Geriatric Dysphonia: Etiological Analysis in a Rural Hospital in India

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Abstract To establish the prevalence of etiological factors for dysphonia in elderly individuals in rural India. Hundred adults aged ≥ 65 years, who presented with dysphonia for ≥ 4 weeks and underwent detailed clinical evaluation including videolaryngoscopic assessment and other appropriate investigations/evaluation, were included in a retrospective cohort clinical study. Patients were classified into eight groups for further descriptive statistical analysis based on standard diagnostic criteria/guidelines i.e. benign vocal cord lesions, inflammatory disorders of the larynx, laryngeal and hypopharyngeal neoplasms, isolated vocal cord palsy/paresis, presbylaryngis, central neurological disorders affecting laryngeal function, impaired pulmonary function and non specific dysphonia. Mean age was 70.73 ± 4.29 years. 58% were aged between 65 and 69 years. Overall, the common causes for dysphonia were laryngopharyngeal reflux disease (23%), carcinoma larynx (12%) and presbylaryngis (8%). Inflammatory disorders of the larynx, benign vocal cord lesions and laryngeal/hypopharyngeal malignancies were the commonest causes for dysphonia in individuals aged between 65 and 74 years. Presbylaryngis and systemic causes were the commonest among individuals aged 75–89 years. 63 males and 37 females met the inclusion criteria. The most common cause for dysphonia among females was laryngopharyngeal reflux disease (17%), followed by vocal palsy (5%) and spasmodic dysphonia (4%). Carcinoma larynx (12%) was the most common cause for dysphonia among males, followed by laryngopharyngeal reflux (6%) and

presbylaryngis (6%). Geriatric dysphonia is an often overlooked symptom of greater underlying disease as evidenced in this study. With its impact on the quality of life in this age group and life expectancy in the rural population, dysphonia requires early detection, prompt evaluation and appropriate management.

Keywords Aged · Dysphonia · Geriatrics · Hoarseness · Voice disorders/etiology

Introduction

India is in a phase of demographic transition [1]. For the first time in history, the elderly have become the fastest growing segment of the population. By 2050, it is estimated that India's elderly population will be 323 million, a number that will be more than the entire population of the United States [2]. India has thus acquired the label of “an ageing nation” with 7.7% of its population being more than 60 years old [1]. 75% of the Indian elderly reside in rural settings [2]. The “2030 problem” refers to the challenge of ensuring that sufficient resources and an effective service delivery system are available when the elderly population is almost twice what it is today [3].

Voice disorders are defined as any time the voice does not work, perform, or sound as it normally should, or interferes with communication [4]. Hoarseness has always been a disturbing symptom for individuals. It may have a variety of organic, functional, or psychological causes [5]. Voice disorders in the general elderly population, have prevalence estimates ranging from 4.8 to 29% [3, 6]. Communication in the presence of a hoarse voice is particularly difficult in advanced age because many accompanying peers are likely to have hearing losses.

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Consequently, hoarseness may result in depression or social isolation in elderly persons [5].

The public health impact of vocal dysfunction is becoming increasingly recognized [7]. Annual direct healthcare costs related to dysphonia increase with age, with seniors incurring the highest per person cost [3]. Significant parts of the elderly population with vocal disorders either do not seek or delay seeking treatment due to underestimation and the assumption that it is a part of the natural aging process, in addition to lack of awareness about treatment possibilities [6].

The etiology of age related voice decline is unclear [8]. Literature shows that dysphonia develops due to disease processes associated with aging rather than due to physiologic aging alone [5]. Normally, voice production depends on properly functioning respiratory, cardiovascular, musculoskeletal, neurological, and psychosocial systems [9]. Since one or more of these systems are often compromised with increasing age, changes in voice characteristics may occur [5]. There are four main causes of voice disorders in the elderly, i.e. voice changes secondary to systemic disease, presbyphonia, laryngeal pathology and vocal misuse; although dysphonia is multifactorial in many cases [10].

Review of literature has shown only studies on voice related problems in Western elderly populations [6]. This study was therefore undertaken with the aim of establishing the prevalence of etiological factors for dysphonia in elderly individuals seeking treatment in rural India.

Materials and Methods

With the approval of the Institute ethics committee and in accordance with ethical standards, data of 100 adults of both sexes aged 65 years and above, who presented to the outpatient section or were referred to the Department of Otorhinolaryngology in our rurally located hospital in Karnataka, India from May 2017 to April 2018 with alteration in voice for more than 4 weeks and having undergone detailed clinical evaluation including videolaryngoscopic assessment and all appropriate investigations/evaluation for the confirmation of its diagnosis, were included in a retrospective cohort clinical study. Excluded from the study were those with an acute infective episode, previous history of voice disorder or incomplete diagnostic workup.

