

Daftar Pustaka

1. Grasselli G, Cattaneo E, Florio G. Secondary infections in critically ill patients with COVID-19. *Crit Care*. 2021;25(1):1–13.
2. Ong CCH, Farhanah S, Linn KZ, Tang YW, Poon CY, Lim AY, et al. Nosocomial infections among COVID-19 patients: an analysis of intensive care unit surveillance data. *Antimicrob Resist Infect Control*. 2021;10(1):1–5.
3. Bardi T, Pintado V, Gomez-Rojo M, Escudero-Sanchez R, Azzam Lopez A, Diez-Remesal Y, et al. Nosocomial infections associated to COVID-19 in the intensive care unit: clinical characteristics and outcome. *Eur J Clin Microbiol Infect Dis*. 2021;40(3):495–502.
4. Elabbadi A, Turpin M, Gerotziafas GT, Teulier M, Voiriot G, Fartoukh M. Bacterial coinfection in critically ill COVID-19 patients with severe pneumonia. *Infection*. 2021;1–4.
5. Rawson TM, Moore LSP, Zhu N, Ranganathan N, Skolimowska K, Gilchrist M, et al. Bacterial and Fungal Coinfection in Individuals with Coronavirus: A Rapid Review to Support COVID-19 Antimicrobial Prescribing. *Clin Infect Dis*. 2020;71(9):2459–68.
6. Langford BJ, So M, Raybardhan S, Leung V, Westwood D, MacFadden DR, et al. Bacterial co-infection and secondary infection in patients with COVID-19: a living rapid review and meta-analysis. *Clin Microbiol Infect*. 2020;26(12):1622–9.
7. Perhimpunan Dokter Paru Indonesia (PDPI). *Pneumonia Komunitas*. 2nd ed. Soepandi PZ, editor. Jakarta: Badan Penerbit FKUI; 2014. 1–51 p.
8. Lagier JC, Edouard S, Pagnier I, Mediannikov O, Drancourt M, Raoult D. Current and past strategies for bacterial culture in clinical microbiology. *Clin Microbiol Rev*. 2015;28(1):208–36.
9. Pink I, Raupach D, Fuge J, Vonberg RP, Hoepfer MM, Welte T, et al. C-reactive protein and procalcitonin for antimicrobial stewardship in COVID-19. *Infection*. 2021;49(5):935–43.
10. Kamat IS, Ramachandran V, Eswaran H, Guffey D, Musher DM. Procalcitonin to distinguish viral from bacterial pneumonia: A systematic review and meta-analysis. *Clin Infect Dis*. 2020;70(3):538–42.
11. Self WH, Balk RA, Grijalva CG, Williams DJ, Zhu Y, Anderson EJ, et al. Procalcitonin as a Marker of Etiology in Adults Hospitalized with Community-Acquired Pneumonia. *Clin Infect Dis*. 2017;65(2):183–90.
12. Garrido P, Cueto P, Rovira C, Garcia E, Parra A, Enriquez R. Clinical value of procalcitonin in critically ill patients infected by SARS-CoV-2. *elsevier*. 2020;1–7.
13. Contou D, Claudinon A, Pajot O, Micaëlo M, Longuet Flandre P, Dubert M, et al. Bacterial and viral co-infections in patients with severe SARS-

