagus. 2008 ; 21(3): 241–250. doi:10.1111/j.1442-2050.2007.00766.x.

Impact of endoscopic ultrasonography and physician specialty on the management of patients with esophagus cancer

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SUMMARY

While endoscopic ultrasonography (EUS) and EUS-guided fine-needle aspiration (EUS-FNA) are the most accurate techniques for locoregional staging of esophageal cancer, little evidence exists that these innovations impact on clinical care. The objective on this study was to determine the frequency with which EUS and EUS-FNA alter the management of patients with localized esophageal cancer, and assess practice variation among specialists at a tertiary care center. Three gastroenterologists, three medical oncologists, three radiation oncologists and four thoracic surgeons were asked to independently report their management recommendations as the anonymized staging information of 50 prospectively enrolled patients from another study were sequentially disclosed on-line. Compared to initial management recommendations, that were based upon history, physical examination, upper endoscopy and CT scan results, EUS prompted a change in management 24% (95% CI: 12–36%) of the time; usually to a more resource-intensive approach (71%), for example from recommending palliation to recommending neoadjuvant chemoradiation therapy. EUS-FNA plus cytology results altered management an additional 8% (95% CI: 6–15%) of the time. Agreement between specialists ranged from fair (intraclass correlation [ICC] = 0.32) to substantial (ICC = 0.65); improving with additional information. Among specialists, agreement was greatest for patients with stage I disease. EUS and EUS-FNA changed patient management the most for patients with stages IIA, IIB or III disease. EUS, with or without FNA, significantly impacts the management of patients with localized esophageal cancer. With respect to the optimal treatment for each patient, agreement among physicians incrementally increases with endoscopic ultrasound results. Specialty training appears to influence therapeutic decision-making behavior.

Keywords

clinical management; endoscopic ultrasonography; esophagus cancer; multidisciplinary; practice variation

INTRODUCTION

Esophageal cancer ranks among the 10 most frequent cancers in the world. Over the last three decades the incidence of adenocarcinoma has been exponentially increasing in developed countries without apparent reason.¹⁻³ Unfortunately, the prognosis with this cancer remains quite poor. Overall 5-year survival ranges from 2% to 20%.⁴ The main factors negatively impacting prognosis are advanced tumor depth (T stage) and/or nodal involvement (N stage).⁵⁻⁸ The major difference between stages IIA and IIB disease is the presence of local lymph node metastases in IIB disease. Consequently 5-year survival may be as high as 40% in stage IIA disease versus 5–20% in stage IIB disease.^{9,10} While treatment strategies, such as definitive chemoradiation therapy, neoadjuvant or adjuvant chemoradiation therapy, or preoperative solo chemotherapy have demonstrated benefit in small subsets of patients, surgery remains the most commonly utilized modality for resectable disease.¹¹⁻¹⁶

The patient's physical condition and clinical stage are the two primary factors that influence therapeutic decision-making.⁴ Therefore, accurate cancer staging is crucial to the selection of the most appropriate treatment regimen. However, accurate staging of esophageal cancer remains a challenge. No single imaging modality has demonstrated the ability to detect both distant disease and locoregional spread with high accuracy. While computed tomography (CT) scanning is useful to detect meta-static disease,¹⁷⁻²⁰ ¹⁸F-fluoro-2-deoxyglucose positron emission tomography (PET) scanning appears to be superior to CT scan for the detection of distant metastases, including non-regional lymph node metastases.²¹⁻²⁶ Alternatively, endoscopic ultrasonography (EUS) is the most accurate technique for locoregional staging^{27,28} and, as shown in a recent systematic review, is highly effective at discriminating early (T1/T2) from advanced (T3/T4) cancers.²⁹ Accuracy in N staging has improved with the addition of fine needle aspiration (FNA) to EUS (EUS-FNA), as recently demonstrated in a prospective study.³⁰

Although much is known about the performance characteristics of different staging techniques for esophageal cancer, little data is available in regard to the therapeutic impact (as assessed by change in management) of these expensive techniques.³¹⁻³⁴ In a retrospective chart review study, in which blinding was not done, survival by stage did not differ between patients staged with CT scan alone, in the days before EUS was available, compared to patients staged by CT and EUS.³⁵ Lack of blinding, retrospective study design, and variation in the operators who interpreted the CT scans and EUS findings were weaknesses of this study. No study has prospectively and blindly assessed the impact of the different imaging techniques on the management of patients with esophageal cancer. We describe a prospective multidisciplinary assessment of the impact of EUS and EUS-FNA on therapeutic decision-making in patients with esophageal cancer.

