

- Abidi, K., Khoudri, I., Belayachi, J., Madani, N., Zekraoui, A., Zeggwagh, A., *et al.* 2008. Eosinopenia Is A Reliable Marker Of Sepsis On Admission To Medical Intensive Care Units. *Critical Care*. [Online] 12 (2), R59. Available from: doi:10.1186/cc6883.
- Arumaningsih, F. & Suhariyadi 2018. *Hubungan Nilai Sel Polimorfonuklear (Neutrofil, Eosinofil, Dan Basofil) Dengan Kadar Procalcitonin Pada Pasien Sepsis Bakteri*. 7, 9.
- Ashton, N. 2010. Physiology of Red and White Blood Cells. *Anaesthesia & Intensive Care Medicine*. [Online] 11 (6), 236–241. Available from: doi:10.1016/j.mpaic.2010.02.018.
- Bagus, E., Kahar, H. & Wardhani, P. 2014. *Diagnostic Values Of Immature Granulocytes, Eosinopenia And I/T Ratio In Detection Of Early Onset Neonatal Sepsis In Neonates With Bacterial Infection Risk*. 50 (1), 5.
- Bischof, A., Brumshagen, C., Maus, R., Mack, M., Hollingshead, S., Briles, D., *et al.* 2012. Role of Basophils in Immunological Memory Responses to Pneumococcal Protein Antigens and *S. pneumoniae* Infections in Mice. *European Respiratory Journal*. [Online] 40 (Suppl 56). Available from: [https://erj.ersjournals.com/content/40/Suppl\\_56/P2526](https://erj.ersjournals.com/content/40/Suppl_56/P2526).
- Bouadma, L., Luyt, C.-E., Tubach, F., Cracco, C., Alvarez, A., Schwebel, C., *et al.* 2010. *Use Of Procalcitonin To Reduce Patients' Exposure To Antibiotics In Intensive Care Units (PRORATA Trial): a Multicentre Randomised Controlled Trial*. 375, 12.
- Braden, C.D., Talavera, F., Besa, E.C. & Seiter, K. 2020. *Neutropenia: Practice Essentials, Background, Pathophysiology*. [Online] Available from: <https://emedicine.medscape.com/article/204821-overview#a10> [Accessed 6 January 2021].
- Burkhardt, O., Ewig, S., Haagen, U., Giersdorf, S., Hartmann, O., Wegscheider, K., *et al.* 2010. Procalcitonin Guidance And Reduction Of Antibiotic Use In Acute Respiratory Tract Infection. *European Respiratory Journal*. [Online] 36 (3), 601–607. Available from: doi:10.1183/09031936.00163309.
- Carcamo Yañez, V., Göpfert, J., Otto, M., Tumani, H., Peter, A. & Joos, T. 2017. Development and Validation of an Ultrasensitive Procalcitonin Sandwich Immunoassay. *High-Throughput*. [Online] 6 (4), 18. Available from: doi:10.3390/ht6040018.
- Christ-Crain, M., Stolz, D., Bingisser, R., Müller, C., Miedinger, D., Huber, P.R., *et al.* 2006. Procalcitonin Guidance of Antibiotic Therapy in Community-acquired Pneumonia: A Randomized Trial. *American Journal of Respiratory and Critical Care Medicine*. [Online] 174 (1), 84–93. Available from: doi:10.1164/rccm.200512-1922OC.
- Dahlan, M.S. 2011. *Statistik Untuk Kedokteran Dan Kesehatan*. Penerbit Salemba.
- Drewry, A.M., Samra, N., Skrupky, L.P., Fuller, B.M., Compton, S.M. & Hotchkiss, R.S. 2014. Persistent Lymphopenia After Diagnosis of Sepsis Predicts Mortality: *Shock*. [Online] 42 (5), 383–391. Available from: doi:10.1097/SHK.0000000000000234.
- Fischbach, F. & Fischbach, M. 2019. Basophil count: *Nursing Critical Care*. [Online] 14 (4), 35. Available from: doi:10.1097/01.CCN.0000559778.07144.9d.