- CoV-2 pneumonia admitted to a French ICU. *Ann Intensive Care*. 2020;10(1):1–9.
14. Asmarawati TP, Rosyid AN, Suryantoro SD, Mahdi BA, Windradi C, Wulaningrum PA, et al. The clinical impact of bacterial co-infection among moderate, severe and critically ill COVID-19 patients in the second referral hospital in Surabaya. *F1000 Res*. 2021;10(februari):1–16.
 15. University of Michigan. Inpatient guidance for diagnosis and treatment of COVID-19 in adults and children. *Univ Michigan*. 2020;
 16. Azzini AM, Dorizzi RM, Sette P, Vecchi M, Coledan I, Righi E, et al. A 2020 review on the role of procalcitonin in different clinical settings: an update conducted with the tools of the Evidence Based Laboratory Medicine. *Ann Transl Med*. 2020;8(9):1–13.
 17. Nugraha B, Wahyuni LK, Laswati H, Kusumastuti P, Tulaar AB, Gutenbrunner C. COVID-19 pandemic in Indonesia: Situation and challenges of rehabilitation medicine in Indonesia. *Acta Med Indones*. 2020;52(3):299–305.
 18. Pérez-Campos Mayoral L, Hernández-Huerta MT, Mayoral-Andrade G, Pérez-Campos Mayoral E, Pérez-Campos E. A letter to the editor on -World Health Organization declares global emergency: A review of the 2019 novel Coronavirus (COVID-19). *Int J Surg*. 2020;79(January):163–4.
 19. Lloyd-Sherlock P, Ebrahim S, Geffen L, McKee M. Bearing the brunt of covid-19: Older people in low and middle income countries. *BMJ*. 2020;368:1–2.
 20. Ritchie H, Ospina-Ortiz E, Beltekian D, Mathieu E, Hasell J, Macdonald B, et al. Indonesia: Coronavirus Pandemic Country Profile - Our World in Data [Internet]. *Our World in Data*. 2020. Available from: <https://ourworldindata.org/coronavirus/country/indonesia?country=~IDN>
 21. Biodiaspora A. COVID-19 Situational Report in the ASEAN Region. *ASEAN BioDiaspora Virtual Center (ABVC)*. 2022.
 22. Ahmad FB, Cisewski JA, Miniño A, Anderson RN. Provisional Mortality Data — United States, 2020. *MMWR Surveill Summ*. 2021;70(14):519–22.
 23. Kuldeep Dhama, Khan S, Tiwari R, Sircar S, Bhat S, Malik YS, et al. Coronavirus Disease 2019–COVID-19. *Clin Microbiol Rev*. 2020;33(4):1–48.
 24. Kemenkes RI. Pedoman Pencegahan dan Pengendalian Corona Virus Disease (COVID-19). *Math Didact*. 2019;4:1–214.
 25. Di Gennaro F, Pizzol D, Marotta C, Antunes M, Racalbuto V, Veronese N, et al. Coronavirus diseases (COVID-19) current status and future perspectives: A narrative review. *Int J Environ Res Public Health*. 2020;17(8):1–11.

26. Li X, Geng M, Peng Y, Meng L, Lu S. Molecular immune pathogenesis and diagnosis of COVID-19. *J Pharm Anal.* 2020;10(2):102–8.
27. Zhong J, Tang J, Ye C, Dong L. The immunology of COVID-19: is immune modulation an option for treatment? *Lancet Rheumatol.* 2020;2(7):1–9.
28. Qin C, Zhou L, Hu Z, Zhang S, Yang S, Tao Y, et al. Dysregulation of immune response in patients with coronavirus 2019 (COVID-19) in Wuhan, China. *Clin Infect Dis.* 2020;71(15):762–8.
29. Zumla A, Hui DS, Azhar EI, Memish ZA, Maeurer M. Reducing mortality from 2019-nCoV: host-directed therapies should be an option. *Lancet.* 2020;395:1–2.
30. Williams P, McWilliams C, Williams OM, Soomro K, Harding I, Gurney S, et al. The dynamics of procalcitonin in COVID-19 patients admitted to Intensive care unit - a multi-centre cohort study in the South West of England, UK. *J Infect.* 2021;82(January):24–6.
31. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan. *medRxiv.* 2020;2019(January):19–21.
32. Nishiura H, Kobayashi T, Miyama T, Suzuki A, Jung S, Hayashi K, et al. Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). *Int J Infect Dis.* 2020;94(January):154–5.
33. Stokes EK, Zambrano LD, Anderson KN, Marder EP, Raz KM, El Burai Felix S, et al. Coronavirus Disease 2019 Case Surveillance — United States, January 22–May 30, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(24):759–65.
34. Feldman C, Anderson R. The role of co-infections and secondary infections in patients with COVID-19. *Pneumonia.* 2021;13(1):1–15.
35. Sloan CE, Bernard S, Nachamkin I. Appropriateness of expectorated sputum cultures in the hospital setting. *Diagn Microbiol Infect Dis.* 2015;83(1):74–6.
36. Baskaran V, Lawrence H, Lansbury LE, Webb K, Safavi S, Zainuddin NI, et al. Co-infection in critically ill patients with COVID-19: An observational cohort study from England. *J Med Microbiol.* 2021;70(4):1–9.
37. Saukkoriipi A, Palmu AA, Jokinen J. Culture of all sputum samples irrespective of quality adds value to the diagnosis of pneumococcal community-acquired pneumonia in the elderly. *Eur J Clin Microbiol Infect Dis.* 2019;38(7):1249–54.
38. Avadhanula V, Rodriguez CA, DeVincenzo JP, Wang Y, Webby RJ, Ulett GC, et al. Respiratory Viruses Augment the Adhesion of Bacterial

