

Alliance for Cell Therapy Now
Compilation of Published Articles on the Role of Regenerative Medicine and Cell Therapies in Treating Patients with COVID-19
Updated, December 27, 2020

Article Name	Cell Type	Citation	Date	Summary
1 Human iPSC-derived Alveolar and Airway Epithelial Cells Can be Cultured at Air-Liquid Interface and Express SARS-CoV-2 Host Factors	iPSCs	Abo, K. M., Ma, L., Matte, T., Huang, J., Alysandratos, K. D., Werder, R. B., Mithal, A., Beermann, M. L., Lindstrom-Vautrin, J., Mostoslavsky, G., Ikonomidou, L., Kotton, D. N., Hawkins, F., Wilson, A., & Villacorta-Martin, C. (2020). Human iPSC-derived alveolar and airway epithelial cells can be cultured at air-liquid interface and express SARS-CoV-2 host factors. <i>BioRxiv</i> . https://doi.org/10.1101/2020.06.03.132639	2020 Jun 4	This article compares pluripotent stem cell (iPSC)-derived alveolar and airway epithelial cells to primary lung epithelial cell controls, focusing on expression levels of genes relevant for COVID-19 disease modeling.
2 COVID-19 and Mesenchymal Stem Cell Treatment; Mystery or Not	MSC	Akkoc, T. (2020). COVID-19 and Mesenchymal Stem Cell Treatment; Mystery or Not. In K. Turksen (Ed.), <i>Cell Biology and Translational Medicine, Volume 10: Stem Cells in Tissue Regeneration</i> (pp. 167–176). Springer International Publishing. https://doi.org/10.1007/5584_2020_557	2020 Jul 10	This review highlights studies the beneficial effect of mesenchymal stem cell (MSC) therapy for COVID-19. MSCs are known for their regenerative and immunomodulatory impact. Since COVID-19 is noted for cytokine storm and high inflammation in lungs, MSC seems to be a treatment option.
3 Potential Application of Mesenchymal Stem Cells and their Exosomes in Lung Injury: an Emerging Therapeutic Option for COVID-19 Patients	MSC	Al-Khawaga, S., & Abdelalim, E. M. (2020). Potential application of mesenchymal stem cells and their exosomes in lung injury: An emerging therapeutic option for COVID-19 patients. <i>Stem Cell Research & Therapy, 11</i> . https://doi.org/10.1186/s13287-020-01963-6	2020 Oct 15	This review sheds light on the mechanistic view of MSC therapeutic role based on preclinical and clinical studies on acute lung injury and ARDS; therefore, offering a unique correlation and applicability in COVID-19 patients. The review further highlights the challenges and opportunities in the use of MSC-based therapy.
4 COVID 19 Therapy with Mesenchymal Stromal Cells (MSC) and Convalescent Plasma Must Consider Exosome Involvement: Do the Exosomes in Convalescent Plasma Antagonize the Weak Immune Antibodies?	MSC	Askenase, P. W. (2020). COVID-19 therapy with mesenchymal stromal cells (MSC) and convalescent plasma must consider exosome involvement: Do the exosomes in convalescent plasma antagonize the weak immune antibodies? <i>Journal of Extracellular Vesicles, 10</i> (1), e12004. https://doi.org/10.1002/jev2.12004	2020 Nov 14	This article discusses exosome extracellular vesicles as a biologic therapy for COVID 19. It is recommended to treat the profound clinical cytokine storm and severe pneumonia in COVID 19 patients with mesenchymal stromal cell released exosomes rather than MSCs.
5 Expanded Umbilical Cord Mesenchymal Stem Cells (UC-MSCs) as a Therapeutic Strategy In Managing Critically Ill COVID-19 Patients: The Case for Compassionate Use	MSC	Atluri, S., Manchikanti, L., & Hirsch, J. A. (2020). Expanded Umbilical Cord Mesenchymal Stem Cells (UC-MSCs) as a Therapeutic Strategy In Managing Critically Ill COVID-19 Patients: The Case for Compassionate Use. <i>Pain Physician, 23</i> (2), E71-E83.	2020 Mar	This manuscript describes the pathogenesis of coronavirus and the clinical evidence for treatment of COVID-19 with stem cells along with the urgent need for various solutions. The limited but emerging evidence regarding UC-MSC in managing COVID-19 suggests that it might be considered for compassionate use in critically ill patients to reduce morbidity and mortality in the United States.

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6 Safety and Effectiveness of Intravascular Mesenchymal Stem Cells to Treat Organ Failure and Possible Application in COVID-19 Complications	MSC	Atluri, S., Manocha, V., Boddu, N., Bhati, S., Syed, Z., Diwan, S., & Manchikanti, L. (2020). Safety and Effectiveness of Intravascular Mesenchymal Stem Cells to Treat Organ Failure and Possible Application in COVID-19 Complications. <i>Pain Physician</i> , 23, S391-S420.	2020 Aug 23	This article assesses the safety and efficacy of MSC therapy in organ failure commonly seen in seriously complicated COVID-19 patients by reviewing human randomized controlled trials (RCTs) and observational studies.
7 Can Mesenchymal Stem Cell Therapy be the Interim Management of COVID-19?	MSC	Bamba, C., Singh, S. P., & Choudhury, S. (2020). Can mesenchymal stem cell therapy be the interim management of COVID-19? <i>Drug Discoveries & Therapeutics</i> , 14 (3), 139–142. https://doi.org/10.5582/ddt.2020.03032	2020 Jun 16	This article summarizes recent studies showing that MSC-therapy significantly dampens the cytokine storm in critically ill COVID-19 patients. One of the promising immune-modulator is the mesenchymal stem cells (MSCs) that can surmount the severity of COVID-19 infections.
8 Mesenchymal Stromal Cell Secretome for Severe COVID-19 Infections: Premises for the Therapeutic Use	MSC	Bari, E., Ferrarotti, I., Saracino, L., Perteghella, S., Torre, M. L., & Corsico, A. G. (2020). Mesenchymal Stromal Cell Secretome for Severe COVID-19 Infections: Premises for the Therapeutic Use. <i>Cells</i> , 9 (4). https://doi.org/10.3390/cells9040924	2020 Apr 9	This article discusses how mesenchymal stem cell secretome could offer a new therapeutic approach in treating COVID-19 pneumonia, due to the broad pharmacological effects it shows, including anti-inflammatory, immunomodulatory, regenerative, pro-angiogenic and anti-fibrotic properties.
9 Regenerative Medicine in COVID-19 Treatment: Real Opportunities and Range of Promises	MSC	Basiri, A., Pazhouhnia, Z., Beheshtizadeh, N., Hoseinpour, M., Saghazadeh, A., & Rezaei, N. (2020). Regenerative Medicine in COVID-19 Treatment: Real Opportunities and Range of Promises. <i>Stem Cell Reviews and Reports</i> , 1–13. https://doi.org/10.1007/s12015-020-09994-5	2020 Jun 20	This article discusses the promising features of cell-based therapy, including their regenerative properties and ability to differentiate into diverse cell lineages. The immunomodulatory effects of MSCs, which may assist in inhibiting cytokine storm and lung inflammation, are of particular interest for COVID-19 therapy.
10 Treatment of COVID-19 Pneumonia: the Case for Placenta-Derived Cell Therapy	MSC	Berishvili, E., Kaiser, L., Cohen, M., Berney, T., Scholz, H., Floisand, Y., & Mattsson, J. (2020). Treatment of COVID-19 Pneumonia: The Case for Placenta-derived Cell Therapy. <i>Stem Cell Reviews and Reports</i> , 1–8. https://doi.org/10.1007/s12015-020-10004-x	2020 Jul 21	This article reviews characteristics of placenta-derived MSCs that make attractive candidates for the treatment of COVID-19 pneumonia. In light of the existing clinical evidence for the innocuousness and efficiency of systemic administration of DSCs or AECs in similar conditions, the article advocates for the initiation of clinical trials using this strategy in the treatment of severe COVID-19 disease.
11 Mesenchymal Stem Cell Derived Extracellular Vesicles: Promising Immunomodulators Against Autoimmune, Autoinflammatory Disorders and SARS-CoV-2 Infection	MSC	Bulut, Ö., & Gürsel, İ. (2020). Mesenchymal stem cell derived extracellular vesicles: Promising immunomodulators against autoimmune, autoinflammatory disorders and SARS-CoV-2 infection. <i>Turkish Journal of Biology</i> , 44 (3), 273–282. https://doi.org/10.3906/biy-2002-79	2020 Jun 21	This review presents the outcomes of preclinical and clinical studies utilizing MSC EVs as therapeutic agents for the treatment of a wide variety of immunological disorders. MSC EVs are preferable over MSC-based therapies due to their lower risk of immunogenicity, tumorigenicity and overall superior safety.
12 Harnessing HLA-E-Restricted CD8 T Lymphocytes for Adoptive Cell Therapy of Patients with Severe COVID-19	T-Reg	Caccamo, N., Sullivan, L. C., Brooks, A. G., & Dieli, F. (2020). Harnessing HLA-E-restricted CD8 T lymphocytes for adoptive cell therapy of patients with severe COVID-19. <i>British Journal of Haematology</i> , 190 (4), e185–e187. https://doi.org/10.1111/bjh.16895	2020 Jun 1	This article proposes that the utilisation of HLA E restricted CD8 T cells may offer several advantages to improve T cell immunotherapy in patients with COVID 19, such as the simultaneous capacity to kill infected cells and inhibit intracellular infections, and to reduce the extent of the inflammatory response and limit collateral tissue damage, which is an important component in the pathogenesis of COVID 19.

