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Screening oropharyngeal dysphagia in patients with head and neck cancer in a radiation oncology department

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ABSTRACT

Background: Oropharyngeal dysphagia (OD) occurs in up to 40% of head and neck cancer (HNC) patients before treatment and remains a common symptom (23–60%) after oncological treatments, leading to several consequences. Early detection is essential for effective swallowing-rehabilitation and nutritional-support. The increased radiosensitivity of tumors associated with human papillomavirus (HPV) and advances in imaging techniques have stimulated research into deintensified strategies to minimize radiotherapy (RT) side effects. The purposes of the study are to establish the percentage of patients with HNC who are candidates to RT who are at risk of dysphagia [Eating Assessment Tool (EAT) score ≥ 3], determine if tumor location and previous surgery were related to a higher risk of dysphagia and if patients suffering severe toxicity during cancer therapy are at greater risk of posttreatment-dysphagia.

Materials and methods: Patients diagnosed of HNC who were referred to RT treatment at our Radiation Oncology Department were prospectively included. Questionnaire EAT-10 was filled in the first assessment used as a screening tool and repeated one month after treatment. Treatment toxicity was established according to common toxicity criteria adverse effects (CTCAE4.03).

Results: From November 2019 to January 2021, 72 patients were included. All completed pretreatment EAT-10 questionnaire. The mean (SD) score of the pretreatment EAT-10 was 7.26 ± 11.19 and 43.1% were at dysphagia risk. Patients with tumors located in the oral cavity, oropharynx and those that had received surgery prior to RT had higher risk than the rest of locations or those who had not previous surgery ($p = 0.001$ and $p = 0.002$, respectively). After oncological treatment 95.83% completed EAT-10 post-treatment and 45,6% showed positive EAT-10 score.

Conclusions: Patients with tumors in the oral cavity or oropharynx, presenting in advanced stage, and who previously received surgery are at higher risk of developing dysphagia. The EAT-10 is a simple tool that can help us identify those patients and refer them for an intensive evaluation to reduce dysphagia-consequences.

Key words: dysphagia; head and neck cancer; radiation oncology department

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Introduction

Oropharyngeal dysphagia and head and neck cancer

Oropharyngeal dysphagia (OD) is a gastrointestinal motility disorder that includes difficulty or inability to form or move the alimentary bolus safely, from the mouth to the esophagus [1]. OD is a highly prevalent form of swallowing impairment, estimated to affect between 2–16% of general population and up to 40% of hospitalized patients [2]. So, it is specifically classified as a digestive condition by the World Health Organization in the International Statistical Classification of Diseases and Related Health Problems ICD-9 and ICD-10 [3].

Many head and neck cancer (HNC) patients experience some degree of OD [4]. The nature and degree of OD depend on the site and size of the primary tumor [5]. All stages of the physiologic swallowing process including motility, sensitivity, and biomechanical events may be altered in HNC patients [2].

Dysphagia occurs in up to 40% of head and neck cancer patients prior to treatment(6) . After oncological treatments, dysphagia is also a common symptom in HNC patients with a prevalence ranging from 23% to 60% [7–12]. Furthermore, silent aspiration as a more severe expression of OD, has been reported up to 45% in this population and is accompanied by a higher risk of serious consequences such as pneumonia, malnutrition, dehydration and death [13, 14]. Despite the development of organ-saving therapies for HNC, early and late toxicities of radiochemotherapy (RTCT) or surgery cannot be avoided, and full function preservation of the upper aerodigestive tract is usually not possible [15].

Dysphagia detection

The high prevalence of OD and its consequences of health-related quality of life in this population calls for early detection of this condition in order to facilitate early implementation of swallowing rehabilitation and nutritional support [16–18].

In the literature, videofluoroscopic evaluation of swallowing (VFS) and fiberoptic endoscopic evaluation of swallowing (FEES) are taken as the gold standards for further assessment [2, 19].However, it is not feasible to perform this test to every patient at risk for OD as it requires specific equipment not available in all health-care facilities [20].