MATERIALS AND METHODS

Overall study design

Case vignettes of patients with cancer of the esophagus were used to reveal staging information, in a sequential stepwise fashion, to physicians who were asked to individually report their therapeutic management recommendations at each step. The study protocol was approved by the Mayo Foundation Institutional Review Board on 1 April 2003.

Study population – case vignettes

We used a database containing the information of unselected patients with esophageal cancer evaluated in the Division of Gastroenterology and Hepatology (Esophagus Clinic), and the

Departments of Medical Oncology, Radiation Oncology and General Thoracic Surgery, at Mayo Clinic, Rochester, Minnesota, from December 1999 to March 2001. This database was selected because the information had been gathered in a prospective, protocolized, blinded and uniform fashion for a project that has since been published.³⁰ It contained baseline data on clinical and epidemiologic variables (age, sex, smoking status, body mass index), tumor histology and location, as well as comorbid illnesses (presence of congestive heart failure, coronary artery disease, chronic obstructive pulmonary disease and/or chronic renal insufficiency).

Inclusion criteria included: (i) patients with known adenocarcinoma or squamous cell carcinoma of the esophagus without distant metastatic disease on helical CT (no M1b); and (ii) patients who were deemed candidates for surgical resection based on the overall health assessment of their primary physician.

Exclusion criteria were: (i) tumor histology other than adenocarcinoma or squamous cell carcinoma; (ii) prior chemoradiation therapy; (iii) concomitant other nonesophageal tumor; (iv) recalcitrant coagulopathy (platelet count < 50 000 and prothrombin time < 50%); (v) comorbid conditions precluding consideration of surgery; or (vi) refusal or inability to provide informed consent for the original research protocol. Thereafter, the final cohort of 50 was selected using a random orders table.

After clinical interview and physical examination, all patients underwent tumor staging (American Joint Committee on Cancer classification)³⁶ with helical CT scan, EUS and EUS-FNA. In all cases, interpretation of the helical CT and EUS results was performed with investigators blind to the results of the other technique. Similarly, to preserve blinding, the EUS report was performed without information on FNA results, and the cytopathologist analyzing the cytology smear was unaware of both helical CT and EUS findings.

From this database we retrieved a sample of 50 patients demonstrating a wide range of esophageal cancers; from superficial (stage I) disease to patients with disease metastatic to the celiac lymph nodes (stage IVA). This group of patients constitutes the study population for the present investigation.

Study subjects – physicians

The panel consisted of 13 physicians who routinely evaluate and treat patients with cancer of the esophagus: three gastroenterologists who subspecialize in esophageal disorders, three medical oncologists and three radiation oncologists who focus on patients with gastrointestinal malignancies, and four general thoracic surgeons who routinely operate on esophageal cancer patients. None of the gastroenterologists included in the panel perform EUS. Physicians were not informed about the proportion of patients with different stages of disease, nor were they privy to inclusion or exclusion criteria. Physicians were also kept blind as to the actual treatment administered to each patient, final postoperative staging (if surgery performed) and ultimate patient outcome.

Study flow

Clinical information and test results were sequentially disclosed on-line in a clinically meaningful stepwise sequential manner: from clinical data to CT scan, to EUS, to EUS-FNA results, progressively. Because PET scanning was only available in a minority of cases, we did not include this information in the case vignettes. Case vignettes were constructed using original reports, only modified to remove patient identifiers (name and identification number). An Access (Microsoft™) database was developed to facilitate the capture of physician treatment recommendations. Each question was answered in order and only when answered

would the next question appear. The user was only able to view individual patient information at the time of data entry. Once data was entered on a given patient, it could not be altered.

The on-line survey disclosed five levels of information: (i) demographic and clinical presentation; (ii) esophagogastroduodenoscopy (EGD) with histopathology results; (iii) CT scan results; (iv) EUS; and (v) EUS-FNA results. Clinicians individually indicated their treatment recommendation after each level of information was presented. Discussion among members of the panel was not permitted.