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13 The Rationale of Using Mesenchymal Stem Cells in Patients with COVID 19 Related Acute Respiratory Distress Syndrome: What to Expect	MSC	Can, A., & Coskun, H. (2020). The rationale of using mesenchymal stem cells in patients with COVID 19 related acute respiratory distress syndrome: What to expect. <i>Stem Cells Translational Medicine</i> . https://doi.org/10.1002/sctm.20-0164	2020 Jul 21	This review documents the rationale and possible outcomes of compassionate use of MSCs, particularly in patients with SARS CoV 2 infections, toward proving or disproving the efficacy of this approach in the near future.
14 The Use of Mesenchymal Stromal Cells in the Treatment of Coronavirus Disease 2019	MSC	Canham, M. A., Campbell, J. D. M., & Mountford, J. C. (2020). The use of mesenchymal stromal cells in the treatment of coronavirus disease 2019. <i>Journal of Translational Medicine</i> , 18 (1), 359. https://doi.org/10.1186/s12967-020-02532-4	2020 Sep 21	This review discusses novel therapeutics for critically ill patients suffering from COVID-19-induced acute respiratory distress syndrome (ARDS). MSCs possess both regenerative and immunomodulatory properties, the latter of which can be harnessed to reduce the severity and longevity of ARDS in patients under intensive care due to SARS-CoV-2 infection.
15 Stem Cell Therapy for COVID 19: Possibilities and Challenges	MSC	Choudhery, M. S., & Harris, D. T. (2020). Stem cell therapy for COVID-19: Possibilities and challenges. <i>Cell Biology International</i> , 44 (11), 2182–2191. https://doi.org/10.1002/cbin.11440	2020 Aug 7	In this review, the possibilities of stem cell use in COVID 19 patients and relevant challenges in their use have been discussed. Several clinical trials have been registered using stem cells for COVID 19 treatment that aim to use different cell sources, dosage, and importantly diverse targeted patient groups.
16 Can Stem Cells Beat COVID-19: Advancing Stem Cells and Extracellular Vesicles Toward Mainstream Medicine for Lung Injuries Associated With SARS-CoV-2 Infections	MSC	Chrzanowski, W., Kim, S. Y., & McClements, L. (2020). Can Stem Cells Beat COVID-19: Advancing Stem Cells and Extracellular Vesicles Toward Mainstream Medicine for Lung Injuries Associated With SARS-CoV-2 Infections. <i>Frontiers in Bioengineering and Biotechnology</i> , 8. https://doi.org/10.3389/fbioe.2020.00554	2020 May 26	This review article outlines the mechanisms of cytokine storm and lung damage caused by SARS-CoV-2 virus leading to COVID-19 disease and how mesenchymal stem cells (MSCs) and their secreted EVs can be utilized to tackle this damage by harnessing their regenerative properties, which gives them potential enhanced clinical utility compared to other investigated pharmacological treatments.
17 Mesenchymal Stem Cells (MSCs) as a Potential Therapeutic Strategy in COVID-19 Patients: Literature Research	MSC	Coelho, A., Alvites, R. D., Branquinho, M. V., Guerreiro, S. G., & Mauricio, A. C. (2020). Mesenchymal Stem Cells (MSCs) as a Potential Therapeutic Strategy in COVID-19 Patients: Literature Research. <i>Frontiers in Cell and Developmental Biology</i> , 8. https://doi.org/10.3389/fcell.2020.602647	2020 Nov 19	This study analyzes the MSCs, their origin, differentiation, therapeutic potential, making a bridge with the COVID-19 disease and its characteristics, as a potential therapeutic strategy, and also reports recent studies where these cell-based therapies were used for the treatment of COVID-19 patients.
18 Stem Cell Therapies for COVID 19: Strategy and Application	MSC	Darabi, R., & Li, Y. (2020). Stem cell therapies for COVID-19: Strategy and application. <i>Journal of Cellular Biochemistry</i> , 121 (12), 4696–4698. https://doi.org/10.1002/jcb.29816	2020 Jul 21	This article discusses the beneficial effects of MSC treatment for COVID-19 complications. So far, a limited clinical trial of MSCs indicated their safety and possible effectiveness to treat pneumonia. Except for pneumonia, other severe complications of the infection such as multi organ failure and sepsis might also benefit from MSC treatment.

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19 Mesenchymal Stem Cell (MSC) Secretome: A Possible Therapeutic Strategy for Intensive-Care COVID-19 Patients	MSC	Deffune, E., Prudenciatti, A., & Moroz, A. (2020). Mesenchymal stem cell (MSC) secretome: A possible therapeutic strategy for intensive-care COVID-19 patients. <i>Medical Hypotheses</i> , 142, 109769. https://doi.org/10.1016/j.mehy.2020.109769	2020 Apr 25	This article hypothesizes MSC secretome testing and production to be used as an alternative approach in SARS-Cov-2 patients in critical conditions.
20 Race to Arsenal COVID-19 Therapeutics: Current Alarming Status and Future Directions	MSC	Dubey, A. K., Singh, A., Prakash, S., Kumar, M., & Singh, A. K. (2020). Race to arsenal COVID-19 therapeutics: Current alarming status and future directions. <i>Chemico-Biological Interactions</i> , 332, 109298. https://doi.org/10.1016/j.cbi.2020.109298	2020 Oct 27	This review is consequently an endeavour to highlight the several aspects of COVID-19, with incorporation of important treatment strategies discovered to date and the effort towards future therapeutic directions.
21 Stem Cells Therapy as a Possible Therapeutic Option in Treating COVID-19 Patients	MSC	Esquivel, D., Mishra, R., Soni, P., Seetharaman, R., Mahmood, A., & Srivastava, A. (2020). Stem Cells Therapy as a Possible Therapeutic Option in Treating COVID-19 Patients. <i>Stem Cell Reviews and Reports</i> , 1–9. https://doi.org/10.1007/s12015-020-10017-6	2020 Aug 1	This review discusses the possible therapeutic uses of MSCs for treating COVID-19. Results from clinical trials are encouraging as patients treated with MSCs regain lung functions and have restored levels of cytokines and trophic factors, underscoring the fact that stem cell therapy can be, at least, a complementary therapy to alleviate sufferings in COVID-19 patients.
22 Distinct Stem/Progenitor Cells Proliferate to Regenerate the Trachea, Intrapulmonary Airways and Alveoli in COVID-19 Patients	Progenitor	Fang, Y., Liu, H., Huang, H., Li, H., Saqi, A., Qiang, L., & Que, J. (2020). Distinct stem/progenitor cells proliferate to regenerate the trachea, intrapulmonary airways and alveoli in COVID-19 patients. <i>Cell Research</i> , 1–3. https://doi.org/10.1038/s41422-020-0367-9	2020 Jun 30	This report shows the major cell types damaged by SARS-CoV-2 infection and demonstrates that distinct proliferating cells are present in the trachea/large airways, small airways and alveoli following SARS-CoV-2 infection.
23 Mesenchymal Stem Cell Use in Acute Respiratory Distress Syndrome: a Potential Therapeutic Application	MSC	Freitag, J., Wickham, J., Shah, K., & Tenen, A. (2020). Mesenchymal stem cell use in acute respiratory distress syndrome: A potential therapeutic application. <i>Future Science OA</i> , 6 (6). https://doi.org/10.2144/fsoa-2020-0048	2020 May 12	This article discusses the potential role of mesenchymal stem cells in combating the inflammatory cascade through immunomodulatory mechanisms and assisting in tissue repair. Early-phase clinical trials have shown safety in the intravenous application of MSC therapy for ARDS, which represents a promising breakthrough in the active management of a condition, which until now has had limited treatment options.
24 Adipose Stem Cells (ASCs) and Stromal Vascular Fraction (SVF) as a Potential Therapy in Combating (COVID-19)-Disease	MSC	Gentile, P., & Sterodimas, A. (2020a). Adipose Stem Cells (ASCs) and Stromal Vascular Fraction (SVF) as a Potential Therapy in Combating (COVID-19)-Disease. <i>Aging and Disease</i> , 11 (3), 465–469. https://doi.org/10.14336/AD.2020.0422	2020 Apr 22	This article discusses adipose stem cells (ASCs) are a therapy for COVID-19. The MSCs could represent an effective, autologous and safe therapy, and the potential use possibilities in COVID-19 of the most common MSCs represented by ASCs are reported.
25 Adipose-Derived Stromal Stem Cells (ASCs) as a New Regenerative Immediate Therapy Combating Coronavirus (COVID-19)-Induced Pneumonia	MSC	Gentile, P., & Sterodimas, A. (2020b). Adipose-derived stromal stem cells (ASCs) as a new regenerative immediate therapy combating coronavirus (COVID-19)-induced pneumonia. <i>Expert Opinion on Biological Therapy</i> , 1–6. https://doi.org/10.1080/14712598.2020.1761322	2020 Apr 29	This article discusses the possibility of mesenchymal stem cell treatment as a safe and efficient approach in selected patients with COVID-19 pneumonia. ASCs, A-Se-MiR, and each type of MSCs may offer new and alternative approaches for the COVID-19 therapy.