Dysphagia screening

The development of clinical methods for easy screening and accurate clinical assessment of OD is, therefore, necessary [21]. The aim would be to use an inexpensive, non-invasive, valid, reliable, simple and safe method accepted by the target population, in order to identify patients at risk of dysphagia [19]. The goal of the screening methods for OD should be a quick identification of patients with OD, at risk of aspiration or malnutrition and who need to be referred for more formal and extensive swallowing assessment [19]. One of such screening tools is the Eating Assessment Tool-10 (EAT-10). The EAT-10 is a short 10-item, self-administered questionnaire, developed to evaluate dysphagia symptoms in people with a wide variety of clinical settings [22]. Belafsky et al. [22] found that a sum score ≥ 3 indicates that a patient is at risk of dysphagia and warrants further examination. Several studies have shown a good correlation between the gold standard test to detecting dysphagia (FEES/VFS) and this tool in oncological and non-oncological patients [15, 23].

Rofes et al. [24] showed that both clinical methods for screening (EAT-10) and clinical assessment through the Volume-Viscosity Swallow Test (V-VST) of OD offer high discriminating ability. Cheney et al. [25] observed that subjective dysphagia symptoms as documented with the EAT-10 can predict aspiration risk. In fact, a linear correlation exists between the EAT-10 and either aspiration events (Penetration and Aspiration Scale, PAS) and aspiration risk. Patients with an EAT-10 >15 are 2.2 times more likely to aspirate [25]. Dewan et al. [26] demonstrated a relationship between patient reported symptoms (dry mouth, change in voice, nasal regurgitation, cough…) and objective VFSS findings in a cohort of patients referred for multidisciplinary swallowing assessment. They suggest that such surveys are helpful screening tools but inadequate to fully characterize swallowing impairment. Florie et al. [15] also demonstrated that EAT-10 questionnaire seems to have an indicative value for the presence of post-swallow pharyngeal residue in dysphagic HNC patients, and a value of 19 points turned out to be useful

Table 1. Estimated incidence of dysphagia in patients with head and neck cancer according to Eating Assessment Tool (EAT-10)

Reference	Study design	Patients	Tumor stage	EAT-10 Mean (points)	Dysphagia (%)/Location
Belafsky et al. [22]	Observational prospective	482	Not reported	22.42 ± 14.06 in patients with history of head and neck cancer.	Not reported
Bofill-Soler et al. [29]	Observational prospective	47	I–IV	Pretreatment 3.3 ± 5.3 Postreatment 9.1 ± 7.3	Not reported/Oral cavity — oropharynx, larynx and, nasopharynx
Xiaoyan Yin et al. [28]	Observational prospective	462	I–IV	Pretreatment 3.1 ± 2.5 Postreatment 13.2 ± 11.3	Not reported
Zebralla et al. [33]	Observational prospective	689	I–IV	Not reported	59.4 % posttreatment/(Oral cavity 51%;Oropharynx 76.4%, Larynx/Hypopharynx 45.3%; Other 37.5%)
Roba Tamer et al. [27]	Observational prospective	271	I–IV	Pre surgery 6.91 ± 6 Post surgery 21.71 ± 5.98	Not reported/Tongue tumors
Brinkman et al. [40]	Observational retrospective	11	I–IV	Post surgery 8.4	Not reported
Ortiz-Comino et al. [41]	Observational prospective	32	I–IV	16.7 ± 10.7 Postreatment	Not reported
Harris et al. [42]	Observational prospective	179	I–IV	Postreatment Oral cavity 7.94 ± 10.44; Oropharynx 11.79 ± 10.34; Larynx/hypopharynx 9.46 ± 12.47	Not reported
Cates et al. [30]	Observational retrospective	144	I–IV	Pretreatment 9.4 ± 11.8 Postreatment 10.8 ± 11.4	Not reported/oral cavity, oropharynx, nasopharynx, hipopharynx, larynx

as a cutoff point for the presence of pharyngeal residue in this study population.

The estimated incidence of dysphagia in head and neck cancer patients according to EAT-10 result is shown in Table 1.

EAT-10 has been used to screen for dysphagia in patients suffering from head and neck tumors in the Roba Tamer (pre-surgery) study [27], Xiaoyan study [28], Boffil-Soller study [29] and Cates study [30]. The mean EAT-10 score range from 3,3 9,4 points in such studies. But most studies do not provide the number of patients at risk (patients with EAT-10 over a cut-off value of 3) but instead a mean score value that is no clinically useful to detect such patients.

We consider that identification of patients at risk of dysphagia using the EAT-10 is essential to improve compliance of head and neck cancer treatments and reduce patients' complications. The primary objective of the present study is to establish for the first time the percentage of patients with HNC who are candidates for curative radiotherapy (RT) who are at risk of dysphagia (EAT score ≥ 3).

