ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 05 | May - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CLINICOPATHOLOGICAL ANALYSIS OF UNILATERAL VOCAL CORD PARALYSIS: A CROSS-SECTIONAL STUDY

Otorhinolaryngology

Dr. Raj Narayan Samanta	Jr 3 Department Of Otorhinolaryngology
Dr. Satguru Saran Singh	Assistant Professor Department Of Otorhinolaryngology
Dr. Helena Babu	Assistant Professor, Department Of Otorhinolaryngology
Dr. Shradha Chandra	Assistant Professor, Department Of Otorhinolaryngology
Dr. Hari Gupta	Professor, Department Of Otorhinolaryngology

ABSTRACT

Background And Aims: Unilateral vocal cord paralysis (UVCP) is a debilitating condition caused by recurrent laryngeal nerve dysfunction, affecting speech, swallowing, and breathing. Despite its prevalence, UVCP often remains underdiagnosed, prolonging patient morbidity. This study aimed to evaluate the clinical, pathological, and demographic characteristics of UVCP to improve diagnostic accuracy, refine treatment strategies, and enhance patient outcomes. **Methods:** A cross-sectional study was conducted at the Otorhinolaryngology Department of Rohilkhand Medical College, Bareilly, Uttar Pradesh, from August 2023 to July 2024. Fifty patients aged ≥18 years, diagnosed with UVCP, were included. Ethical approval and informed consent were obtained. Data collection involved detailed clinical evaluation, laryngeal endoscopy, and investigations like FNAC, imaging (CT, MRI), and biopsies. Statistical analysis was performed using SPSS version 23.0, with $p < 0.05$ considered significant. **Results:** The study revealed a male predominance (84%), with most patients aged 21–50 years (50%) and from rural areas (66%). Significant symptoms included voice changes (100%), dysphagia (26%), and breathing difficulties (20%). MRI (90%) and CT scans (78%) were highly diagnostic. Thyroidectomy (16%) was the most common surgical cause, while malignancies (56%) were the leading etiology. Statistically significant associations were observed for gender, rural residence, and comorbidities like malignancy (32%) and tuberculosis (34%). **Conclusion:** UVCP predominantly affects males from rural areas, with malignancies and post-surgical complications as leading causes. Advanced imaging and FNAC are critical for diagnosis. Early detection and multidisciplinary care are essential for better patient outcomes.

KEYWORDS

Unilateral Vocal Cord Paralysis, Recurrent Laryngeal Nerve, FNAC, MRI, Thyroidectomy

INTRODUCTION

Unilateral vocal cord paralysis (UVCP) is a disorder resulting from dysfunction of the recurrent laryngeal nerve (RLN), leading to impaired mobility of one vocal fold. This condition significantly affects essential functions such as speech, swallowing, and respiration, causing symptoms like dysphonia, dysphagia, aspiration, and dyspnea (1-4). Studies indicate that UVCP accounts for approximately 80% of all vocal cord paralysis cases, with a majority caused by surgical interventions (47%–56%) or idiopathic origins (12%–37%) (5-7). The most frequently implicated procedures include thyroid and parathyroid surgeries, cardiothoracic interventions, anterior cervical spine surgeries, and neurological procedures (5-7).

The etiology of UVCP has evolved over time. A North American study reported that between 1985 and 1995, malignancies were the leading cause, whereas from 1996 to 2005, surgical injuries became more frequent, particularly from non-thyroid-related surgeries (8). Similarly, data from Italy revealed that thyroid surgeries accounted for nearly 50% of UVCP cases, followed by idiopathic cases and thoracic surgeries (8). Malignancies affecting the lungs, larynx, thyroid, and central nervous system also play a crucial role in UVCP pathogenesis (1,8,9-11).

Despite its high prevalence, UVCP remains underdiagnosed, with an average diagnostic delay of 6 months to 2 years, prolonging patient morbidity (1-4). Available treatments, including voice therapy, laryngeal framework surgery, injection laryngoplasty, and reinnervation techniques, provide symptomatic relief but often fail to restore pre-paralysis function (12). Additionally, limited research on the clinicopathological correlation of UVCP restricts comprehensive disease understanding and hinders targeted management strategies.

