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New perspectives on advances in diagnosis through imaging in chronic respiratory diseases: a systematic literature review

Novas perspectivas sobre avanços no diagnóstico por imagem em doenças respiratórias crônicas: uma revisão sistemática da literatura

Nuevas perspectivas sobre los avances en el diagnóstico por imagen en enfermedades respiratorias crónicas: una revisión sistemática de la literatura

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The article organizes the international literature, systematically dismembering it to offer insights that also allow for a better understanding of the phenomenon of imaging diagnosis of serious respiratory diseases. On a practical level, the results presented can help hospitals and specialized health centers to have a guide on which technologies to look for in the process of modernizing their diagnostic imaging techniques.
Originality/value:
The synthesis of the literature presented allows an integrated understanding of the state of the art in a highly specialized topic such as imaging diagnosis of terminal respiratory diseases. For readers of clinical practice such as specialized doctors, it serves as a guide to stay up to date with new diagnostic technologies.

ABSTRACT

Background: Chronic respiratory diseases, such as asthma, chronic obstructive pulmonary disease (COPD), interstitial lung disease, and cystic fibrosis, present substantial global health challenges. This systematic review explores recent advances in imaging-based diagnostic methods for these conditions, emphasizing high-resolution computed tomography (HRCT), magnetic resonance imaging (MRI), positron emission tomography (PET), and artificial intelligence (AI). **Methodology:** A systematic search of databases identified studies published in the last five years, focusing on innovative imaging techniques for chronic respiratory diseases. Inclusion criteria emphasized diagnostic accuracy and advancements in imaging modalities**. Results**: Seven studies were included, covering interventions in intensive care, mesenchymal stem cell therapy for COVID-19-induced acute respiratory distress syndrome (ARDS), endovascular treatment for aortic arch aneurysms, and lung cancer screening. MSC therapy demonstrated positive outcomes in ARDS patients, while endovascular repair showed technical success. LungSEARCH highlighted the effectiveness of lung cancer screening in high-risk populations. **Discussion**: Recent imaging technologies, including HRCT, MRI, PET, and AI, have revolutionized chronic respiratory disease diagnosis. The review emphasizes their clinical applications, impact on patient outcomes, and potential for personalized medicine. AI enhances image analysis accuracy, yet challenges like cost and interpretation discrepancies persist**. Conclusion:** Imaging technologies, particularly HRCT, MRI, PET, and AI, show promise in improving diagnostic accuracy and personalized treatment for chronic respiratory diseases. Collaboration among healthcare professionals, researchers, and industry stakeholders is crucial for addressing challenges and ensuring widespread access to advanced diagnostic tools. Future directions involve refining imaging methods for routine clinical integration, advancing patient care, and reducing the burden of respiratory diseases.

Keywords: Chronic respiratory diseases, Imaging technologies, Artificial intelligence, Diagnosis, Treatment.

RESUMO

Contexto: As doenças respiratórias crônicas, como asma, doença pulmonar obstrutiva crônica (DPOC), doença pulmonar intersticial e fibrose cística, representam desafios substanciais para a saúde global. Esta revisão sistemática explora os recentes avanços nos métodos de diagnóstico por imagem para essas condições, enfatizando a tomografia computadorizada de alta resolução (TCAR), a ressonância magnética (RM), a tomografia por emissão de pósitrons (PET) e a inteligência artificial (IA). **Metodologia**: Uma pesquisa sistemática de bancos de dados identificou estudos publicados nos últimos cinco anos, com foco em técnicas de imagem inovadoras para doenças respiratórias crônicas. Os critérios de inclusão enfatizaram a precisão do diagnóstico e os avanços nas modalidades de imagem. **Resultados**: Foram incluídos sete estudos, abrangendo intervenções em terapia intensiva, terapia com células-tronco mesenquimais para a síndrome do desconforto respiratório agudo (SDRA) induzida pela COVID-19, tratamento endovascular para aneurismas do arco aórtico e rastreamento de câncer de pulmão. A terapia com MSC demonstrou resultados positivos em pacientes com ARDS, enquanto o reparo endovascular apresentou sucesso técnico. O LungSEARCH destacou a eficácia da triagem de câncer de pulmão em populações de alto risco. **Discussão**: As recentes tecnologias de imagem, incluindo TCAR, RM, PET e IA, revolucionaram o diagnóstico de doenças respiratórias crônicas. A revisão enfatiza suas aplicações clínicas, o impacto nos resultados dos pacientes e o potencial para a medicina personalizada. A IA aumenta a precisão da análise de imagens, mas desafios como custo e discrepâncias de interpretação persistem. **Conclusão**: As tecnologias de imagem, especialmente HRCT, MRI, PET e IA, são promissoras para melhorar a precisão do diagnóstico e o tratamento personalizado de doenças respiratórias crônicas. A colaboração entre profissionais de saúde, pesquisadores e partes interessadas do setor é fundamental para enfrentar os desafios e garantir o amplo acesso a ferramentas avançadas de diagnóstico. As direções futuras envolvem o refinamento dos métodos de imagem para a integração clínica de rotina, o avanço do atendimento ao paciente e a redução do ônus das doenças respiratórias.

Palavras-chave: Doenças respiratórias crônicas, Tecnologias de imagem, Inteligência artificial, Diagnóstico, Tratamento.