As secondary objectives we aimed to determine if the tumor location and the previous surgery were related to a higher risk of dysphagia and if patients suffering sever toxicity during cancer therapy are at greater risk of posttreatment dysphagia.

Materials and methods

Study design and patient selection

Patients older than 18 years diagnosed of squamous HNC who were referred to curative RT at the Radiation Oncology Department at University Hospital of Gran Canaria Dr Negrín and were free of psychological or medical disease that could prevent the full understanding and completion of the EAT-10 were prospectively included in this study. Concomitant systemic therapy was allowed.

Exclusion criteria were: age under 18, non-squamous HNC, palliative RT treatment and any disability that prevents the correct understanding and compliance with the EAT-10. The study was approved by the Ethic Committee of Hospital Dr. Negrín (Las Palmas) and registered by CEIm number 2020-025-1. Written inform consent for treatment was obtained from all the patients.

Radiotherapy was planned by the volumetric intensity-modulated arc therapy (VMAT) technique by ECLIPSE. Timmermann constraints were used to evaluate the limit doses of the organs at risk. To-

tal planned doses were 63 Gy (1.8 Gy/fr) in early stages and 70 Gy (2 Gy/fr) in advanced stage for radical patients. In adjuvant indications doses used were 63 Gy (1.8 Gy/fx) for locally tumors and 66 Gy (2 Gy/fx) for advanced cases. Cancer staging was performed according to the tumor, nodes, and metastasis established by the 8th edition of the TNM classification system [31]. The toxicity of treatments was established according to the common toxicity criteria adverse effects (CTCAE 4.03) and was evaluated by the physician during and one month after radiotherapy.

Dysphagia protocol

The Spanish validated version of the EAT-10 questionnaire was used as a screening tool in this study [32]. The questionaries were filled in the first pretreatment assessment in the Radiation Oncology Department and one month after the end of the treatment. Patients were considered to be at risk of dysphagia if EAT-10 has a score value ≥ 3 [3].

Statistical analysis

Statistical analyses were conducted using IBM SPPSS Statistics for Mac, version 26 (IBM Corp., Armonk, NY). Analysis of statistical differences in discrete variables were done by means of the Chi-square test, p-value less than 0.05 was considered to be statistically significant.

Results

Participants

From November 2019 to January 2021, eighty-eight patients were initially assessed for eligibility in the study. Seven of them were not squamous HNC and 9 received only palliative radiotherapy. So, seventy-two patients were finally included in this study (Fig. 1). The mean age of the patients was 64.83 years (range 44–85). Patients' characteristics are presented in Table 2. Briefly, most of them were male (83.3%), stage III–V (73.6%) and suffered from larynx cancer. Radical treatment was indicated in 59.7% and a systemic treatment was associated in 40.3%.

Only one patient, out of the 72 cases included, did not complete the planned treatment, because he required hospital admission due to febrile neutropenia related to chemotherapy treatment. Two patients had temporary interruptions of the prescribed treatment (one due to mucositis and the other one due to a lineal accelerator breakdown). The rest of the patients completed the planned treatment schedule. Radiotherapy treatment was well tolerated. Toxicity grade III was not seen in any of the patients.