Article Name	Cell Type	Citation	Date	Summary
26 Research Progress on Mesenchymal Stem Cells (MSCs), Adipose-Derived Mesenchymal Stem Cells (AD-MSCs), Drugs, and Vaccines in Inhibiting COVID-19 Disease	MSC	Gentile, P., Sterodimas, A., Pizzicannella, J., Calabrese, C., & Garcovich, S. (2020). Research progress on Mesenchymal Stem Cells (MSCs), Adipose-Derived Mesenchymal Stem Cells (AD-MSCs), Drugs, and Vaccines in Inhibiting COVID-19 Disease. <i>Aging and Disease</i> , 11 (5), 1191–1201. https://doi.org/10.14336/AD.2020.0711	2020 Oct 1	In this literature review, the roles of regenerative strategies with MSCs, AD-MSCs, and adipocyte-secreted exosomal microRNAs (A-SE-miRs) as potential antiviral therapies are reported, comparing the results found with current research progress on drugs and vaccines in COVID-19 disease.
27 Cell-Based Therapy for Severe COVID-19 Patients: Clinical Trials and Cost-Utility	MSC	Golchin, A. (2020). Cell-Based Therapy for Severe COVID-19 Patients: Clinical Trials and Cost-Utility. <i>Stem Cell Reviews and Reports</i> . https://doi.org/10.1007/s12015-020-10046-1	2020 Oct 3	This summary describes cell-based clinical trials and the cost-utility aspects of cell therapy. Several clinical trials have been approved for starting phases 2 and 3 of their trials for treating COVID-19 patients with acute respiratory distress syndrome. Many believe that the high cost of cell-based therapy will decrease substantially. Hence, there are hopes that cellular therapy can be approved soon for the treatment of viral diseases such as COVID-19.
28 Mesenchymal Stem Cell Therapy for COVID-19: Present or Future	MSC	Golchin, A., Seyedjafari, E., & Ardeshiryajimi, A. (2020). Mesenchymal Stem Cell Therapy for COVID-19: Present or Future. <i>Stem Cell Reviews and Reports</i> , 1–7. https://doi.org/10.1007/s12015-020-09973-w	2020 Apr 13	This study considers mesenchymal stem cell (MSC) therapy to improve patient's immunological responses to COVID-19 using MSCs and discusses the aspects of this proposed treatment. However, currently, there are no approved MSC-based approaches for the prevention and/or treatment of COVID-19 patients, but clinical trials are ongoing.
29 Emerging Cellular and Pharmacologic Therapies for Acute Respiratory Distress Syndrome	MSC	Gonzalez, H., Horie, S., & Laffey, J. G. (2020). Emerging cellular and pharmacologic therapies for acute respiratory distress syndrome. <i>Current Opinion in Critical Care</i> . https://doi.org/10.1097/MCC.0000000000000784	2020 Dec 3	This article discusses promising cellular and pharmacological therapies for ARDS, including Mesenchymal Stem Cell therapy, which can modulate the immune response, reduce epithelial injury, target endothelial and vascular dysfunction, have anticoagulant effects, and enhance ARDS resolution.
30 The Promise of Mesenchymal Stem Cells Therapy for Acute Respiratory Distress Syndrome Caused by COVID-19	MSC	Gu, J., Zhao, Q., Han, Z., & Han, Z. (2020). The Promise of Mesenchymal stem cells therapy for acute Respiratory Distress Syndrome Caused by COVID-19. <i>Current Stem Cell Research & Therapy</i> . https://doi.org/10.2174/1574888X15999200729161539	2020 Jul 29	This review discusses mesenchymal stem cell (MSC)-based treatment for ARDS caused by SARS-CoV-2. MSCs have the advantage of targeting numerous pathophysiological components of ARDS by secreting a series of cell factors, exerting anti-inflammatory, antioxidative, immunomodulatory, antiapoptotic, and proangiogenic effects, resulting in significant structural and functional recovery following ARDS in various preclinical models and pilot clinical studies.
31 Mesenchymal Stem Cells and Exosome Therapy for COVID-19: Current Status and Future Perspective	MSC	Gupta, A., Kashte, S., Gupta, M., Rodriguez, H. C., Gautam, S. S., & Kadam, S. (2020). Mesenchymal stem cells and exosome therapy for COVID-19: Current status and future perspective. <i>Human Cell</i> , 1–12. https://doi.org/10.1007/s13577-020-00407-w	2020 Aug 11	This review explores the therapeutic potential of both mesenchymal stem cells (MSCs) and MSC-derived exosomes in mitigating the COVID-19 induced cytokine storm as well as promoting the regeneration of alveolar tissue, attributed to the intrinsic cytokines and growth factor present in the MSC secretome.

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32 Therapeutic Potential of Mesenchymal Stem Cells and Their Secretome in the Treatment of SARS-CoV-2-Induced Acute Respiratory Distress Syndrome	MSC	Harrell, C. R., Jovicic, B. P., Djonov, V., & Volarevic, V. (2020). Therapeutic Potential of Mesenchymal Stem Cells and Their Secretome in the Treatment of SARS-CoV-2-Induced Acute Respiratory Distress Syndrome. <i>Analytical Cellular Pathology; Hindawi</i> . https://doi.org/10.1155/2020/1939768	2020 Nov 20	This review article describes molecular mechanisms that are responsible for MSC-based modulation of immune cells, which play a pathogenic role in the development of SARS-CoV-2-induced ARDS. It also provides a brief outline of already conducted and ongoing clinical studies regarding the therapeutic potential of MSCs and their secretome in the therapy of COVID-19-related ARDS.
33 The Role of Extracellular Vesicles in COVID-19 Virus Infection	MSC	Hassanpour, M., Rezaie, J., Nouri, M., & Panahi, Y. (2020). The role of extracellular vesicles in COVID-19 virus infection. <i>Infection, Genetics and Evolution, 85</i> , 104422. https://doi.org/10.1016/j.meegid.2020.104422	2020 Jun 13	This review discusses mesenchymal stem cells (MSCs) and MSC-derived exosomes for the treatment of COVID-19. Exosome-based strategies may include following items: inhibition of exosome biogenesis and uptake, exosome-therapy, exosome-based drug delivery system, and exosome-based vaccine. Mesenchymal stem cells can suppress nonproductive inflammation and improve/repair lung cells including endothelial and alveolar cells, which damaged by COVID-19 virus infection.
34 Novel Therapeutic Approaches for Treatment of COVID-19	MSC	Hosseini-khannazer, N., Shokohian, B., Shpichka, A., Aghdaei, H. A., Timashev, P., & Vosough, M. (2020). Novel therapeutic approaches for treatment of COVID-19. <i>Journal of Molecular Medicine (Berlin, Germany)</i> , 1–15. https://doi.org/10.1007/s00109-020-01927-6	2020 Jun 3	This article summarizes the therapeutic approaches that are used to treat COVID-19. It seems that MSC therapy could be a novel therapeutic approach for the treatment of COVID-19. MSC therapy could inhibit excessive immune system reaction, modulate inflammatory milieu, and prevent virus-mediated cytokine storm.
35 SARS-CoV-2 Infection of Pluripotent Stem Cell-derived Human Lung Alveolar Type 2 Cells Elicits a Rapid Epithelial-Intrinsic Inflammatory Response	iPSCs	Huang, J., Hume, A. J., Abo, K. M., Werder, R. B., Villacorta-Martin, C., Alysandratos, K.-D., Beermann, M. L., Simone-Roach, C., Lindstrom-Vautrin, J., Olejnik, J., Suder, E. L., Bullitt, E., Hinds, A., Sharma, A., Bosmann, M., Wang, R., Hawkins, F., Burks, E. J., Saeed, M., ... Kotton, D. N. (2020). SARS-CoV-2 Infection of Pluripotent Stem Cell-Derived Human Lung Alveolar Type 2 Cells Elicits a Rapid Epithelial-Intrinsic Inflammatory Response. <i>Cell Stem Cell, 27</i> (6), 962-973.e7. https://doi.org/10.1016/j.stem.2020.09.013	2020 Sep 18	This article reveals the cell-intrinsic responses of a key lung target cell to infection, providing a platform for further drug development and facilitating a deeper understanding of COVID-19 pathogenesis.

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36 Stem Cell Based Therapy Option in COVID-19: Is It Really Promising?	MSC	Irmak, D. K., Darıcı, H., & Karaöz, E. (2020). Stem Cell Based Therapy Option in COVID-19: Is It Really Promising? <i>Aging and Disease</i> , 11 (5), 1174–1191. https://doi.org/10.14336/AD.2020.0608	2020 Oct 1	This paper intends to analyze the current clinical trials on stem cell treatment of novel virus, searching and reviewing the available information and the International Clinical Trials Registry Platform (ICTRP) of World Health Organization (WHO). The paper concludes that the stem cell treatment of COVID-19 is found promising with pilot studies' results, but still in the early development phase. There is an urgent need for large-scale investigations to confirm and validate the safety and efficacy profile of these therapies with reliable scientific evidence.
37 Immunomodulatory Effect of Mesenchymal Stem Cells and Mesenchymal Stem-Cell-Derived Exosomes for COVID-19 Treatment	MSC	Jayaramayya, K., Mahalaxmi, I., Subramaniam, M. D., Raj, N., Dayem, A. A., Lim, K. M., Kim, S. J., An, J. Y., Lee, Y., Choi, Y., Raj, A., Cho, S.-G., & Vellingiri, B. (2020). Immunomodulatory effect of mesenchymal stem cells and mesenchymal stem-cell-derived exosomes for COVID-19 treatment. <i>BMB Reports</i> , 53 (8), 400–412.	2020 Jul 31	This review discusses the basics of the cytokine storm in COVID-19, MSCs and MSC-derived exosomes, and both ongoing and potential stem-cell-based clinical trials for COVID-19.
38 Fostering Mesenchymal Stem Cell Therapy to Halt Cytokine Storm in COVID-19	MSC	Jeyaraman, M., John, A., Koshy, S., Ranjan, R., Anudeep, T. C., Jain, R., Swati, K., Jha, N. K., Sharma, A., Kesari, K. K., Prakash, A., Nand, P., Jha, S. K., & Reddy, P. H. (2021). Fostering mesenchymal stem cell therapy to halt cytokine storm in COVID-19. <i>Biochimica et Biophysica Acta. Molecular Basis of Disease</i> , 1867 (2), 166014. https://doi.org/10.1016/j.bbadis.2020.166014	2020 Nov 22	This article revolves around the usage of novel MSCs therapy for combating COVID-19. With the available evidence of immunomodulatory and immune-privilege actions, mesenchymal stem cells (MSCs) can repair, regenerate and remodulate the native homeostasis of pulmonary parenchyma with improved pulmonary compliance.
39 Cellular Therapy: Shafts of Light Emerging for COVID-19	MSC	Jeyaraman, M., Ranjan, R., Kumar, R., Arora, A., Chaudhary, D., Ajay, S. S., & Jain, R. (2020). Cellular Therapy: Shafts of Light Emerging for COVID-19. <i>Stem Cell Investigation</i> , 7. https://doi.org/10.21037/sci-2020-022	2020 Jun 30	This review article discusses emerging novel approaches to combat severe forms of COVID-19. Currently, these aren't approved for preventing or treating COVID-19 cases; however, clinical trials are afoot to dispense the utmost understanding in terms of efficacy and safety concerns. Mesenchymal stem cells (MSCs) have yielded the most promising results among stromal vascular fraction (SVF); placental cells; natural killer (NK) cell and platelet lysate respectively.
40 Endothelial Progenitor Cells and Mesenchymal Stem Cells to Overcome Vascular Deterioration and Cytokine Storm in Critical Patients with COVID-19	MSC	Karaahmet, F., & Kocaman, S. A. (2020). Endothelial progenitor cells and mesenchymal stem cells to overcome vascular deterioration and cytokine storm in critical patients with COVID-19. <i>Medical Hypotheses</i> , 144, 109973. https://doi.org/10.1016/j.mehy.2020.109973	2020 Jun 10	This article discusses mesenchymal stem cell treatment for vascular deterioration and the cytokine storm in critically-ill COVID-19 patients. The restoration of vascular endothelial function and modulation of immune system by synergistic use of EPCs and MSCs may have a crucial role to overcome the vascular collapse driving forces in COVID-19 patients.