With the aim of establishing the prevalence of specific causes for dysphonia in this cohort, patients were classified into eight pathogenic profiles based on standard diagnostic criteria/guidelines for further descriptive statistical analysis: (1) Benign vocal cord lesions, (2) Inflammatory disorders of the larynx, (3) Laryngeal and hypopharyngeal

neoplasms, (4) Vocal cord palsy/paresis (other than laryngeal and hypopharyngeal neoplasms), (5) Presbylaryngis, (6) Central neurological disorders affecting laryngeal function, (7) Impaired pulmonary function and (8) Non specific dysphonia.

Benign and malignant lesions were confirmed following histopathological examination of tissue excised during microlaryngeal surgery or direct laryngoscopy and biopsy respectively. Those with suspected malignant neoplasm detected on videolaryngoscopy, underwent appropriate contrast enhanced computerised tomography (CT) scan prior to biopsy. Among those with laryngeal inflammation, a specific diagnosis of laryngopharyngeal reflux disease (LPRD) was made based on a Reflux Finding Score (RFS) > 7. The etiology for vocal cord palsy/paresis (on videolaryngoscopic examination) was determined based on history (e.g. thyroidectomy, endotracheal intubation) and relevant radiological investigation (CT of the neck and thorax for the detection of neoplasm). Patients with a clinical/radiological diagnosis of central neurological disorders {e.g. cerebrovascular accident (CVA), Parkinson's disease etc.} or impaired pulmonary function documented on pulmonary function testing {e.g. chronic obstructive pulmonary disease (COPD)} as confirmed by their treating Physician, were referred to our Department to exclude the presence of localised laryngeal pathology causing their change of voice. Presbylaryngis was diagnosed based on its characteristic videolaryngoscopic findings. Those with no identifiable pathology/etiology were categorised under non specific dysphonia.

Results

The mean age of the study patients was 70.73 ± 4.29 years and ranged from 65 to 88 years. Age distribution of the study patients was as follows: 58% were aged between 65 and 69 years, 17% between 70 and 74 years, 14% between 75 and 79 years, 5% between 80 and 84 years and 6% between 85 and 89 years of age.

Subjects suffered from dysphonia for a duration ranging from 5 to 52 weeks, with a mean of 9.7 ± 2.51 weeks. 67% were symptomatic for 5–20 weeks, 24% for 21–36 weeks and 9% for 37–52 weeks. Current or former smokers accounted for 57% of the study group; all were males.

The most common causes for hoarseness of voice were LPRD (23%), followed by carcinoma larynx (12%) and presbylaryngis (8%) (Fig. 1). Benign vocal cord lesions were identified in 13% of cases which included vocal nodules (6%), vocal polyps (2%), leukoplakia (2%) and Reinke's oedema (3%). Chronic laryngitis (excluding LPRD and other etiologies classified in the study) accounted for 4% of

Fig. 1 Frequency of etiological factors in geriatric dysphonia

cases. 10% of cases had vocal cord palsy (excluding laryngeal/hypopharyngeal malignancies). Of the various central neurological disorders affecting laryngeal function (16%), spasmodic dysphonia was diagnosed in 5%, while 6% had residual weakness and sequelae following a CVA, 3% had essential tremors and 2% suffered from Parkinson's disease. Impaired pulmonary function/respiratory deficit as seen in COPD, was the only identifiable etiology in 5% of our cases, all of whom were smokers. Having excluded all identifiable local and systemic causes for dysphonia, a diagnosis of non specific dysphonia was seen in 4% of our study group (Table 1).

Analysis of age distribution of disease identified inflammatory disorders of the larynx (majority being LPRD), benign vocal cord lesions and laryngeal/hypopharyngeal malignancies as the commonest causes for dysphonia in individuals aged between 65 and 74 years. With progressing age, presbylaryngis and systemic causes (central neurological disorders affecting laryngeal function and impaired pulmonary function) showed an increase in incidence among individuals aged 75–89 years (Fig. 2).