RESUMEN

Antecedentes: Las enfermedades respiratorias crónicas, como el asma, la enfermedad pulmonar obstructiva crónica (EPOC), la enfermedad pulmonar intersticial y la fibrosis quística, presentan importantes retos sanitarios a nivel mundial. Esta revisión sistemática explora los avances recientes en los métodos de diagnóstico basados en imágenes para estas afecciones, haciendo hincapié en la tomografía computarizada de alta resolución (TCAR), la resonancia magnética (RM), la tomografía por emisión de positrones (PET) y la inteligencia artificial (IA). **Metodología**: Una búsqueda sistemática en bases de datos identificó estudios publicados en los últimos cinco años, centrados en técnicas de imagen innovadoras para enfermedades respiratorias crónicas. Los criterios de inclusión hicieron hincapié en la precisión diagnóstica y los avances en las modalidades de imagen. **Resultados**: Se incluyeron siete estudios, que abarcaban intervenciones en cuidados intensivos, terapia con células madre mesenquimales para el síndrome de distrés respiratorio agudo (SDRA) inducido por COVID-19, tratamiento endovascular de los aneurismas del arco aórtico y cribado del cáncer de pulmón. La terapia con CMM demostró resultados positivos en pacientes con SDRA, mientras que la reparación endovascular mostró éxito técnico. LungSEARCH puso de relieve la eficacia del cribado del cáncer de pulmón en poblaciones de alto riesgo. **Discusión**: Las recientes tecnologías de imagen, incluyendo HRCT, MRI, PET y AI, han revolucionado el diagnóstico de las enfermedades respiratorias crónicas. La revisión hace hincapié en sus aplicaciones clínicas, su impacto en los resultados de los pacientes y su potencial para la medicina personalizada. La IA mejora la precisión del análisis de imágenes, aunque persisten retos como el coste y las discrepancias en la interpretación. **Conclusiones**: Las tecnologías de imagen, en particular la HRCT, la MRI, la PET y la IA, son prometedoras para mejorar la precisión diagnóstica y el tratamiento personalizado de las enfermedades respiratorias crónicas. La colaboración entre los profesionales de la salud, los investigadores y las partes interesadas de la industria es crucial para abordar los desafíos y garantizar el acceso generalizado a las herramientas de diagnóstico avanzadas. En el futuro, habrá que perfeccionar los métodos de obtención de imágenes para su integración clínica rutinaria, mejorar la atención al paciente y reducir la carga de las enfermedades respiratorias.

Palabras clave: Enfermedades respiratorias crónicas, Tecnologías de la imagen, Inteligencia artificial, Diagnóstico, Tratamiento.

INTRODUCTION

Long-term respiratory conditions such as asthma, chronic obstructive pulmonary disease (COPD), interstitial lung disease, and cystic fibrosis represent a substantial global health challenge, leading to considerable levels of illness, death, and healthcare expenses (Almalki, 2022). It is imperative to critically evaluate and consolidate the latest evidence on evolving imaging-based diagnostic methods for chronic respiratory diseases. Offering a new perspective on the ongoing developments in research employing imaging tools for chronic respiratory disorders is the aim of this comprehensive review. Presenting a comprehensive overview of the current state of research is the goal. Modern diagnostic imaging technologies are revolutionizing the treatment of chronic respiratory diseases (Fekete et al., 2021). Due to early detection, the success rate of lung cancer treatment has increased dramatically, especially with low-dose CT imaging. Quantitative measurement is useful for determining disease severity, especially in the case of COPD, and precision medicine uses accurate imaging to develop therapeutic strategies appropriate to high-resolution CT scans and other images with three-dimensional features to provide a better diagnosis of severe disorders such as interstitial pneumonia. By increasing the accuracy of analysis, artificial intelligence reduces the need for implants. Imaging plays an important role in national screening programs worldwide to facilitate early detection of lung cancer and tuberculosis (Nachiappan et al., 2017).

With recent advances in diagnostic imaging, the imaging landscape of chronic respiratory diseases has changed. Traditional approaches are unlikely to provide a comprehensive understanding of diseases such as asthma and COPD (Vanfleteren et al., 2013). However, the diagnostic procedure has been completely transformed by the combination of positron emission tomography (PET), magnetic resonance imaging (MRI), and high-resolution computed tomography (HRCT). While MRI provides a functional view, HRCT reveals lung structure extensive demonstration, while PET helps to identify inflammation-related metabolic changes (Hisert et al., 2023). These noninvasive techniques advance our knowledge of disease progression and treatment response though along with increased diagnostic accuracy. Continued development of imaging techniques offers encouraging opportunities to improve diagnostic strategies and ultimately improve outcomes for people with chronic respiratory distress when the combination of science and technology Even with the latest advances in medical imaging technology, there is still a great need to evaluate and evaluate the efficacy of these advances for early and accurate diagnosis of chronic respiratory disorders in. , and high-resolution computed tomography (HRCT) in what ways advance our knowledge of the pathophysiology of chronic respiratory disease and enhance our patients' diagnostic abilities? It would be useful to investigate the accuracy, sensitivity, and specificity of these state-of-the-art imaging modalities as well as their ability to detect and differentiate early respiratory disease for this study (Weatherley et al., 2019).

