

DAFTAR PUSTAKA

- Ahmadi Ganjeh, Z., Eslami-Kalantari, M., dan Mowlavi, A. A. (2019). Dosimetry calculations of involved and noninvolved organs in proton therapy of liver cancer: a simulation study. *Nuclear Science and Techniques*, 30(12). <https://doi.org/10.1007/s41365-019-0698-8>.
- An, J., dan Lee, H. C. (2015). Surveillance for hepatocellular carcinoma in chronic hepatitis B virus infection: for whom. *Hepatic Oncology*, 2(3), 225–229. <https://doi.org/10.2217/hep.15.17>.
- Andreo, P. (2018). Monte Carlo simulations in radiotherapy dosimetry. Dalam *Radiation Oncology* (Vol. 13, Nomor 1). BioMed Central Ltd. <https://doi.org/10.1186/s13014-018-1065-3>.
- Apisarnthanarax, S., Bowen, S. R., dan Combs, S. E. (2018). Proton Beam Therapy and Carbon Ion Radiotherapy for Hepatocellular Carcinoma. *Seminars in Radiation Oncology*, 28(4), 309–320. <https://doi.org/10.1016/j.semradonc.2018.06.008>.
- Balogh, J., Victor, D., Asham, E. H., Burroughs, S. G., Boktour, M., Saharia, A., Li, X., Ghobrial, M., dan Monsour, H. (2016). Hepatocellular carcinoma: a review. *Journal of Hepatocellular Carcinoma, Volume 3*, 41–53. <https://doi.org/10.2147/JHC.S61146>.
- Barazzuol, L., Coppes, R. P., dan van Luijk, P. (2020). Prevention and treatment of radiotherapy-induced side effects. Dalam *Molecular Oncology* (Vol. 14, Nomor 7, hlm. 1538–1554). John Wiley and Sons Ltd. <https://doi.org/10.1002/1878-0261.12750>.
- Bhangoo, R. S., Mullikin, T. C., Ashman, J. B., Cheng, T. W., Golafshar, M. A., DeWees, T. A., Johnson, J. E., Shiraishi, S., Liu, W., Hu, Y., Merrell, K. W., Haddock, M. G., Krishnan, S., Rule, W. G., Sio, T. T., dan Hallemeier, C. L. (2021). Intensity Modulated Proton Therapy for Hepatocellular Carcinoma: Initial Clinical Experience. *Advances in Radiation Oncology*, 6(4). <https://doi.org/10.1016/j.adro.2021.100675>.
- Chadha, A. S., Gunther, J. R., Hsieh, C. E., Aliru, M., Mahadevan, L. S., Venkatesulu, B. P., Crane, C. H., Das, P., Herman, J. M., Koay, E. J., Taniguchi, C., Holliday, E. B., Minsky, B. D., Suh, Y., Park, P., Sawakuchi, G., Beddar, S., Odisio, B. C., Gupta, S., Krishnan, S. (2019). Proton beam therapy outcomes for localized unresectable hepatocellular carcinoma. *Radiotherapy and Oncology*, 133, 54–61. <https://doi.org/10.1016/j.radonc.2018.10.041>.
- Chhabra, A. M., Frick, M. A., Diwanji, T., Molitoris, J. K., dan Simone, C. B. (2019). Charged Particle Stereotactic Body Radiation Therapy. Dalam *Stereotactic Radiosurgery and Stereotactic Body Radiation Therapy* (hlm. 217–233). Springer International Publishing. https://doi.org/10.1007/978-3-030-16924-4_20.
- Choi, C., Son, A., Lee, G. H., Shin, S. W., Park, S., Ahn, S. H., Chung, Y., Yu, J. I., dan Park, H. C. (2019). Targeting DNA-dependent protein kinase sensitizes hepatocellular carcinoma cells to proton beam irradiation through apoptosis induction. *PLoS ONE*, 14(6). <https://doi.org/10.1371/journal.pone.0218049>