- Pathogens to Respiratory Epithelium in a Viral Species- and Cell Type-Dependent Manner. *J Virol.* 2006;80(4):1629–36.
39. Li S, Fu B, Meshram CD. Innate Immune and Inflammatory Responses to Respiratory Viruses. *Mediators Inflamm.* 2019;2019:1–3.
 40. Justine Oliva and Olivier Terrier. Viral and Bacterial Co-Infections in the Lungs: Dangerous Liaisons. *viruses Rev.* 2021;13:17–25.
 41. Rezaee F, DeSando SA, Ivanov AI, Chapman TJ, Knowlden SA, Beck LA, et al. Sustained Protein Kinase D Activation Mediates Respiratory Syncytial Virus-Induced Airway Barrier Disruption. *J Virol.* 2013;87(20):11088–95.
 42. McGillivray G, Mason KM, Jurcisek JA, Peeples ME, Bakaletz LO. Respiratory syncytial virus-induced dysregulation of expression of a mucosal B-defensin augments colonization of the upper airway by nontypeable *Haemophilus influenzae*. *Cell Microbiol.* 2009;11(9):1399–408.
 43. Vareille M, Kieninger E, Edwards MR, Regamey N. The airway epithelium: Soldier in the fight against respiratory viruses. *Clin Microbiol Rev.* 2011;24(1):210–29.
 44. Li Eon Kuek RJL. First contact: The role of respiratory cilia in host-pathogen interactions in the airways. *Am J Physiol Cell Mol Physiol.* 2020;319:603–19.
 45. Zanin M, Baviskar P, Webster R, Webby R. The Interaction between Respiratory Pathogens and Mucus. *Cell Host Microbe.* 2016;19(2):159–68.
 46. Avadhanula V, Wang Y, Portner A, Adderson E. Nontypeable *Haemophilus influenzae* and *Streptococcus pneumoniae* bind respiratory syncytial virus glycoprotein. *J Med Microbiol.* 2007;56(9):1133–7.
 47. Kash JC, Walters KA, Davis AS, Sandouk A, Schwartzman LM, Jagger BW, et al. Lethal Synergism of 2009 Pandemic H1N1 Influenza Virus and *Streptococcus pneumoniae* Coinfection Is Associated with Loss of Murine Lung Repair Responses. *MBio.* 2011;2(5):1–11.
 48. Farrell JM, Zhao CY, Tarquinio KM, Brown SP. Causes and Consequences of COVID-19-Associated Bacterial Infections. *Front Microbiol.* 2021;12(July):1–6.
 49. Hatzistilianou M. Diagnostic and prognostic role of procalcitonin in infections. *ScientificWorldJournal.* 2010;10:1941–6.
 50. Riedel S, Melendez JH, An AT, Rosenbaum JE, Zenilman JM. Procalcitonin as a marker for the detection of bacteremia and sepsis in the emergency department. *Am J Clin Pathol.* 2011;135(2):182–9.
 51. Hu R, Han C, Pei S, Yin M, Chen X. Procalcitonin levels in Covid-19 Patients. *Int J Antimicrob Agents.* 2020;56(January):1–3.
 52. Lippi G, Sanchis-Gomar F. Procalcitonin in inflammatory bowel disease:

