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Oromaxillofacial Complications in Stroke Patients: A Diagnostic Gap

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Abstract

Background: *India experiences a significant stroke burden, with incidence rates estimated between 116 and 163 cases per 100,000 individuals—surpassing many Western statistics. Currently, stroke ranks as the fourth most common cause of death and the fifth major contributor to disability nationwide. While nearly half of all stroke survivors experience oropharyngeal dysphagia, which can lead to life-threatening aspiration pneumonia if left untreated, a comprehensive national estimate of these complications in India has remained elusive.*

Methods: *Adhering to the PRISMA framework, a systematic search of contemporary literature on post-stroke swallowing disorders was performed across major academic databases. Two reviewers independently screened all retrieved records, and selected manuscripts were evaluated for methodological quality using the GRADE system. The review synthesized reported frequencies of dysphagia and pneumonia, calculated relative risks for pulmonary complications, and extracted secondary data concerning inpatient duration and mortality.*

Results: *From an initial pool of 86 citations, four studies met the criteria for inclusion and data extraction. The findings revealed a wide but high prevalence of dysphagia among Indian stroke patients, ranging from 11.1 percent to 87.5 percent. Pneumonia incidence was documented in only two studies, varying between 22.8 percent and 32 percent. Based on the pooled data, patients with dysphagia faced a relative risk (RR) of 5.82 (95 percent CI: 4.6, 7.2) for developing pneumonia compared to those with intact swallowing. The review also identified correlations between these complications and both extended hospital stays and higher fatality rates.*

Conclusion: *Although swallowing disorders and secondary pneumonia appear highly prevalent in the Indian stroke population, the existing body of research is characterized by low methodological quality. There is an urgent requirement for high-quality, standardized research to accurately quantify the impact of dysphagia and inform clinical guidelines for stroke rehabilitation in India.*

Keywords: Deglutition, Deglutition Disorders, Dysphagia, Stroke, Incidence, India

1. Introduction

In the Indian context, the incidence of stroke is high, with estimates ranging between 116 and 163 cases per 100,000 individuals [1]. According to a landmark report by the Indian Council of Medical Research (ICMR) entitled "India: Health of the Nation's States," stroke is now recognized as the nation's fourth most frequent cause of mortality and the fifth primary driver of Disability Adjusted Life Years (DALY) [2]. In response to this growing health crisis, the Government of India established the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular

Diseases and Stroke (NPPCDCS) [3]. The management protocols developed under this initiative are largely consistent with international standards practiced in the United States, Canada, and the United Kingdom [4-6]. Central to these global and domestic guidelines is the recommendation that all conscious stroke patients undergo mandatory dysphagia screening. However, India faces significant hurdles in implementation, structured rehabilitation infrastructure is scarce, and there is a critical shortage of healthcare providers with specialized expertise in stroke recovery. Furthermore, advanced stroke care facilities are disproportionately concentrated in urban metropolitan areas. Consequently, a vast number of stroke survivors are left to manage chronic disabilities and preventable post-stroke complications without adequate clinical support.

Dysphagia manifests in roughly 50 percent of the stroke-affected population [7]. If these swallowing impairments are not detected early, they often precipitate severe pulmonary issues, most notably aspiration pneumonia. Beyond the immediate physiological dangers, dysphagia imposes a heavy economic burden on healthcare systems. In Western nations, the financial impact is well-documented, for instance, Altman et al. reported that the annual costs attributable to dysphagia reach approximately 547 million dollars. Similarly, an analysis by Patel et al. using the US National Inpatient Sample Database (2009–2013) highlighted the substantial escalation in healthcare expenditures associated with this condition. In India, while specific cost-of-care data is limited, the economic strain on families and the public health sector is presumed to be equally significant given the high volume of cases.