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Garnache, J., Annie Harrington, Nader Kamangar, Guy W Soo Hoo, Paul Blackburn, Barry E Brenner, *et al.* 2020. *Bacterial Pneumonia: Practice Essentials, Background, Pathophysiology*. [Online] Available from: <https://emedicine.medscape.com/article/300157-overview> [Accessed 14 December 2020].

Garnacho-Montero, J., Gutiérrez-Pizarraya, A., Escobresca-Ortega, A., Corcia-Palomo, Y., Fernández-Delgado, E., Herrera-Melero, I., *et al.* 2014. De-Escalation Of Empirical Therapy Is Associated With Lower Mortality In Patients With Severe Sepsis And Septic Shock. *Intensive Care Medicine*. [Online] 40 (1), 32–40. Available from: doi:10.1007/s00134-013-3077-7.

Gül, F., Arslantaş, M.K., Cinel, İ. & Kumar, A. 2017. Changing Definitions of Sepsis. *Turkish Journal of Anaesthesiology and Reanimation*. [Online] 45 (3), 129–138. Available from: doi:10.5152/TJAR.2017.93753.

Guyton, A.C. & Hall, J.E. 2006. Resistance of the Body to Infection: I. Leukocytes, Granulocytes, the Monocyte-Macrophage System, and Inflammation. *Textbook of Medical Physiology, 11th edn. Guyton AC and Hall JE (Editors). Saunders Publishers, Philadelphia*. 431–434.

Hamad, H. & Mangla, A. 2020. Lymphocytosis. In: *StatPearls*. [Online]. Treasure Island (FL), StatPearls Publishing. p. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK549819/> [Accessed 10 January 2021].

Hoeboer, S.H., van der Geest, P.J., Nieboer, D. & Groeneveld, A.B.J. 2015. The Diagnostic Accuracy Of Procalcitonin For Bacteraemia: A Systematic Review And Meta-Analysis. *Clinical Microbiology and Infection*. [Online] 21 (5), 474–481. Available from: doi:10.1016/j.cmi.2014.12.026.

Huang, Y., Xiao, J., Cai, T., Yang, L., Shi, F., Wang, Y., *et al.* 2019. Immature Granulocytes: A Novel Biomarker Of Acute Respiratory Distress Syndrome In Patients With Acute Pancreatitis. *Journal of Critical Care*. [Online] 50, 303–308. Available from: doi:10.1016/j.jcrc.2018.12.002.

de Jager, C.P., van Wijk, P.T., Mathoera, R.B., de Jongh-Leuvenink, J., van der Poll, T. & Wever, P.C. 2010. Lymphocytopenia And Neutrophil-Lymphocyte Count Ratio Predict Bacteremia Better Than Conventional Infection Markers In An Emergency Care Unit. *Critical Care*. [Online] 14 (5), R192. Available from: doi:10.1186/cc9309.

Jonathan, S. 2006. *Metode Penelitian Kuantitatif Dan Kualitatif*. Graha Ilmu.

Kameshwar, P. 2019. Serum Procalcitonin as Outcome Predictors in Deep Neck Infections. *Biomedical Journal of Scientific & Technical Research*. [Online] 22 (2). Available from: doi:10.26717/BJSTR.2019.22.003729 [Accessed 17 December 2019].

Karakonstantis, S., Gryllou, N., Papazoglou, G. & Lydakis, C. 2019. Eosinophil Count (EC) as a Diagnostic and Prognostic Marker for Infection in the Internal Medicine Department Setting. *Romanian Journal of Internal Medicine*. [Online] 57 (2), 166–174. Available from: doi:10.2478/rjim-2018-0039.

Khajuria, R., Jamwal, V., K. Gupta, A. & Gupta, A. 2017. Evaluation Of Eosinophil Count And Neutrophil-Lymphocyte Count Ratio Versus C-Reactive Protein Levels In Patients With Sepsis. *International Journal of Research in Medical Sciences*. [Online] 5 (11), 4754. Available from: doi:10.18203/2320-6012.ijrms20174686.