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41 The Role of Mesenchymal Stromal Cells in Immune Modulation of COVID-19: Focus on Cytokine Storm	MSC	Kavianpour, M., Saleh, M., & Verdi, J. (2020). The role of mesenchymal stromal cells in immune modulation of COVID-19: Focus on cytokine storm. <i>Stem Cell Research & Therapy</i> , 11 (1), 404. https://doi.org/10.1186/s13287-020-01849-7	2020 Sep 18	This review highlights the newest research findings regarding mesenchymal stem cell (MSC)-based immunomodulation in patients with COVID-19. MSCs can reduce the cytokine storm produced by coronavirus infection. In a number of studies, the administration of these cells has been beneficial for COVID-19 patients.
42 Overview of Stem Cell Therapy for Acute Respiratory Distress Syndrome with Focus on COVID 19	MSC	Kaye, R. J. (2020). Overview of Stem Cell Therapy for Acute Respiratory Distress Syndrome with Focus on. <i>Pain Physician</i> , 23, S421-S431.	2020 Aug 23	This review examines recent research studies in humans to determine whether mesenchymal stem cells (MSCs) may be used effectively and safely to target potentially deadly lung damage that may follow infection by COVID-19.
43 Promising Impacts of Mesenchymal Stem Cell Therapy in Treatment of SARS-CoV-2 (COVID-19)	MSC	Khorshidi, M., Zarezadeh, M., Emami, M., Olang, B., & Moghaddam, O. M. (2020). Promising impacts of mesenchymal stem cell therapy in treatment of SARS-CoV-2 (COVID-19). <i>Heart & Lung: The Journal of Cardiopulmonary and Acute Care</i> , 49 (6), 745–748. https://doi.org/10.1016/j.hrtlng.2020.08.007	2020 Aug 19	This article discusses whether mesenchymal stem cell (MSC) could be considered as an efficacious and safe treatment approach for COVID-19-induced pneumonia.
44 Current Status of Cell-Based Therapies for Respiratory Virus Infections: Applicability to COVID-19	MSC	Khoury, M., Cuenca, J., Cruz, F. F., Figueroa, F. E., Rocco, P. R. M., & Weiss, D. J. (2020). Current status of cell-based therapies for respiratory virus infections: Applicability to COVID-19. <i>The European Respiratory Journal</i> , 55 (6). https://doi.org/10.1183/13993003.00858-2020	2020 Jun 4	This review presents current clinical investigations of cell-based therapy approaches for COVID-19. To provide a rational strategy to maximise potential therapeutic use, it is critically important to understand the relevant pre-clinical studies and postulated mechanisms of MSC actions in respiratory virus-induced lung injuries.
45 Perspectives on Mesenchymal Stem/Progenitor Cells and Their Derivates as Potential Therapies for Lung Damage Caused by COVID-19	MSC	Klimczak, A. (2020). Perspectives on mesenchymal stem/progenitor cells and their derivates as potential therapies for lung damage caused by COVID-19. <i>World Journal of Stem Cells</i> , 12 (9), 1013–1022. https://doi.org/10.4252/wjsc.v12.i9.1013	2020 Sep 26	This review discusses mesenchymal stem cells (MSCs) and/or their secretome as cell-based therapy for critically ill patients of COVID-19. MSCs secrete a variety of bioactive factors that can be applied for respiratory tract regeneration in COVID-19 patients thanks to their trophic, anti-inflammatory, immunomodulatory, anti-apoptotic, pro-regenerative, and proangiogenic properties.
46 Current Treatment Approaches for COVID-19 and The Clinical Value of Transfusion-Related Technologies	MSC	Li, Y., Liu, S., Zhang, S., Ju, Q., Zhang, S., Yang, Y., & Wang, H. (2020). Current treatment approaches for COVID-19 and the clinical value of transfusion-related technologies. <i>Transfusion and Apheresis Science</i> , 59 (5). https://doi.org/10.1016/j.transci.2020.102839	2020 Jun 3	This article summarizes the current potential therapeutic approaches for diseases related to COVID-19 infection and discusses the clinical value of blood transfusion-related technologies used in COVID-19 treatment.
47 Stem Cell Therapy for COVID 19, ARDS and Pulmonary Fibrosis	MSC	Li, Z., Niu, S., Guo, B., Gao, T., Wang, L., Wang, Y., Wang, L., Tan, Y., Wu, J., & Hao, J. (2020). Stem cell therapy for COVID-19, ARDS and pulmonary fibrosis. <i>Cell Proliferation</i> , 53 (12), e12939. https://doi.org/10.1111/cpr.12939	2020 Oct 24	This review systematically summarizes the pathogenic progression and potential mechanisms underlying stem cell therapy in COVID 19 and discusses registered COVID 19 clinical trials. Of all the stem cell therapies touted for COVID 19 treatment, mesenchymal stem cells (MSCs) or MSC like derivatives have been the most promising in preclinical studies and clinical trials so far.

Article Name	Cell Type	Citation	Date	Summary
48 Mesenchymal Stem Cell Therapy Can Transcend Perianal Crohn's Disease: How Colorectal Surgeons Can Help in the Coronavirus Disease 2019 Crisis	MSC	Lightner, A. L., & Garcia-Olmo, D. (2020). Mesenchymal Stem Cell Therapy Can Transcend Perianal Crohn's Disease: How Colorectal Surgeons Can Help in the Coronavirus Disease 2019 Crisis. <i>Diseases of the Colon & Rectum</i> , 63 (7), 874–878. https://doi.org/10.1097/DCR.0000000000001700	2020 July	The purpose of this review is to help colorectal surgeons apply their experience with MSCs to Covid-19. Just as Crohn's disease is characterized by increased inflammatory cytokines and aberrant ratios of immune cells, patients with COVID-19 also exhibit hyperinflammation with a cytokine storm that results in an ARDS picture.
49 Mesenchymal Stem Cells as Living Anti-Inflammatory Therapy for COVID-19 Related Acute Respiratory Distress Syndrome	MSC	Lin, F., Ichim, T. E., Pingle, S., Jones, L. D., Kesari, S., & Ashili, S. (2020). Mesenchymal stem cells as living anti-inflammatory therapy for COVID-19 related acute respiratory distress syndrome. <i>World Journal of Stem Cells</i> , 12 (10), 1067–1079. https://doi.org/10.4252/wjsc.v12.i10.1067	2020 Oct 26	This review discusses the unique ability of mesenchymal stem cells (MSCs), to act as a “living anti-inflammatory”, which can “rebalance” the cytokine/immune responses to restore equilibrium. It also discusses current MSC trials and present different concepts for optimization of MSC therapy in patients with COVID-19 acute respiratory distress syndrome.
50 Mesenchymal Stem Cells as a Potential Therapy for COVID-19	MSC	Liu, S., Peng, D., Qiu, H., Yang, K., Fu, Z., & Zou, L. (2020). Mesenchymal stem cells as a potential therapy for COVID-19. <i>Stem Cell Research & Therapy</i> , 11. https://doi.org/10.1186/s13287-020-01678-8	2020 May 4	This commentary summarizes the clinical trials of MSCs treatments on ALI/ARDS and raises MSCs as a hopefully alternative therapy for severe or critical COVID-19. MSCs can balance the inflammatory response and has been mentioned to be effective on ALI/ARDS from both infectious and noninfectious causes previously, presenting an important opportunity to be applied to COVID-19.
51 Mesenchymal Stromal Cells as Potential Immunomodulatory Players in Severe Acute Respiratory Distress Syndrome Induced by SARS-CoV-2 Infection	MSC	Mallis, P., Michalopoulos, E., Chatzistamatiou, T., & Stavropoulos-Giokas, C. (2020). Mesenchymal stromal cells as potential immunomodulatory players in severe acute respiratory distress syndrome induced by SARS-CoV-2 infection. <i>World Journal of Stem Cells</i> , 12 (8), 731–751. https://doi.org/10.4252/wjsc.v12.i8.731	2020 Aug 26	This article discusses how, taking into account the multifunctional properties of MSCs, the proposed stem-cell-based therapy may be proven significantly effective in critically-ill COVID-19 patients. The current therapeutic strategy may improve the patient's overall condition and in parallel may decrease the mortality rate of the current disease.
52 The Immune System as a Target for Therapy of SARS-CoV-2: A Systematic Review of the Current Immunotherapies for COVID-19	MSC	Mansourabadi, A. H., Sadeghalvad, M., Mohammadi-Motlagh, H.-R., & Rezaei, N. (2020). The immune system as a target for therapy of SARS-CoV-2: A systematic review of the current immunotherapies for COVID-19. <i>Life Sciences</i> , 258, 118185. https://doi.org/10.1016/j.lfs.2020.118185	2020 Oct 1	This article aims to describe the role of the immune system in response to COVID-19. A systematic review is provided to collate and describe all published reports of immunotherapies, including convalescent plasma therapy, monoclonal antibodies, cytokine therapy, mesenchymal stem cell therapy, and intravenous immunoglobulin, and their important outcomes in COVID-19 patients.
53 Flattening the COVID-19 Curve With Natural Killer Cell Based Immunotherapies	NK	Market, M., Angka, L., Martel, A. B., Bastin, D., Olanubi, O., Tennakoon, G., Boucher, D. M., Ng, J., Ardolino, M., & Auer, R. C. (2020). Flattening the COVID-19 Curve With Natural Killer Cell Based Immunotherapies. <i>Frontiers in Immunology</i> , 11. https://doi.org/10.3389/fimmu.2020.01512	2020 Jun 23	This review summarizes the current understanding of how NK cells respond in both early and late coronavirus infections, and the implication for ongoing COVID-19 clinical trials. Using this immunological lens, recommendations for therapeutic strategies against COVID-19 in clearing the virus while preventing the harm of immunopathological responses are outlined.

