Analysis of Factors Influencing Dysphagia Severity Following Treatment of Head and Neck Cancer

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Abstract. *The aim was to assess the influence of treatment, tumor stages and sites on the severity of dysphagia following treatment. Sequential modified barium swallow (MBS) examinations were performed in patients who complained of chronic dysphagia following treatment of their head and neck cancer. Patients were selected if they were cancer free at their last MBS and had 2 or more MBS studies. Dysphagia severity was graded on a scale of 1 to 7. Dysphagia grade was compared between the first and last MBS to assess its evolution. Between 1996 and 2005, 63 patients with chronic dysphagia underwent MBS to assess dysphagia severity for nutritional support. Twenty-one patients (33%) had improvement of their dysphagia. Two of these patients (3%) achieved normalization of the swallowing. Twenty-five patients (40%) had no change of the dysphagia severity. Dysphagia grade increased in 17 patients (27%). Analysis of patient characteristics did not show any significant difference between these three groups of patients. MBS is a useful tool to monitor dysphagia severity and to identify aspiration risk. Stages of disease and treatment modality do not seem to impact on the course of dysphagia.*

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The standard treatment for locally advanced head and neck cancer is surgery followed by postoperative radiation (1). Recent studies indicated that concurrent chemoradiation may confer an advantage over postoperative radiation because of organ preservation (2-4). However, both modalities may result in significant long-term sequelae (5, 6). Surgical ablation of normal tissue, xerostomia and scarring from postoperative radiation, and abnormal motility of oropharyngeal muscles secondary to chemoradiation, all contribute to the dysphagia commonly seen in cancer survivors (7-9). In severe cases, aspiration, often silent, may result in death (10). Malnutrition, anxiety and depression may alter patient quality of life (11). Thus, it is important for clinicians to monitor dysphagia severity for patient management. Modified barium swallow (MBS) is a proven diagnostic and therapeutic tool for evaluation of dysphagia from miscellaneous clinical conditions (12, 13). Sequential MBS may be useful to monitor dysphagia evolution following treatment of head and neck cancer (14). Factors which may influence dysphagia severity such as disease stages and sites and type of treatment remain unknown (15, 16). It would be helpful for clinicians to assess prognostic factors which may have an impact on dysphagia course for patient counseling and management, for which this retrospective study was conducted.

Patients and Methods

Patient selection. The study cohort consisted of 63 patients who complained of chronic dysphagia following treatment for head and neck cancer at the Veterans Affairs North Texas Health Care System between 1996 and 2004; 161 head and neck cancer patients had MBS for dysphagia post treatment during that time.

Table I. *Patient characteristics*.

Characteristic	No. of patients (%)
No. of patients	63 (100)
Male	63 (100)
Age (years)	34-78 (median: 58)
Race	
Caucasians	51 (81)
African–Americans	11 (17)
Hispanic	1 (2)
Histology	
Squamous	62 (98)
Sarcoma	1 (2)
Site	
Oropharynx	27 (43)
Larynx	18 (28)
Hypopharynx	7 (11)
Oral cavity	6 (10)
Unknown	5 (8)
Stage	
I	3 (5)
II	5 (8)
III	16 (25)
IVA	32 (51)
IVB	4 (6)
Recurrence	3 (5)
Treatment	
Chemoradiation	28 (44)
Postoperative radiation	24 (38)
Surgery	6 (10)
Radiation	5 (8)
Follow-up (months)	5-178 (19 months)

Table II. *Characteristics of patients with dysphagia improvement*.

No. of patients	21
Site	
Oropharynx	12
Larynx	3
Hypopharynx	3
Unknown	2
Oral cavity	1
Stage	
I	1
II	1
III	3
IVA	14
IVB	2
Treatment	
Postoperative radiation	11
Chemoradiation	9
Surgery	1
Number of MBS	
2	12
3	9
Time between MBS (months)	
MBS 1	1-123 (median: 8)
MBS 2	1-47 (median: 8)
MBS 3	5-26 (median: 9)
Follow-up (months)	7-178 (median: 21)

MBS: Post treatment modified barium swallow.