Kibe, S., Adams, K. & Barlow, G. 2011. Diagnostic And Prognostic Biomarkers Of Sepsis In Critical Care. *Journal of Antimicrobial Chemotherapy*. [Online] 66 (Supplement 2), ii33–ii40. Available from: doi:10.1093/jac/dkq523.



Kim, J. Y., Im, H. B., Sung, M. J., Son, S. H. & Seo, S. S. 2010. Analysis On The Cause Of Eosinophilia In A Neonatal Intensive Care Unit. *Korean Journal of Pediatrics*. [Online] 53 (1), 28. Available from: doi:10.3345/kjp.2010.53.1.28.

Kreisler, W. H. & Modiano, M. 2010. Leukopenia. In: Stuart B. Mushlin & Harry L. Greene (eds.). *Decision Making in Medicine (Third Edition)*. [Online]. Philadelphia, Mosby. pp. 242–243. Available from: doi:10.1016/B978-0-323-04107-2.50090-9 [Accessed 14 December 2020].

Krisman, B. D. & Natadidjaja, R. I. 2018. *Hubungan Antara Kadar Leukosit Dengan Procalcitonin Pada Pasien Sepsis Relationship Between Leukocyte Count And Procalcitonin In Patients With Sepsis*.

László, I., Trásky, D., Molnár, Z. & Fazakas, J. 2015. Sepsis: From Pathophysiology to Individualized Patient Care. *Journal of Immunology Research*. [Online] 2015, 1–13. Available from: doi:10.1155/2015/510436.

Lee, A.-J. & Kim, S.-G. 2013. Mean Cell Volumes Of Neutrophils And Monocytes Are Promising Markers Of Sepsis In Elderly Patients. *Blood Research*. [Online] 48 (3), 193. Available from: doi:10.5045/br.2013.48.3.193.

Linscheid, P., Seboek, D., Schaer, D., Zulewski, H., Keller, U. & Müller, B. 2004. Expression And Secretion Of Procalcitonin And Calcitonin Gene-Related Peptide By Adherent Monocytes And By Macrophage-Activated Adipocytes. *Critical Care Medicine*. [Online] 32 (8), 1715–1721. Available from: doi:10.1097/01.CCM.0000134404.63292.71.

Ljungström, L., Pernestig, A.-K., Jacobsson, G., Andersson, R., Usener, B. & Tilevik, D. 2017. Diagnostic Accuracy Of Procalcitonin, Neutrophil-Lymphocyte Count Ratio, C-Reactive Protein, And Lactate In Patients With Suspected Bacterial Sepsis Luciano Cesar Pontes Azevedo (ed.). *PLOS ONE*. [Online] 12 (7), e0181704. Available from: doi:10.1371/journal.pone.0181704.

Matthaiou, D. K., Ntani, G., Kontogiorgi, M., Poulakou, G., Armaganidis, A. & Dimopoulos, G. 2012. An ESICM Systematic Review And Meta-Analysis Of Procalcitonin-Guided Antibiotic Therapy Algorithms In Adult Critically Ill Patients. *Intensive Care Medicine*. [Online] 38 (6), 940–949. Available from: doi:10.1007/s00134-012-2563-7.

Monneret, G. & Venet, F. 2012. A Rapidly Progressing Lymphocyte Exhaustion After Severe Sepsis. *Critical Care*. [Online] 16 (4), 140. Available from: doi:10.1186/cc11416.

Mouloudi, E., Katsanoulas, C., Vrochides, D., Giasnetsova, T., Papageorgiou, C. & Gritsi-Gerogianni, N. 2008. Eosinophilia As A Marker Of Adrenal Insufficiency In Critically Ill Patients With Severe Septic Shock: 1-Year Prospective Study. *Critical Care*. [Online] 12 (Suppl 5), P9. Available from: doi:10.1186/cc7042.

Munshi, H. G. & Montgomery, R. B. 2000. Severe Neutropenia. *Western Journal of Medicine*. 172 (4), 248–252.

Murzalina, C. 2007. *Procalcitonin Pada Pasien Sepsis Yang Telah Mendapat Perawatan di Ruang Rawat Intensif*.