Article Name	Cell Type	Citation	Date	Summary
54 Mesenchymal Stem Cells and Management of COVID-19 Pneumonia	MSC	Metcalfe, S. M. (2020). Mesenchymal stem cells and management of COVID-19 pneumonia. <i>Medicine in Drug Discovery</i> , 5, 100019. https://doi.org/10.1016/j.medidd.2020.100019	2020 Mar 19	This article considers new approaches to improve patient's biological resistance to COVID-19 using stem cells, and how benefit might be scaled and simplified using synthetic stem cells to meet logistical needs within a short time frame. The finding that MSC are safe and can reverse severe critical disease with high potency is a major breakthrough representing an entirely new biological approach to treatment that needs to be developed urgently.
55 MSC Therapies for COVID-19: Importance of Patient Coagulopathy, Thromboprophylaxis, Cell Product Quality and Mode of Delivery for Treatment Safety and Efficacy	MSC	Moll, G., Drzeniek, N., Kamhieh-Milz, J., Geissler, S., Volk, H.-D., & Reinke, P. (2020). MSC Therapies for COVID-19: Importance of Patient Coagulopathy, Thromboprophylaxis, Cell Product Quality and Mode of Delivery for Treatment Safety and Efficacy. <i>Frontiers in Immunology</i> , 11. https://doi.org/10.3389/fimmu.2020.01091	2020 May 19	In order to minimize the evident risk of high doses of poorly characterized unregulated cell products, this article proposes three decisive steps for integrating innate immune hemocompatibility testing into the standard characterization and clinical routines or IV applied cell therapies; and this article also encourages the considerations of alternative non-intravascular application regimes, which may prove to be safer and more efficient alternatives in the long-run.
56 Mesenchymal Stromal Cells and their Secreted Extracellular Vesicles as Therapeutic Tools for COVID-19 Pneumonia?	MSC	Muraca, M., Pessina, A., Pozzobon, M., Dominici, M., Galderisi, U., Lazzari, L., Parolini, O., Lucarelli, E., Perilongo, G., & Baraldi, E. (2020). Mesenchymal stromal cells and their secreted extracellular vesicles as therapeutic tools for COVID-19 pneumonia? <i>Journal of Controlled Release</i> , 325, 135–140. https://doi.org/10.1016/j.jconrel.2020.06.036	2020 Jul 3	This review summarizes the experimental evidence underlying the possible use of MSCs and of MSC-EVs in severe COVID-19 infection and underlines the need to evaluate the possible efficacy of these therapeutic approaches through controlled studies under the supervision of the Regulatory Authorities.
57 Extracellular Vesicles from Mesenchymal Stem Cells as a Covid-19 Treatment	MSC	O'Driscoll, L. (2020). Extracellular vesicles from mesenchymal stem cells as a Covid-19 treatment. <i>Drug Discovery Today</i> , 25 (7), 1124–1125. https://doi.org/10.1016/j.drudis.2020.04.022	2020 May 6	This article discusses the potential advantages of MSC-EVs over MSCs as a treatment for COVID-19. MSC-EVs bear the benefits of MSCs and then some; research focused on their exploitation as a therapeutic option in COVID-19 is warranted, while giving due consideration to the fact that they might also exacerbate some of the symptoms.
58 Novel Insights into the Treatment of SARS-CoV-2 Infection: An Overview of Current Clinical Trials	MSC	Oroojalian, F., Haghbin, A., Baradaran, B., Hemmat, N., Shahbazi, M.-A., Baghi, H. B., Mokhtarzadeh, A., & Hamblin, M. R. (2020). Novel insights into the treatment of SARS-CoV-2 infection: An overview of current clinical trials. <i>International Journal of Biological Macromolecules</i> , 165, 18–43. https://doi.org/10.1016/j.ijbiomac.2020.09.204	2020 Sep 28	This review provides an overview of the biological properties, functional mechanisms, and molecular components of SARS-CoV-2, along with investigational therapeutic and preventive approaches for this virus, including Mesenchymal stem cells and natural killer cells.

Article Name	Cell Type	Citation	Date	Summary
59 Mesenchymal Stem Cells for Coronavirus (COVID-19)-Induced Pneumonia: Revisiting the Paracrine Hypothesis with New Hopes?	MSC	Öztürk, S., Elçin, A. E., & Elçin, Y. M. (2020). Mesenchymal Stem Cells for Coronavirus (COVID-19)-Induced Pneumonia: Revisiting the Paracrine Hypothesis with New Hopes? <i>Aging and Disease</i> , 11 (3), 477–479. https://doi.org/10.14336/AD.2020.0403	2020 Apr 2	This study comments on the possible therapeutic effects of MSCs in COVID-19 infection. Mesenchymal stem cells bear a promising potential for regenerative medicine therapies and they repair damaged tissue through secretion of immune modulatory and anti-inflammatory molecules acting in a paracrine fashion.
60 Auxiliary Role of Mesenchymal Stem Cells as Regenerative Medicine Soldiers to Attenuate Inflammatory Processes of Severe Acute Respiratory Infections Caused by COVID-19	MSC	Parhizkar Roudsari, P., Alavi-Moghadam, S., Payab, M., Sayahpour, F. A., Aghayan, H. R., Goodarzi, P., Mohamadi-jahani, F., Larijani, B., & Arjmand, B. (2020). Auxiliary role of mesenchymal stem cells as regenerative medicine soldiers to attenuate inflammatory processes of severe acute respiratory infections caused by COVID-19. <i>Cell and Tissue Banking</i> , 1–21. https://doi.org/10.1007/s10561-020-09842-3	2020 Jun 25	This review focuses on the auxiliary role of mesenchymal stem cells to reduce inflammatory processes of acute respiratory infections caused by COVID-19. More investigations with a long follow-up period are demanded to increase the therapeutic outcome of MSCs besides creating the best strategy for application of them, including the best route and dose of administration.
61 Mesenchymal Stem Cell Derived Exosomes: a Nano Platform for Therapeutics and Drug Delivery in Combating COVID-19	MSC	Pinky, Gupta, S., Krishnakumar, V., Sharma, Y., Dinda, A. K., & Mohanty, S. (2020). Mesenchymal Stem Cell Derived Exosomes: A Nano Platform for Therapeutics and Drug Delivery in Combating COVID-19. <i>Stem Cell Reviews and Reports</i> , 1–11. https://doi.org/10.1007/s12015-020-10002-z	2020 Jul 13	This review briefly recapitulates the recent evidence and developments in understanding exosomes as a promising candidate for novel nano-intervention in the current pandemic scenario. Furthermore, this review will highlight and discuss mechanistic role of exosomes to combat severe lung pathological conditions.
62 The Current Understanding and Potential Therapeutic Options to Combat COVID-19	MSC	Pooladanda, V., Thatikonda, S., & Godugu, C. (2020). The current understanding and potential therapeutic options to combat COVID-19. <i>Life Sciences</i> , 254, 117765. https://doi.org/10.1016/j.lfs.2020.117765	2020 May 8	This review focuses on possible therapeutic options for COVID-19 such as repurposing drugs including antimalarials, antivirals, antiparasitic drugs, and anti-HIV drugs, as well as monoclonal antibodies, vaccines as potential treatment options. It also summarizes the latest research progress on the usage of stem cell therapy, human convalescent serum, interferon's, in the treatment of COVID-19.
63 The Role of Mesenchymal Stem/Stromal Cells in the Acute Clinical Setting	MSC	Premer, C., Schulman, I. H., & Jackson, J. S. (2020). The role of mesenchymal stem/stromal cells in the acute clinical setting. <i>The American Journal of Emergency Medicine</i> . https://doi.org/10.1016/j.ajem.2020.11.035	2020 Nov 24	This article reviews the current state of MSC-based therapeutics and further explores the untapped potential role to treat various acute, life-threatening injuries in the ED and ICU.
64 Mesenchymal Stem Cell Therapy for Acute Respiratory Distress Syndrome: from Basic to Clinics	MSC	Qin, H., & Zhao, A. (2020). Mesenchymal stem cell therapy for acute respiratory distress syndrome: From basic to clinics. <i>Protein & Cell</i> , 1–16. https://doi.org/10.1007/s13238-020-00738-2	2020 June 9	This article provides a comprehensive review of the mechanisms and optimization of MSC therapy in ARDS and highlights the potentials and possible barriers of MSC therapy for COVID-19 patients with ARDS.

