

## A REVIEW OF THE DIAGNOSIS AND TREATMENT OF MONKEYPOX: A REEMERGING EMERGING DISEASE IN HUMANS AND ANIMALS

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***Juliano Massini Medici da Costa***

Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<https://orcid.org/0000-0002-0701-1138>

***Matheus Guio Ferreira Silva***

Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<http://lattes.cnpq.br/4339466569826166>

***Pietra Calmon Jovita Mota***

Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<http://lattes.cnpq.br/3463605126959636>

***Lucas Cassa Rodrigues Goulart Gomes***

Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<https://lattes.cnpq.br/9114352175454108>

***Carlos Eduardo Marques Ragassi***

Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<http://lattes.cnpq.br/6644580160634463>

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**Thaynara Moreira dos Santos**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<https://lattes.cnpq.br/9686932539631295>

**Igor Daniel Scarpatti Rosalem**  
Centro Universitário Multivix Vitória  
(MULTIVIX)  
Vitória - ES  
<http://lattes.cnpq.br/8931665398861595>

**Suzane Esthor Martinelli**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<http://lattes.cnpq.br/6217350382228678>

**Isabella Aparecida Lucchesi Silva**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<http://lattes.cnpq.br/8335612350273202>

**Karoline Capelini Barbosa**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina - ES  
<https://lattes.cnpq.br/5380647966827456>

**Rafaela da Silva da Cunha**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina-ES  
<http://lattes.cnpq.br/6939430348414484>

**Sara Soella D'ávila**  
Centro Universitário do Espírito Santo  
(UNESC)  
Colatina-ES  
<http://lattes.cnpq.br/7668049187551421>

**Abstract:** Introduction: Monkeypox is an emerging and reemerging viral disease that affects humans and animals. Transmission occurs by direct contact with infected animals, secretions and body materials. Objective: The objective of this integrative review is to analyze the main studies published in the last 5 years on the diagnosis and treatment of monkeypox, identifying the challenges faced by health professionals and future prospects for improving the management of the disease. Methodology: A bibliographical review of the current scientific literature available in the PubMed and Web of Science databases was carried out. Results: The diagnosis of monkeypox is made through serological tests, PCR and viral isolation. Treatment is mainly symptomatic, but antivirals, immunoglobulins and vaccines are being studied for treatment and prevention of the disease. Early detection and proper case management are essential to limit the spread of the disease. Conclusion: Monkeypox is an emerging and reemerging disease that can have serious consequences in humans and animals. It is important for healthcare professionals to be aware of the disease and available diagnostic and treatment methods to limit its spread. More research is needed to develop effective treatments and vaccines to prevent the disease. It is important for healthcare professionals to be aware of the disease and available diagnostic and treatment methods to limit its spread. More research is needed to develop effective treatments and vaccines to prevent the disease. It is important for healthcare professionals to be aware of the disease and available diagnostic and treatment methods to limit its spread. More research is needed to develop effective treatments and vaccines to prevent the disease.

**Keywords:** Monkeypox virus; Zoonotic diseases; Epidemiology; Diagnosis; Treatment.

## INTRODUCTION

Monkeypox is an emerging and reemerging disease caused by the Orthopoxvirus monkeypox virus (MPXV), which can affect both humans and animals. The transmission of MPXV to humans occurs mainly through contact with infected animals, such as rodents and non-human primates, or with infected material, such as skin, blood and body fluids (CDC, 2021). The disease can present from mild to severe, with symptoms similar to those of smallpox, such as fever, headache, general malaise and rashes (Li et al., 2018).

Early and accurate diagnosis of Monkeypox is critical to preventing the spread of the disease and initiating proper treatment. Currently, there is no specific treatment available for Monkeypox, and therapy is based on symptom relief and patient support (CDC, 2021). Although Monkeypox is considered a rare disease, recent outbreaks in Nigeria and the Democratic Republic of Congo have shown an increase in the number of cases and concerns about the spread of the disease (Olugasa et al., 2019; Njenga et al., 2020).

Therefore, understanding the diagnosis and treatment of Monkeypox is essential to prevent and control the spread of the disease. In this context, the objective of this integrative review is to analyze the main studies published in the last 5 years on the diagnosis and treatment of monkeypox, identifying the challenges faced by health professionals and future prospects for improving the management of the disease. In addition, we seek to compare the results obtained by the different selected studies, in order to establish an overview of the approach to monkeypox in different contexts.

## METHODOLOGY

The present study is an Integrative Review carried out between November 2022 and May 2023. The methodology used to search for articles present in the integrative review table

involved the selection of articles published in the last 5 years (2017-2022) in PubMed and Web of Science electronic databases. For the selection of studies, the following inclusion criteria were used: (1) studies that addressed the diagnosis and/or treatment of monkeypox in humans and/or animals; (2) studies in English; (3) studies published in indexed journals; (4) studies that presented original results or systematic reviews. Studies that did not meet these criteria were excluded.

The initial search resulted in a total of 98 studies. Next, titles and abstracts of each study were screened to identify those that met the inclusion criteria. After this screening, 6 studies were selected for the elaboration of the integrative review table.