Ni, J., Wang, H., Li, Y., Shu, Y. & Liu, Y. 2019. Neutrophil To Lymphocyte Ratio (Nlr) As A Prognostic Marker For In-Hospital Mortality Of Patients With Sepsis: A Secondary Analysis Based On A Single-Center, Retrospective, Cohort Study. *Medicine*. [Online] 98 (46), e18029. Available from: doi:10.1097/MD.00000000000018029.



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Nierhaus, A., Klatte, S., Linssen, J., Eismann, N.M., Wichmann, D., Hedke, J., *et al.* 2013. Revisiting the white blood cell count: immature granulocytes count as a diagnostic marker to discriminate between SIRS and sepsis - a prospective, observational study. *BMC Immunology*. [Online] 14 (1). Available from: doi:10.1186/1471-2172-14-8 [Accessed 1 May 2019].

Novita, C., Hernaningsih, Y., Wardhani, P. & Veterini, A.S. 2019. *The Correlation between CD64 Leukocyte, Immature Granulocyte and Presepsin with Procalcitonin in Bacterial Sepsis Patient.*

Nurmalia, P., W, N. & Imam, B. 2018. Correlation Of Monocyte Count, MLR And NLCR With Presepsin Level In SIRS. *Indonesian Journal Of Clinical Pathology And Medical Laboratory*. [Online] 22, 212. Available from: doi:10.24293/ijcpml.v22i3.1234.

de Pablo, R., Monserrat, J., Prieto, A. & Alvarez-Mon, M. 2014. Role of Circulating Lymphocytes in Patients with Sepsis. *BioMed Research International*. [Online] 2014, 1–11. Available from: doi:10.1155/2014/671087.

Parrino, J., Hotchkiss, R.S. & Bray, M. 2007. *Prevention of Immune Cell Apoptosis as Potential Therapeutic Strategy*. [Online]. 2007. Medscape. Available from: <http://www.medscape.com/viewarticle/551371> [Accessed 10 January 2021].

Piliponsky, A.M., Shubin, N.J., Lahiri, A.K., Truong, P., Clauson, M., Niino, K., *et al.* 2019. Basophil-Derived Tumor Necrosis Factor Can Enhance Survival In A Sepsis Model In Mice. *Nature Immunology*. [Online] 20 (2), 129–140. Available from: doi:10.1038/s41590-018-0288-7.

Polito, A., Aboab, J. & Annane, D. 2006. *Adrenal Insufficiency in Sepsis*. 18, 9.

Pradian, E. & Zulfariansyah, A. 2019. Correlation Between Neutrophil-lymphocyte Count Ratio and Procalcitonin in Sepsis and Septic Shock. *Majalah Kedokteran Bandung*. 51 (3), 7.

Prakoso, B.J., Oesman, F., Chen, L.K. & Kekalih, A. 2018. Flow Cytometric Analysis Of Total Lymphocyte Apoptosis, A Potential Prognostic Assay For Sepsis. *Journal of Physics: Conference Series*. [Online] 1073, 022018. Available from: doi:10.1088/1742-6596/1073/2/022018.

Rhodes, A., Evans, L.E., Alhazzani, W., Levy, M.M., Antonelli, M., Ferrer, R., *et al.* 2017. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock. *Critical Care Medicine*. [Online] 45 (3), 486–552. Available from: doi:10.1097/CCM.0000000000002255.

Rochmah, E.N., Haksari, E.L. & Mulatsih, S. 2016. Association Between Neutropenia And Death Rate Of Bacterial Neonatal Sepsis. *Paediatrica Indonesiana*. [Online] 48 (5), 284. Available from: doi:10.14238/pi48.5.2008.284-7.

Sastroasmoro, S. & Ismael, S. 2016. *Dasar-dasar Metodologi Penelitian Klinis*. 5th edition. Jakarta, Sagung Seto.

Satriasa, Y.A. 2017. *Hubungan Antara Kadar Procalcitonin Dengan Jumlah Eosinofil Pada Pasien Sepsis Yang Dirawat Di Ruang Intensive Care Unit RSUD Dr. Saiful Anwar Malang*. Magister. [Online]. Universitas Brawijaya. Available from: <http://repository.ub.ac.id/9403/> [Accessed 17 December 2019].