Within the study period analyzed by Patel et al., the cumulative financial impact of dysphagia was estimated at a staggering 16.8 billion dollars. Furthermore, the presence of swallowing disorders significantly extended hospital stays, with dysphagic patients requiring an average of 8.8 days of inpatient care compared to just 5 days for those without such impairments. While the precise economic burden within the Indian healthcare system has yet to be quantified, the impact is arguably more profound. In India, the responsibility for prolonged rehabilitation and chronic care typically falls upon family members, creating a substantial socioeconomic strain on the household unit.

Global data further underscores the severity of this condition. A systematic review by Kishore et al. indicates that pneumonia affects approximately 14 percent of stroke survivors worldwide, with the risk escalating eightfold in the presence of dysphagia. Similarly, research conducted in Brazil by Pacheco-Castilho et al. identified a dysphagia frequency of 59 percent to 76 percent among stroke patients, with an associated relative risk for pneumonia of 8.4. Despite these international findings, India currently lacks a synthesized, collective report on the incidence of post-stroke dysphagia. For a nation with such a high stroke burden, this epidemiological data is indispensable. Accurate statistics are required to strategically distribute limited national health resources, optimize clinical outcomes, establish recovery benchmarks, and shape future public health legislation. To address this significant void in the literature, the current systematic review was conducted. This study seeks to analyze existing research to provide a comprehensive synthesis of dysphagia incidence and the related risks of aspiration pneumonia within the Indian population.

2. Methodology

2.1. Study Objectives

The primary goal of this systematic review is to evaluate the current state of clinical evidence regarding swallowing disorders in the Indian stroke population. Specifically, the study aims to:

- **Quantify the reported incidence and prevalence** of oropharyngeal dysphagia following a stroke in India.
- **Determine the relative risk of aspiration pneumonia** in Indian stroke survivors with confirmed dysphagia.
- **Examine secondary outcomes,** including the length of hospital stay and mortality rates associated with these complications.

2.1.1. Operational Definitions

To ensure consistency and clarity in data extraction, this study adopted the following standardized definitions, modified from the framework established by Pacheco-Castilho et al.:

- **Oropharyngeal Dysphagia:** Characterized as any functional or physiological disruption occurring during the oral, pharyngeal, or upper esophageal stages of the deglutition process.
- **Pneumonia:** Classified as any infectious inflammatory condition affecting one or both lungs. For a study to be included, the specific diagnostic criteria (clinical or radiological) used to identify pneumonia must have been explicitly stated.
- **Stroke:** Defined as a medically confirmed cerebrovascular accident verified through clinical examination and/or neuroimaging (CT/MRI). This includes patients managed in acute, sub-acute, rehabilitation, or long-term care facilities within either the public or private sectors, irrespective of the stroke's subtype or anatomical location.

2.1.2. Information Sources and Search Strategy

This systematic review was conducted in strict adherence to the **PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)** guidelines. (15) A comprehensive electronic search was executed between October and December 2019, targeting the following high-impact academic databases:

- PubMed / MEDLINE
- CINAHL
- ProQuest
- Ovid
- Scopus
- The Cochrane Library

In addition to the database search, a manual "snowball" screening of the reference lists from identified papers was performed to ensure that no relevant gray literature or eligible studies were overlooked.

The search architecture was tailored for each database using a

combination of Boolean operators (AND/OR) and Medical Subject Headings (MeSH). Primary keywords included "deglutition," "deglutition disorders," "dysphagia," and "stroke,

2.1.3. Study Selection Protocol

The selection of studies for final inclusion was conducted through a rigorous three-stage filtering process. Initially, all citations retrieved from the electronic databases were imported into the Mendeley Desktop reference management software to facilitate organization and the identification of duplicates.

Phase I: Preliminary Screening

The authors independently reviewed the titles of all unique records. At this stage, entries that were clearly irrelevant to the research objectives were discarded. Exclusion criteria included:

- Non-original research (e.g., review articles, editorials, and commentaries).
- Individual case reports.
- Studies not published in English or appearing in non-peer-reviewed outlets (with the exception of academic dissertations).