The study included 63 males and 37 females, with a male:female ratio of 1.7:1. The most common cause for dysphonia among females was LPRD (17%), followed by vocal palsy in 5%, spasmodic dysphonia in 4%, CVA in 3%, essential tremors in 3%, presbylaryngis in 2% and vocal nodules, Reinke's oedema, chronic laryngitis and hypopharyngeal malignancy each constituting 1% of cases. Carcinoma larynx (12%) was the most common cause for dysphonia among males, followed by LPRD in 6%, presbylaryngis in 6%, vocal nodules in 5%, vocal palsy in 5%, COPD in 5%, hypopharyngeal carcinoma in 4%,

nonspecific dysphonia in 4%, chronic laryngitis in 3%, spasmodic dysphonia in 1% and vocal polyps, Reinke's oedema, leukoplakia and Parkinson's disease each constituting 2% of cases (Fig. 3).

Discussion

Hoarseness is a common symptom in older individuals and may reflect a wide variety of pathologic, medical, physiologic and/or functional causes [11]. During the aging process, the voice goes through perceptual and acoustic transformations that can affect the communication process. Vocal symptoms in elderly individuals include hoarseness, breathiness, vocal fatigue, strain, instability, decreased loudness and changes in vocal pitch. These symptoms could be correlated with the anatomic and physiologic changes that occur in the larynx with aging, such as calcification and ossification of cartilages, muscle atrophy, fragile bloody supply and histological impairments of vocal folds [6].

Older adults may also be at increased risk for voice disorders because of possible alteration of voice use patterns, the presence of vocal fold lesions (e.g. carcinoma, Reinke's oedema and paralysis), development of systemic diseases known to be associated with alterations in laryngeal function and voice production (e.g. stroke, respiratory disease and arthritis), and degenerative changes in the structure and function of the vocal fold mucosa, musculature, and peripheral nerve supply [4].

With the elderly population growing rapidly worldwide, disorders involving the quality of communication in this

Table 1 Prevalence of etiological factors in geriatric dysphonia

Etiology for dysponia ↓	Age range →	65–69 years	70–74 years	75–79 years	80–84 years	85–89 years	Total number (%)
Benign vocal cord lesions	Vocal Nodules	6	–	–	–	–	6
	Vocal polyp	2	–	–	–	–	2
	Leukoplakia	–	–	2	–	–	2
	Reinke's oedema	2	–	1	–	–	3
Inflammatory disorders of the larynx	Laryngopharyngeal reflux disease	16	3	3	1	–	23
	Miscellaneous chronic laryngitis	3	1	–	–	–	4
Laryngeal and hypopharyngeal neoplasms	Carcinoma larynx	7	3	1	1	–	12
	Carcinoma hypopharynx	3	–	1	–	1	5
Vocal cord palsy/pareisis (other than laryngeal/hypopharyngeal neoplasms)	Right	3 (thyroid carcinoma—1, total thyroidectomy—1, idiopathic—1)	1 (post intubation)	–	–	–	4
	Left	5 (thymoma—1, bronchogenic carcinoma—2, total thyroidectomy—2,	1 (oesophageal carcinoma)	–	–	–	6
Presbylaryngis		5	2	–	–	1	8
Central neurological disorders affecting laryngeal function	Spasmodic dysphonia	2	2	1	–	–	5
	Cerebrovascular accident	1	1	–	1	3	6
	Essential tremor	1	–	1	1	–	3
	Parkinson's disease	–	–	1	–	1	2
Impaired pulmonary function	Chronic obstructive pulmonary disease	1	–	3	1	–	5
Non specific dysphonia		1	3	–	–	–	4
Total number (%)		58	17	14	5	6	100

population, including voice-related issues, are becoming more common [6]. According to the United Nations Development Programme report of 2011, life expectancy at birth was more than 65 years in four states in India i.e. Kerala, Karnataka (our study location), Maharashtra and Tamil Nadu. The latest report (2016) by the Social Statistics division of the Government of India, pegs the life expectancy at birth today at 69.3 years for females and 65.8 years for males [2]. The mean age of our study group was 70.73 years, which was comparable with other study populations [3, 12]. Symptoms in Ciyiltepe's geriatric study population ranged from 2 months to 1 year as seen in our study [13]. Analysis of age distribution of patients with voice changes in studies by Roy et al. and Ciyiltepe et al. showed a maximum prevalence of cases aged 65–74 years

and 60–69 years respectively, followed by a steep decline thereafter, as seen in our study [3, 13].