The nine options for management included: (i) palliative support and management; (ii) radiation alone; (iii) chemotherapy alone; (iv) surgery alone; (v) surgery and reassessment for postoperative chemoradiation therapy; (vi) chemoradiation alone; and (vii) chemoradiation or (viii) chemotherapy or (ix) radiation, followed by restaging in anticipation of offering surgery to those patients in whom the cancer became resectable.

Finally, for each patient, physicians were asked to evaluate which technique had the greatest impact in their overall management and if they felt a more invasive procedure, such as mediastinoscopy or laparoscopy, would be necessary to completely stage the subject. A final question, directed solely to the radiation oncologists, attempted to ascertain the impact of EUS information on radiation field design.

Definitions

Stage of disease was assessed as per the classification system of the American Joint Committee on Cancer: Stage 0 (Tis, N0, M0); Stage I (T1, N0, M0); Stage IIA (T2 or 3, N0, M0); Stage IIB (T1 or 2, N1, M0); Stage III (T3, N1, M0; OR T4, N0 or 1, M0); Stage IVA (any T, any N, M1a); Stage IVB (any T, any N, M1b).³⁶ Our reference standard for T-stage was based on the surgical specimen or EUS if an operation was not performed. N-stage was based upon surgical specimen if available or EUS-FNA cytological results in patients not submitted to surgery or in those cases in whom neoadjuvant treatment had been administered.

To facilitate statistical calculations, the nine different treatment options available to participating physicians were grouped into three major therapeutic categories:

- Treatment Option 1: Palliation, radiation alone or chemotherapy alone.
- Treatment Option 2: Surgery alone or surgery + reassessment for post-operative chemoradiation.
- Treatment Option 3: Combined chemoradiation therapy as definitive treatment; or neoadjuvant chemoradiation therapy with the plan to restage for possible surgery; or neoadjuvant solo chemo-therapy or solo radiation therapy with the plan to stage for possible surgery.

We defined 'impact on management' of EUS and EUS-FNA as change in the therapeutic option recommended based upon reception of EUS or EUS-FNA results. The phrase, 'change in management' implies that the physician changed from offering one modality of treatment, for example from Treatment Option 1 (palliation), to Treatment Option 3 (neoadjuvant chemoradiation therapy followed by restaging for possible surgery) after reviewing new data. 'No impact' is therefore defined as consistently selecting the same treatment option, regardless of the new information revealed.

Changes in management were classified as more or less resource-intensive. 'More resource intensive' was defined as moving:

- From Treatment Option 1 to Treatment Options 2 or 3 (i.e. from recommending a palliative approach to either offering immediate surgery; or a number of other treatment regimens such as neoadjuvant therapy)
- From Treatment Option 2 to Treatment Option 3 (i.e. from recommending immediate surgery to offering neoadjuvant treatment)

‘Less resource intensive’ was defined as moving:

- From Treatment Options 2 or 3 to Treatment Option 1 (i.e. initially offering curative intent measures, but altering the recommendation to one of palliation)
- From Treatment Option 3 to Treatment Option 2 (i.e. from recommending neoadjuvant treatment to proceeding directly to surgery)

Calculations and analysis of data

Statistical analysis was done using the SAS® (SAS Institute Inc., Cary, NC, US, 1989) software package. Therapeutic change induced by EUS and EUS-FNA results are expressed as the proportion of physicians indicating treatment modality changes (and 95% CIs) calculated over the data from the whole series of patients. Interobserver agreement was summarized using the intraclass correlation coefficient (ICC) assuming the set of physicians participating were a random sample of a physician population making such decisions and in which each one ‘rated’ all 50 patient records.³⁷ The ICC values were computed separately using the information available at each level of techniques evaluated (i.e. CT, CT + EUS, CT + EUS/FNA) and for each of the ‘grouped’ treatment modalities. Continuous variables are expressed as mean $\pm$ SD.

RESULTS

Forty-five patients were male and five were female, with a mean age of 64 ± 11 years (range 39–85). Sixteen patients (32%) presented with early stage disease (T1 or T2, N0) whereas the remaining 34 (68%) had advanced disease. Nine patients were stage IVA due to the presence of metastatic celiac lymph nodes. Table 1 shows the disease stage of patients described in the case vignettes.

