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White Coat Lung Syndrome (Byssinosis): A Contemporary Review for Nursing Practice

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Abstract

White Coat Lung Syndrome, commonly known as byssinosis, is a chronic and preventable occupational respiratory condition arising from repeated inhalation of dust from raw cotton, flax, or hemp. Despite advancements in textile mechanisation, the disease continues to pose significant health threats in low- and middle-income countries (LMICs), where manual processing and inadequate dust control remain prevalent. Byssinosis follows a progressive trajectory beginning with reversible episodes of chest tightness and eventually advancing to chronic airway obstruction resembling chronic obstructive pulmonary disease (COPD). This expanded contemporary review integrates updated global evidence and provides a comprehensive discussion on the epidemiology, pathophysiology, clinical manifestations, diagnostic criteria, management, preventive interventions, and the critical responsibilities of nurses in occupational health settings. As frontline healthcare providers, nurses assume a vital role in early identification, worker education, symptom surveillance, health promotion, and workplace advocacy. Strengthening nursing competencies in occupational lung diseases is essential for reducing disease burden and promoting safer textile work environments across LMICs.

Keywords: Byssinosis, White Coat Lung, cotton dust, occupational lung disease, textile workers, endotoxin exposure, nursing management.

1. Introduction

Occupational lung diseases account for a substantial proportion of work-related morbidity worldwide. Among them, byssinosis referred to in the textile sector as White Coat Lung Syndrome remains a persistent concern. The illness predominantly affects workers involved in ginning, spinning, weaving, and carding operations where large amounts of organic dust are released (WHO, 2020). Although described centuries ago during the Industrial Revolution, the disease remains entrenched in modern textile industries, particularly in LMICs where workplace regulations are not strictly enforced, and dust levels frequently exceed permissible exposure limits.

The term “White Coat Lung Syndrome” reflects the dust-laden white coats traditionally worn by cotton workers, symbolising the inhalation of fine fibres that accumulate on clothing and enter the respiratory tract. Byssinosis is not merely a respiratory condition it is a socioeconomic problem that

disproportionately affects marginalised populations employed in informal or semi-formal textile units. Limited awareness, insufficient personal protective equipment (PPE), and a lack of periodic health screening further exacerbate the problem.

For nurses working in occupational health, understanding the disease is essential for effective prevention, early detection, and holistic care. This review presents an expanded discussion tailored for nursing practice, emphasising not only disease characteristics but also practical nursing strategies that support worker well-being and workplace safety.

Definition

Byssinosis is a chronic occupational respiratory disorder caused by repeated inhalation of cotton, flax, or hemp dust contaminated with bacterial endotoxins. The hallmark feature is chest tightness or breathlessness that typically occurs at the beginning of the workweek ("Monday chest tightness") and improves as the week progresses (Christiani et al., 2001). Over continued exposure, reversible airway narrowing can progress to fixed airway obstruction.

Other Names

- White Coat Lung Syndrome
- Monday Fever
- Brown Lung Disease (broader term for dust-related textile lung diseases)
- Cotton Dust Asthma (early reversible phase)

Epidemiology

Byssinosis remains highly prevalent in LMICs, where occupational safety regulations are weak, and textile production continues to rely on manual labour.

Global Burden

A systematic review reported prevalence rates between 8% and 38% among textile workers, with up to 30% exhibiting obstructive lung patterns (Nafees et al., 2022). While high-income countries have observed a significant decline due to modern industrial hygiene practices, LMICs face persistent risks due to outdated machinery, inadequate ventilation, and lack of compliance with international safety standards.

Regional Trends

India:

Historical data indicate high prevalence among spinning and carding workers, especially in states such as Gujarat and Tamil Nadu. Recent studies report 7–8% prevalence among ginning workers (Rathod et al., 2024). Informal units show much higher, yet underreported, rates due to poor worker documentation.

Pakistan:

Prevalence ranges from 19% to 36% in Karachi and other industrial hubs. Peak exposure is associated with blow-room operations (Memon et al., 2008).