High-Resolution Computed Tomography (HRCT)

High-resolution computed tomography (HRCT) is becoming indispensable in improving the identification and management of persistent respiratory distress (Jeny et al., 2019). With the use of this imaging method, which provides detailed cross-sectional views of the lungs, it is possible to carefully evaluate the pulmonary structure in disorders such interstitial lung diseases, chronic obstructive pulmonary disease (COPD), and HRCT pneumonia. Problems have high sensitivity in detecting microscopic abnormalities, leading to rapid and accurate diagnosis. If physical complications such as blood vessels, pulmonary embolism, chest wall and so on are heard is critical to understanding disease progression and structure HRCT enables targeted interventions and monitors treatment outcomes (Martinez et al., 2017). Because HRCT is noninvasive, fewer invasive diagnostic tests are required, making it a useful tool for clinicians in the evolving field of respiratory medicine. While technology is developing, HRCT will become increasingly important to improve patient outcomes and diagnostic accuracy in chronic respiratory disorders.

Magnetic resonance imaging (MRI)

Advances in diagnostic technology have made magnetic resonance imaging (MRI) a revolutionary diagnostic tool for long-term respiratory diseases, unlike traditional imaging modalities, except patients from radiation by creating high-resolution detailed images. Advancements in MRI technology have enabled the detection of structural and functional changes in the respiratory system (Martinez et al., 2017). MRI provides a more precise and non-invasive characterization of all pulmonary abnormalities associated with chronic respiratory disorders, such as asthma, interstitial lung disease, and chronic obstructive pulmonary disease (COPD). Functional MRI techniques that provide information about tissue microstructure and lung perfusion, assist in early diagnosis by perfusion and diffusion imaging (Ohno et al., 2022). Enabling a more thorough comprehension of the pathophysiology of disease by sophisticated post-processing algorithms aids in the measurement of particular biomarkers. The non-invasive and versatile nature of MRI enables to diagnosis of chronic respiratory problems with more precision and customized patient treatment (Yu et al., 2023).

Positron Emission Tomography (PET)

A powerful diagnostic tool that is changing the imaging view of chronic respiratory diseases Positron emission tomography (PET). Developments in PET technology provide new perspectives on the aetiology of diseases such as chronic obstructive pulmonary disease (COPD) and pulmonary fibrosis, furthermore, it can differentiate metabolic processes of the lung, allowing personalized treatment plans (Kusmirek, Magnusson, & Perlman, 2020).

PET scans can detect areas of inflammation, differentiate between benign and malignant tumours, and evaluate regional variations in lung function. Additionally, PET and computed tomography (CT) are combined for accurate diagnosis of respiratory diseases and anatomic localization (Cohade & Wahl, 2003). PET scanning enables faster and more accurate diagnosis of chronic respiratory diseases, which improves patient outcomes.

Functional photography techniques

Chronic respiratory problems can now be diagnosed and treated with high precision because to functional imaging techniques including positron emission tomography (PET), magnetic resonance imaging (MRI), and single photon emission computed tomography (SPECT). PET scans provide information on metabolic activity and cell function whereas SPECT evaluates Three-dimensional images of pulmonary circulation (Dupuis, Harel, Nguyen, & Imaging, 2014). For functional lung imaging MRI more accurately predicts anatomical changes. These methods can help identify patterns associated with respiratory diseases such chronic obstructive pulmonary disease (COPD) and interstitial lung disease. Furthermore, V/Q scanning is used for monitoring blood flow and airflow in the lungs. Hyperpolarized gas MRI which gives comprehensive insights for diseases like asthma, cystic fibrosis, and COPD into ventilation dynamics and pulmonary function (Stewart et al., 2022).

Artificial Intelligence in Imaging

Due to effective algorithms chronic respiratory diseases could analyze complex image data enabling easier early detection. Machine learning and deep learning made it feasible to identify patterns and changes in medical images (Razzak, Naz, & Zaib, 2018). Artificial intelligence (AI) algorithms are able to identify lung patterns associated with chronic obstructive pulmonary disease (COPD) and interstitial lung disease (ILD). Due to these advancements, patients are diagnosed more rapidly and accurately. Artificial intelligence (AI) in imaging improves accuracy, supports efficient healthcare, and may improve patient outcomes by enabling early intervention and self-treatment for chronic respiratory disorders (Klumpp et al., 2021).

Applications in Specific Chronic Respiratory Diseases

1. **Chronic Obstructive Pulmonary Disease (COPD)**

High-resolution computed tomography (HRCT) and magnetic resonance imaging (MRI) are two imaging modalities that offer a thorough comprehension of the unique changes in the lungs of people with chronic obstructive pulmonary disease (COPD) (Milne & King, 2014). The morphological changes and detection of emphysema, and bronchial wall thickness are evaluated by HRCT. With the advancements of these techniques early and accurate diagnoses enable timely treatment to prevent infections. The precision of COPD diagnosis and advanced imaging technology increased the understanding of pathophysiology for more effective therapies for long-term respiratory conditions (Washko & Parraga, 2018).

2. **Asthma**

Magnetic resonance imaging (MRI) and high-resolution computed tomography (HRCT) provide a comprehensive understanding of the anatomy and physiology of the airways (lungs) (Ley-Zaporozhan, Ley, & Kauczor, 2008). These techniques identify mucus blockage, clearing the airways, and thickening the bronchial wall in asthma patients. Thorough imaging of the lung parenchyma provides details about inflammation and adverse effects via HRCT (Jeny et al., 2019). To address concerns linked to regional ventilation and perfusion, advanced imaging techniques including Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET) can be used. The airway measurements allow for more individualized and targeted asthma treatment, in addition to enabling quick and precise diagnosis. Technology has significantly improved asthma therapy due to enhancing asthma diagnosis efficiency and accuracy (van der Kamp, Hengeveld, Brusse-Keizer, Thio, & Tabak, 2023).