In this cohort, physicians indicated they would proceed with curative intent based on clinical data alone 94% of the time, (median = 100%, range [77%, 100%]). EUS prompted a change in management, from that initially recommended based on CT scan results, 24% of the time (95% CI: 12–36%). This change resulted in a more resource-intensive treatment plan 17% of the time; and a less resource-intensive treatment plan 7% of the time. The addition of FNA results to the post-CT/EUS impression resulted in change in the treatment plan 8% of the time (95% CI: 6–15%); 7% of the time the plan was for a more resource-intensive strategy. It was uncommon for the EUS-FNA results to prompt change to a less resource-intensive strategy (1%). Figure 1 shows the treatment recommendations of all specialists, by patient stage, as additional information from CT, EUS and EUS-FNA was revealed.

For patients ultimately shown to have stage I (T1N0M0) disease, upon reception of the clinical history, physical examination, EGD and CT scan results, Gastroenterologists initially recommended Treatment Option 1 (palliation, solo chemotherapy or radiation) 8% of the time (Fig. 2a). Once this specialty group received the EUS and EUS-FNA results, their recommendation became congruent with the rest of the group, that being esophagectomy. EUS findings resulted in high agreement among all specialists that surgery is the treatment of choice for patients with stage I disease. Therefore, although the impact was small in percent, it was clinically substantial. The impact of EUS-FNA for patients with early disease was minimal (Fig. 1).

For patients with stage IIA disease (T2 or T3, N0M0), EUS and EUS-FNA altered management 26% of the time. Post-CT scan, physicians originally recommended surgery for this cohort of patients 61% of the time. Upon reception of the EUS results, the recommendation for surgery decreased to 50%, and after EUS-FNA information was revealed, the recommendation for surgery declined even further to 35% (Fig. 1). The greatest magnitude of change, from initially offering surgery to the final plan for neoadjuvant therapy, was seen among the thoracic surgeons (from initially offering surgery 73% of the time to 38% of the time after reception of all information) (Fig. 2d). Among patients ultimately found to have stage IIA disease, gastroenterologists recommended proceeding directly to surgery 44% of the time (Fig. 2a). Once EUS results were available, immediate surgery was only recommended 16% of the time. The impact was less dramatic for the medical oncologists (from 60% to 40%, Fig. 2b) and radiation oncologists (from 61% to 50%, Fig. 2c). EUS clearly influences the management of patients with stage IIA disease.

For patients ultimately found to have stage IIB disease (T1 or T2, N1) the impact of EUS and EUS-FNA was clinically significant. These patients were initially thought to have superficial disease by EGD and CT scan, and then eventually suspected and confirmed to have locoregional lymph node involvement by EUS-FNA. The majority of physicians altered their initial recommendation, from that of directly proceeding to surgery (61% of the time) to ultimately recommending some type of neoadjuvant or definitive chemo/radiation therapy (49% of the time) (Fig. 1). Despite EUS-FNA results, the medical oncologists recommended immediate surgery as their final plan in this cohort 62% of the time (Fig. 2b). Even with this apparent lack of uniformity among the different specialty groups, overall, in patients ultimately found to have stage IIB disease, EUS and EUS-FNA impacted management 38% of the time.

Endoscopic ultrasonography and EUS-FNA results also had a significant clinical impact on the management of patients with stage III disease (T3 N1, or T4 N0, or T4 N1). Based upon history, EGD and CT scan results, physicians initially recommended some type of chemo/radiation therapy 68% of the time. Immediate surgery was only recommended 19% of the time to this cohort. Upon learning the EUS results, demonstrating tumor extension to the adventitia or surrounding structures, patients initially considered for surgery were directed towards neoadjuvant therapy or some other chemo/radiation therapy strategy (83% of the time); an operation without neoadjuvant therapy was ultimately recommended only 3% of the time (Fig. 1). Overall, the percent change in the treatment recommendations for patients with stage III disease impacted by EUS and EUS-FNA was 31%. A difference in specialty decision-making behavior became apparent for patients with stage III disease. Gastroenterologists were more likely to recommend Treatment Option 1 (Palliation or radiation alone or chemotherapy alone) upon learning the EUS results, while the same EUS findings prompted the other physician groups to recommend chemo/radiation therapy. Another difference in practice became apparent in this group of patients. While gastroenterologists, medical oncologists and for the most part, thoracic surgeons did not offer surgery without neoadjuvant therapy to patients with stage III disease, the radiation oncologists did so about 10% of the time. Despite six patients in this cohort having T4N1 disease, medical oncologists were reticent to offer palliation, the majority opting for some type of combined modality (Treatment Option 3: Combined chemoradiation therapy as definitive treatment; or neoadjuvant chemoradiation therapy, solo chemotherapy or solo radiation therapy with the plan to restage for possible surgery).