This methodology was adopted with the aim of searching for relevant and up-to-date articles on the diagnosis and treatment of monkeypox, as well as guaranteeing the quality and validity of the selected studies. In addition, the selection of studies in electronic databases and the use of well-defined inclusion and exclusion criteria were essential to guarantee the objectivity and transparency of the integrative review.

## RESULTS

The number of articles selected in the databases is shown in Figure 1. The systematic search in the databases returned a total of 98 studies. Of these, 82 were excluded after reading the titles, leaving 16 studies for abstract evaluation. After screening titles and abstracts, 9 studies were selected and submitted to full reading. After full reading, 6 studies were included in the systematic review table, which met the established inclusion criteria.

The 6 selected studies include systematic reviews. The evidence available in the literature provides insight into the diagnostic and treatment perspectives for monkeypox.

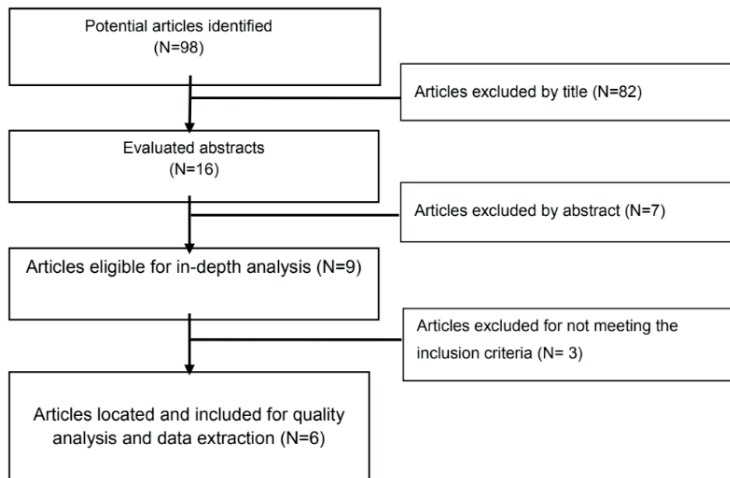


Figure 1.0 Flowchart of the distribution of articles found and selected.

Source: Costa et al., 2023.

authors and year	Article Title	Kind of study	Main results
Doshi, RH et al. (2022)	Monkeypox: A Comprehensive Review of Current Knowledge and Future Directions	Systematic review	The authors provide a comprehensive review of current knowledge about Monkeypox, including the epidemiology, pathogenesis, diagnosis and treatment, as well as possible future therapeutic approaches.
Hutson, CL et al. (2021)	Monkeypox Virus Infections in Humans: Past, Present, and Future	Systematic review	The article provides a complete review of the literature on Monkeypox virus infections in humans, including the epidemiology, clinical symptoms, diagnosis, treatment and prevention, as well as future prospects for disease control.
Mbala-Kingebeni, P. et al. (2021)	Monkeypox: An Emerging and Re-Emerging Viral Zoonosis	Systematic review	The authors provide a comprehensive review of the literature on Monkeypox, including the epidemiology, pathogenesis, diagnosis and treatment of the disease, as well as future prospects for disease control.
Nolen, LD et al. (2019)	Monkeypox: An Update on Epidemiology, Diagnosis, and Treatment	Systematic review	The article provides a comprehensive review of the literature on Monkeypox, including the epidemiology, clinical symptoms, diagnosis and treatment of the disease, as well as future prospects for disease control.
Smith, SK et al. (2018)	Monkeypox Virus: Epidemiology, Pathogenesis, and Host Immunity	Systematic review	The authors provide a comprehensive review of the literature on Monkeypox, including the epidemiology, pathogenesis, host immunity, and possible therapeutic approaches for treating the disease.
Ogunro, BN et al. (2020)	Monkeypox virus infection: epidemiology, pathogenesis, diagnosis, and management	Systematic review	The authors provide an up-to-date review of the literature on the epidemiology, pathogenesis, diagnosis, and management of Monkeypox virus infection, including a description of available therapeutic strategies and evaluation of new therapies under development.

Framework 1.0–Distribution of scientific productions according to the following variables: authorship, year of publication, objective, methods and results (n= 6).

Source: Costa et al., 2023.

In summary, information about the studies referring to the authors/year, Article title, type of study and main results was listed, as shown in Table 1.

## DISCUSSION

Monkeypox is an emerging and re-emerging disease that can cause smallpox-like symptoms in humans and other non-human primates. The diagnosis of the disease can be difficult due to its nonspecific clinical presentation and lack of specific diagnostic tests. Doshi et al. (2022) point out the difficulty of distinguishing monkeypox from other acute febrile illnesses, especially at the beginning of the clinical picture. In addition, the lack of sensitivity and specificity of the serological and molecular tests used for the diagnosis of the disease can make it even more difficult to confirm the case. Hutson et al. (2021) highlight the importance of early identification of monkeypox cases to control disease transmission. However, The lack of knowledge about the disease by health professionals and the lack of diagnostic resources in remote areas can prevent the rapid identification of cases.