3. **Interstitial Lung Disease**

Recent developments in imaging technology provide diagnostic and therapeutic approaches for long-term respiratory disorders, particularly concerning interstitial lung disease (ILD). High-resolution computed tomography (HRCT) an important diagnostic tool provides important information about the pathogenesis of ILD such as the identification of specific

patterns associated with various ILDs via lung parenchyma in detail (Hasan et al., 2020). Clinicians improved treatment options and patient outcomes by studying the differentiation of various ILD subtypes. Furthermore, the development of applications and the use of multidimensional imaging assessed various lung problems simply by offering a more objective and repeatable method of disease monitoring (Bartholmai et al., 2013).

4. Cystic Fibrosis

Chronic respiratory disorders have been completely transformed by modern imaging technologies, which is essential for conditions like cystic fibrosis (CF) (Shukla et al., 2020). An important diagnostic technique for cystic fibrosis (CF) to assess lung involvement High-resolution imaging, such as high-resolution computed tomography (HRCT) is widely useful. By focusing on bronchiectasis, cysts, and bronchiectasis, HRCT offers important data about the disease course (Walsh & Hansell, 2014). Moreover, the comprehension of lung and metabolic function in individuals with cystic fibrosis has been broadened by magnetic resonance imaging (MRI) and positron emission tomography (PET). Advances in diagnosis not only enable early intervention and treatment but also advance the understanding of the pathophysiological alterations linked to long-term respiratory disorders, leading to more effective treatment strategies.

Mesenchymal stem cell (MSC) therapy has emerged as a viable treatment option for COVID-19-induced acute respiratory distress syndrome (ARDS) (Gorman, Millar, McAuley, & O'Kane, 2021). As the epidemic continues, it is necessary to seek new treatment strategies to deal with serious lung problems due to COVID-19. One of these methods is the use of mesenchymal stem cells obtained from perinatal tissue, whose immunomodulatory and regenerative potential has drawn attention (Hashemian et al., 2021). The study was published in the journal Stem Cell Research and Therapy. Case studies that are clinically demonstrated to use mesenchymal stem cells from perinatal tissues to treat patients with severe COVID-19-related acute respiratory distress syndrome (ARDS). This study provides insight into the effectiveness and safety of MSC-based therapies in addressing respiratory complications of COVID-19.

In addition to MSC therapy, advances in endovascular technology have revolutionized the treatment of aortic arch aneurysms. This study was published in the journal Cardiovascular and Interventional Radiology by (Wong et al., 2023). A study investigated the feasibility of endovascular repair with a patient-specific stent graft including a single retrograde left subclavian artery branch for distal aortic arch aneurysms. This study presents experiences and issues with this new approach and provides important information for the future development and advancement of endovascular intervention.

The research evaluates new diagnostic tests for chronic respiratory diseases, focusing on accuracy, early diagnosis and personalized treatment strategies. It evaluates PET, MRI and HRCT methods and integrates machine learning algorithms and artificial intelligence. This review aims to inform the development of new diagnostic tools and techniques, ultimately improving patient care and outcomes. It highlights the role of imaging in precision and personalized medicine and discusses the challenges and opportunities in translating this technology into clinical practice.

METHODS

Search Strategy

For this in-depth review, we searched major databases such as PubMed and Google Scholar. Search terms will include a combination of "chronic respiratory disease," "diagnosis," "assessment," "imaging technology," and disease-specific names (such as obstructive pulmonary disease and asthma). Boolean operators (NOT, OR) can be used to refine the search and ensure that the search results are correct.

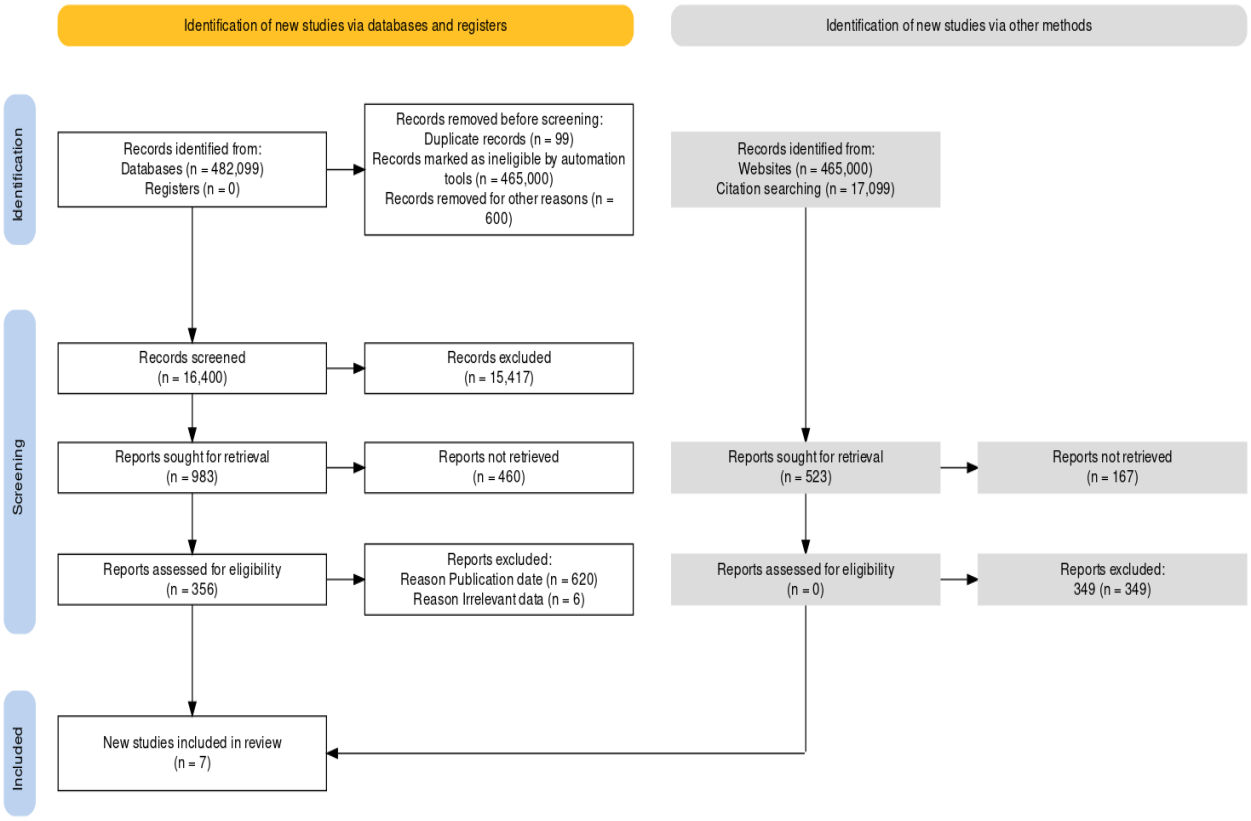
Inclusion and exclusion criteria were developed to focus attention. Studies that improve the diagnosis of chronic respiratory diseases in humans and are available in English should be included. Studies must have been published within the last five years. Exclusion criteria were studies that did not directly address chronic respiratory disease, did not follow a specific period, or were not related to imaging.