Africa:

Benin reports a prevalence as high as 44% among cotton-processing workers (Hinson et al., 2016). Similar trends are documented in Nigeria and Ethiopia.

Determinants of Variability

- Differences in dust levels and engineering controls
- Underreporting in unorganised sectors
- Limited worker awareness
- Variations in diagnostic criteria used by researchers
- Healthy worker effect (symptomatic workers leave employment early)

These epidemiological insights underscore the urgent need for stronger preventive measures and nursing-led health surveillance in LMICs.

Aetiology and Risk Factors

Etiologic Agents

- Organic dust from raw cotton, flax, and hemp
- Endotoxins from Gram-negative bacteria
- Plant debris, spores, fungus, and particulate contaminants

Occupational Risk Factors

- High dust exposure in the blow room, carding, and spinning
- Poor ventilation and inadequate exhaust systems
- Extended working hours and prolonged exposure
- Lack of PPE standards or compliance

Personal Risk Factors

- Cigarette smoking synergistically worsens lung damage

- Chronic respiratory illnesses
- Age-related decline in lung function
- Individual immunological or genetic susceptibility

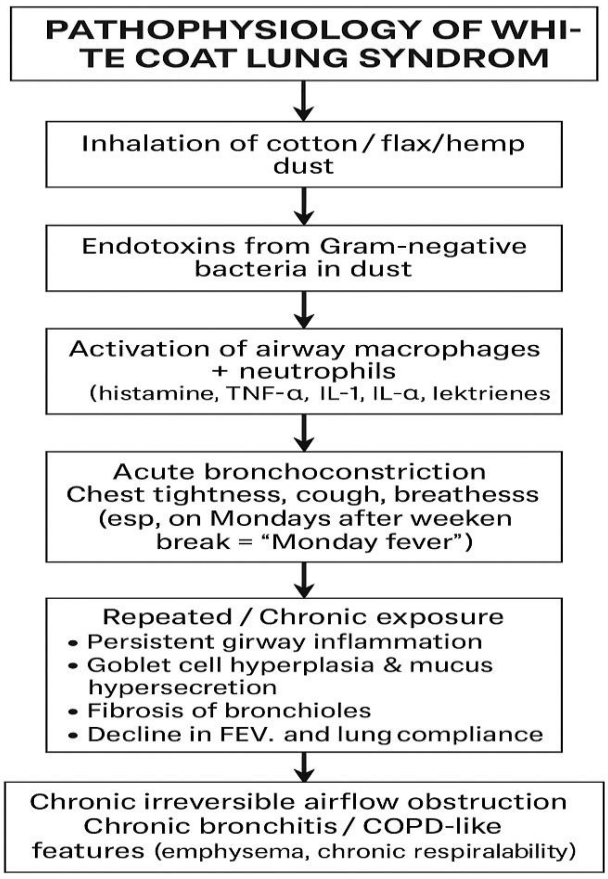
Socioeconomic Determinants

- Informal labour practices
- Inadequate access to occupational health services
- Poverty-driven inability to refuse hazardous work environments
- Limited health literacy among workers

A multifactorial understanding of these risks is essential for designing comprehensive nursing interventions.

Pathophysiology

Byssinosis develops through a series of pathophysiological events triggered primarily by endotoxin-laden dust:



1. Endotoxin-Induced Inflammation

Inhaled endotoxins stimulate alveolar macrophages, leading to the release of cytokines such as IL-1, IL-6, and TNF-α.

2. Bronchoconstriction

Histamine release and neural reflexes trigger reversible narrowing of small airways.

3. Chronic Inflammation and Mucosal Changes

Recurrent exposure causes goblet cell hyperplasia, mucous hypersecretion, and chronic inflammatory cell infiltration.

4. Airway Remodelling

Peribronchiolar fibrosis and smooth muscle hypertrophy develop, producing irreversible airflow obstruction similar to COPD.

5. Declining Lung Function

Long-term exposure results in reduced FEV_1 and fixed airflow limitation.

This progression underscores the importance of early detection and immediate exposure reduction in nursing responsibilities.

