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Plummer-Vinson Syndrome: A Single Centre Cross Sectional Longitudinal Study from South India

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ABSTRACT

This study aimed to investigate the clinical characteristics, blood abnormalities, endoscopic findings, and long-term outcomes of Plummer-Vinson syndrome (PVS) in patients from India. A retrospective descriptive cross-sectional study was conducted on 50 patients diagnosed with PVS at Meenakshi Medical College and Research Institute, India, over a 4-year period. The study included 50 patients, with a predominantly female population (male-to-female ratio: 1:4) and mean age ±SD of 42±3.24 years. The majority (90%) belonged to lower socioeconomic classes. Intermittent dysphagia was the main presenting symptom. Blood tests revealed severe iron deficiency anemia, with a median hemoglobin level of 6 g/dl. Esophageal webs were detected in 92% of patients. Treatment primarily involved dilatation procedures. While 74% of patients responded favorably to iron supplementation alone. Over a 4-year follow-up, 4% of patients developed malignancy, and 2% needed repeat dilatation procedures. This study highlights the high prevalence of PVS in India, particularly among females from lower socioeconomic backgrounds. However, vigilant post-treatment monitoring is crucial due to the risk of malignancy and potential need for repeat interventions.

INTRODUCTION

Plummer-Vinson syndrome (PVS), or Paterson-Brown-Kelly syndrome, is a rare condition with post-cricoid dysphagia, iron-deficiency anaemia, and upper oesophageal webs. Primarily affecting middle-aged women, PVS is linked to a higher risk of squamous cell carcinoma in the pharynx and proximal oesophagus. The name honours British laryngologists and Mayo Clinic physicians who identified the syndrome in 1919[1-4]. After a century, literature on PVS is still limited to case reports, but recent recognition in Asian nations is increasing[5-8].

The cause of Plummer-Vinson syndrome (PVS) remains uncertain, with proposed factors including nutritional and iron deficiencies, genetic predisposition and autoimmunity. Iron deficiency is consistently implicated, supported by studies demonstrating symptom improvement with iron supplementation[9]. Suggestions of malnutrition and vitamin B deficiency lack conclusive evidence[10]. PVS is linked to conditions like coeliac disease, Crohn's disease, rheumatoid arthritis and thyroid disease, indicating immune deregulation[11,12]. Investigating underlying causes of iron deficiency, such as gastrointestinal bleeding and coeliac disease, is crucial in all PVS cases[13].

The precise pathogenesis of Plummer-Vinson syndrome and oesophageal web formation is unclear. Iron deficiency may induce dysfunction in iron-dependent enzymes, leading to oxidative stress and DNA damage[4]. This dysfunction can cause muscular changes affecting swallowing, oesophageal mucosal atrophy and web development[14,15]. These webs typically form beneath the cricopharyngeal muscle, composed of squamous epithelia. Additionally, an autoimmune component is proposed, linked to disorders like pernicious anaemia, rheumatoid arthritis, coeliac disease and thyroiditis[16,17].

Prolonged iron deficiency anaemia may manifest as breathlessness, rapid heart rate, weakness, paleness and koilonychia development. Dysphagia, a slow-progressing, painless symptom, begins with solids and progresses to difficulty swallowing liquids[18]. Dysphagia becomes noticeable when the oesophageal web's luminal diameter shrinks below 12 mm, classified as grade I (intermittent difficulty with solids) or grade II (restricted to a semi-solid diet) in Plummer-Vinson syndrome[19]. Additional manifestations include glossitis, angular cheilitis, splenomegaly, enlarged nodular thyroid glands and edentia[20].

In suspected cases of Plummer-Vinson syndrome, haematological tests, including a full blood count and iron studies, are used to confirm iron deficiency anaemia. Radiographic methods like barium swallow and video fluoroscopy are employed to examine oesophageal webs, with the latter being more reliable. Esophagoscopy, a fibreoptic endoscopic examination, is the safest and most reliable diagnostic tool for assessing oesophageal webs[21,22].

Medical management of Plummer-Vinson syndrome focuses on iron supplementation to correct anaemia associated with iron deficiency[23]. While many patients with dysphagia may experience symptom relief through iron supplementation, more advanced cases are unlikely to respond to medical treatment alone and may require endoscopic dilation[4,24]. Dietary modification is typically adequate for mildly symptomatic patients, but those with long-standing dysphagia may necessitate mechanical dilation, such as endoscopic balloon dilation or Savary-Gilliard dilators[25,26]. In some cases, rupture of the oesophageal web during endoscopy is sufficient for symptom relief, while needle-knife electro-incision is considered as an alternative therapeutic option[27].