Given the rising incidence of surgical procedures linked to UVCP, this study aimed to analyze its clinical, pathological, and demographic aspects to enhance diagnosis, refine treatments, and improve patient outcomes amid rising surgical cases.

MATERIAL AND METHODS

This cross-sectional study was conducted in the Otorhinolaryngology Department of Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, over one year (August 1, 2023 – July 31, 2024). The study included all patients with vocal cord palsy who presented to the outpatient department (OPD) during the study period.

Inclusion Criteria:

- Patients clinically diagnosed with vocal cord palsy with noticeable voice changes.
- Individuals aged 18 years and above.
- Patients willing to provide written informed consent.

Exclusion Criteria:

- Patients refusing consent due to lack of understanding of study terms.
- Children below 18 years.
- Patients currently recovering from thyroplasty.

The sample size was calculated using the formula for cross-sectional studies:

$$n = (Z1 - alpha/2)^2 P(1-P)/d^2$$

where Z = 1.96 (~2) (at 5% type 1 error), P = 97% (anticipated proportion of dysphonia cases), q = 100 - P, and L = 5% (absolute error) (8).

The required sample size was 50 patients, selected using simple random sampling.

Data Collection And Investigations

All participants underwent a detailed history and ENT examination, including laryngeal endoscopy for vocal cord assessment. Depending on suspected pathology, additional investigations were conducted, such as:

- Fine Needle Aspiration Cytology (FNAC)
- Sputum AFB (for tuberculosis screening)
- Biopsy
- **Imaging:** Computed Tomography (CT) and Magnetic Resonance Imaging (MRI)
- Barium Swallow and Upper GI Endoscopy (for esophageal pathology)

Ethical Considerations
Prior to the study, Institutional Ethics Committee approval was obtained. Patients were fully informed, and written consent was acquired before participation.

Statistical Analysis
Data was entered in Microsoft Excel and analyzed using SPSS version 23.0. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used. Appropriate statistical tests were applied, and a p-value <0.05 was considered statistically significant.

RESULTS
Table 1 shows the age, gender, residence, symptoms, and comorbidities of the study participants. The majority were aged 21-50 years (50%), male (84%), and from rural areas (66%). All patients experienced voice changes (100%), while 46% reported pain while swallowing, and 20% had breathing difficulties. Among comorbidities, previous diabetes (52%), radiation therapy (48%), and tuberculosis (34%) were the most common. Statistically significant associations ($p < 0.05$) were noted for gender, residence, difficulty in swallowing, breathing difficulty, previous malignancy, chemotherapy, and tuberculosis, highlighting their relevance in vocal cord palsy cases.

Table 1: Demographic, Clinical, And Comorbid Characteristics Of Study Participants

Parameter		Frequency (N)	Percentage (%)	P-value
Age Group (Years)	21-50 years	25	50.0%	0.116
	51-80 years	24	48.0%	-
	>80 years	1	2.0%	-
Gender	Male	42	84.0%	<0.001
	Female	8	16.0%	-
Residence	Rural	33	66.0%	0.024
	Urban	17	34.0%	-
Symptoms	Change in Voice	50	100.0%	-
	Pain while Swallowing	23	46.0%	0.572
	Difficulty in Swallowing	13	26.0%	<0.001
	Choking on Liquids	23	46.0%	0.572
	Breathing Difficulty	10	20.0%	<0.001
Comorbidities	Previous Radiation Therapy	24	48.0%	0.777
	Previous Malignancy	16	32.0%	0.011
	Previous Chemotherapy	13	26.0%	<0.001
	Previous Tuberculosis (TB)	17	34.0%	0.024
	Previous Diabetes (DM)	26	52.0%	0.777
	Previous Bronchial Asthma	19	38.0%	0.090

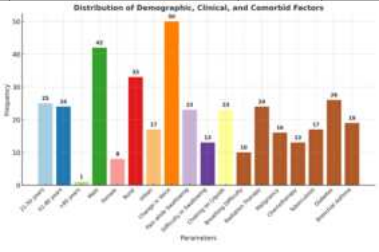


Table 2 shows the personal history, general physical examination, and clinical symptoms of the study participants. Smoking (56%), alcohol use (52%), and lymphadenopathy (62%) were prevalent, while significant clinical findings included dysphagia (22%), tumor/mass lesions (20%), and fibrosis (10%), with notable statistical associations ($p < 0.05$) for several conditions.