Clinical Features

Stage I (Reversible Phase)

- Chest tightness on the first working day
- Mild cough or throat irritation
- Symptoms improve mid-week

Stage II (Persistent Symptoms)

- Chest tightness on multiple days
- Increasing cough (dry or productive)
- Wheezing, exertional dyspnea

Stage III (Chronic Airflow Obstruction)

- Persistent breathlessness
- Exercise intolerance
- Frequent respiratory infections

- Signs similar to COPD

Physical Findings

- Diffuse wheezes
- Prolonged expiration
- Cyanosis (severe cases)
- Barrel-shaped chest in chronic lung disease

Diagnostic Evaluation

1. Detailed Occupational History

- Duration of exposure
- Section of work (blow room, carding, spinning)
- Use and frequency of PPE
- Monday symptom pattern

2. Physical Examination

- Respiratory rate
- Accessory muscle use
- Auscultation findings

3. Lung Function Tests

- **Spirometry:** Reduced FEV_1 and FEV_1/FVC ratio
- **PEFR monitoring:** Variation between working days and off-days
- **Bronchodilator response:** Helps differentiate byssinosis from asthma

4. Imaging

- Chest X-ray: May be normal or show hyperinflation
- HRCT: Air trapping, small airway disease

5. Laboratory Tests

- CBC (infection)
- IgE (allergic involvement)
- Sputum cytology

6. Environmental Assessment

- Dust sampling and air quality monitoring
- Ventilation system evaluation

Differential Diagnosis

- Asthma
- COPD
- Hypersensitivity pneumonitis
- Chronic bronchitis
- Occupational asthma