MATERIAL AND METHODS

Study Design: This is a retrospective, descriptive cross-sectional study conducted over four years, from July 2019 to July 2023. The study aimed to assess the clinical, haematological and endoscopic characteristics of patients diagnosed with Plummer-Vinson syndrome (PVS) at the outpatient department (OPD) of the Department of Gastroenterology, Meenakshi Medical College and Research Institute, Kanchipuram.

Participants: A total of 50 patients diagnosed with PVS and who underwent endoscopic examinations at the department were included in the final analysis.

Inclusion Criteria:

- Individuals of any age and gender
- Diagnosed with PVS
- Underwent endoscopic examination at the department

Exclusion Criteria:

- Incomplete or inadequate clinical and pathological data
- Inability or unwillingness to provide informed consent

Data Collection: Information was collected on the following:

- Patient demographics: Socioeconomic status
- Clinical presentation: Dysphagia, dyspepsia, food impaction
- Diagnostic procedures
- Esophageal web diagnosis: Olympus CV 190 endoscope and barium swallow
- Haematological tests: Complete blood count, iron studies

- Management approaches: Dilation procedures using devices like the Savary-Gillard dilator for patients with severe dysphagia
- Outcomes: Development of esophageal malignancy

Statistical Analysis: Descriptive statistics were used to summarize patient characteristics and clinical presentations. Relative risk (RR) was calculated to estimate the risk of malignancy and the lifetime risk of malignancy was calculated using incidence data and follow-up duration.

RESULTS

Demographics: Total 50 patients diagnosed with PVS were included. There was a significant gender imbalance, with a 1:4 male-to-female ratio (consistent with PVS affecting women predominantly). The median age was 42 years, with a wide range, indicating PVS can affect various age groups.

Clinical Presentation: The most common symptom was intermittent, non-progressive dysphagia (consistent with typical PVS presentation due to esophageal webs).

Haematological Profile: Average hemoglobin was 4.6 g dL^{-1} (range 2.9-6.8 g dL^{-1}) and ferritin was 5.2 microgm $dL^{-}1$, indicating iron deficiency anemia. Microcytic hypochromic anemia (smaller, paler red blood cells) was prevalent (Table 1).

Socioeconomic Status: Ninety percent of patients belonged to lower socioeconomic classes (IV/V), raising questions about socioeconomics and PVS.

Endoscopic Findings: Ninety two percent had a single esophageal web, 6% had multiple webs. Additional observations included monilial esophagitis (10%), atrophic gastritis (6%) and other anomalies (6%). These findings highlight the need for comprehensive endoscopic assessment.

Treatment: Management methods were: Savary-Gillard dilatation (60%), Endoscopic rupture dilatation (38%), 2% declined dilatation, 4% needed blood transfusion, Treatment selection appeared individualized (Table 3).

Biopsy and Malignancy: 4% (1 esophageal, 1 gastric) developed malignancies after 4 years, emphasizing the importance of vigilant follow-up and cancer screening.

Follow-Up: Over 4 years, favourable responses were seen with: Iron supplementation (74%), H. pylori eradication (10%), Deworming (2%), However, 4% developed malignancies, highlighting the need for long-term monitoring and early detection.

Table 1: Haematological Profile

Parameter	Value, median (range)
Hemoglobin (g dL^{-1})	4.6 (2.1-11.4)
Mean Corpuscular Volume (fL)	59 (49-78)
Mean Corpuscular Hemoglobin (pg)	16 (11-28)
Mean Corpuscular Hemoglobin Concentration (g L^{-1})	28 (20-33)
Serum Ferritin (µg L^{-1})	5.2 (0.5-17.6)

Table 2: Endoscopic Findings

Severity of Narrowing	Location of Esophageal Web (%)	Total (%)
	Circumferential	Anterior
Moderate (>1/2)	18	6
Severe (>2/3rd)	17	9
Total (%)	35 (50)	15 (50)

Table 3: Treatment

	Treatment		
Parameter	Before	After	p-value
Hemoglobin (g dL^{-1})	4.6 (2.1-11.5)	11.4 (9.7-16.1)	<0.001
Mean Corpuscular Volume (fL)	59 (50.0-75.0)	83.5 (77.0-90.0)	<0.001
Serum Ferritin (µg L^{-1})	5.2 (0.5-17.0)	68.0 (45.0-135.0)	<0.001

DISCUSSION

This study investigated the clinical and endoscopic characteristics of Plummer-Vinson syndrome (PVS) in 50 patients diagnosed and treated at a single centre in India.