Patients were selected if they had 2 or more MBS studies and were cancer-free at the last MBS. They were referred to the Speech Pathology Service by their primary care or Ear, Nose and Throat physicians.

Swallowing study. During the MBS procedure, the patient was either sitting or standing and viewed in frontal and lateral planes. The fluoroscopy tube was positioned to view the oral cavity anteriorly, the soft palate superiorly, the posterior pharyngeal wall posteriorly, and the seventh cervical vertebra inferiorly. In this way, the oral preparatory, oral, pharyngeal and cervical esophageal phases of deglutition could be assessed and viewed simultaneously. Seven consistencies of food and liquid were introduced in teaspoons to the patient. Water, liquid barium, apple sauce, mashed potatoes, green beans, ground meat and sliced meat mixed with barium paste were used in the assessment. With each swallow, patients were instructed to hold the material in their mouth until told to swallow. The fluoroscope remained focused on the oral cavity and pharynx during and after each swallow. A numberof observations were made during each swallow. Residue on the tongue or in the pharynx after the swallow, laryngeal penetration or aspiration during or after the swallow, backflow, esophageal-pharyngeal reflux, and disordered peristalsis in the pharynx or esophagus were noted. The patient was then repositioned in the anterior-posterior position and presented with at least two additional consistencies, usually liquid barium and mashed potatoes introduced by teaspoon. Finally, at the completion of swallowing, the patient was instructed to vocalize on and count to five while being videotaped with fluoroscopy.

Each patient was scored using the Swallowing Performance Scale (17), as follows: grade 1: normal; grade 2: within functional limits: abnormal oral or pharyngeal stage but able to eat a regular diet without modifications or swallowing precautions; grade 3: mild impairment: mild dysfunction in oral or pharyngeal stage, requiring a modified diet without need for therapeutic swallowing precautions; grade 4: mild-to-moderate impairment with need for therapeutic precautions: mild dysfunction in oral or pharyngeal stage, requiring a modified diet and therapeutic precautions to minimize aspiration risk; grade 5: moderate impairment: moderate dysfunction in oral or pharyngeal stage, aspiration noted on exam, requiring a modified diet, and swallowing precautions to minimize aspiration risk; grade 6: moderate-severe dysfunction: moderate dysfunction of oral or pharyngeal stage, aspiration noted on exam; requiring a modified diet and swallowing precautions to minimize aspiration risks; needs supplemental enteral feeding support; grade 7: severe impairment: severe dysfunction with significant aspiration or inadequate oropharyngeal transit to the esophagus, nothing by mouth, requiring primary enteral feeding support.

In addition to a modified diet, patients were instructed about safe eating techniques, and the swallowing maneuvers designed to facilitate the safest swallow. The rehabilitation technique was individualized for each patient who was then followed at regular intervals by the speech pathologist. Modified barium was repeated if

Table III. *Characteristics of patients with no change of dysphagia severity.*

No. of patients	25
Site	
Oropharynx	9
Larynx	8
Hypopharynx	3
Oral cavity	3
Unknown	2
Stage	
I	1
II	2
III	9
IVA	10
IVB	1
Recurrence	2
Treatment	
Chemoradiation	13
Postoperative radiation	7
Surgery	3
Radiation	2
Number of MBS	
2	21
3	2
4	2
Time between MBS (months)	
MBS 1	1-46 (median: 4)
MBS 2	3-47 (median: 11)
MBS 3	4-14
MBS 4	9-11
Follow-up (months)	8-53 (median: 18)

MBS: Post-treatment modified barium swallow.

deemed necessary by the team. Traditional barium swallow was also obtained to complement the MBS if abnormal structural integrity of the pharynx and esophagus were suspected by the team. The patient's weight and nutritional status were also monitored by a dietitian who provided enteral nutritional support recommendations as needed.

Results

Patient characteristics. Sixty-three male patients were selected. Their ages ranged from 34 to 78 years (median 59). The sites of disease were: oropharynx (n=27), larynx (n=18), hypopharynx (n=7), oral cavity (n=6) and unknown (n=5). The stages of the disease were: IV (n=36), III (n=16), II (n=5), I (n=3) and recurrence (n=3). The histology was squamous (n=62) and sarcoma (n=1). Their treatment were respectively: chemoradiation (n=28), postoperative radiation (n=24), surgery (n=6) and radiation (5).