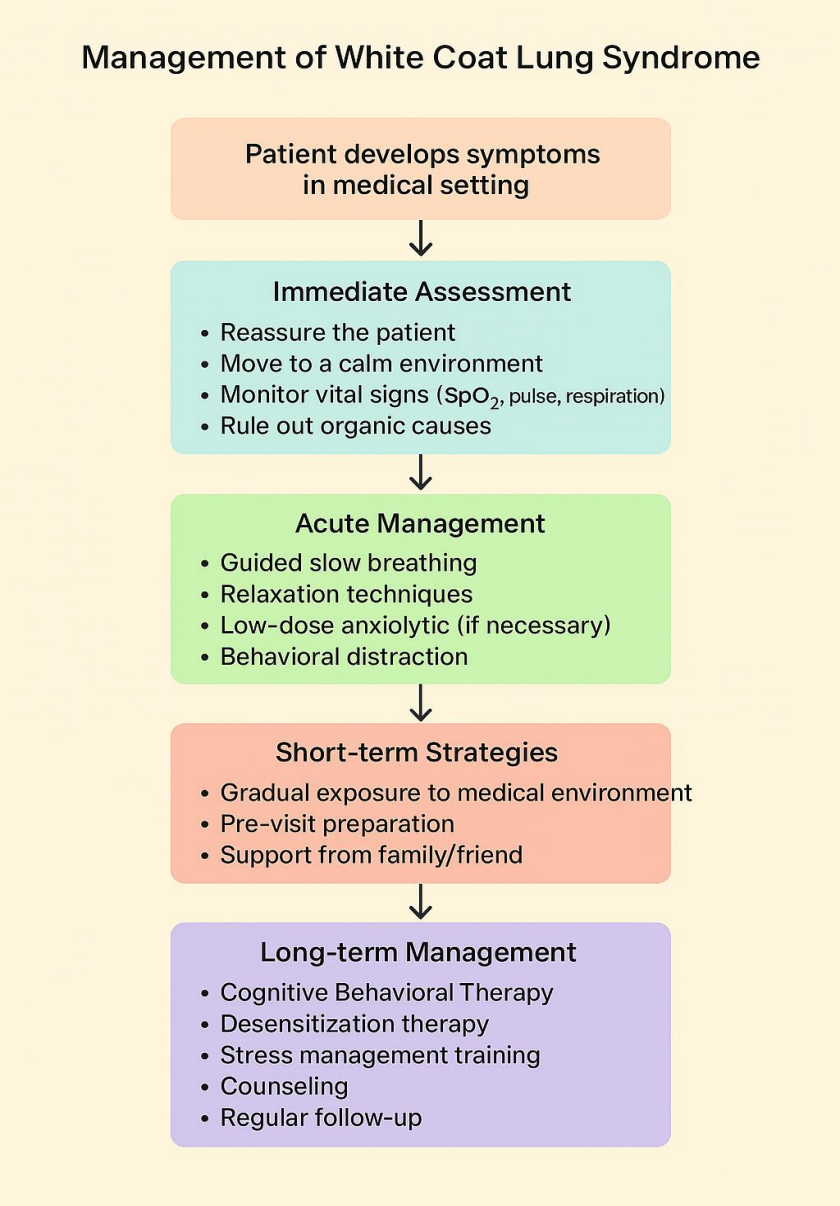
Management

Goals of Management

- Reduce exposure
- Control symptoms
- Preserve lung function
- Enhance quality of life
- Prevent complications

1. Pharmacological Treatment

- Short-acting bronchodilators (salbutamol)
- Inhaled corticosteroids
- Long-acting bronchodilators
- Mucolytics
- Antibiotics for secondary infections
- Oxygen therapy in advanced cases



2. Workplace Interventions

- High-efficiency dust extraction systems
- Machine enclosure
- Humidification and wet cleaning methods
- Regular cleaning of work areas
- Engineering controls mandated by safety regulations

3. Administrative Measures

- Worker rotation to reduce exposure
- Annual health check-ups
- Pre-placement evaluation
- Occupational health record maintenance

4. Personal Protective Equipment

- N95 or equivalent masks
- Fit testing and training
- Scheduled replacement of masks

5. Rehabilitation

- Pulmonary rehabilitation
- Breathing exercises (pursed-lip breathing, diaphragmatic breathing)
- Nutritional counselling
- Progressive exercise training

Nursing Responsibilities

Nurses play an indispensable role in the prevention and management of byssinosis.

1. Assessment

- Comprehensive occupational history
- Symptom surveillance and PEFR monitoring
- Identification of early warning signs

2. Clinical Management

- Administering inhalers, steroids, and bronchodilators
- Monitoring oxygen saturation
- Collaboration with physicians for treatment modification

3. Health Education

- Importance of PPE and proper fit
- Smoking cessation counselling
- Hydration and nutrition advice
- Techniques for airway clearance
- Guidance on recognizing worsening symptoms

4. Workplace Advocacy

- Participation in occupational safety committees
- Educating employers on engineering controls
- Promoting dust monitoring initiatives
- Advocating for government-level regulatory enforcement

5. Psycho-social Support

- Counselling workers coping with chronic illness
- Supporting job transitions in advanced cases
- Facilitating worker compensation and awareness of rights

These responsibilities highlight the central role of nurses as clinicians, educators, and advocates.

Complications

- Chronic obstructive pulmonary disease
- Chronic bronchitis
- Recurrent infections
- Respiratory failure
- Disability and loss of income
- Reduced quality of life

Prevention

Primary Prevention

- Effective ventilation
- Dust suppression technologies
- PPE enforcement
- Worker safety training

Secondary Prevention

- Periodic spirometry
- Annual health surveillance
- Early detection programs
- Health camps in textile clusters

Tertiary Prevention

- Pulmonary rehabilitation
- Chronic disease management
- Relocation to low-dust workstations

Challenges and Research Gaps

- Lack of real-time dust monitoring in LMICs
- Underreporting due to informal sector employment
- Limited access to occupational health services

- Need for biomarker research for early detection
- Inadequate data on long-term disease progression

Strengthening research and policy implementation will be crucial in eliminating the disease.

Conclusion

Byssinosis, or White Coat Lung Syndrome, continues to affect thousands of textile workers across LMICs despite being entirely preventable. The disease reflects systemic occupational inequities, inadequate workplace safety standards, and limited worker awareness. Nurses play a crucial role in early detection, ongoing surveillance, worker education, and workplace advocacy. With stronger occupational health policies, improved dust control technologies, and sustained nursing involvement, byssinosis can be significantly reduced and eventually eliminated from the textile industry

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