- Chuong, M., Badiyan, S. N., Yam, M., Li, Z., Langen, K., Regine, W., Morris, C., Snider, J., Mehta, M., Huh, S., Rutenberg, M., dan Nichols, R. C. (2018). Pencil beam scanning versus passively scattered proton therapy for unresectable pancreatic cancer. *Journal of Gastrointestinal Oncology*, 9(4), 687–693. <https://doi.org/10.21037/jgo.2018.03.14>.
- Chuong, M., Kaiser, A., Molitoris, J., Romero, A. M., dan Apisarnthanarax, S. (2020). Proton beam therapy for liver cancers. Dalam *Journal of Gastrointestinal Oncology* (Vol. 11, Nomor 1, hlm. 157–165). AME Publishing Company. <https://doi.org/10.21037/jgo.2019.04.02>.
- de Marzi, L., Nauraye, C., Lansonneur, P., Pouzoulet, F., Patriarca, A., Schneider, T., Guardiola, C., Mammar, H., Dendale, R., dan Prezado, Y. (2019). Spatial fractionation of the dose in proton therapy: Proton minibeam radiation therapy. *Cancer/Radiotherapie*, 23(6–7), 677–681. <https://doi.org/10.1016/j.canrad.2019.08.001>.
- Fahrurrozi, H., Harto, A. W., Triatmoko, I. M., Wijaya, G. S., dan Sardjono, Y. (2021). DOSE OPTIMIZATION ON LIVER CANCER PROTON THERAPY AND BORON NEUTRON CAPTURE THERAPY USING PARTICLE AND HEAVY IONS TRANSPORT CODE SYSTEM. *JURNAL TEKNOLOGI REAKTOR NUKLIR TRI DASA MEGA*, 23(1), 33. <https://doi.org/10.17146/tdm.2021.23.1.6183>.
- Fitriatuzzakiyyah, N., Sinuraya, R. K., dan Puspitasari, I. M. (2017). Cancer Therapy with Radiation: The Basic Concept of Radiotherapy and Its Development in Indonesia. *Indonesian Journal of Clinical Pharmacy*, 6(4), 311–320. <https://doi.org/10.15416/ijcp.2017.6.4.311>.
- Fukumitsu, N., Takahashi, S., Okumura, T., Ishida, T., Murofushi, K. N., Ohnishi, K., Aihara, T., Ishikawa, H., Tsuboi, K., dan Sakurai, H. (2018). Normal liver tissue change after proton beam therapy. *Japanese Journal of Radiology*, 36(9), 559–565. <https://doi.org/10.1007/s11604-018-0757-9>.
- Guido, Mch., SCHcognato, S., SacCHi, D., dan Ludwig, K. (2019). The anatomy and histology of and biliCHy tract. Dalam *Pediatric Hepatology and Liver Transplantation* (hlm. 41–55). Springer International Publishing. https://doi.org/10.1007/978-3-319-96400-3_3.
- Gupta, R., Schrooders, Y., Hauser, D., van Herwijnen, M., Albrecht, W., ter Braak, B., Brecklinghaus, T., Castell, J. v., Elenschneider, L., Escher, S., Guye, P., Hengstler, J. G., Ghallab, A., Hansen, T., Leist, M., MacLennan, R., Moritz, W., Tolosa, L., Tricot, T., ... Caiment, F. (2021). Comparing in vitro human liver models to in vivo human liver using RNA-Seq. *Archives of Toxicology*, 95(2), 573–589. <https://doi.org/10.1007/s00204-020-02937-6>.
- Herrmann, E., Naehrig, D., Sassowsky, M., Bigler, M., Buijsen, J., Ciernik, I., Zwahlen, D., Pellanda, A. F., Meister, A., Brauchli, P., Berardi, S., Kuettel, E., Dufour, J. F., dan Aebersold, D. M. (2017). External beam radiotherapy for unresectable hepatocellular carcinoma, an international multicenter phase I trial, SAKK 77/07 and SASL 26. *Radiation Oncology*, 12(1). <https://doi.org/10.1186/s13014-016-0745-0>.
- Hong, T. S., Wo, J. Y., Yeap, B. Y., Ben-Josef, E., McDonnell, E. I., Blaszkowsky, L. S., Kwak, E. L., Allen, J. N., Clark, J. W., Goyal, L., Murphy, J. E., Javle,