Phase II: Abstract Appraisal

The remaining citations underwent a secondary, independent screening of their abstracts. Any discrepancies between the two reviewers regarding a study's eligibility were resolved through thorough discussion until a full consensus was reached. Following this phase, the surviving records were slated for comprehensive full-text analysis. To ensure the search was exhaustive, the reference lists of these full-text articles were manually scrutinized to capture any additional relevant studies.

Phase III: Full-Text Evaluation

The final selection was based on a meticulous review of the complete manuscripts, ensuring they met the pre-defined inclusion criteria and provided sufficient data for analysis.

2.1.4. Quality Assessment and Risk of Bias

To evaluate the methodological integrity of the included research, the Cochrane Risk of Bias framework was utilized. This standardized tool allowed for the systematic appraisal of each study across five critical domains:

- **Selection Bias:** Assessing the adequacy of participant recruitment and sequence generation.
- **Performance Bias:** Evaluating systematic differences in the care provided to participants.
- **Detection Bias:** Checking for systematic differences in how outcomes were determined.
- **Attrition Bias:** Analyzing the impact of withdrawals or missing data.
- **Reporting Bias:** Determining if results were reported selectively.

2.1.6. Evaluation of Evidence Quality and Methodological Appraisal

The foundational reliability of the synthesized data was evaluated using the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) system. As a globally accepted standard, the GRADE approach stratifies evidence quality by examining the inherent design and practical execution of each study. Within this evaluative hierarchy, randomized controlled trials (RCTs) are prioritized with a high-quality baseline, while observational research is categorized as moderate, and case-series or non-controlled studies are assigned a lower evidentiary grade.

Supplementing the GRADE framework, the authors engineered a custom methodological quality appraisal instrument (presented in Table 1) tailored to the specific nuances of Indian stroke and dysphagia literature. To objectively measure study rigor, a numerical indexing system was implemented: a percentage was calculated by comparing the points earned against the total possible score. These resulting values served as the basis for a three-tier classification of methodological integrity:

- **Superior (Strong):** Cumulative scores of 67 percent or higher.
- **Intermediate (Moderate):** Scores spanning the 34 percent to 66.9 percent range.
- **Limited (Weak):** Scores totaling 33.9 percent or less.

By integrating the standardized GRADE methodology with a domain-specific scoring tool, this study ensures a comprehensive and unbiased appraisal of the extant literature concerning post-stroke swallowing disorders and associated pulmonary risks in India.

3. Results

3.1. Search Outcomes and Literature Selection

The systematic search and screening procedure are visually detailed in the PRISMA flow diagram (Figure 1).

The initial multi-database search yielded a total of 86 citations. Following a primary review for overlap, 12 duplicate records were identified and removed. The remaining 74 unique titles underwent a preliminary screening for relevance to the study's objectives.

3.2. Critical Appraisal of Methodological Quality

A comprehensive analysis of these scores revealed that all four articles incorporated into the final review fall within the moderate quality tier. Specifically, while Sreeraj et al. (2018) achieved a score of 40 percent, the subsequent studies by Rai et al. (2016), Sundar et al. (2010), and Sebastian et al. (2015) each attained a consistent rating of 60 percent.Despite this moderate internal scoring, when evaluated through the lens of the GRADE framework, the overall body of literature was classified as providing a low level of evidence. This discrepancy is primarily attributed to the observational nature of the study designs and limitations in participant stratification. A comprehensive overview of the specific attributes, including participant demographics and clinical settings for each included paper, is provided in the summary of study characteristics.