India is one of the few countries in the world in which the sex ratio of the aged favours males, with only 48.2% of elderly persons being women [1]. Our study included 63% males and 37% females, closely paralleling national statistics. However, most studies reviewed show a female predominance of voice disorders in this age group [3, 12]. Cohen et al. and Ciyiltepe et al. demonstrated a higher prevalence of dysphonia in males aged above 70 years [7, 13]. In males, thinning of vocal folds due to atrophic changes (elastic and collagen fibers) predominates, contributing to an overall increase in vocal pitch. However, in females, concomitant post menopause decrease in sex hormones causes increase in the vibratory mass by

Fig. 2 Age distribution of etiological factors in geriatric dysphonia

Fig. 3 Gender distribution of etiological factors in geriatric dysphonia

edematous thickening of the vocal cord cover, thereby decreasing vocal pitch. This however, is more acceptable than the high pitch in males [5, 14]. These factors explain the higher proportion of males in our study group.

The commonest etiological factor identified in our study was LPRD (23%). This concurred with a study by Gregory et al. in which LPRD (91%) was identified as the commonest cause for voice disorders in the elderly [15]. Research into early detection and diagnosis of LPRD with a simple, economical and non invasive instrument led Belfasky et al. to develop the RFS an 8-item, validated, reliable, easily administered clinical severity scale used to interpret the most common laryngoscopic findings related to LPRD. As subtle findings of LPRD are present in most individuals, RFS > 7 indicates that the patient has LPRD with 95% certainty [16, 17], and is thus a part of the

standard diagnostic protocol for patients with dysphonia in our Department. Twenty-four-hour ambulatory dual-probe pH monitoring is currently the gold standard for the objective diagnosis of LPRD [16]. Multichannel intraluminal impedance measurement has been added to pH monitoring (MII-pH) and may improve diagnostic accuracy. Both techniques are invasive, expensive, and are poorly tolerated by some patients [18]. None of these tests were considered appropriate for routine clinical practice [16], and were not performed in our rural hospital.

Malignancies of the larynx and hypopharynx were the second most common cause for dysphonia in our study (17%), and concurred with certain other studies [3]. Several studies documented laryngeal carcinoma as the commonest malignancy causing hoarseness, followed by hypopharyngeal carcinoma, as seen in our study with 12%

and 6% rates respectively [5]. As seen in our study, there is a slightly decreasing odds of a laryngeal cancer diagnosis with advancing age and a strong negative association between laryngeal cancer and women [3, 7]. Roy et al. reported that laryngeal cancer accounted for 5.8% of all diagnoses among men, but only 1.2% among women [3]. In our study, laryngeal carcinoma was seen exclusively in males, while hypopharyngeal carcinoma was seen in 5 males and 1 female.

Kandogan et al. and Ciyiltepe et al. reported that hoarseness was caused most commonly by benign vocal fold lesions (28.6% and 29.3% respectively) [5, 13]. This accounted for only 13% of our cases, decreased with advancing age and included vocal nodules (6%), vocal polyps (2%), leukoplakia (2%) and Reinke's oedema (3%). This concurred with Roy et al. whose study reported that benign vocal fold lesions consistently decreased across the age span. This can be explained by minimal phonotrauma in the geriatric population due to a decrease in frequency, duration and intensity of social, vocational and avocational voice use with advanced age. Alternatively, atrophic changes of the lamina propria and/or intrinsic laryngeal muscles, or reduced neural drive to produce loud voice, may contribute to mild glottic insufficiency, thereby preventing strong medial vocal fold compression/collision forces necessary for phonotrauma. This glottic insufficiency would potentially prevent cycles of tissue injury and repair necessary for most midmembranous benign lesions [3].

Several studies have demonstrated vocal cord palsy as a common cause for geriatric dysphonia, with a male predominance and a generally increasing incidence with advancing age [3, 5, 10]. Our study however, identified vocal cord palsy in 10%, with an equal male:female ratio, with decreasing prevalence as age increased. The most common cause was total thyroidectomy (3%) in females, followed by bronchogenic carcinoma (2%) in males, which concurred with other studies in view of the surgical anatomy of the recurrent laryngeal nerves and its neighbouring structures [5, 13].

Presbylaryngis is characterised by vocal fold bowing, prominence of vocal processes and spindle shaped glottic chink [19]. Thinning of the superficial lamina propria of the vocal fold interferes with its vibratory properties, and atrophy of the thyroarytenoid muscle, can lead to vocal fold bowing and incomplete glottal closure [12]. Its prevalence of 8% in our study, concurred with its prevalence in a study by Gregory et al. [15]. It remains a source of controversy, and estimates vary substantially ranging from 0 to 30%. Certain investigators have concluded that presbylaryngis is not common, and dysphonia among the elderly is more often secondary to disease processes (i.e. comorbid diseases), rather than aging alone, as seen in our study as well [3].