- Drawbacks and opportunities. *World J Gastroenterol*. 2017;23(47):8283–90.
53. Schuetz P, Albrich W, Mueller B. Procalcitonin for diagnosis of infection and guide to antibiotic decisions: Past, present and future. *BMC Med*. 2011;9(1):107–16.
 54. Christ-Crain M, Müller B. Biomarkers in respiratory tract infections: Diagnostic guides to antibiotic prescription, prognostic markers and mediators. *Eur Respir J*. 2007;30(3):556–73.
 55. Bouadma L, Luyt CE, Tubach F, Cracco C, Alvarez A, Schwebel C, et al. Use of procalcitonin to reduce patients' exposure to antibiotics in intensive care units (PRORATA trial): a multicentre randomised controlled trial. *Lancet*. 2010;375(9713):463–74.
 56. Oussalah A, Ferrand J, Filhine-Tresarrieu P, Aissa N, Aimone-Gastin I, Namour F, et al. Diagnostic Accuracy of Procalcitonin for Predicting Blood Culture Results in Patients with Suspected Bloodstream Infection. *Med (United States)*. 2015;94(44):1–7.
 57. Ticinesi A, Nouvenne A, Prati B, Guida L, Parise A, Cerundolo N, et al. The Clinical Significance of Procalcitonin Elevation in Patients over 75 Years Old Admitted for COVID-19 Pneumonia. *Mediators Inflamm*. 2021;2021:1–10.
 58. Vazzana N, Dipaola F, Ognibene S. Procalcitonin and secondary bacterial infections in COVID-19: association with disease severity and outcomes. *Acta Clin Belgica Int J Clin Lab Med*. 2020;1–6.
 59. Ponti G, Maccaferri M, Ruini C, Tomasi A, Ozben T. Biomarkers associated with COVID-19 disease progression. *Crit Rev Clin Lab Sci*. 2020;389–99.
 60. Van Berkel M, Kox M, Frenzel T, Pickkers P, Schouten J, Van Berkel M, et al. Biomarkers for antimicrobial stewardship: A reappraisal in COVID-19 times? *Crit Care*. 2020;24(1):1–4.
 61. Li H, Liu L, Zhang D, Xu J, Dai H, Tang N, et al. SARS-CoV-2 and viral sepsis: observations and hypotheses. 2020;(January):19–21.
 62. Feng T, James A, Doumlele K, White S, Twardzik W, Zahid K, et al. Procalcitonin levels in covid-19 patients are strongly associated with mortality and icu acceptance in an underserved, inner city population. *Med*. 2021;57(10):1–11.
 63. Philipp Schuetz. The Role of Procalcitonin for Risk Assessment and Treatment of COVID-19 Patients. *Health Manage*. 2020;20(5):380–2.
 64. Vanhomwegen C, Veliziotis I, Malinverni S, Konopnicki D, Dechamps P, Claus M, et al. Procalcitonin accurately predicts mortality but not bacterial infection in COVID-19 patients admitted to intensive care unit. 2021;1649–52.

65. Williams P, McWilliams C, Soomro K, Harding I, Gurney S, Thomas M, et al. The dynamics of procalcitonin in COVID-19 patients admitted to Intensive care unit - a multi-centre cohort study in the South West of England, UK. 2020;(January).
66. Williams EJ, Mair L, de Silva TI, Green DJ, House P, Cawthron K, et al. Routine measurement of serum procalcitonin allows antibiotics to be safely withheld in patients admitted to hospital with SARS-CoV-2 infection. medRxiv. 2020;2020.06.29.20136572.
67. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, et al. Baseline Characteristics and Outcomes of 1591 Patients Infected with SARS-CoV-2 Admitted to ICUs of the Lombardy Region, Italy. JAMA - J Am Med Assoc. 2020;323(16):1574–81.
68. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Respir Med [Internet]. 2020;8(5):475–81. Available from: [http://dx.doi.org/10.1016/S2213-2600\(20\)30079-5](http://dx.doi.org/10.1016/S2213-2600(20)30079-5)
69. Ticinesi A, Nouvenne A, Prati B, Guida L, Parise A, Cerundolo N, et al. The Clinical Significance of Procalcitonin Elevation in Patients over 75 Years Old Admitted for COVID-19 Pneumonia. Mediators Inflamm. 2021;2021.
70. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA - J Am Med Assoc. 2020;323(11):1061–9.
71. Wei-jie Guan^{1,26}, Wen-hua Liang^{2,26}, Yi Zhao^{2,26}, Heng-rui Liang^{2,26}, Zi-sheng Chen^{2,3,26}, Yi-min Li⁴, Xiao-qing Liu⁴, Ru-chong Chen¹ CT. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur Respir Soc. 2020;74(10):640.
72. Arumugam VA, Thangavelu S, Fathah Z, Ravindran P, Sanjeev AMA, Babu S, et al. COVID-19 and the world with co-morbidities of heart disease, hypertension and diabetes. J Pure Appl Microbiol. 2020;14(3):1623–38.
73. He S, Liu W, Jiang M, Huang P, Xiang Z, Deng D, et al. Clinical characteristics of COVID-19 patients with clinically diagnosed bacterial co-infection: A multi-center study. PLoS One. 2021;16(4):1–12.
74. Milenkovic M, Hadzibegovic A, Kovac M, Jovanovic B, Stanisavljevic J, Djikic M, et al. D-dimer, CRP, PCT, and IL-6 Levels at Admission to ICU Can Predict In-Hospital Mortality in Patients with COVID-19 Pneumonia. Oxid Med Cell Longev. 2021;2022(februari):1–9.
75. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet.

