

Post-operative oropharyngeal dysphagia after surgical removal of metastatic tumors in the cerebellum: Report of a case

Mohammad Hossein Dashti^{1*} and Roxana Hashemian²

¹Department of Restorative Sciences and Biomaterials, Henry M. Goldman School of Dental Medicine, Boston University, USA

²Department of General Dentistry, Henry M. Goldman School of Dental Medicine, Boston University, USA

Abstract

Swallowing disorders can occur in all age groups, resulting from congenital abnormalities, structural damage, and/or medical conditions. Oropharyngeal dysphagia arises from abnormalities of muscles, nerves or structures of the oral cavity, pharynx, and upper esophageal sphincter. If left untreated, swallowing disorders can potentially cause aspiration pneumonia, malnutrition, or dehydration. Central to providing comprehensive interdisciplinary care are the head and neck surgeon, laryngologist, and speech-language pathologist. Routine assessment, long-term follow-up, and regular communication and coordination among these specialists help maximize quality of life in this challenging patient population.

Introduction

Brain metastases represent a significant healthcare problem. It is estimated that 20% to 40% of patients with cancer will develop metastatic cancer to the brain during their illness. The burden of brain metastases impacts on quality and length of survival [1].

Presenting symptoms include headache (49%), focal weakness (30%), mental disturbances (32%), gait ataxia (21%), seizures (18%), speech difficulty (12%), visual disturbance (6%), sensory disturbance (6%) and limb ataxia (6%) [1].

Brain metastases may spread from any primary site. The most common primary site is the lung, followed by the breast then gastrointestinal sites. Eighty-five per cent of brain metastases are found in the cerebral hemispheres, 10% to 15% in the cerebellum and 1% to 3% in the brainstem [1].

Swallowing disorders can occur in all age groups, resulting from congenital abnormalities, structural damage, and/or medical conditions. Oropharyngeal dysphagia arises from abnormalities of muscles, nerves or structures of the oral cavity, pharynx, and upper esophageal sphincter [2]. If left untreated, swallowing disorders can potentially cause aspiration pneumonia, malnutrition, or dehydration. Central to providing comprehensive interdisciplinary care are the head and neck surgeon, laryngologist, and speech-language pathologist. Routine assessment, long-term follow-up, and regular communication and coordination among these specialists help maximize quality of life in this challenging patient population [3]. The goal of this presentation is to highlight the occurrence of dysphagia as it relates to central or peripheral nervous system, as well as local trauma.

Swallowing (deglutition) is a complicated act whereby food is moved from the mouth through the pharynx and esophagus to the stomach. It occurs in the following three stages.

First stage, food is placed on the surface of the tongue. The tip of the tongue is placed against the hard palate; elevation of the larynx and backward movement of the tongue forces food through the isthmus of the fauces in the pharynx.

Second stage, the food passes through the pharynx. This involves constriction of the walls of the pharynx, backward bending of the epiglottis, and an upward and forward movement of the larynx and trachea. Food is kept from entering the nasal cavity by elevation of the soft palate and from entering the larynx by closure of the glottis and backward inclination of the epiglottis. During this stage, respiratory movements are inhibited by reflex.

Third stage, food moves down the esophagus and into the stomach. The medulla oblongata controls breathing, blood pressure, heart rhythms and swallowing. Messages from the cortex to the spinal cord and nerves that branch from the spinal cord are sent through the pons and the brainstem [4].

The upper esophageal sphincter (UES) is defined physiologically as a high-pressure zone forming a barrier between the pharynx and the esophagus. Three muscles contribute to the formation of the UES, the cricopharyngeus (CP) muscle; the most inferior muscle fibers of the inferior pharyngeal constrictor muscle; and the most superior portion of the longitudinal esophageal muscular fibers. First described by Valsalva in 1717, the cricopharyngeus is the main component of

Correspondence to: Mohammad Hossein Dashti, Department of Restorative Sciences and Biomaterials, Henry M. Goldman School of Dental Medicine, Boston University, 100 East Newton Street, Boston, Ma 02118, USA, Tel: 617-916-5046; Email: mhdashti@bu.edu