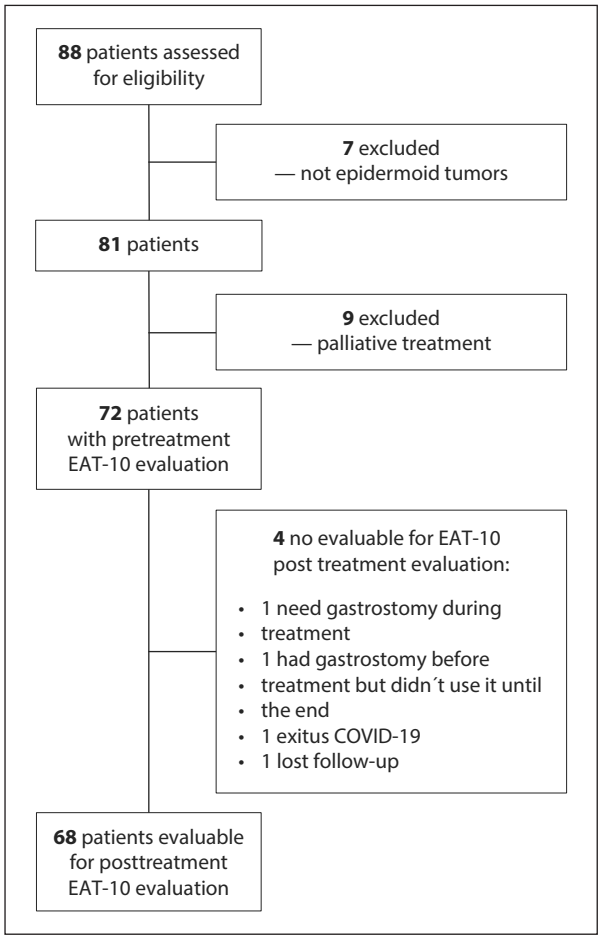

Figure 1. aaaaaaaaaaaaaaaaa

Risk of dysphagia in the first assessment in our Radiation Oncology Department

All 72 patients completed pretreatment EAT-10 questionnaire. The mean (SD) score of the EAT-10 pretreatment was 7.26 ± 11.19 (range 0–39). Using the EAT-10 cutoff ≥ 3 [22] there were 31 out of 72 patients (43.1%) at risk of dysphagia (Supplementary File — Fig. S1). Focusing on the patients who had interruptions during treatment, it is worth noting that all of them had a positive EAT-10 score before treatment. Patients with tumors located in the oral cavity and oropharynx and those that had

Table 2. Patient and treatment characteristics

Characteristic	Number of patients (%)
Sex	
Male	60 (83.3%)
Female	12 (16.7%)
Tumoral stage	
E.I–II	19 (26.4%)
E.III–IV	53 (73.6%)
Tumor location	
Nasopharynx	3 (4.2%)
Oral cavity	14 (19.4%)
Oropharynx	15 (20.8%)
Hypopharynx	7 (9.7%)
Larynx	27 (37.5%)
Other (M.O.D, salivary gland, maxilar)	6 (8.4%)
Loco-regional treatment	
Radiotherapy	43 (59.7%)
Surgery + radiotherapy	29 (40.3%)
Systemic treatment	
No systemic treatment	25 (33.4%)
Cetuximab	16 (22.2%)
Chemotherapy*	32 (44.4%)

*The drug used was cisplatin; M.O.D. — **xxxxxxxxxxxxxxxxxx**

received surgery prior to radiotherapy had a statistically significant higher risk of dysphagia than the rest of tumor locations or those who had not previous surgery (p = 0.001 and p = 0.002, respectively) (Supplementary File — Tab. S1). Prior to treatment, 91.5% of patients maintained oral feeding, 4.2% used a combination of tube feeding and oral feeding, and 4.2% used exclusive tube feeding.

Risk of dysphagia after oncological treatment

Sixty-eight out of 72 patients (94.44%) completed post-treatment EAT-10 questionnaire. The reasons why they did not complete the test are described in Figure 1. Thirty-one patients out of 68 (45.6%) showed an EAT-10 score ≥ 3 one month after concluded radiotherapy (Supplementary File — Fig. S2). Patients who experienced interruptions during cancer treatment continued to be at risk for dysphagia after treatment, with their EAT-10 score worsening even further. After treatment, 90.1% of patients maintained oral feeding. 8.4% used exclusive tube feeding and only 1.4% used combined enteral and oral feeding.

Patients with tumors located in the oral cavity and oropharynx (p = 0.036), those that had received concurrent systemic treatment to radiotherapy (p = 0.005) and patients suffering from more advanced tumors (stage II–IV) also showed a statistically significant higher risk of dysphagia (Supplementary File — Tab. S1). The presence of mucositis after oncological treatments was not related to a higher prevalence of post-treatment dysphagia (p = 0.07).

Discussion

In the present study we estimate for the first time the percentage of HNC patients referred for curative radiotherapy that are at risk of suffering dysphagia. Also, the study demonstrated that the dysphagia screening using the EAT-10 is feasible in daily clinical practice in a radiation oncology department. EAT-10 has shown

good correlation with the gold standard test to detecting dysphagia (FEES/VFS) [15, 23].

EAT-10 has been employed to screen dysphagia in head and neck tumors, with a wide range of EAT-10 score (3.1 ± 2.5 to 22.42 ± 14.06) mainly related to selection criteria and treatment options [22, 27–30]. However, all these studies but one [33] only showed the mean EAT-10 score of the series of patients, without stablishing a cut-off value representing risk. So, they cannot define which individual patients are at risk of dysphagia and, therefore, which patients would need a specific and individualized approach to prevent future complications derived from their swallowing limitations.