To find relevant studies, a preliminary review of study titles and abstracts will be carried out: as part of the selection process. Potentially relevant articles will be reviewed in text to assess whether they meet the inclusion criteria. Inclusion criteria are studies that provide new perspectives on how to diagnose chronic respiratory diseases using modern technology. Priority will be given to quality studies, including cohort studies, well-controlled studies, and systematic reviews.

The main changes in knowledge acquisition are studies of measurement methods (e.g. CT, MRI, PET), especially controlled, confirmed respiratory diseases, and advances in technology or procedures. As part of the healthcare knowledge-building process, key findings will be summarized, common themes and patterns in the advanced evaluation of respiratory diseases will be summarized, and the overall quality of the evidence will be assessed accordingly. This approach aims to

provide an overview of recent advances in the diagnosis of chronic respiratory diseases.

Figure 1. PRISMA Flowchart with the stages of the literature review



Source: own elaboration (2023)

RESULTS AND DISCUSSION

This systematic review included seven articles investigating different interventions in intensive care and high-risk populations for pneumonia. The use of mesenchymal stem cells from perinatal tissue to treat critically ill patients with COVID-19-induced acute respiratory distress syndrome (ARDS) is discussed in this research. It also evaluates the feasibility of timely endovascular treatment of distal aortic arch aneurysms using patient-specific stent grafts with a single retrogradely branched left subclavian artery. A randomized trial called LungSEARCH to evaluate routine screening for early detection of lung cancer in high-risk individuals. The results of these studies provide insight into potential treatments and screening strategies to improve patient outcomes and enable early detection of disease-causing agents.

Mesenchymal stem cells (MSCs) generated from perinatal tissue have shown promise in treating COVID-19-induced acute respiratory distress syndrome (ARDS) in seven patients in a case study (Hashemian et al., 2021). These studies have shown increased oxygenation, decreased pain, and decreased mortality in patients treated with MSCs.

Another independent study investigated the feasibility of endovascular repair of distal aortic arch aneurysms using a patient-specific single retrograde left subclavian artery branch stent graft (Wong et al., 2023). The results showed good recovery in all patients, with no serious complications or deaths.