Article Name	Cell Type	Citation	Date	Summary
65 Cell Based Therapy to Reduce Mortality from COVID 19: Systematic Review and Meta Analysis of Human Studies on Acute Respiratory Distress Syndrome	MSC	Qu, W., Wang, Z., Hare, J. M., Bu, G., Mallea, J. M., Pascual, J. M., Caplan, A. I., Kurtzberg, J., Zubair, A. C., Kubrova, E., Engelberg Cook, E., Nayfeh, T., Shah, V. P., Hill, J. C., Wolf, M. E., Prokop L. J., Murad, M. H., & Sanfilippo, F. P. (2020). Cell based therapy to reduce mortality from COVID 19: Systematic review and meta analysis of human studies on acute respiratory distress syndrome. <i>Stem Cells Translational Medicine</i> . https://doi.org/10.1002/sctm.20-0146	2020 May 9	This analysis of published reports demonstrated the potential benefits, minimal risks, and presumptive mechanisms of MSC therapy for ARDS, which support the rationale for treatment of COVID 19 patients with pulmonary disease. Adequately powered clinical trials are urgently needed to test clinical outcomes in patients with COVID 19 syndrome and SARS CoV 2 infection, and should use well characterized MSC products with documented safety profiles from FDA approved studies.
66 Combating COVID-19 with Mesenchymal Stem Cell Therapy	MSC	Rajarshi, K., Chatterjee, A., & Ray, S. (2020). Combating COVID-19 with mesenchymal stem cell therapy. <i>Biotechnology Reports</i> , 26, e00467. https://doi.org/10.1016/j.btre.2020.e00467	2020 May 14	In this review highlights all the implications associated with mesenchymal stem cell (MSC) therapy application in case of COVID-19. MSC therapy offers a promising approach towards mitigating the delirious effects of the infection in the COVID-19 patients.
67 Therapeutic Modalities and Novel Approaches in Regenerative Medicine for COVID-19	MSC	Ramezankhani, R., Solhi, R., Memarnejadian, A., Nami, F., Hashemian, S. M. R., Tricot, T., Vosough, M., & Verfaillie, C. (2020). Therapeutic modalities and novel approaches in regenerative medicine for COVID-19. <i>International Journal of Antimicrobial Agents</i> , 56 (6), 106208. https://doi.org/10.1016/j.ijantimicag.2020.106208	2020 Oct 23	This article reviews the underlying mechanisms for the pathogenesis of severe acute respiratory syndrome coronavirus-2, and discusses available therapeutic candidates and advanced modalities that are being evaluated in in-vitro/in-vivo models and are of note in clinical trials.
68 Mesenchymal Stem Cells-Bridge Catalyst Between Innate and Adaptive Immunity in COVID 19	MSC	Rao, V., Thakur, S., Rao, J., Arakeri, G., Brennan, P. A., Jadhav, S., Sayeed, M. S., & Rao, G. (2020). Mesenchymal stem cells-bridge catalyst between innate and adaptive immunity in COVID 19. <i>Medical Hypotheses</i> , 143, 109845. https://doi.org/10.1016/j.mehy.2020.109845	2020 May 18	This article summarizes treatments for critically-ill COVID-19 patients. Mesenchymal stem cells are known to suppress overactive immune responses as well as bring about tissue regeneration and repair. This immuno-modulatory effect of MSCs could hold potential to manage a patient with severe symptoms of COVID 19 infection due to a dysfunctional adaptive immune system.
69 Mesenchymal Stem Cells: A New Front Emerge in COVID19 Treatment	MSC	Raza, S. S., & Khan, M. A. (2020). Mesenchymal Stem Cells: A new front emerge in COVID19 treatment: Mesenchymal Stem Cells therapy for SARS-CoV2 viral infection. <i>Cytotherapy</i> , 0 (0). https://doi.org/10.1016/j.jcyt.2020.07.002	2020 Jul 15	This article highlights results from preliminary clinical investigations of MSCs therapy for SARS-CoV-2 infected patients. The preliminary clinical data suggest that MSCs possess the capacity to lessen systemic inflammatory responses and protect against SARS-COV-2 virus-induced injury. Additional studies in a larger cohort of patients are needed to validate their potential efficacy.
70 'Primed' Mesenchymal Stem Cells: a Potential Novel Therapeutic for COVID19 Patients	MSC	Raza, S. S., Seth, P., & Khan, M. A. (2020). 'Primed' Mesenchymal Stem Cells: A Potential Novel Therapeutic for COVID19 Patients. <i>Stem Cell Reviews and Reports</i> , 1–10. https://doi.org/10.1007/s12015-020-09999-0	2020 Jun 26	This article discusses the priming of MSCs are a novel approach to improve the responses of COVID19 patients. When transplanted in vivo, MSCs are governed by the locally regulated microenvironment, suggesting that the restorative variability could be tailored by choosing a priming regimen to specifically correct a given pathology.

Article Name	Cell Type	Citation	Date	Summary
71 Immunomodulatory-Based Therapy as a Potential Promising Treatment Strategy Against Severe COVID-19 Patients: A Systematic Review	MSC	Razmi, M., Hashemi, F., Gheytauchi, E., Dehghan Manshadi, M., Ghods, R., & Madjd, Z. (2020). Immunomodulatory-based therapy as a potential promising treatment strategy against severe COVID-19 patients: A systematic review. <i>International Immunopharmacology</i> , 88, 106942. https://doi.org/10.1016/j.intimp.2020.106942	2020 Nov	This review indicates that immunomodulatory therapies are potentially effective for COVID-19 and provides comprehensive information for clinicians to fight this outbreak.
72 Mesenchymal Stem Cell (MSC)-Derived Exosomes as a Cell-Free Therapy for Patients Infected with COVID-19: Real Opportunities and Range of Promises	MSC	Rezakhani, L., Kelishadrokh, A. F., Soleimanizadeh, A., & Rahmati, S. (2020). Mesenchymal stem cell (MSC)-derived exosomes as a cell-free therapy for patients Infected with COVID-19: Real opportunities and range of promises. <i>Chemistry and Physics of Lipids</i> . https://doi.org/10.1016/j.chemphyslip.2020.105009	2020 Nov 12	In this review, the recent exosome-based clinical trials for the treatment of COVID-19 are presented. Potential therapy may include the following items: First, using mesenchymal stem cells secretome. Second, incorporating specific miRNAs and mRNAs into exosomes and last, using exosomes as carriers to deliver drugs.
73 Elucidating the Pivotal Role of Immune Players in the Management of COVID-19: Focus on Mesenchymal Stem Cells and Inflammation	MSC	Richard, S. A., Kampo, S., Sackey, M., Hechavarria, M. E., Buunaaim, A. D. B., Kuugbee, E. D., & Anabah, T. W. (2020). Elucidating the Pivotal Role of Immune Players in the Management of COVID-19: Focus on Mesenchymal Stem Cells and Inflammation. <i>Current Stem Cell Research & Therapy</i> . https://doi.org/10.2174/1574888X15666200705213751	2020 Jul 5	This review elucidates the immune players in the management of COVID-19; focusing principally on mesenchymal stem cells (MSCs) and inflammatory mediators. MSCs are capable of suppressing several kinds of cytokines via the paracrine secretion system. Therefore, MSCs therapy could be game changes in the treatment of the current COVID-19 pandemic.
74 Mesenchymal Stromal Cells in Viral Infections: Implications for COVID-19	MSC	Rocha, J. L. M., de Oliveira, W. C. F., Noronha, N. C., dos Santos, N. C. D., Covas, D. T., Picanço-Castro, V., Swiech, K., & Malmegrim, K. C. R. (2020). Mesenchymal Stromal Cells in Viral Infections: Implications for COVID-19. <i>Stem Cell Reviews and Reports</i> . https://doi.org/10.1007/s12015-020-10032-7	2020 Sep 7	This article critically discusses the rationale, advantages, and disadvantages of mesenchymal stem cell (MSC)-based therapies for viral infections and also specifically for COVID-19. The article also points out some directions for this field.
75 Umbilical Cord: an Allogenic Tissue for Potential Treatment of COVID-19	MSC	Rodríguez, H. C., Gupta, M., Cavazos-Escobar, E., El-Amin, S. F., & Gupta, A. (2020). Umbilical cord: An allogenic tissue for potential treatment of COVID-19. <i>Human Cell</i> , 1–13. https://doi.org/10.1007/s13577-020-00444-5	2020 Oct 9	This article reviews the current evidences and explores the potential therapeutic use of allogenic UC and/or WJ-derived MSCs for the treatment of COVID-19. Although, preliminary preclinical and clinical studies indicate that their use is safe and potentially effective, more multi-center, randomized, controlled trials are needed to adequately assess the safety and efficacy of UC and/or WJ-derived MSCs for the treatment of COVID-19.