Demographics and Gender Bias: Our research primarily involved Females with PVS, with a male-to-female ratio of 1:4 (similar to findings by Kitahara *et al*.[28] and Kim KH *et al*.[29]). The median age of the participants was 42 years, with a broad range spanning from 18 to 76 years, confirming observations made by Karthikeyan *et al*.[18] and Novacek *et al*.[31].

Iron Deficiency: Our study revealed severe iron deficiency anemia in all patients, with an average hemoglobin level of 4.6±0.6 g dL^{-1} (ranging from 2.9 to 6.8 g dL^{-1}). Additionally, the mean ferritin level was 5.2±0.8 micrograms per deciliter (microgm/dL), mirroring the findings reported by Makharia *et al*.[31].

Socioeconomic Status: Strikingly, 90% of our patients belonged to lower socioeconomic brackets (classes IV/V), suggesting a possible association between PVS and malnutrition, as previously indicated by Jones *et al*.[32]. This finding underscores the need for further investigation into the socioeconomic factors potentially influencing PVS development and access to healthcare for affected individuals.

Endoscopic Findings: Our endoscopic examinations revealed that 92% of patients had a single esophageal web, while 6% presented with multiple webs. Furthermore, we observed additional concurrent conditions in some patients, including monilial esophagitis (10%), atrophic gastritis (6%) and structural anomalies like arytenoid and gastric polyps (6%). These findings are consistent with observations

reported by Dia *et al*.[33], Okamura *et al*.[34,35] and Ben Gamra *et al*.[36], highlighting the potential for various co-occurring conditions in PVS patients.

Treatment: Our treatment approach employed two primary techniques: Savary-Gillard dilatation (60%) and endoscopic rupture dilatation (38%). Interestingly, 2% of patients opted not to undergo dilation, while 4% required blood transfusions. This variation underscores the individualized nature of PVS management, as the most suitable approach can differ based on patient-specific factors.

Biopsy and Malignancy: Biopsies were performed on 10% of our patients, with a concerning finding of malignancies in 4% of these cases. One patient presented with esophageal cancer and another with gastric cancer. Notably, previous studies have also documented associations between PVS and both squamous cell carcinoma and gastric cancer [37-39]. This finding highlights the importance of vigilant follow-up and cancer screening for individuals diagnosed with PVS.

CONCLUSION

This study offers valuable insights into PVS's clinical, endoscopic and management aspects. It highlights the need for a comprehensive approach considering the condition's heterogeneity and potential complications like malignancy. While no autoimmune disease association was found, further research is needed on underlying causes and risk factors, especially in relation to socioeconomic disparities.

Limitations: Single-centre study, limiting generalizability. Retrospective design. Four-year follow-up may not be sufficient for a condition with long-term implication.

New Insights into Plummer-Vinson Syndrome (PVS) from Our Study

Aspect	New Insights
Gender Distribution	Confirmed the significant gender imbalance (1:4) in PVS, consistent with previous studies[18,28,29]
Age Distribution	Highlighted the wide age range (18 to 76 years) for PVS, emphasizing its non-discriminatory nature in terms of age[30]
Anemia Characteristics	Provided data on hemoglobin levels (4.6±0.6 g dL^{-1}) and ferritin concentrations (5.2±0.8 µg dL^{-1}) in PVS patients[31]
Socioeconomic Background	Demonstrated that 90% of PVS patients come from lower socioeconomic classes IV/V, underlining the need for tailored interventions[32]
Esophageal Web Characteristics	Revealed the prevalence of solitary (92%) and multiple (6%) esophageal webs in PVS patients, aligning with previous studies[33-35].
Other Endoscopy Observations	Identified additional findings during endoscopy, including monilial esophagitis (10%), atrophic gastritis (6%) and structural irregularities (6%)[33-35]
PVS Management Methods	Described the primary management techniques, with Savary-Gillard dilatation (60%) and endoscopic rupture dilatation (38%) being the most common approaches[37]
Biopsy and Malignancy	Indicated that 10% of PVS patients underwent biopsies, leading to the diagnosis of malignancies in 4% of cases[37-39]

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