2020;395(10223):497–506.

76. Vazquez Guillamet MC, Kulkarni HS, Montes K, Samant M, Shaikh PA, Betthausen K, et al. Interleukin-6 Trajectory and Secondary Infections in Mechanically Ventilated Patients With Coronavirus Disease 2019 Acute Respiratory Distress Syndrome Treated With Interleukin-6 Receptor Blocker. *Crit Care Explor.* 2021;3(2):1–9.
77. Lai L, Lai Y, Wang H, Peng L, Zhou N, Tian Y, et al. Diagnostic Accuracy of Procalcitonin Compared to C-Reactive Protein and Interleukin 6 in Recognizing Gram-Negative Bloodstream Infection: A Meta-Analytic Study. *Dis Markers.* 2020;2020.
78. Wardika IK, Sikesa IGPH. Pengukuran Interleukin-6 (IL-6), C-Reactive Protein (CRP) dan D-Dimer sebagai prediktor prognosis pada pasien COVID-19 gejala berat: sebuah tinjauan pustaka. *Intisari Sains Medis.* 2021;12(3):901.
79. Cohen R, Finn T, Babushkin F, Geller K, Alexander H, Shapiro M, et al. High rate of bacterial respiratory tract co-infections upon admission amongst moderate to severe COVID-19 patients. *Infect Dis (Auckl).* 2022;54(2):134–44.
80. Pourajam S, Kalantari E, Talebzadeh H, Mellali H, Sami R, Soltaninejad F, et al. Secondary Bacterial Infection and Clinical Characteristics in Patients With COVID-19 Admitted to Two Intensive Care Units of an Academic Hospital in Iran During the First Wave of the Pandemic. *Front Cell Infect Microbiol.* 2022;12(February):1–9.
81. Manna S, Baindara P, Mandal SM. Molecular pathogenesis of secondary bacterial infection associated to viral infections including SARS-CoV-2. *J Infect Public Health.* 2020;13(10):1397–404.
82. Peters R, Bustros A De, Ball DW, Compton D, Nelkin BD. Regulation of Human Calcitonin Gene Transcription by Cyclic AMP. *Biochem Biophys Res Commun.* 1992;189(2):1157–64.
83. Russwurm S, Wiederhold M, Oberhoffer M, Stonans I, Zipfel PF, Reinhart K. Molecular aspects and natural source of procalcitonin. *Clin Chem Lab Med.* 1999;37(8):789–97.
84. Cohen AJ, Glick LR, Lee S, Kunitomo Y, Tsang DA, Pitafi S, et al. Nonutility of procalcitonin for diagnosing bacterial pneumonia in COVID-19. *Pubmed.* 2022;03(April):1–13.
85. Gautam S, Cohen AJ, Stahl Y, Valda Toro P, Young GM, Datta R, et al. Severe respiratory viral infection induces procalcitonin in the absence of bacterial pneumonia. *Thorax.* 2020;75(11):974–81.
86. Heer RS, Mandal AKJ, Kho J, Szawarski P, Csabi P, Grenshaw D, et al. Elevated procalcitonin concentrations in severe Covid-19 may not reflect bacterial co-infection. *Assoc Clin Biochem Lab Med.* 2021;58(5):520–7.

87. May M, Chang M, Dietz D, Shoucri S, Laracy J, Sobieszczyk ME, et al. Limited utility of procalcitonin in identifying community-associated bacterial infections in patients presenting with coronavirus disease 2019. *Antimicrob Agents Chemother.* 2021;65(4).