3.3. Participant Demographics and Stroke Profiles

The sample sizes among the analyzed research varied significantly, from a small cohort of 16 subjects (20) to a larger group of 486 individuals (17). Regarding demographic variables, only Sreeraj

et al. (17) documented the age range of their participants (18 to 90 years), the remaining three studies provided no age-related data (18, 19, 20). Furthermore, none of the four studies offered a clear or comprehensive breakdown of sex distribution among their participants. Regarding clinical diagnosis, all studies included a mixed population of both ischemic and hemorrhagic stroke survivors.

3.4. Methodological Trends in Dysphagia Evaluation

A critical examination of the assessment techniques revealed a heavy reliance on bedside clinical evaluations rather than objective instrumental measures.

- **Assessment Tools:** Clinical examination was the universal diagnostic tool, with the sole exception of the study by Sundar et al. (19), which supplemented the evaluation with pulse oximetry. Notably, none of the studies employed validated or standardized clinical protocols.
- **Clinician Involvement:** In most instances, swallowing assessments were performed by resident physicians rather than specialized Speech-Language Pathologists (SLPs), indicating a potential gap in specialized care.
- **Dietary Consistencies:** The materials used to trigger a swallow varied by study. Rai et al. (18) utilized culturally familiar textures such as Khichdi, Kheer, or Payasam, equating these to a Western "puree" or "thick" consistency. In contrast, Sundar et al. (19) exclusively used a thin liquid challenge (50 ml of water). The remaining two studies failed to specify the consistencies used during their assessments (17, 20).
- **Pneumonia Documentation:** The concurrent presence of dysphagia and pneumonia was only investigated in two papers (17, 19). Crucially, none of the selected studies provided a rigorous operational definition for diagnosing pneumonia, which may impact the reliability of the reported incidence rates.

3.5. Prevalence of Dysphagia and Secondary Pneumonia

Every study included in this review utilized clinical bedside evaluations to diagnose swallowing impairments. The reported prevalence of dysphagia exhibited significant variance, ranging from a low of 11.1 percent (18) to a peak of 87.5 percent (20).

Data regarding the secondary development of aspiration pneumonia was restricted to two specific studies (17, 19). In the cohort analyzed by Sreeraj et al. (17), 91 out of 154 dysphagic patients (22.8 percent) were diagnosed with aspiration pneumonia. Similarly, Sundar et al. (19) observed that 16 out of 21 patients with dysphagia (32 percent) developed pulmonary complications.

By synthesizing this data, the relative risk (RR) of developing pneumonia was calculated for stroke survivors with dysphagia compared to those with intact swallowing function. The analysis revealed a significant RR of 5.82 (95 percent CI: 4.6, 7.2), indicating that dysphagic patients in India are nearly six times more likely to suffer from pneumonia than their non-dysphagic counterparts.

3.6. Impact on Hospitalization and Patient Outcomes

The presence of swallowing disorders was closely linked to prolonged hospitalization and increased mortality rates.

- **Length of Stay (LOS):** Sundar et al. (19) documented that the average duration of hospital residence for dysphagic patients was 10.8 days, significantly higher than the 6.5 days recorded for those without swallowing difficulties. While Sreeraj et al. (17) did not provide raw duration data, they reported an odds ratio (OR) of 1.9 (95 percent CI: 1.2, 2.9) for extended hospital stays among the dysphagic population.
- **Mortality Rates:** Fatal outcomes associated with aspiration pneumonia were addressed in two papers (17, 19). Sreeraj et al. (17) identified a dramatic increase in the risk of death for patients with pneumonia secondary to dysphagia, with an OR of 10.99 (95 percent CI: 6.3, 19.1). Furthermore, Sundar et al. (19) reported that 5 out of the 16 patients who contracted aspiration pneumonia eventually expired.

4. Discussion

This systematic review represents a preliminary effort to synthesize evidence regarding the prevalence of dysphagia and its secondary pulmonary complications among stroke survivors in India. Although a limited number of studies met the inclusion criteria, the synthesized data confirms that swallowing impairments are a pervasive consequence of stroke in the Indian clinical landscape. These findings underscore a critical need for standardized diagnostic and management protocols to mitigate life-threatening post-stroke complications. However, the overall utility of current literature is constrained by low methodological quality and significant risks of bias, which likely impact both the internal consistency and the generalizability of our frequency estimates.