Article Name	Cell Type	Citation	Date	Summary
76 Rationale for the Clinical Use of Adipose-Derived Mesenchymal Stem Cells for COVID-19 Patients	MSC	Rogers, C. J., Harman, R. J., Bunnell, B. A., Schreiber, M. A., Xiang, C., Wang, F.-S., Santidrian, A. F., & Mineev, B. R. (2020). Rationale for the clinical use of adipose-derived mesenchymal stem cells for COVID-19 patients. <i>Journal of Translational Medicine</i> , 18. https://doi.org/10.1186/s12967-020-02380-2	2020 May 18	This literature summary reviews the scientific rationale and need for clinical studies of adipose-derived stem cells (ASCs) and other types of mesenchymal stem cells in the treatment of patients who suffer with COVID-19. ASCs, an abundant type of MSC, are proposed as a therapeutic option for the treatment of COVID-19 in order to reduce morbidity and mortality. Additionally, when proven to be safe and effective, ASC treatments may reduce the demand on critical hospital resources.
77 Mesenchymal Stem Cell Therapies for COVID-19: Current Status and Mechanism of Action	MSC	Sadeghi, S., Soudi, S., Shafiee, A., & Hashemi, S. M. (2020). Mesenchymal stem cell therapies for COVID-19: Current status and mechanism of action. <i>Life Sciences</i> , 262, 118493. https://doi.org/10.1016/j.lfs.2020.118493	2020 Sep 23	In the current article, the potential mechanisms by which MSCs contribute to the treatment of COVID-19 patients are highlighted. Current trials that evaluated the potential of MSC-based treatments for COVID-19 are also briefly reviewed.
78 Mesenchymal Stem Cells in COVID-19: A Journey from Bench to Bedside	MSC	Sahu, K. K., Siddiqui, A. D., & Cerny, J. (2020). Mesenchymal Stem Cells in COVID-19: A Journey from Bench to Bedside. <i>Laboratory Medicine</i> , lmaa049. https://doi.org/10.1093/labmed/lmaa049	2020 Jul 30	This review discusses the potential of MSCs as a therapeutic option for patients with COVID-19, based on the encouraging results from the preliminary data showing improved outcomes in the progression of COVID-19 disease. The patients belonging to this subset are most likely beyond the point where they could benefit from an antiviral therapy because most of their illness at this stage of disease is driven by inflammatory (over)response of the immune system.
79 Mesenchymal Stem Cells: A New Piece in the Puzzle of COVID-19 Treatment	MSC	Saldanha-Araujo, F., Melgaço Garcez, E., Silva-Carvalho, A. E., & Carvalho, J. L. (2020). Mesenchymal Stem Cells: A New Piece in the Puzzle of COVID-19 Treatment. <i>Frontiers in Immunology</i> , 11. https://doi.org/10.3389/fimmu.2020.01563	2020 Jul 3	This article reviews stem cells and stem cell-derived strategies as therapeutic tools to manage COVID-19. Limited observations published so far point to the safety and efficacy of such therapies in the short-term, at least in severe and critically severe patients. A second generation of trials adhering to rigorously designed blind, randomized, placebo-controlled protocols must now be pursued, with the aid of experienced clinical and basic science investigators.
80 Mesenchymal Stem Cell Infusion Shows Promise for Combating Coronavirus (COVID-19)- Induced Pneumonia	MSC	Shetty, A. K. (2020). Mesenchymal Stem Cell Infusion Shows Promise for Combating Coronavirus (COVID-19)- Induced Pneumonia. <i>Aging and Disease</i> , 11 (2), 462–464. https://doi.org/10.14336/AD.2020.0301	2020 Mar 9	This study shows that intravenous infusion of MSCs is a safe and efficient approach for treating patients with COVID-19 pneumonia, including in elderly patients displaying severe pneumonia. MSC therapy inhibiting the overactivation of the immune system and promoting endogenous repair by improving the lung microenvironment after the SARS-CoV-2 infection found in this study is striking. Additional studies in a larger cohort of patients are needed to validate this therapeutic intervention further.

Article Name	Cell Type	Citation	Date	Summary
81 Stem Cell Therapy in Coronavirus Disease 2019: Current Evidence and Future Potential	MSC	Shetty, R., Murugeswari, P., Chakrabarty, K., Jayadev, C., Matalia, H., Ghosh, A., & Das, D. (2020). Stem cell therapy in coronavirus disease 2019: Current evidence and future potential. <i>Cytotherapy</i> . https://doi.org/10.1016/j.jcyt.2020.11.001	2020 Nov 9	This review explores the potential of mesenchymal stromal cells (MSCs) as cell therapy for ARDS. MSCs serve as a potential therapeutic candidate for combating the cytokine storm owing to their primordial cell lineage and multi-potent functions, such as immunomodulation and anti-inflammatory activity, and their ability to secrete various growth factors and soluble vesicles.
82 Emerging Prevention and Treatment Strategies to Control COVID-19	MSC	Singh, V. K., Mishra, A., Singh, S., Kumar, P., Singh, M., Jagannath, C., & Khan, A. (2020). Emerging Prevention and Treatment Strategies to Control COVID-19. <i>Pathogens</i> , 9 (6). https://doi.org/10.3390/pathogens9060501	2020 Jun 23	This review discusses the promising vaccines and treatment options for COVID-19, their challenges, and potential alternative strategies. MSCs are easily expanded to clinical volume in a short amount of time, and their safety and efficacy have been thoroughly documented in many clinical trials.
83 Potential of Regulatory T Cell-Based Therapies in the Management of Severe COVID-19	T-Reg	Stephen-Victor, E., Das, M., Karnam, A., Pitard, B., Gautier, J.-F., & Bayry, J. (2020). Potential of regulatory T-cell-based therapies in the management of severe COVID-19. <i>The European Respiratory Journal</i> , 56 (3). https://doi.org/10.1183/13993003.02182-2020	2020 Jul 2	This article proposes that CD4+CD25+FoxP3+ regulatory T cell-based therapies could be considered for the patient management.
84 Hypothesis for the Management and Treatment of the COVID-19-Induced Acute Respiratory Distress Syndrome and Lung Injury Using Mesenchymal Stem Cell-Derived Exosomes	MSC	Taghavi-Farahabadi, M., Mahmoudi, M., Soudi, S., & Hashemi, S. M. (2020). Hypothesis for the management and treatment of the COVID-19-induced acute respiratory distress syndrome and lung injury using mesenchymal stem cell-derived exosomes. <i>Medical Hypotheses</i> , 144, 109865. https://doi.org/10.1016/j.mehy.2020.109865	2020 May 22	This article reviews the use of MSCs as one of the immunomodulating and tissue regenerating cells that have previously shown satisfactory effects on ARDS and cytokine storms.
85 Controlling Cytokine Storm Is Vital in COVID-19	MSC	Tang, L., Yin, Z., Hu, Y., & Mei, H. (2020). Controlling Cytokine Storm Is Vital in COVID-19. <i>Frontiers in Immunology</i> , 11. https://doi.org/10.3389/fimmu.2020.570993	2020 Nov 30	This review will summarize advances in the research of cytokine storms induced by COVID-19, as well as potential intervention strategies to control cytokine storms.
86 Therapeutic Potential of Mesenchymal Stem Cells and their Exosomes in Severe Novel Coronavirus Disease 2019 (COVID-19) Cases	MSC	Tsuchiya, A., Takeuchi, S., Iwasawa, T., Kumagai, M., Sato, T., Motegi, S., Ishii, Y., Koseki, Y., Tomiyoshi, K., Natsui, K., Takeda, N., Yoshida, Y., Yamazaki, F., Kojima, Y., Watanabe, Y., Kimura, N., Tominaga, K., Kamimura, H., Takamura, M., & Terai, S. (2020). Therapeutic potential of mesenchymal stem cells and their exosomes in severe novel coronavirus disease 2019 (COVID-19) cases. <i>Inflammation and Regeneration</i> , 40. https://doi.org/10.1186/s41232-020-00121-y	2020 Jun 22	This review reports the background of severe cases of COVID-19, basic aspects and mechanisms of action of MSCs and their exosomes, and basic and clinical studies based on MSCs and exosomes for influenza-induced ARDS. The review discusses the potential of MSC and exosome therapy in severe cases of COVID-19 in recently initiated or planned clinical trials.