As one might expect, patients with stage IVA disease were offered palliative measures more often than patients with stage III disease (37% vs. 14%). While the overall recommendation for patients with FNA-confirmed celiac lymph node involvement was palliation 37% of the time, some assortment of chemotherapy or radiation therapy was recommended 59% of the time, and surgery without neoadjuvant therapy was recommended 4% of the time. The various specialists differed in the distribution of their management plans. Gastroenterologists

recommended Treatment Option 1 (palliation) more often than the other groups (70%); this was twice as often as medical oncologists (37%) and radiation oncologists (26%); and more than three times as often as their thoracic surgery colleagues (19%). The greatest impact of EUS and EUS-FNA occurred in patients with stage IIA, IIB or III disease.

Not only did EUS and EUS-FNA influence management, their results increased consensus in management recommendations among specialists. Overall, agreement among physicians at each level of information and for each category of treatment ranged from fair (ICC = 0.32) to substantial (ICC = 0.65). Generally, physician agreement increased with additional stage information, and was hence greatest upon reception of EUS-FNA results (Table 2). The only exception was in those vignettes in which the physician interpreted lack of curative opportunity. Final recommendations as offered by each specialty group, by stage, are shown in Table 3. There was no statistically significant difference in the treatment recommendations made by researchers reviewing the vignettes compared to the treatment recommendations made by the patient's clinical team (data not shown).

When asked at the end of each vignette 'which technique had the greatest impact in overall management?', physicians responded EUS (48%), CT (30%) and EUS-FNA (21%). The participating radiation oncologists in this study relayed that EUS results altered the radiation field in 34 of 40 patients (85%) in which they felt radiation was indicated. In this cohort of 50 clinical vignettes, physicians recommended a more invasive approach, such as mediastinoscopy or laparoscopy, to adequately assess disease stage 4% of the time (median = 0%, range = 0–23%). In most cases, aggressive staging modalities were not deemed necessary.

DISCUSSION

The present investigation shows that EUS and EUS-FNA impact clinical decision making in patients with cancer of the esophagus, especially those ultimately found to have stage IIA, IIB and III disease. Even at a comprehensive cancer center there appears to be heterogeneity in the treatment recommendations made to patients with esophageal cancer, particularly those with stage III disease. This is likely a reflection of the worldwide lack of consensus on the best treatment for esophageal cancer and in turn, the variation in medical specialty. Fortunately, agreement improves as additional staging information is revealed.

Several studies have evaluated the performance characteristics of EUS and EUS-FNA in staging patients with esophageal cancer. However, little information exists on the impact of these techniques on patient management, which is the main aim of the present investigation. Vazquez-Sequeiros *et al.*³² retrospectively compared the results of EUS and EUS-FNA in a series of 74 patients with esophageal cancer. Since sensitivity and specificity for lymph node staging were much higher for EUSFNA than for EUS (93% vs. 63% and 100% vs. 81%, respectively), they concluded that EUS-FNA would have a greater impact on management than EUS alone. However, no direct assessment on actual change in management with either technique was performed. Parmar *et al.*³³ reported the clinical impact of EUS-FNA on celiac lymph nodes in esophageal cancer. Similar to the Vazquez-Sequeiros study, because of the high accuracy of EUS-FNA in providing cytological confirmation of metastatic celiac lymph node involvement, the authors inferred that management would be altered most by EUS-FNA. But again, no direct information on impact, beyond this inference, was provided. Finally, Preston *et al.*³⁴ conducted a prospective investigation to assess whether the addition of EUS influenced decision-making behavior by asking three surgeons their management recommendations for esophageal cancer patients. EUS was judged to be useful in 63–87% of patients and it also increased concordance between physicians. The lack of assessment of the role of EUS-FNA and the participation of a single specialty group, namely surgeons, are some of the differences in study design from the present investigation.