The study of Belafsky et al. [22] defines a cut-off point for a significant risk of developing dysphagia. In their series of patients, a sum score ≥ 3 indicates that a patient is at risk of dysphagia and warrants further examination. Consequently, in our study we used this cut-off point value to identify patients that would deserve an individualized treatment approach.

There are no more published studies assessing this situation, using the EAT-10 to screen for OD in HNC patients and the cut-off point. For this reason, we emphasize that in our series the dysphagia risk before oncological treatment was observed in 43.1% of our patients, using the EAT-10 as a screening test and taking account of the cut-off value of the test (≥ 3).

In our study we have been able to identify which patients (with tumors located in the oral cavity and oropharynx and those that had received surgery prior to radiotherapy) are at real risk of developing such deleterious consequences of dysphagia (EAT-10 score > 3) and therefore would deserve an individualized therapeutic approach.

Once these patients are identified, two different strategies could be approached in order to prevent clinical consequences of dysphagia.

The first one would be to reduce radiation dose to the structures related to swallowing. In those patients at risk of dysphagia, the complex and modern radiotherapy techniques called intensity modulated radiation therapy (IMRT) "save swallowing" that are able to reduce radiation-induced dysphagia-related toxicity should be used [34–36]. Also, the greater radiosensitivity of tumours associated with the HPV and the development of new imaging techniques have encouraged research into new deintensified strategies to reduce the side effects of radiotherapy [37, 38].

Second, dietetic changes in bolus volume and viscosity during oncological treatment as well as rehabilitation procedures can improve deglutition and prevent nutritional and respiratory complications [39]. In these cases, the use of the clinical examination of volume viscosity (MECV-V) would be of interest to maintain the safety and efficacy of swallowing and refer them for a more intensive evaluation with instrumental test such us VFS and FEES in order to establish de OD diagnosis and detect silent aspirations [39].

Despite of these facts, dysphagia screening is not usually included in the assessment of patients with HNC. Our study highlights the importance of performing an OD screening prior to the start of oncological treatments. The EAT-10 is an inexpensive, simple, fast, non-invasive test with good correlation with invasive diagnostic tests and that can allow us to identify patients that require special care and closer follow-up [20].

The strengths of our study are to detect in a simple and quick way in routine clinical practice a group of patients at risk of dysphagia. This easily detects high risk patients, would be candidates in future studies for additional evaluations that include intervention in various aspects: clinical examination with the viscosity volume test (MECV-V) that will allow us to carry out adapted and individualized nutritional intervention taking into account the textures and volumes that each patient requires to maintain effective and safe swallowing And instrumental evaluation with gold standard test (VFS and FEES) to confirm the diagnosis of dysphagia and the use of sophisticated techniques of intensity modulated radiation therapy (IMRT) that will allow us to protect the muscles and organs that intervene in swallowing in these patients as much as possible.

The weaknesses of the study are mainly related to the small number of patients included and the limited resources available in clinical practice. Although we were able to perform a screening test for dysphagia prior to starting cancer treatment, we had no organizational capability to perform a complete evaluation of swallowing, which would have allowed us not only to identify patients at risk but also to diagnose them. However, performing tests such as FEES and VFS requires the involvement and participation of several departments, which would imply most times increasing the treatment waiting time. HNC patients have a rapidly proliferating tumor profile, therefore, we shouldn't delay the start of RTQT treatment.

Conclusion

Patients with tumors in the oral cavity or oropharynx, presenting in advanced stage, and those who previously received surgery are at higher risk of developing dysphagia. The EAT-10 is a simple tool that can help us to identify these patients and refer them for an intensive evaluation to reduce dysphagia consequences. OD screening can help us to select patients who could benefit from "save swallowing" IMRT advanced radiotherapy techniques and refer them for a more intensive evaluation to reduce negative consequences of dysphagia. Further studies are needed to improve early detection of patients with HNC and dysphagia.

Conflict of interest

The authors declare that they have no conflict of interest.

Funding

None declared.

Ethical approval

All human studies have been approved by the appropriate ethics committee and have, therefore, been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Informed consent

All the persons gave their informed consent prior to their inclusion in the study and details that might disclose the identity of the subjects under study were omitted.

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