Table 2: Distribution of Personal History, Clinical Symptoms, and General Physical Examination Findings

Parameter		Present (N, %)	Absent (N, %)	P-value
Personal History	Smoking	28 (56%)	22 (44%)	0.396
	Gutka/Betel Chewing	23 (46%)	27 (54%)	0.572
	Alcohol	26 (52%)	24 (48%)	0.777
General Physical Examination	Pallor	25 (50%)	25 (50%)	1.000
	Icterus	22 (44%)	28 (56%)	0.396
	Clubbing	27 (54%)	23 (46%)	0.572
	Cyanosis	23 (46%)	27 (54%)	0.572
	Lymphadenopathy	31 (62%)	19 (38%)	0.090
	Edema	25 (50%)	25 (50%)	1.000
Clinical Symptoms	Dysphagia	11 (22%)	39 (78%)	<0.001
	Weak Cough	22 (44%)	28 (56%)	0.396
	Stridor	1 (2%)	49 (98%)	<0.001
	Fatigue/Shortness of Breath	19 (38%)	31 (62%)	0.090
	Tumor/Mass Lesions	10 (20%)	40 (80%)	<0.001
	Granulomas/Scar Tissue	7 (14%)	43 (86%)	<0.001
	Fibrosis	5 (10%)	45 (90%)	<0.001

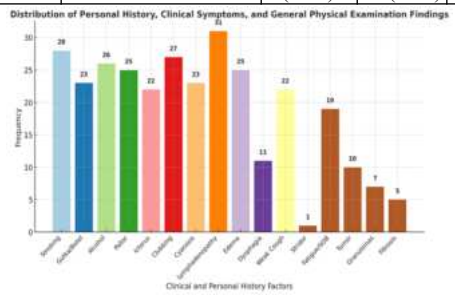


Table 3 shows the ENT examination findings and diagnostic test results of the study participants. Neck abnormalities (36%), true vocal cord abnormalities (60%), and arytenoid abnormalities (32%) were notable ENT findings. Diagnostic imaging revealed abnormal CT scans (78%), MRI findings (90%), and chest X-ray abnormalities (30%), with significant statistical associations ($p < 0.05$) for neck examination, arytenoids, nasal cavity, CT scan, and MRI findings, indicating their importance in diagnosing vocal cord paralysis.

Table 3: Distribution of ENT Examination Findings and Diagnostic Test Results

Parameter		Normal (N, %)	Abnormal (N, %)	P-value
ENT Examination	Oral Cavity	27 (54%)	23 (46%)	0.572
	Oropharynx	22 (44%)	28 (56%)	0.396
	Neck Examination	32 (64%)	18 (36%)	0.048
Laryngeal and Pharyngeal Examination	Laryngeal Examination	28 (56%)	22 (44%)	0.396
	Base of Tongue	32 (64%)	18 (36%)	0.048
	Vallecula	27 (54%)	23 (46%)	0.572
	Epiglottis	21 (42%)	29 (58%)	0.258
	A-E Fold	24 (48%)	26 (52%)	0.777
	Arytenoids	34 (68%)	16 (32%)	0.011
	Interarytenoid Area	25 (50%)	25 (50%)	1.000
	False Cord	30 (60%)	20 (40%)	0.157
	True Vocal Cords	20 (40%)	30 (60%)	0.157
	Pyriform Fossa	21 (42%)	29 (58%)	0.258
	Lateral Pharyngeal Wall	23 (46%)	27 (54%)	0.572
	Ear	32 (64%)	18 (36%)	0.048
	Nose	35 (70%)	15 (30%)	0.005
Diagnostic Tests	Chest X-Ray	35 (70%)	15 (30%)	0.005
	CT Scan	11 (22%)	39 (78%)	<0.001
	MRI	5 (10%)	45 (90%)	<0.001
	Barium Swallow	22 (44%)	28 (56%)	0.396
	Biopsy	31 (62%)	19 (38%)	0.090