Table IV. *Characteristics of patients with increased dysphagia severity.*

No. of patients	17
Site	
Larynx	7
Oropharynx	6
Oral cavity	2
Unknown	1
Stage	
I	1
II	3
III	4
IVA	7
IVB	1
Recurrence	1
Treatment	
Chemoradiation	6
Postoperative radiation	6
Radiation	3
Surgery	2
Number of MBS	2
Time between MBS (months)	
MBS 1	1-59 (median: 3)
MBS 2	2-25 (median: 7)
Follow-up (months)	5-66 (median: 11)

MBS: Post-treatment modified barium swallow.

Table V. *Evolution of dysplasia severity following treatment for head and neck cancer.*

	Group 1 (21 patients)		Group 2 (25 patients)		Group 3 (17 patients)	
Dysphagia grade	MBS 1	Last MBS	MBS 1	Last MBS	MBS 1	Last MBS
1	0	2	0	0	0	0
2	0	0	1	1	4	0
3	1	6	3	3	4	1
4	2	6	5	5	5	3
5	4	4	6	6	1	3
6	9	3	2	2	3	3
7	5	0	8	8	0	7

MBS: Post-treatment modified barium swallow; Group 1: patients with dysphagia improvement; Group 2: patients with unchanged dysphagia; Group 3: patients with increased dysphagia.

In the surgery alone group, the type of operation was: total glossectomy (n=1), wide local excision (n=1), right composite resection with right neck dissection (n=1) and total laryngectomy with bilateral neck dissection (n=3).

Indications for postoperative radiation were positive lymph nodes, and/or close positive margin of resection. Postoperative radiation therapy dose ranged from 5,940 to 6,600 cGy.

In the group which received concurrent chemoradiation for locally advanced tumors, chemotherapy (5-fluorouracil, cisplatin) was delivered at weeks 1 and 4 of radiation.

The radiation therapy dose ranged from 6,600 to 7,000 cGy. Radiation therapy was delivered by a Cobalt or 6 MV linear accelerator, using the standard technique (2 lateral and 1 anterior beam, off cord at 3,960 cGy or 4,000 cGy, at 180-200 cGy/fraction), covering tumor and regional lymph nodes. Four patients and one patient had definitive radiation therapy for laryngeal cancer and hypopharyngeal carcinoma, respectively. The tumor dose was 7,000 cGy.

Table I summarizes the characteristics of the study patients.

Swallowing (MBS) results. The number of MBS performed for each patient was respectively 2 (n=50), 3 (n=11) and 4 (n=2).

Twenty-one patients (33%) had improvement of their dysphagia (Table II). In this group, the first post-treatment MBS was performed at 1 to 123 months (median: 8 months). The interval between the first and second MBS ranged from 1 to 47 months (median: 8 months). In 9 patients who had a third MBS study, the time-interval following the second MBS study ranged from 5 to 26 months. The time-interval from treatment completion to the last MBS ranged from 7 to 178 months (median: 21 months). There were one grade 3, two grade 4, four grade 5, nine grade 6 and five grade 7 at the first MBS. Two patients had grade 1, six patients had grade 3, six patients had grade 4, four patients had grade 5 and three patients had grade 6 at the last MBS.

The severity of dysphagia remained unchanged for 25 patients (40%) (Table III). Their first MBS ranged from 1 to 46 months following treatment (median: 4 months). Their second MBS was performed between 3 to 47 months after the first MBS (median: 11 months). Two patients had a third MBS at 4 to 14 months after the second MBS. Two patients had a fourth MBS at 9 and 11 months after the third MBS. The time interval from treatment completion to the last MBS was 8 to 53 months (median: 18 months). Dysphagia severity ranged from 3 to 7 at the first MBS: 3 (n=4), 4 (n=5), 5 (n=2), 6 (n=3) and 7 (n=5). There were one grade 2, three grade 3, five grade 4, six grade 5, two grade 6, and eight grade 7 at the first and last MBS.