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the UES. In the initial relaxation phase, there is vagal inhibition of the tonic contraction of the CP muscle, as observed by needle electromyography (EMG). This precedes UES opening by 200 msec and lasts 300 to 600 msec. In the second phase, UES opening occurs via the biomechanics of hyolaryngeal excursion. The suprahyoid muscles (geniohyoid, mylohyoid, stylohyoid, hyoglossus and the anterior belly of the digastric) contract causing the hyoid bone to be pulled both anteriorly and superiorly. This movement, paired with contraction of the thyrohyoid, an infrahyoid muscle which is the main connection between the hyoid bone and the larynx, pulls the laryngeal complex in a superior and anterior direction. As the UES is connected to the laryngeal complex via CP muscle attachment to the cricoid cartilage, the anterior portion of the UES is pulled open. The UES assumes an oval cross section and is raised 2 to 2.5 cm in an oral direction. In the third distension phase, pressure applied by the weight and volume of the onrushing bolus distends the lumen of the UES. This distension collapses in the fourth phase as the bolus passes through the sphincter. Finally, in the fifth phase the UES closes as the cricopharyngeus actively contracts [5].

UES dysfunction during swallowing has been reported in numerous acute and progressive neurological conditions including, but not limited to, brainstem stroke, motor neuron disease, Parkinson's disease, myasthenia gravis and inclusion body myositis.

Case report

A 53-year old white female was admitted to the hospital for removal of 2 metastatic brain tumors, secondary to breast cancer. Her breast cancer had been successfully treated around one year prior to this episode and her full-body scan was clear. The metastatic lesions were located at the right cerebellum and were 21 × 10 mm and 11 × 8 mm in size.

The operation lasted about 9 hours and the lesions were successfully removed with minimal invasion to the adjacent tissues. Despite the successful operation, the only notable and extremely uncomfortable postoperative complication was the total sensory and motor shutdown of her swallowing function. It took an extensive interdisciplinary approach and considerable resources (including Botox injection) to manage her dysphagia and bring her back to normal function.

Discussion

The prevalence of UES dysfunction in people with neurological dysphagia varies in the literature as rates depend on the definitions of UES used, the heterogeneity in neurological populations studied and the evaluation methods employed. Videofluoroscopy, fiberoptic endoscopic evaluation of swallowing (FEES), manometry and EMG are the most commonly employed instrumental evaluations to evaluate UES function for swallowing. The causes of impaired UES opening vary across neurological conditions and can result from disordered neurally-mediated CP muscle relaxation, suboptimal anterior and superior hyolaryngeal excursion, weak bolus propulsion, cricopharyngeal fibrosis or a combination of these factors [5].

Dysphagia frequently results, characterized by the prevention of material passing safely and efficiently from the pharynx into the esophagus during swallowing. Solid food can pose particular problems and can lead to choking and multiple swallowing. This typically leads to aspiration (passage of material into the trachea beyond the level of the true vocal cords), post-swallow and pharyngeal retention of material. Clinical complications include aspiration pneumonia, weight loss, dehydration, malnutrition, the need for tube feeding and increased mortality. Quality of life is also frequently affected [5].

Management of impaired UES opening during swallowing varies across individuals and intervention can be pharmacological, compensatory, rehabilitative, or surgical in nature. Frequently it involves a combination of these methods. Compensation includes the use of postural strategies (for example head turn, chin tuck) and voluntary manoeuvres (for example effortful swallow), which are employed clinically to improve and prolong UES opening hence minimizing aspiration and facilitating bolus clearance during swallowing. Rehabilitation programs designed to target impaired UES opening during swallowing include jaw exercises, the Shaker 'head lifting' exercises and the Mendelsohn maneuver. The Shaker exercises are isokinetic and isometric head lifting maneuvers designed to strengthen the suprahyoid muscles (that is the mylohyoid, geniohyoid, stylohyoid and anterior belly of digastric) and infrahyoid muscles (that is the thyrohyoid), which pull open the UES during swallowing. The Mendelsohn maneuver involves purposeful prolongation of the antero-superior displacement of the larynx at mid-swallow. In cases where patients have demonstrated little or no benefit from a trial period of rehabilitation, among other factors, they may be considered for surgical or pharmaceutical interventions to optimize UES opening. Surgical approaches employed to treat UES dysfunction comprise cricopharyngeal myotomy and upper oesophageal dilatation. Pharmacological treatment consists of botulinum toxin injections into the CP muscle to improve UES opening during swallowing [5,6].

Conclusions

Swallowing disorders are multifactorial and their occurrence after surgical removal of metastatic tumors in the cerebellum could be related to:

1. Possible surgical manipulation of the brain stem, particularly the Medulla Oblangata, which contains the swallowing centers,
2. Inflammation of the tissues around the surgical site, affecting the brain stem,
3. Possible endotracheal intubation during the general anesthesia (which was ruled out in the presented case),
4. Other patient-related factors which can be physiological or psychological in nature.

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