Schuetz, P., Christ-Crain, M., Thomann, R., Falconnier, C., Wolbers, M., Widmer, I., *et al.* 2009. Effect of Procalcitonin-Based Guidelines vs Standard Guidelines on Antibiotic Use in Lower Respiratory Tract Infections: The ProHOSP Randomized Controlled Trial. *JAMA*. [Online] 302 (10), 1059. Available from: doi:10.1001/jama.2009.1297.



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Shaban, H., Daniel, S., Sison, R., Slim, J. & Perez, G. 2010. osinopenia: Is It A Good Marker Of Sepsis In Comparison To Procalcitonin And C-Reactive Protein Levels For Patients Admitted To A Critical Care Unit In An Urban Hospital? *Journal of Critical Care*. [Online] 25 (4), 570–575. Available from: doi:10.1016/j.jcrc.2010.03.002.

Singer, M., Deutschman, C.S., Seymour, C.W., Shankar-Hari, M., Annane, D., Bauer, M., *et al.* 2016. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. [Online] 315 (8), 801–810. Available from: doi:10.1001/jama.2016.0287.

Sônego, F., Castanheira, F.V. e S., Ferreira, R.G., Kanashiro, A., Leite, C.A.V.G., Nascimento, D.C., *et al.* 2016. Paradoxical Roles of the Neutrophil in Sepsis: Protective and Deleterious. *Frontiers in Immunology*. [Online] 7. Available from: doi:10.3389/fimmu.2016.00155 [Accessed 17 December 2019].

Soni, N.J., Samson, D.J., Galaydick, J.L., Vats, V., Huang, E.S., Aronson, N., *et al.* 2013. Procalcitonin-Guided Antibiotic Therapy: A Systematic Review And Meta-Analysis: Procalcitonin-Guided Antibiotic Therapy. *Journal of Hospital Medicine*. [Online] 8 (9), 530–540. Available from: doi:10.1002/jhm.2067.

Thijs, L.G. & Hack, C.E. 1995. Time Course Of Cytokine Levels In Sepsis. *Intensive Care Medicine*. [Online] 21 (S2), S258–S263. Available from: doi:10.1007/BF01740764.

Verbrugge, S.E. & Huisman, A. 2015. Verification and Standardization of Blood Cell Counters for Routine Clinical Laboratory Tests. *Clinics in laboratory medicine*. 35 (1), 183–196.

Weber, S., Baessler, B. & Schroeder, S. 2009. *Lymphocyte Apoptosis in Sepsis and Potential Anti-apoptotic Strategies*. 2.

Westwood, M., Ramaekers, B., Whiting, P., Tomini, F., Joore, M., Armstrong, N., *et al.* 2015. Procalcitonin Testing To Guide Antibiotic Therapy For The Treatment Of Sepsis In Intensive Care Settings And For Suspected Bacterial Infection In Emergency Department Settings: A Systematic Review And Cost-Effectiveness Analysis. *Health Technology Assessment*. [Online] 19 (96), 1–236. Available from: doi:10.3310/hta19960.

Whicher, J., Bienvenu, J. & Monneret, G. 2001. Procalcitonin as an Acute Phase Marker. *Ann Clin Biochem*. 11.

Wibowo, E.A.A., Kurniawaty, J. & Jufan, A.Y. 2020. *Hubungan Antara Neutrophyl-Lymphocyte Ratio Dan Kadar Prokalsitonin Plasma Pada Pasien Sepsis Yang Dirawat Di Ruang Intensif RSUP Dr Sardjito*. Universitas Gadjah Mada.

Wickramasinghe, S.N. & Erber, W.N. 2011. Normal Blood Cells. *Blood and Bone Marrow Pathology*. 3–17.

Wile, M.J., Homer, L.D., Gaehler, S., Phillips, S. & Millan, J. 2001. Manual Differential Cell Counts Help Predict Bacterial Infection: A Multivariate Analysis. *American Journal of Clinical Pathology*. [Online] 115 (5), 644–649. Available from: doi:10.1309/J905-CKYW-4G7P-KUK8.