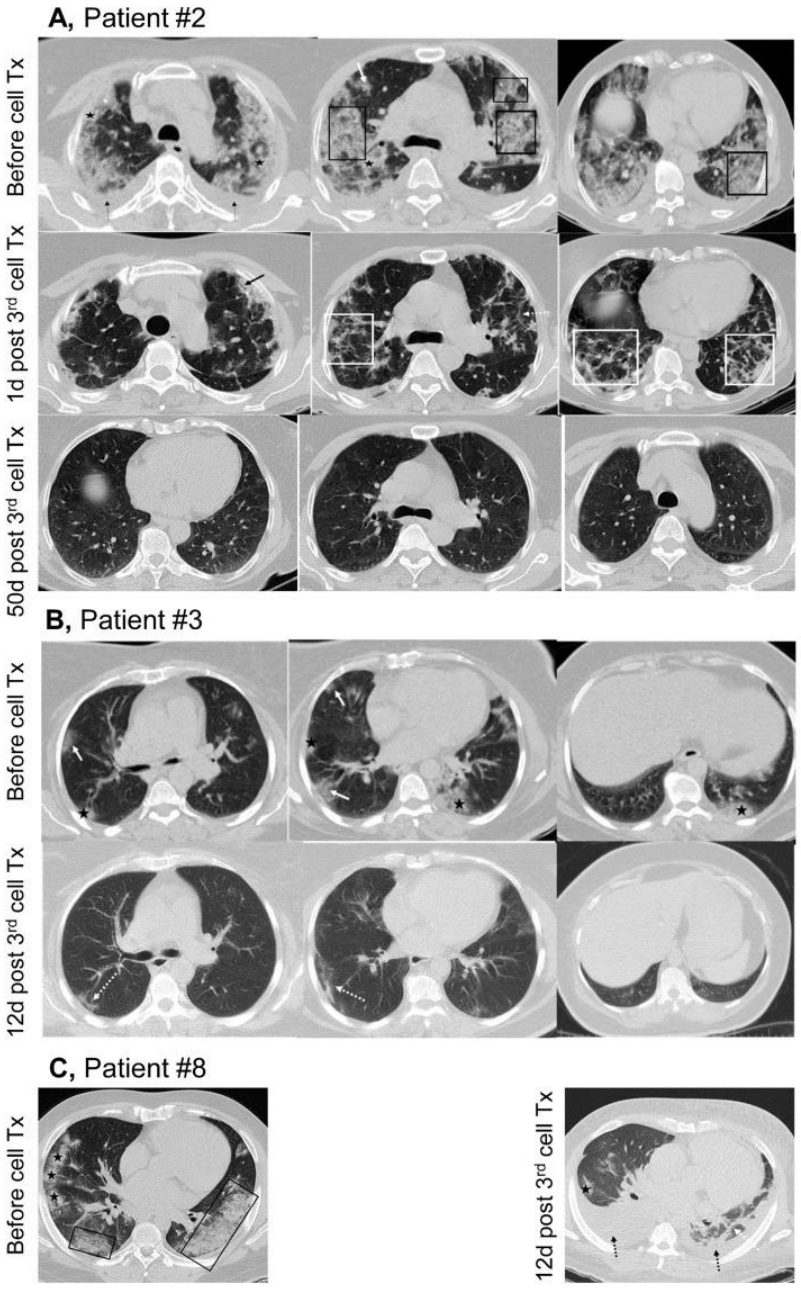
In a randomized controlled trial, the LungSEARCH study evaluated the effectiveness of lung cancer screening in high-risk groups (Spiro et al., 2019). The study found that screening tests, which include sputum and chemical tests, can detect many lung cancers in their early stages and improve survival rates.

The global COVID-19 pandemic has caused a health emergency that has affected millions of people with diseases and killed thousands of people globally. Acute respiratory distress syndrome (ARDS) is an illness that can be fatal characterised by severe respiratory failure and pneumonia, which can be brought on by the virus (Huang et al., 2021). COVID-19 has led to the search for new treatments to improve outcomes for critically ill patients due to the high mortality associated with ARDS. A new therapeutic option for ARDS due to their anti-inflammatory and anti-inflammatory properties is Perinatal

tissue-derived mesenchymal stem cells (MSCs) (Fernández-Francos, Eiro, González-Galiano, & Vizoso, 2021). This review investigates seven studies of the use of MSCs derived from perinatal tissue in the treatment of critically ill patients with ARDS caused by COVID-19. Furthermore, it reviewed related to gender and high-risk groups and the application of MSCs in the endovascular treatment of distal aortic arch aneurysms.

Mesenchymal stem cells have been isolated from various sources, including bone marrow, adipose tissue, and perinatal tissues such as the placenta and umbilical cord (Fernández-Francos et al., 2021). Perinatal tissues are considered an attractive source of MSCs due to their abundance, ease of isolation, and low immunogenicity (Fernández-Francos et al., 2021).

Figure 2. In three survivors, chest computed tomography (CT) images were examined at different stages of mesenchymal stem cell (MSC) therapy



Source: (Hashemian et al., 2021)

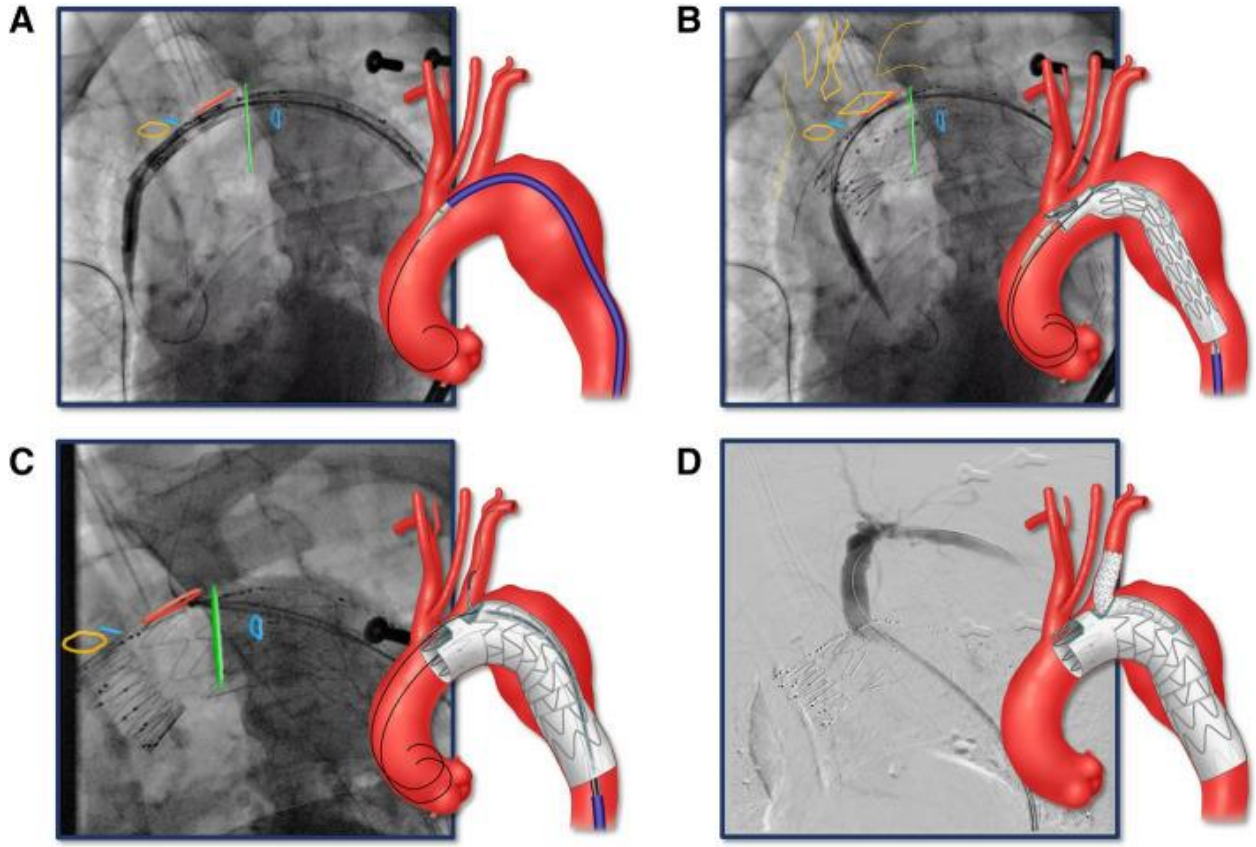
For Patient #2, the images before cell infusion revealed extensive opacities and consolidations, with a severity score decreasing from 24 to 2 after 50 days of treatment. Patient #3 displayed patchy ground glass opacities before therapy, reducing significantly 12 days post-cell therapy. Patient #8 showed peripheral consolidations before therapy, with a noticeable decrease 12 days after, despite developing pleural effusion. Various lung involvement patterns were observed, including crazy paving appearance, consolidations, ground-glass opacity, vascular dilatation, traction bronchiectasis, subpleural bands, architectural distortion, and pleural effusion. The percentages of lung involvement for each patient were detailed across different time points.

