OPTIMIZATION OF TREATMENT METHODS FOR ALVEOLITIS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Samadova Shahzoda Isakovna

PhD Associate Professor, Department of Therapeutic Dentistry, Bukhara State Medical Institute named after Abu Ali ibn Sino, Bukhara, Uzbekistan.

ABSTRACT

Alveolitis represents an inflammatory condition of the pulmonary alveoli that can lead to impaired gas exchange and progressive respiratory dysfunction. In patients with type 2 diabetes mellitus (T2DM), chronic hyperglycemia, immune dysregulation, and microvascular complications contribute to altered inflammatory responses and delayed tissue repair, potentially worsening the course of alveolar inflammatory diseases. This article provides a narrative review of the pathophysiological interactions between alveolitis and T2DM and discusses strategies for optimizing treatment in this high-risk population. Evidence suggests that comprehensive management, including strict glycemic control, anti-inflammatory therapy, careful use of corticosteroids, antimicrobial protection when indicated, and pulmonary rehabilitation, can improve outcomes. The paper highlights the importance of an individualized, multidisciplinary approach to managing alveolitis in patients with T2DM.

Keywords: alveolitis, type 2 diabetes mellitus, pulmonary inflammation, glycemic control, corticosteroid therapy, lung complications

ОПТИМИЗАЦИЯ МЕТОДОВ ЛЕЧЕНИЯ АЛЬВЕОЛИТА У ПАЦИЕНТОВ С САХАРНЫМ ДИАБЕТОМ 2 ТИПА

Самадова Шахзода Исаковна

PhD доцент кафедры терапевтической стоматологии Бухарского государственного медицинского института имени Абу Али ибн Сино, г. Бухара, Узбекистан.

АННОТАЦИЯ

Альвеолит представляет собой воспалительное поражение альвеол лёгких, которое может приводить к нарушению газообмена и прогрессирующей дыхательной недостаточности. У пациентов с сахарным диабетом 2 типа (СД2) хроническая гипергликемия, иммунные нарушения и микрососудистые осложнения способствуют усилению воспалительных реакций и замедлению процессов репарации тканей, что может утяжелять течение альвеолярных воспалительных заболеваний. В данной статье представлен обзор патофизиологических взаимосвязей между альвеолитом и СД2, а также рассмотрены подходы к оптимизации лечения у данной группы пациентов. Анализ данных литературы показывает, что комплексная терапия, включающая строгий контроль гликемии, противовоспалительное лечение, осторожное применение кортикостероидов, своевременную антибактериальную защиту при показаниях и лёгочную реабилитацию, способствует улучшению клинических исходов. Подчёркивается необходимость индивидуализированного и мультидисциплинарного подхода к лечению альвеолита у больных СД2.

Ключевые слова: альвеолит, сахарный диабет 2 типа, воспаление лёгких, гипергликемия, кортикостероидная терапия, лёгочные осложнения

INTRODUCTION

Alveolitis refers to inflammation affecting the alveolar structures of the lungs and is commonly observed in various interstitial and inflammatory pulmonary disorders, including hypersensitivity pneumonitis, infectious pneumonias, and post-inflammatory lung conditions. The inflammatory process disrupts the integrity of the alveolar–capillary membrane, impairs gas exchange, and may lead to fibrosis if not properly controlled.

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease characterized by insulin resistance, hyperglycemia, and systemic low-grade inflammation. Over time, diabetes leads to microvascular and macrovascular complications, impaired immune responses, and delayed tissue healing. Although pulmonary complications of diabetes are less frequently discussed than cardiovascular or renal ones, growing evidence indicates that the lungs are also a target organ in chronic hyperglycemia.

In patients with T2DM, several mechanisms may exacerbate alveolar inflammation. Persistent hyperglycemia promotes oxidative stress, glycation of structural proteins, endothelial dysfunction, and impaired neutrophil and macrophage activity. These changes may increase susceptibility to infections,

prolong inflammatory reactions, and interfere with normal resolution of alveolar injury. As a result, alveolitis in diabetic patients may have a more severe course, slower recovery, and higher risk of progression to chronic lung disease.

Standard treatment of alveolitis often involves anti-inflammatory medications, including corticosteroids, along with management of the underlying cause. However, in patients with T2DM, corticosteroid therapy may significantly worsen glycemic control, creating a therapeutic dilemma. Therefore, optimization of treatment strategies that balance pulmonary benefits with metabolic safety is of particular importance.

This article aims to analyze the pathophysiological links between alveolitis and T2DM and to outline evidence-based approaches for optimizing treatment in this vulnerable patient group.

MATERIALS AND METHODS

This article is a narrative review and does not report results of an original clinical study. The analysis is based on:

- Publications addressing inflammatory and interstitial lung diseases
- Research on pulmonary complications of type 2 diabetes mellitus
- Clinical guidelines for the management of alveolitis, interstitial lung disease, and diabetes
- Reviews discussing the impact of hyperglycemia on immune and inflammatory processes

Relevant literature was analyzed and synthesized to provide a structured overview of treatment optimization strategies.