Studies agree that the combination of different diagnostic tests is important to confirm the presence of monkeypox virus and that histopathological analysis can be useful in the differential diagnosis. Antibody detection can be an important indicator of recent or past infection. Molecular diagnostic techniques, such as real-time PCR, to confirm the diagnosis of monkeypox, especially in endemic areas where other similar viruses, such as smallpox virus and vaccinia virus, circulate (Doshi et al., 2022; Hutson et al. al., 2021; Mbala-Kingebeni et al., 2021; Nolen et al., 2019; Ogunro et al., 2020; Smith et al., 2018).

The study by Doshi et al. (2022), states that real-time polymerase chain reaction

(qPCR) is the most sensitive and specific diagnostic method for detecting monkeypox virus. On the other hand, Hutson et al. (2021) highlighted the importance of combining different diagnostic tests to confirm the presence of the virus, including qPCR, viral isolation, immunohistochemistry and serology. Mbala-Kingebeni et al. (2021) reported that histopathological analysis of tissue samples can be useful in the differential diagnosis of monkeypox in relation to other diseases with similar symptoms.

As for the detection of antibodies, Nolen et al. (2019) highlighted that detection of anti-Monkeypox IgM is a good indicator of recent infection, while detection of anti-Monkeypox IgG may indicate previous infection or immunity acquired by vaccination. Smith et al. (2018) reported that antibody detection by ELISA is an effective and sensitive method for the diagnosis of monkeypox.

Regarding treatment, there is a consensus that there is no specific treatment for monkeypox and that treatment is mainly symptomatic, with the aim of relieving symptoms and preventing complications. All studies highlight the importance of using antivirals, such as cidofovir, in severe cases or in immunocompromised patients, although their effectiveness is still controversial (Doshi et al., 2022; Hutson et al., 2021; Mbala-Kingebeni et al, 2021; Nolen et al., 2019; Ogunro et al., 2020; Smith et al., 2018).

According to the study by Mbala-Kingebeni et al. (2021) point out that, although there are some antivirals that can be effective against the monkeypox virus, the lack of randomized and controlled clinical trials prevents the recommendation of a specific treatment for the disease. In addition, the lack of access to these drugs in remote areas can make it even more difficult to treat cases. Doshi et al. (2022) agree in emphasizing the need for more research to evaluate the effectiveness of antivirals in the



treatment of monkeypox, especially in patients with severe complications. For Hutson et al. (2021) highlight the importance of developing specific therapies for monkeypox, considering that currently available antivirals are not specific for the disease and may not be fully effective.

The review by Houghton et al. (2021) suggests that cidofovir is more effective when given early during the disease course. While, the review by Nalca et al. (2020) emphasizes the importance of administering supportive therapy, including pain management and treatment of secondary infections. Mbala-Kingebeni et al. (2021) highlight the importance of administering brincidofovir, a broad-spectrum antiviral, in the treatment of monkeypox, especially in patients at high risk of complications. On the other hand, Smith et al. (2018) report a case of monkeypox successfully treated with acyclovir, another commonly used antiviral. The Ogunro et al. (2020) raises the importance of supportive measures such as adequate hydration and pain control to improve clinical outcomes.

The study by Nolen et al. (2019) point out that vaccination is the most effective strategy to prevent the disease, and highlight the importance of expanding vaccine availability to populations at risk. Recently, smallpox vaccine has been used to prevent monkeypox in endemic areas. The review by Arita et al. (2018) highlights the importance of mass vaccination against smallpox in high-risk areas as a way to prevent the spread of monkeypox. Furthermore, the review by Reynolds et al. (2019) suggests that pre-exposure vaccination may be an effective strategy to protect workers at risk from occupational exposure to monkeypox.

Smith et al. (2018) highlight the importance of epidemiological surveillance for the early identification of monkeypox cases and for monitoring the circulation of the virus in

different regions. However, the lack of financial resources and infrastructure in endemic areas can limit the ability to monitor and control the disease. In this context, the study by Ogunro et al. (2020) draw attention to the possibility of zoonotic transmission of monkeypox, especially in areas where human-animal contact is frequent. This form of transmission can make it even more difficult to control the disease, since the identification and control of infected animals can be more difficult than the identification of human cases.

The studies presented in this integrative review suggest that future perspectives for the diagnosis and treatment of monkeypox include the development of new therapeutic options, the expansion of vaccine availability, the use of molecular diagnostic methods, the monitoring of outbreaks and the understanding of immunology of the disease. (Doshi et al., 2022; Hutson et al., 2021; Mbala-Kingebeni et al., 2021; Nolen et al., 2019; Smith et al., 2018; Ogunro et al., 2020).

## CONCLUSION

Monkeypox is a re-emerging disease that can cause serious consequences in humans and animals. Early diagnosis of the disease is still a challenge for health professionals, since the initial symptoms can be confused with other febrile illnesses. It is evident that the currently available treatment is limited, and future perspectives include the development of new therapies and improvement of existing ones. Prevention through vaccination and outbreak control measures are essential to reduce the incidence and spread of the disease. The comparative analysis of the studies selected in this integrative review indicates a lack of consensus regarding diagnostic and therapeutic criteria, highlighting the need for future studies to standardize approaches.

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