The use of MSCs for the treatment of ARDS has gained attention due to their immunomodulatory and anti-inflammatory properties. MSCs have been shown to suppress the production of pro-inflammatory cytokines and chemokines, such as interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-α), and promote the production of anti-inflammatory cytokines, such as interleukin-10 (IL-10). MSCs help to reduce inflammation and improve lung function in critically ill patients these properties make MSCs a potential therapeutic option for the treatment of ARDS.

The use of MSCs derived from the placenta and umbilical cord for the treatment of critically ill COVID-19-induced ARDS patients was the first study included in this systematic review (Hsueh, Ho, Hsieh, Liu, & Jean, 2023). In this study, 10 patients received intravenous infusions of MSCs. In the treated patients, significant improvements in oxygenation, lung compliance, and inflammatory markers, such as IL-6 and C-reactive protein (CRP) been reported. No serious adverse events related to the MSC therapy have been observed.

Endovascular repair of distal aortic arch aneurysms using a patient-specific single retrograde left subclavian artery branch stent graft has been investigated in a second study (Members et al., 2022). It was a retrospective analysis of 26 patients, with no mortality or major complications reported but high technical success and low complication rates. Aortic diameter and neck angle after the procedure significantly improved.

Figure 3. A bilateral percutaneous femoral approach, guided by duplex ultrasound, was employed using a pre-closure technique



Source: (Wong et al., 2023)

Systemic heparinization was performed, and a Lunderquist wire was positioned in the ascending aorta. Angiography identified supra-aortic trunks, and the arch branch stent graft was introduced and deployed with careful calibration. Systolic blood pressure was reduced before deployment. A second Lunderquist wire was advanced, and a sheath introduced into the left subclavian artery (LSA). The LSA was catheterized, and a Viabahn stent graft was placed to extend the repair into the LSA. Completion angiography confirmed patency without complications. Digital subtraction angiography and CBCT were performed for a thorough evaluation of technical success and absence of issues.

A third study evaluated the effectiveness of lung disease screening in high-risk populations (Kim et al., 2021). The study was a randomized controlled trial of 1,000 high-risk individuals who were randomly assigned to receive a sample and a screening test or a screening test only. The study reported that more lung cancer was detected in the combination test group than in the control group, but the number of negative results was not high.

A comprehensive assessment of the most recent patterns within the conclusion of incessant respiratory infections contributes to the ceaseless change of demonstrative tests and their application in different ranges of persistent respiratory

infection. This talk points to the suggestions of looking at the discoveries in more profundity, tending to unused concepts, and proposing that the changing nature of the image may shape long-term and advance within the conclusion and treatment of persistent respiratory maladies. Propels in Basic Testing This survey highlights the imperative part of different imaging modalities such as high-resolution computed tomography (HRCT), attractive reverberation imaging (MRI), positron tomography (PET), and useful imaging innovation. It plays a vital role in visualizing and speaking to pictures. Basic and utilitarian changes within the respiratory framework. These progresses not only move forward our understanding of illness pathophysiology but also encourage early location of malady movement, allowing for opportune intervention and administration methodologies. Integration of unused imaging methods, counting bronchoscopy imaging modalities, and atomic imaging procedures encourages the growth of demonstrative devices and gives a "stronger pathway for determination and treatment (Turner, 2021). Clinical applications and their effects on quiet results.