Article Name	Cell Type	Citation	Date	Summary
87 CD147 as a Target for COVID-19 Treatment: Suggested Effects of Azithromycin and Stem Cell Engagement	MSC	Ulrich, H., & Pillat, M. M. (2020). CD147 as a Target for COVID-19 Treatment: Suggested Effects of Azithromycin and Stem Cell Engagement. <i>Stem Cell Reviews and Reports</i> , 1–7. https://doi.org/10.1007/s12015-020-09976-7	2020 Apr 20	This article discusses CD147, a receptor on host cells, as a novel route for SARS-CoV-2 invasion. The possible direct viral invasion of progenitor/stem cells via CD147 or ACE2, could result in the decline of these cellular stocks and failing lung repair. Clinical tests with allogeneic MSCs from healthy individuals are underway to enhance endogenous lung repair and suppress inflammation.
88 COVID-19 and its Therapeutics: Special Emphasis on Mesenchymal Stem Cells Based Therapy	MSC	Verma, Y. K., Verma, R., Tyagi, N., Behl, A., Kumar, S., & Gangenahalli, G. U. (2020). COVID-19 and its Therapeutics: Special Emphasis on Mesenchymal Stem Cells Based Therapy. <i>Stem Cell Reviews and Reports</i> . https://doi.org/10.1007/s12015-020-10037-2	2020 Sep 12	This review highlights the minute details of SARS-CoV-2 and its genomic organization. This compilation emphasizes Mesenchymal Stem Cells (MSCs) based therapy alone or in combination with other therapeutics as an attractive curative approach for COVID-19 pandemic.
89 MSCs Transplantation May be a Potential Therapeutic Strategy for COVID-19 Treatment	MSC	Wang, X.-Y. (2020). MSCs transplantation may be a potential therapeutic strategy for COVID-19 treatment. <i>European Review for Medical and Pharmacological Sciences</i> , 24 (8), 4537–4538. https://doi.org/10.26355/eurrev_202004_21037	2020 Apr	This report, combined with the progress of preclinical and clinical research, comments on the efficacy of MSCs in the treatment of COVID-19. On the basis of ensuring the survival rate and activity of MSCs, it is worth an attempt to utilize MSCs transplantation to treat severe COVID-19 to curb the progression of critically ill patients and reduce the mortality.
90 Mesenchymal Stem Cells: Current Clinical Progress in ARDS and COVID-19	MSC	Xiao, K., Hou, F., Huang, X., Li, B., Qian, Z. R., & Xie, L. (2020). Mesenchymal stem cells: Current clinical progress in ARDS and COVID-19. <i>Stem Cell Research & Therapy</i> , 11. https://doi.org/10.1186/s13287-020-01804-6	2020 Jul 22	This review focuses on clinical progress in the use of MSCs as a cell therapy for ARDS, which may have clinical implications during the coronavirus disease 2019 (COVID-19) pandemic. Limited clinical data have shown that systemic administration of MSCs can significantly alleviate lung injury in COVID-19 patients. Large-scale, long-term, multicenter trials are needed to further explore the therapeutic effects and safety of MSCs.
91 Mesenchymal Stem Cell-Based Therapy for COVID-19: Possibility and Potential	MSC	Xiong, J., Bao, L., Qi, H., Feng, Z., & Shi, Y. (2020). Mesenchymal Stem Cell-based Therapy for COVID-19: Possibility and Potential. <i>Current Stem Cell Research & Therapy</i> . https://doi.org/10.2174/1574888X15666200601152832	2020 Jun 1	This study summarizes the clinical outcomes of MSCs for ARDS patients in some preclinical and clinical studies and discusses the application of MSCs for patients with COVID-19 in China and the related important issues with MSCs use during the outbreak. Given the previous preclinical and clinical studies, MSCs therapy has been shown safety and efficacy in the treatment of respiratory failure or ARDS. Based on similar principles, MSCs therapy may also be an effective therapy in the treatment of COVID-19.
92 Mesenchymal Stem Cell Immunomodulation and Regeneration Therapeutics as an Ameliorative Approach for COVID-19 Pandemics	MSC	Yadav, P., Vats, R., Bano, A., & Bhardwaj, R. (2020). Mesenchymal stem cell immunomodulation and regeneration therapeutics as an ameliorative approach for COVID-19 pandemics. <i>Life Sciences</i> , 263, 118588. https://doi.org/10.1016/j.lfs.2020.118588	2020 Oct 10	The current review summarizes and emphasizes how mesenchymal stem cells (MSCs) modulate the immune response, can repair the lungs from the impact of the virus, and various aspects of MSCs as a remedial source for COVID-19, to provide better insight for biomedical researchers and for those who are fascinated by stem cells as a therapeutic approach.

Article Name	Cell Type	Citation	Date	Summary
93 Characteristics of Registered Studies for Coronavirus Disease 2019 (COVID-19): A Systematic Review	MSC	Yang, M., Shang, Y., Tian, Z., Xiong, M., Lu, C., Jiang, Y., Zhang, Y., Zhang, Y., Jin, X., Jin, Q., Zhang, Y., Willcox, M. L., & Liu, J. (2020). Characteristics of registered studies for Coronavirus disease 2019 (COVID-19): A systematic review. <i>Integrative Medicine Research</i> , 9 (3), 100426. https://doi.org/10.1016/j.imr.2020.100426	2020 May 20	This study systematically reviews available registered studies for COVID-19 with the analyses of their distributions and characteristics. 393 studies were registered for the prevention, treatment, diagnosis and prognosis of COVID-19.
94 Mesenchymal Stem Cell Research Progress for the Treatment of COVID-19	MSC	Yao, D., Ye, H., Huo, Z., Wu, L., & Wei, S. (2020). Mesenchymal stem cell research progress for the treatment of COVID-19. <i>Journal of International Medical Research</i> , 48 (9), 0300060520955063. https://doi.org/10.1177/0300060520955063	2020 Sep 24	This review discusses the research progress related to using stem cells to treat patients with COVID-19. Mesenchymal stem cells (MSCs) are expected to reduce the risk of complications and death in patients because they have strong anti-inflammatory and immunomodulatory capabilities, which can improve the microenvironment, promote neovascularization, and enhance tissue repair capabilities.
95 Current Status of Mesenchymal Stem Cell Therapy for Immune/Inflammatory Lung Disorders: Gleaning Insights for Possible Use in COVID 19	MSC	Yen, B. L., Yen, M., Wang, L., Liu, K., & Sytwu, H. (2020). Current status of mesenchymal stem cell therapy for immune/inflammatory lung disorders: Gleaning insights for possible use in COVID 19. <i>Stem Cells Translational Medicine</i> . https://doi.org/10.1002/sctm.20-0186	2020 Jun 11	This article reviews the mechanistic evidence for clinical use of MSCs in pulmonary immune/inflammatory disorders, and survey the ongoing clinical trials—including for COVID 19—of MSC therapy for these diseases, with some perspectives and comment on MSCT for COVID 19.
96 SARS-CoV-2 Infection and Stem Cells: Interaction and Intervention	MSC	Yu, F., Jia, R., Tang, Y., Liu, J., & Wei, B. (2020). SARS-CoV-2 infection and stem cells: Interaction and intervention. <i>Stem Cell Research</i> , 46, 101859. https://doi.org/10.1016/j.scr.2020.101859	2020 Jun 1	This review focuses on the possible involvement of ACE2+ stem/progenitor cells from both the upper and lower respiratory tracts in coronavirus infection. Viral infection-associated acute respiratory distress syndrome and acute lung injury occur because of dysregulation of the immune response. Mesenchymal stem cells appear to be a promising cell therapy given that they favorably modulate the immune response to reduce lung injury.
97 Immunomodulation and Regeneration Properties of Dental Pulp Stem Cells: A Potential Therapy to Treat Coronavirus Disease 2019	MSC	Zayed, M., & Iohara, K. (2020). Immunomodulation and Regeneration Properties of Dental Pulp Stem Cells: A Potential Therapy to Treat Coronavirus Disease 2019. <i>Cell Transplantation</i> , 29. https://doi.org/10.1177/0963689720952089	2020 Aug 23	This review analyzes the potential use of dental pulp stem cells (DPSCs) and their significance in the development of a therapy for COVID-19. DPSCs are considered a potential source of MSCs for immunomodulation, tissue regeneration, and clinical application. Although some current clinical trials have treated COVID-19 patients with DPSCs, this therapy has not been approved.
98 Current Status of Potential Therapeutic Candidates for the COVID-19 Crisis	MSC	Zhang, J., Xie, B., & Hashimoto, K. (2020). Current status of potential therapeutic candidates for the COVID-19 crisis. <i>Brain, Behavior, and Immunity</i> , 87, 59–73. https://doi.org/10.1016/j.bbi.2020.04.046	2020 Apr 22	This article summarizes the current potential therapeutic approaches for diseases related to COVID-19 infection and introduce their mechanisms of action, safety, and effectiveness. Intensive research and clinical trials are underway to assess the efficacy of existing drugs and identify potential therapeutic targets to develop new drugs for treating COVID-19.

Article Name	Cell Type	Citation	Date	Summary
99 Transplantation of Mesenchymal Stem Cells: A Potential Adjuvant Therapy for COVID-19	MSC	Zhu, Y., Geng, S., Li, Q., & Jiang, H. (2020). Transplantation of Mesenchymal Stem Cells: A Potential Adjuvant Therapy for COVID-19. <i>Frontiers in Bioengineering and Biotechnology</i> , 8. https://doi.org/10.3389/fbioe.2020.557652	2020 Nov 5	This article aims to review the beneficial effects of mesenchymal stem cells (MSCs) in treating ALI/ARDS, which provides novel insight into the potential therapeutic strategies against COVID-19. MSCs are emerging as a promising adjuvant therapy for the attenuation of COVID-19 based on its putative pathogenesis.
100 Reducing Mortality and Morbidity in Patients with Severe COVID-19 Disease by Advancing Ongoing Trials of Mesenchymal Stromal (Stem) Cell (MSC) therapy — Achieving Global Consensus and Visibility for Cellular Host-Directed Therapies	MSC	Zumla, A., Wang, F.-S., Ippolito, G., Petrosillo, N., Agrati, C., Azhar, E. I., Chang, C., El-Kafrawy, S. A., Osman, M., Zitvogel, L., Galle, P. R., Locatelli, F., Gorman, E., Cordon-Cardo, C., O’Kane, C., McAuley, D., & Maeurer, M. (2020). Reducing mortality and morbidity in patients with severe COVID-19 disease by advancing ongoing trials of Mesenchymal Stromal (stem) Cell (MSC) therapy—Achieving global consensus and visibility for cellular host-directed therapies. <i>International Journal of Infectious Diseases</i> , 96, 431–439. https://doi.org/10.1016/j.ijid.2020.05.040	2020 May 17	This editorial focuses specifically on the background to, and the rationale for, the use and evaluation of mesenchymal stromal cells (MSCs) in treatment trials of patients with severe COVID-19 disease. MSC therapy could turn out to be an important contribution to bringing an end to the high COVID-19 death rates and preventing long-term functional disability in those who survive disease.

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Search Terms Used on Pubmed:

Advanced search settings, added words in quotation marks to search terms in title. Titles always had full names instead of abbreviations.

- "cell therapy" AND "covid"
- "MSCs" AND "covid"
- "mesenchymal" AND "covid"
- "stem cell" AND "covid"
- "T cell" AND "covid"
- "natural killer" AND "covid"
- "hematopoietic" AND "covid"
- "progenitor" AND "covid"
- "induced pluripotent stem cell" AND "covid"
- Any field: "stem cell" AND "covid"

Search Terms Used on Google:

- Mesoblast covid stem cell
- Cell therapy covid

Article Name	Cell Type	Citation	Date	Summary
Scopus: "mesenchymal stem cells" AND "covid"				