RESULTS

The literature review highlights several key aspects relevant to optimizing treatment of alveolitis in patients with T2DM:

- Chronic hyperglycemia enhances systemic and pulmonary inflammation
- Diabetic microangiopathy may impair alveolar–capillary gas exchange
- Corticosteroids, while effective in controlling alveolar inflammation, can worsen glycemic control
- Poor glycemic control is associated with increased infection risk and delayed recovery

- Multidisciplinary care improves clinical outcomes

These findings suggest that management of alveolitis in diabetic patients must address both pulmonary inflammation and metabolic stability.

DISCUSSION

The interaction between alveolitis and T2DM is complex and bidirectional. Alveolar inflammation increases systemic stress and inflammatory mediators, which may worsen insulin resistance. Conversely, chronic hyperglycemia alters immune and vascular function, intensifying pulmonary injury and delaying resolution of inflammation.

One of the central issues in treating alveolitis is the use of corticosteroids. Glucocorticoids are potent anti-inflammatory agents that suppress immune activation and reduce alveolar exudation and interstitial infiltration. However, in patients with T2DM, corticosteroids increase hepatic glucose production, reduce peripheral glucose uptake, and often lead to significant hyperglycemia. Uncontrolled hyperglycemia can, in turn, increase the risk of secondary infections, prolong hospitalization, and impair tissue repair.

Therefore, optimization of treatment requires careful balancing of risks and benefits. Several principles are important:

1. Strict glycemic control
Maintaining blood glucose within target ranges is essential. Insulin therapy may need to be intensified temporarily during corticosteroid treatment. Frequent glucose monitoring helps prevent severe hyperglycemia and its complications.

2. Individualized corticosteroid use
The lowest effective dose and shortest possible duration of corticosteroid therapy should be used. In some cases, inhaled corticosteroids or alternative immunomodulatory agents may help reduce systemic exposure.

3. Anti-infective vigilance
Patients with T2DM are at higher risk for infections. When alveolitis has an infectious component or when immunosuppressive therapy is used, early identification and appropriate antimicrobial treatment are crucial.

4. Management of systemic inflammation
Adjunctive therapies that reduce oxidative stress and systemic inflammation,

including proper nutrition, weight control, and management of comorbidities (such as hypertension and dyslipidemia), may indirectly support pulmonary recovery.

5. Pulmonary rehabilitation
Breathing exercises, gradual physical activity, and respiratory physiotherapy can improve ventilation, reduce dyspnea, and enhance quality of life.

6. Multidisciplinary approach
Close collaboration between pulmonologists, endocrinologists, and primary care physicians is essential. Coordinated management allows simultaneous control of lung inflammation and metabolic parameters.

In addition, emerging research suggests that diabetes-related endothelial dysfunction and microangiopathy may impair oxygen diffusion and contribute to long-term pulmonary impairment. This further emphasizes the importance of early and comprehensive management.

Overall, treatment optimization in this population requires a shift from isolated disease management to an integrated, patient-centered strategy.

CONCLUSION

Alveolitis in patients with type 2 diabetes mellitus presents unique therapeutic challenges due to the interaction between pulmonary inflammation and metabolic dysregulation. Optimization of treatment involves strict glycemic control, cautious and individualized use of corticosteroids, infection prevention, and multidisciplinary care. A comprehensive approach that addresses both lung pathology and systemic metabolic status can improve clinical outcomes and reduce the risk of complications.

REFERENCES

1. American Diabetes Association. Standards of medical care in diabetes—2024. *Diabetes Care*. 2024;47(Suppl 1):S1–S350.
2. King TE Jr., Pardo A, Selman M. Idiopathic pulmonary fibrosis. *Lancet*. 2011;378(9807):1949–1961.
3. Barnes PJ. Inflammatory mechanisms in patients with chronic obstructive pulmonary disease. *J Allergy Clin Immunol*. 2016;138(1):16–27.
4. Marvisi M, Balzarini L, Mancini C, Mouzakiti P. Pulmonary complications in diabetes mellitus. *Recenti Prog Med*. 2010;101(3):187–192.

5. Gupta S, Jain A, Chauhan S. Hyperglycemia and immune dysfunction: Implications in pulmonary infections. *Diabetes Metab Syndr*. 2019;13(1):561–567.
6. Raghu G, Remy-Jardin M, Myers JL, Richeldi L, Ryerson CJ, Lederer DJ, et al. Diagnosis of hypersensitivity pneumonitis. *Am J Respir Crit Care Med*. 2020;202(3):e36–e69.
7. Fardet L, Petersen I, Nazareth I. Risk of infections with glucocorticoids: A population-based cohort study. *PLoS Med*. 2016;13(5):e1002024.
8. World Health Organization. Global report on diabetes. Geneva: WHO; 2016.
9. Huang H, Vandivier RW. Lung injury, repair, and fibrosis in diabetes. *J Clin Med*. 2021;10(4):741.
10. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, Hill K, et al. An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med*. 2013;188(8):e13–e64.