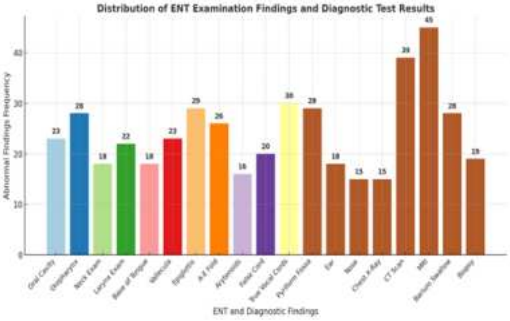
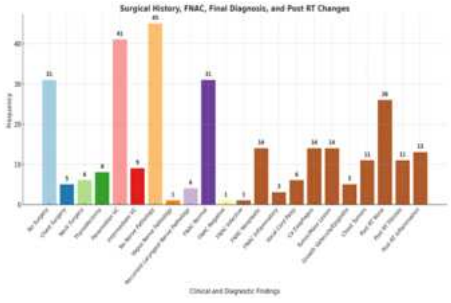


Table 4 shows the distribution of Past Surgeries, Vocal Cord Position, FNAC Findings, Final Diagnosis, and Post RT Changes. It shows no prior surgery in 62% of patients, with thyroidectomy being the most common surgery (16%). Most vocal cords were in the paramedian position (82%), and FNAC identified neoplastic cases in 28%. Common diagnoses included esophageal cancer (28%) and tumor/mass lesions (28%). Post-RT changes, such as fibrosis (22%) and inflammation (26%), were significant.

Table 4: Distribution of Past Surgeries, Vocal Cord Position, FNAC Findings, Final Diagnosis, and Post RT Changes

Parameter		Frequency	Percentage	P-value
Past Surgery	No Surgery	31	62.0%	<0.001
	Chest Surgery	5	10.0%	-
	Neck Surgery	6	12.0%	-
	Thyroidectomy	8	16.0%	-
Vocal Cord Position	Paramedian	41	82.0%	<0.001
	Intermediate	9	18.0%	-
Nerve Pathology	None	45	90.0%	<0.001
	Vagus Nerve	1	2.0%	-
	Recurrent Laryngeal Nerve	4	8.0%	-
FNAC Findings	Normal	31	62.0%	<0.001
	Negative	1	2.0%	-
	Infective	1	2.0%	-
	Neoplastic	14	28.0%	-
	Inflammatory	3	6.0%	-
Final Diagnosis	Vocal Cord Palsy	6	12.0%	0.116
	Ca Esophagus	14	28.0%	-
	Tumor/Mass Lesion	14	28.0%	-
	Growth Vallecula/Epiglottis	5	10.0%	-
	Chest Wall Tumors (Secondary to VCP)	11	22.0%	-
Post RT Changes	None	26	52.0%	0.019
	Fibrosis	11	22.0%	-
	Inflammation	13	26.0%	-



DISCUSSION

We analyzed 50 patients with unilateral vocal cord paralysis (UVCP) in our study, comparing findings with previous studies on demographics, clinical presentation, diagnostics, and etiology. Most patients in our study were aged 31–40 years (24%), while 61–70 years (20%) and 51–60 years (16%) followed. No significant association was found with age ($p = 0.116$). Toutounchi et al. (2014) (8) found a median age of 53 years, while Senniappan et al. (2019) (13) (61–70 years: 40.9%). We found a strong male predominance (84%, $p < 0.001$), aligning with Toutounchi et al. (2014) (8) (68.9% male) but contrasting with Senniappan et al. (2019) (13), where females predominated. In our study, employed individuals (28%) were most affected, followed by students (24%) and housewives (22%), but no occupational link was found ($p = 0.331$). Liu AY et al. (2001) (14) analyzed UVCP's economic burden but did not assess occupation. UVCP was significantly higher in rural residents (66%, $p = 0.024$), reflecting possible environmental or healthcare accessibility factors. Liu AY et al. (2001) (14) highlighted resource limitations in diagnosis, indirectly supporting this trend. Middle socioeconomic status (56%) had the highest prevalence ($p = 0.002$), suggesting healthcare access disparities, as also emphasized by Liu AY et al. (2001) (14).