Seventeen patients (27%) had worsening of their dysphagia grade (Table IV). Their first MBS was performed at 1 to 59 months following treatment (median: 3 months). Their second MBS ranged from 2 to 25 months following the first MBS (median: 7 months). The time interval from treatment completion to the last MBS was 5 to 66 months (median 11 months). There were four grade 2, four grade 3, five grade 4, one grade 5 and three grade 6 at the first MBS. One patient had grade 3, three patients had grade 4, four patients had grade 5, three patients had grade 6 and seven patients had grade 7 at the last MBS.

Table V summarizes the evolution of dysphagia severity following treatment for head and neck cancer.

Discussion

The management of locally advanced head and neck cancer represents a challenge to the clinician. Despite surgery followed by postoperative radiation, the survival rate remains poor (18). In addition, disfiguration from surgery compounded by the effect of postoperative radiation may result in patient anxiety and depression (19). The introduction of chemotherapy concurrently with radiation may improve local control because of its additive or synergistic effect (20). Anatomic organ preservation from the chemoradiation may improve patient quality of life (21, 22). However, increased apoptosis from the combined modality may induce abnormal movement of the organs critical to deglutition, resulting in chronic dysphagia (6, 8). In severe cases, silent aspiration may result in death (10, 22). Dysphagia may also affect quality of life, as patients often feel isolated (11). Feeding difficulty may lead to malnutrition, decreased activity, weight loss and lethargy (23).

All treatment modalities for head and neck cancer have been associated with a high rate of dysphagia. Following laryngectomy and pharyngolaryngectomy, up to 50% of patients experienced long-term dysphagia requiring a modification of their diet or tube feeding (5). A 41% rate of aspiration by endoscopic exam has been reported following radiation for nasopharyngeal carcinoma (24). Sixty-four percent of patients treated with concurrent chemotherapy and radiation for oro-and hypopharyngeal carcinoma experienced severe odynophagia at 12 months post treatment (8). Silent aspiration is commonly observed following chemoradiation and ranges from 60 to 65% (8, 10). However, these studies are limited by the short follow-up. The duration and severity of dysphagia secondary to treatment remain unknown.

In order to investigate these issues, sequential MBS was used as a reliable way to monitor dysphagia severity and for therapeutic purposes. MBS has been validated to define the anatomy and physiology of the oropharyngeal phase of swallowing for a range of condition such as stroke, head and neck injury or malignancies (12, 13). Various strategies may be introduced by the speech therapist to decrease the risk of aspiration and to improve swallowing efficiency (25, 26).

In this study, only 21 patients (33%) experienced improvement of the dysphagia severity at a median follow-up of 21 months. Nineteen of these 21 patients (90%) still presented with mild (12 grade 3-4), trace (4 grade 5) or severe aspiration (3 grade 6). Twenty-five patients (40%) had unchanged dysphagia (median follow-up: 18 months). Their dysphagia severity ranged from mild (8 grade 3-4) and moderate (6 grade 5), to severe (10 grade 6-7) requiring tube feedings. Seventeen patients (27%) had worsening of

dysphagia at a median follow-up of 11 months. Aspiration was present in 13 patients (3 grade 5, 10 grade 6-7). Since the follow-up of this group of patients was shorter than that of the other two groups, it is quite possible that the dysphagia severity may improve with time. However, since the group with improved or unchanged dysphagia still had a significant number of patients with trace or severe aspiration (23), the possibility that their dysphagia grade may become worse cannot be excluded.

The treatment for these three groups of patients did not differ significantly. The majority of these patients received chemoradiation and postoperative radiation. A few patients had radiation and surgery. Looking at other characteristics which may influence dysphagia severity such as stages and sites of the disease, no significant differences could be found among the three dysphagia groups. However, the patient number may be too small to detect any difference.

The limitations of this study includes its retrospective nature, selection process, heterogeneity of the patient population and treatment modality, and lack of baseline MBS.

Conclusion

Sequential MBS is a useful tool to assess dysphagia evolution following head and neck cancer treatment, and in particular the risk of aspiration as it may be silent. Site and stage of the disease, and treatment modality do not seem to impact the course of dysphagia.

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