As previously stated, our main goal was to directly assess the impact of EUS and EUS-FNA on the management of patients with esophageal cancer by inviting a panel of physicians to delineate their treatment recommendations as information was disclosed in serial fashion. Overall, EUS and EUS-FNA results changed the therapeutic strategy 24% and 8% of the time, respectively, resulting in more resource intensive therapeutic recommendations most of the time. Interestingly, in most cases, management recommendations changed without waiting for cytological results. This behavior may have been related to two factors. First, many of the patients with locoregional lymph node metastases in this study also had T3 or T4 tumor involvement. Their treatment might have been predicated on the extent of the tumor penetration as assessed by EUS. Second, it is possible that the physicians in this study have a high level of confidence in our institutional echoendoscopists. Thus, it is possible that at institutions without recognized expertise in EUS, EUS-FNA results may have more impact.

One of the limitations of this study is that we presented patient information to the evaluating physicians in the same order for all patients. It is possible that the impact of a technique on an individual patient's management depends not only on the information it provides, but also at what time in the patient's course the results are available. For consistency, we provided information in a standard serial fashion. Even if different protocols are valid, we chose a logical and efficient sequential order to present the information to the evaluating physicians: (i) clinical information on past history, symptoms and physical examination; (ii) upper endoscopy results; (iii) CT scan results to rule out distant metastases; (iv) EUS evaluation to assess locoregional spread of the disease; and (v) cytological results obtained from EUS-FNA.

A potential weakness of this study is its limited generalizability. As pointed out, only a small proportion of patients in this cohort were considered candidates for palliative care. Because our main interest was to assess the impact of EUS and EUS-FNA, we deliberately excluded patients with distant metastases, in whom the impact of a CT scan would have presumably been very high and EUS potentially not indicated. Furthermore, EUS in the community may have in some sense, a slightly different performance than in major academic centers. Thus, the results of this study are not generalizable to the entire population of patients newly diagnosed with esophageal cancer.

By the time the current study was undertaken, many of the patients in the original study had already been treated or had experienced tumor recurrence or death. Nonetheless, because the imaging studies in the original study were conducted in a blinded fashion, the current study lacks some of the limitations of retrospective analyses. Therefore, one strength of this study is blinding. Persons conducting all imaging studies, be it helical CT, EUS/EUS-FNA or cytology, were blind to the results of the other modalities. In the current study, participating physicians were blind to the actual treatment given and ultimate patient outcome; and blind in regard to the treatment recommendations of their colleagues. The clinicians who were involved in the patient's care in life had two advantages compared to the researchers who reviewed vignettes. The clinicians were able to physically meet the patient and glean the patient's ability to tolerate surgery, chemotherapy and radiation therapy, and discuss the patient's needs and choices personally with them. Researchers were not made aware as to the candidacy of each patient for treatment, but did receive a list of comorbidities. Patient wishes were not disclosed to the research group. Despite these differences in available information there was no statistically significant difference in the treatment recommendations made by the clinicians and the researchers. Finally, none of the participating physicians in the current study performed any of the imaging evaluations themselves; diminishing the overestimation of the usefulness of a particular imaging technique. An additional strength of the current study is the inclusion of a variety of specialists who participate in the management of patients with esophageal cancer.

Heterogeneity in treatment recommendations between specialists was surprising in light of the extensive literature regarding the treatment of esophageal cancer, and yet not altogether unexpected in that physician bias according to specialty has long been recognized as a confounding factor in implementing evidence-based medicine recommendations.³⁸ Another factor that may have played a role in the heterogeneity of management recommendations was the inclusion of patients with tumors at the gastroesophageal junction, in whom some physicians may have taken the approach of offering surgery first to document nodal involvement, with the plan to proceed with adjuvant therapy if lymph node involvement was found.

This study shows that beyond stage I disease, in which the most commonly offered definitive treatment is esophagectomy, for patients with any other stage of esophageal cancer, the specialty training of the physician consulted greatly impacts the recommendation received. In other words, lack of consensus opens the door to a variety of alternatives that may be influenced by physician specialty. Fortunately, agreement improves as additional staging information is revealed by EUS and EUS-FNA, which is consistent with previous data,²⁸ supporting the need for these techniques in patients with esophagus cancer. Overall, these results suggest that more research and standardization in patient care is needed to identify the optimal management plan for patients with different stages of disease.

In conclusion, the results of our study demonstrate that both EUS and EUS-FNA impact on management of patients with esophageal cancer and improve agreement between physicians in regard to management. Specialty training appears to impact treatment. This diversity of opinions and perspectives underscores the importance of the multidisciplinary interaction inherent in the modern care of cancer patients.