We found that malignancy (32%, $p = 0.011$), chemotherapy (26%, $p < 0.001$), and tuberculosis (34%, $p = 0.024$) were significantly associated. Diabetes (52%) and asthma (38%) were not significant. M. Kikura et al. (2007) (15) found diabetes (29.2%) and hypertension (29.2%) to be risk factors, while Khtoum N et al. (2013) (16) reported radiation therapy in only 1.9%, much lower than our 48% prevalence. In our study, thyroidectomy (16%) was the most common surgery, but 62% had no past surgical history ($p < 0.001$). Khtoum N et al. (2013) (16) (thyroidectomy in 50.9%) had a much higher surgical association. Sahai et al. (2023) (17) (idiopathic: 16.67%, post-surgical: 20%) aligns with our findings, showing similar etiological patterns. We analyzed Paramedian vocal cord position (82%) was predominant, and 90% had no identifiable nerve pathology ($p < 0.001$). KP Singh et al. (2016) (18) (paramedian: 91.3%) and Ahmad et al. (2002) (19) (paramedian: 78.18%) closely support our results.

In our study, MRI (90%) and CT (78%) had the highest abnormality detection rates ($p < 0.001$), while chest X-ray (30%, $p = 0.005$) was less effective. Gupta et al. (2013) (20) (MRI: 85.71%) strongly aligns with our results, emphasizing MRI's diagnostic superiority. FNAC showed neoplastic pathology in 28% ($p < 0.001$), higher than Omokanye et al. (2015) (21) (7.3%), indicating a higher malignancy association in UVCP. In our study, Esophageal cancer (28%) and tumor/mass lesions (28%) were the most common causes, followed by chest wall tumors (22%). Pavithran et al. (2011) (22) (malignancy: 53.85%) closely aligns with our findings, reinforcing malignancy's role in UVCP. Post-RT fibrosis (22%) and inflammation (26%) were significant complications ($p = 0.019$), requiring post-treatment monitoring.

Our findings confirm male predominance, malignancy as a major etiology, and MRI as the most effective diagnostic tool. Differences from previous studies suggest regional and demographic variations, emphasizing early diagnosis and individualized management strategies for UVCP.

CONCLUSION

Unilateral vocal cord paralysis (UVCP) affects voice, swallowing, and breathing, often linked to malignancies, post-surgical complications, and neurological conditions. MRI and CT scans proved essential for diagnosis, while FNAC highlighted malignancy risks. Thyroidectomy was a key surgical cause, with paramedian vocal cord positioning most common. Post-radiotherapy complications emphasized the need for early intervention. A multidisciplinary approach is crucial for timely diagnosis, individualized treatment, and improved patient outcomes.

Strengths

This study provides a comprehensive clinicopathological analysis of UVCP, integrating clinical evaluation, imaging, and FNAC for accurate diagnosis. The inclusion of MRI, CT scans, and FNAC enhances reliability, while statistical validation strengthens findings. It highlights prevalence, risk factors, and healthcare disparities, offering valuable insights for early diagnosis and management.

Limitations

The small sample size (50 patients) limits generalizability, and the lack of long-term follow-up prevents assessment of treatment outcomes. Hospital-based data may introduce selection bias, while histopathological confirmation was not done for all cases. Future studies with larger populations and longitudinal follow-ups are needed for validation.

Conflict Of Interest: None.
Funding: None.
Ethical Approval: Obtained.
Consent: Written consent secured.

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