4.1. National Trends in Swallowing Assessment

A primary objective of this review was to evaluate how oropharyngeal dysphagia is currently assessed in India. Our analysis reveals that existing diagnostic trends fail to capture the physiological complexities of swallowing. Diagnostic reliance rests almost exclusively on bedside clinical examinations, often focusing solely on overt signs of aspiration. Critically, the absence of validated, standardized clinical protocols or instrumental examinations—such as Video Fluoroscopic Swallow Study (VFSS) or Fiberoptic Endoscopic Evaluation of Swallowing (FEES)—suggests a high probability of underdiagnosis. Events of silent aspiration, which lack an overt cough reflex, are likely being missed entirely. This diagnostic gap reflects the broader infrastructure limitations within the Indian medical sector, where specialized swallowing services remain scarce.

4.2. Comparative Analysis of Prevalence Rates

The estimated incidence of post-stroke dysphagia in India (11.6 percent to 87.5 percent) appears markedly higher than figures reported in Western literature. For instance, Martino et al. reported significantly lower estimates (51–55 percent) in developed nations. Similar conservative trends are noted in Spain (47 percent) (23), Canada (45 percent) (24), and Italy (50 percent) . Notably, India's reported figures also exceed those of other emerging economies, such as South Africa (53 percent) (25) and Brazil (59–76 percent) (14).

4.3. Pneumonia Risk and Clinical Implications

The incidence of aspiration pneumonia in Indian stroke patients (22.8 percent to 32 percent) is nearly double the global average of 15 percent. It also surpasses rates documented in other developing regions, including Brazil (15 percent) (26) and Chile (23 percent) (27). Based on the available data, this review identified a Relative Risk (RR) of 5.82 (95 percent CI 4.6, 7.2) for pneumonia in dysphagic stroke patients. While this risk is higher than the Western baseline of 3.2 reported by Martino et al. (7), it remains lower than the risk identified in Brazil (RR 8.4) (14). However, these comparisons must be viewed with caution, the lack of a standardized operational definition for pneumonia across the reviewed Indian studies compromises the clinical validity of these figures.

4.4. Limitations of the Systematic Review

As is common with secondary research, the conclusions of this review are primarily constrained by the methodological integrity of the source literature. A significant drawback was the absence of detailed clinical variables essential for a nuanced understanding of dysphagia. Most of the analyzed studies failed to report on critical factors such as the specific classification of the stroke, the occurrence of recurrent neurological events, the precise anatomical site of the brain lesion, or the baseline severity of the stroke. Furthermore, there was a lack of transparency regarding the timing of the assessments and the specific parameters of the swallowing trials, such as the exact volume or consistency of the boluses used. A notable concern across all included research was the potential for detection bias. Swallowing impairments were identified through subjective bedside screenings that lacked established psychometric validation or objective instrumental confirmation. These procedural inconsistencies likely introduced a high risk of error, potentially leading to the overestimation or underestimation of the true prevalence of dysphagia and its associated pulmonary risks.

5. Conclusion

This systematic review serves as an essential effort to quantify the burden of swallowing disorders and secondary pneumonia within the Indian stroke population. The evidence synthesized here provides a vital framework for healthcare providers to prioritize early diagnostic screening and evidence-based management of dysphagia.The investigation highlights a critical shortage of high-quality, comprehensive research in this field within the Indian context. Current literature is characterized by both a low volume of studies and significant methodological weaknesses. Moving forward, there is an urgent need for methodologically rigorous, large-scale studies to better map the relationship between stroke, dysphagia, and pneumonia risk in India. Such data will be instrumental in developing specialized care pathways and optimizing rehabilitation outcomes for stroke survivors across the country.

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