Vocal folds vibrate with expiration creating sound which is modified by the remaining vocal tract. Voice production is a multisystem process that depends upon vibratory and acoustic properties of the vocal tract, neuromuscular co-ordination and respiratory control. A multitude of systemic diseases, often more prevalent in the elderly, have manifestations affecting the voice [10]. According to the Government of India statistics, cardiovascular disorders account for one-third of elderly mortality, respiratory disorders account for 10%, infections including tuberculosis account for another 10%, neoplasms account for 6% and other miscellaneous causes constitute less than 8% of elderly mortality [1]. Respiratory disease affects expiratory volumes and breathing co-ordination necessary for voice production [10]. 5% of cases in our study were diagnosed with COPD as the cause for dysphonia.

Central neurological disorders such as Parkinson's disease and stroke, can result in dysphonia through its effect on laryngeal function. They have shown a higher frequency among women and with increasing age, as seen in our study [3]. In Parkinson's disease, patients often have a weak breathy monotone, delayed voice onset, and an increase in pitch and roughness. Due to the complex interrelationship between phonation, voice/speech and language, stroke can result in complex disorders of communication [10]. Lundy et al. observed a high frequency of cases with dysphonia due to voice tremor and spasmodic dysphonia [11]. In our study, central neurological disorders causing voice alteration accounted for 16% of cases; they were spasmodic dysphonia (5%), CVA (6%), essential tremors (3%) and Parkinson's disease (2%).

Chronic laryngitis and non specific dysphonia showed a high prevalence rate in certain studies, as seen more commonly among women, with a linear increase with advancing age. Both these etiologies were equally prevalent in our study (4% each) and concurred with the age and gender distribution of these factors in literature. A diagnosis of non specific dysphonia is compatible with no obvious structural/inflammatory or vocal fold mobility issues appreciated during laryngoscopy. Considerable ambiguity surrounds this particular diagnostic category. It could include presbylaryngis, undetected/subtle vocal fold mobility issues (e.g. vocal fold paresis), primary or secondary muscle tension dysphonia, scar, or occult neurological disease (e.g. Parkinson's disease) [3]. The high incidence of medical illnesses in the elderly may further affect the underlying vocal disturbance, or be causative itself [11]. The addition of stroboscopy to videolaryngoscopy is useful in accurately identifying laryngeal pathology, but there have also been recognized subjective difficulties in interpretation of stroboscopic images. A composite assessment of acoustic, aerodynamic,

electroglottographic and videostroboscopic phonatory features should be added for diagnostic accuracy of different vocal pathologies [20]. The absence of these additional tools in our rural setup is a limitation, although videolaryngoscopy remains a useful screening method in the diagnosis of etiology for dysphonia.

Conclusion

Age-related dysphonia is becoming a common complaint worldwide. With the predicted growth of the elderly population and the implications for healthcare utilization and costs, our study enumerated and analysed the etiological factors in the development of voice disorders in this relatively poorly studied section of the community in rural India. Our study reaffirms the fact that geriatric patients suffer from dysphonia due to disease process associated with aging, rather than physiologic aging alone, necessitating the need for positive steps towards preventive measures, early and accurate diagnosis of disease and the initiation of appropriate treatment. The following are our recommendations: (1) Population based studies to improve understanding of the frequency, causes and factors associated with voice disorders in the elderly on a national scale is essential. (2) The clinical protocol for the evaluation of age-related dysphonia should include complete systemic and laryngeal function assessment as identification of a pathogenic profile would allow for specific treatment of each contributing factor, thereby improving the management of the pathology. (3) Elderly care has to become multi-disciplinary with strong preventive, palliative and rehabilitative elements factored into it. (4) There is a need to highlight the medical and socio-economic problems that are being faced by elderly people in India, and strategies for bringing about an improvement in health care delivery and their quality of life need to be explored. (5) Education of the general public and health professionals about the symptoms that indicate the possible presence of voice disorders and stimulating more active participation from primary healthcare professionals in the early identification and management of vocal disorders, would help to reduce the number of elderly people who are not receiving adequate attention and minimize the possible social and individual consequences of this condition.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of

the institutional research committee and with the 1964 Helsinki declaration and its later amendments and comparable ethical standards.

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