Acknowledgments

We would like to thank Christopher J. Gostout, MD, Michael J. Levy, MD, and Jeff A. Sloan, PhD, for their helpful comments and review of the manuscript, and Lori R. Anderson for her help in typing and submitting the manuscript

Study support

Grant support – Angels Gines was the recipient of a grant of the *Societat Catalana de Digestologia* (Beca de Formació de llarga durada a l'estranger, 2002) and the Agència de Gestió d'Ajuts Universitaris i de Recerca (Beca per a la recerca for a de Catalunya, 2002BEAI400016). Yvonne Romero was supported in part by a grant from the NIH (NIDDK 02956) as was Joseph A. Murray (NIDDK 57892). The Mayo Comprehensive Cancer Center Grant number is P30 CA15083.

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Fig. 1.
Overall treatment recommendations in response to step-wise imaging results.

Fig. 2. Treatment recommendations, in response to step-wise imaging results, by specialty group.

Table 1
Stage of 50 esophageal cancer patients used in case vignettes. Stage and details regarding T, N and M1a extent.

Stage	T and N extent			
	Overall <i>n</i>	T	N	M1a
I	8	1	0	—
IIa	12	2	0	—
		3	0	—
IIb	7	1	1	—
		2	1	—
III	14	3	1	—
		4	1	—
IVa	9	x	x	+

Table 2

ICC (95% CI) at each level of information

Imaging results	Treatment option		
	1	2	3
	Palliation, radiation alone, chemotherapy alone	Surgery alone or surgery with reassessment for post operative chemoradiation	Definitive chemoradiation, or neoadjuvant chemoradiation therapy with plan to restage for possible surgery, or neoadjuvant solo chemo or neoadjuvant solo radiation therapy with plan to restage for possible surgery
CT only	0.37 (0.27, 0.49)	0.43 (0.32, 0.55)	0.32 (0.23, 0.44)
CT + EUS	0.36 (0.27, 0.49)	0.61 (0.51, 0.72)	0.45 (0.35, 0.57)
CT + EUS + EUS-FNA	0.34 (0.24, 0.46)	0.65 (0.55, 0.75)	0.49 (0.39, 0.61)

ICC = intraclass correlation; CT = computed tomography; EUS = endoscopic ultrasonography; EUS-FNA = EUS with fine-needle aspiration.

This table summarizes the agreement among physicians separately, for each treatment category, listed in the column headings, given the level of information provided, listed in each row.

Table 3
Final recommendations made by specialists, by stage (%)

Stage of disease	Specialty	Treatment option									
		1					2				
		Pall	Rays	Chemo	Surg	Surg & reassess for post-op chemorays	Chemo rays	Neo chemo rays	Neo chemo	Neo rays	Neo rays
I	GI	0	0	0	83	0	0	17	0	0	0
	MO	0	0	0	88	0	0	4	0	0	0
	RO	0	0	0	69	15	8	8	0	0	0
IIA	TS	0	0	0	78	9	0	13	0	0	0
	GI	11	0	0	17	0	6	58	0	8	0
	MO	3	0	0	38	3	11	46	0	0	0
IIB	RO	0	0	0	17	33	3	47	0	0	0
	TS	0	2	0	31	6	2	58	0	0	0
	GI	14	0	0	29	0	0	57	0	0	0
III	MO	0	0	5	29	33	5	29	0	0	0
	RO	0	0	0	29	26	5	41	0	0	0
	TS	3	0	0	34	6	4	53	0	0	0
IV	GI	33	2	2	0	0	14	48	0	0	0
	MO	0	2	5	0	0	38	52	2	0	0
	RO	5	0	2	0	11	14	68	0	0	0
IVA	TS	5	0	0	4	0	14	77	0	0	0
	GI	63	0	7	4	0	7	19	0	0	0
	MO	4	4	30	0	11	11	41	0	0	0
	RO	19	0	7	0	4	22	48	0	0	0
	TS	17	0	3	0	0	11	69	0	0	0

Pall = palliation; Rays = radiation therapy; Chemo = chemotherapy; Surg = surgery; Chemorays = combination chemotherapy with radiation therapy; Post-op = post operative; Neo = neoadjuvant; GI = gastroenterologists; MO = medical oncologists; RO = radiation oncologists; TS = thoracic surgeons.