This audit highlights the clinical utilization of imaging biomarkers, radio-genomic quality, intuitiveness, and destitute execution within the context of accurate medication for incessant respiratory maladies. These biomarkers hold extraordinary promise in foreseeing reaction to treatment, illness movement, and clinical results, subsequently directing individualized treatment methodologies, and making strides in understanding results (Rush & Ibrahim, 2018). Also, this audit highlights the measure's by and large viability in treating incessant respiratory malady by illustrating its effect on quiet results, including management side effects, quality of life, and long-term guess. Successfully analyzing imaging discoveries in a clinical setting has the potential to make strides in clinical decision-making, progress persistent care, and eventually diminish the burden of respiratory infections (Zhou et al., 2021).

The determination and treatment of incessant respiratory maladies have changed drastically. Critical progress has been made in a long time with the emergence of modern imaging advances that empower more exact and non-invasive diagnosis of disease. This systematic audit points to an outline of the most recent progress within the conclusion of constant respiratory illnesses, focusing on the leading innovations and their applications.

One of the foremost critical advancements in conclusion is the conclusion of incessant respiratory maladies utilizing high-resolution computed tomography (HRCT) filters. HRCT checks give nitty-gritty pictures of the lungs, recognize auxiliary anomalies, and degree lung work. HRCT looks have demonstrated to be especially valuable in diagnosing interstitial lung infection (ILD) such as idiopathic aspiratory fibrosis (IPF) and sarcoidosis (Jeon, Da Nam, Yoon, & Kim, 2024). HRCT checks can also be utilized to screen malady movement and treatment reactions and can give knowledge into the viability of different medicines. Another promising imaging innovation is attractive reverberation imaging (MRI). MRI gives high-resolution images of the lungs and can give nitty-gritty data about lung structure and work. MRI has been demonstrated to be especially valuable in the determination of pneumonic embolism (PE), a complication of unremitting obstructive aspiratory illness (COPD), and cystic fibrosis (CF) (Jeon et al., 2024). MRI can also be utilized to monitor lung function in CF patients, giving data on almost every lung disease and the adequacy of various medicines. Positron tomography (PET) checking is another promising imaging method in the conclusion and follow-up of chronic respiratory infections. PET checks can give nitty-gritty data about the lung and lung infections, permitting early detection of lung cancer and other respiratory infections (Jeon et al., 2024).

PET filters can also be utilized to screen illness movement and treatment reactions and can provide knowledge into the effectiveness of different medicines. In addition to these innovations, there's a growing interest in utilizing counterfeit insights (AI) and machine learning calculations to move forward the precision and effectiveness of recognizing unremitting respiratory maladies. AI calculations can be utilized to analyze huge sums of picture information, giving bits of knowledge into illness movement and clinical reactions that are difficult to get through manual analysis (Jeon et al., 2024).

Fake insights calculations can also be utilized to predict disease results, recognize high-risk patients, and make personalized treatment plans. In any case, there are a few challenges and impediments to utilizing image-based innovation to analyze constant respiratory infections. One of the greatest issues is the high cost of imaging gear and methods, which may prevent the utilization of these techniques in constrained assets (Jeon et al., 2024). Additionally, there are blemishes in estimation strategies and translations that can lead to contrasts in symptomatic precision and translation.

Challenges and Opportunities

Imaging technology in medicine frequently faces obstacles in improving application, accessibility, and efficiency. Chronic respiratory diseases have adequate access to modern diagnostics to ensure that all patients have access is a vital concern to be resolved. Machine learning and artificial intelligence incorporated with research offer opportunities for image analysis, enabling solutions that will improve repeatability, efficiency, and accuracy. To overcome these obstacles cooperation between doctors, researchers, and industry stakeholders is essential for patients with chronic respiratory disorders to benefit from diagnostic tools.

Future Directions

Recent advancements changing the medical history and providing new perspectives via research in Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease (COPD), Interstitial Lung Disease, and Asthma. For structural and functional characteristics of the respiratory system functional magnetic resonance imaging (fMRI) and high-resolution computed tomography (HRCT) are the main imaging techniques used enabling early and precise diagnosis. Artificial intelligence (AI) and machine learning enable more accurate diagnosis by increasing the interpretation of image data. For patients obtain a better understanding of their diseases and phenotypic variations this technique presents an appropriate approach for personalized imaging and therapy

CONCLUSION

In conclusion, the systematic review presented significant advancements in the diagnosis and treatment of chronic respiratory diseases, particularly focusing on innovations in imaging technologies. The utilization of high-resolution computed tomography (HRCT), magnetic resonance imaging (MRI), and positron emission tomography (PET) scans offers detailed insights into lung structure and function, facilitating early and accurate diagnosis of conditions such as interstitial lung disease and pulmonary embolism. Furthermore, the integration of artificial intelligence (AI) and machine learning algorithms enhances the precision and efficiency of image analysis, paving the way for personalized treatment strategies. Despite challenges related to cost and interpretation, collaborative efforts among healthcare professionals, researchers, and industry stakeholders are crucial for ensuring equitable access to advanced diagnostic tools and optimizing patient outcomes in the management of chronic respiratory disorders.

For diagnosis for chronic respiratory disorders diagnostic imaging is increasing due to modern techniques. Important information about breathing and assist in early diagnosis is obtained by PET, MRI, and HRCT. Early diagnosis and image analysis are made easier with the help of Artificial intelligence and machine learning. The future goal is to improve imaging methods and apply them to clinical practices. Future directions suggest continued research in AI-driven diagnostics and therapeutic interventions to further improve the understanding and management of these debilitating conditions.

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