- M. M., Wolfgang, J. A., Drapek, L. C., Arellano, R. S., Mamon, H. J., Mullen, J. T., Yoon, S. S., Tanabe, K. K., ... Zhu, A. X. (2016). Multi-Institutional Phase II Study of High-Dose Hypofractionated Proton Beam Therapy in Patients With Localized, Unresectable Hepatocellular Carcinoma and Intrahepatic Cholangiocarcinoma. *Journal of clinical oncology: official journal of the American Society of Clinical Oncology*, 34(5), 460–468. <https://doi.org/10.1200/JCO.2015.64.2710>.
- Igaki, H., Mizumoto, M., Okumura, T., Hasegawa, K., Kokudo, N., dan Sakurai, H. (2018). A systematic review of publications on charged particle therapy for hepatocellular carcinoma. Dalam *International Journal of Clinical Oncology* (Vol. 23, Nomor 3, hlm. 423–433). Springer Tokyo. <https://doi.org/10.1007/s10147-017-1190-2>.
- International Agency for Research on Cancer. (2020). *Indonesia*. <https://gco.iarc.fr/today/about#references>.
- International Atomic Energy Agency (IAEA). (2008). *Relative Biological Effectiveness In Ion Beam Therapy*.
- International Commission on Radiological Protection., dan International Commission on Radiation Units and Measurements. (2009). *Adult reference computational phantoms : joint ICRP/ICRU report*. Polestar Wheatons Ltd.
- Jiang, F., Ding, K. Z., Chen, G., Chen, Y. H., Li, J. J., Wu, Z., Wang, Z., Zhou, J., dan Song, Y. T. (2019). *DESIGN STUDY OF A COMPACT SUPERCONDUCTING CYCLOTRON SC240 FOR PROTON THERAPY **. <https://doi.org/10.18429/JACoW-IPAC2019-THPMP029>.
- Jones, B. (2017). Proton radiobiology and its clinical implications. Dalam *ecancermedicalscience* (Vol. 11). Cancer Intelligence. <https://doi.org/10.3332/ecancer.2017.777>.
- Karger, C. P., Glowa, C., Peschke, P., dan Kraft-Weyrather, W. (2021). The RBE in ion beam radiotherapy: In vivo studies and clinical application. *Zeitschrift fur Medizinische Physik*, 31(2), 105–121. <https://doi.org/10.1016/j.zemedi.2020.12.001>.
- Kim, C. H., Yeom, Y. S., Petoussi-Henss, N., Zankl, M., Bolch, W. E., Lee, C., Choi, C., Nguyen, T. T., Eckerman, K., Kim, H. S., Han, M. C., Qiu, R., Chung, B. S., Han, H., dan Shin, B. (2020). ICRP Publication 145: Adult Mesh-Type Reference Computational Phantoms. *Annals of the ICRP*, 49(3), 13–201. <https://doi.org/10.1177/0146645319893605>.
- Kim, C., Kim, Y. J., Lee, N., Ahn, S. H., Kim, K. H., Kim, H., Shin, D., Lim, Y. K., Jeong, J. H., Kim, D. Y., Shin, W. G., Min, C. H., dan Lee, S. B. (2021). Evaluation of the dosimetric effect of scattered protons in clinical practice in passive scattering proton therapy. *Journal of Applied Clinical Medical Physics*, 22(6), 104–118. <https://doi.org/10.1002/acm2.13284>.
- Kim, D. H., Cho, S., Jo, K., Shin, E. H., Hong, C. S., Han, Y., Suh, T. S., Lim, D. H., dan Choi, D. H. (2018). Proton range verification in inhomogeneous tissue: Treatment planning system vs. measurement vs. Monte Carlo simulation. *PLoS ONE*, 13(3). <https://doi.org/10.1371/journal.pone.0193904>.

- Kuznetsov, M. B., dan Kolobov, A. v. (2022). Spatial Optimization of Fractionated Proton Therapy via Mathematical Modeling. *Bulletin of the Lebedev Physics Institute*, 49(6), 174–179. <https://doi.org/10.3103/S1068335622060045>.
- LaRiviere, M. J., Santos, P. M. G., Hill-Kayser, C. E., dan Metz, J. M. (2019). Proton Therapy. Dalam *Hematology/Oncology Clinics of North America* (Vol. 33, Nomor 6, hlm. 989–1009). W.B. Saunders. <https://doi.org/10.1016/j.hoc.2019.08.006>.
- Lievens, Y., Borrás, J. M., dan Grau, C. (2020). Provision and use of radiotherapy in Europe. Dalam *Molecular Oncology* (Vol. 14, Nomor 7, hlm. 1461–1469). John Wiley and Sons Ltd. <https://doi.org/10.1002/1878-0261.12690>
- Maradia, V. ;, Meer, D. ;, Giovannelli, A. C. ;, Lomax, A. J. ;, Weber, D. C. ;, Schippers, J. M. ;, dan Psoroulas, S. (2021). *A Novel Beam Optics Concept to Maximize the Transmission Through Cyclotron-based Proton Therapy Gantries Conference Paper*. <https://doi.org/10.3929/ethz-b-000507001>.
- Maradia, V., Meer, D., Weber, D. C., Lomax, A. J., Schippers, J. M., dan Psoroulas, S. (2021). A new emittance selection system to maximize beam transmission for low-energy beams in cyclotron-based proton therapy facilities with gantry. *Medical Physics*, 48(12), 7613–7622. <https://doi.org/10.1002/mp.15278>.
- Mohan, R., dan Grosshans, D. (2017). Proton therapy – Present and future. Dalam *Advanced Drug Delivery Reviews* (Vol. 109, hlm. 26–44). Elsevier B.V. <https://doi.org/10.1016/j.addr.2016.11.006>.
- Newhauser, W. D., dan Zhang, R. (2015). The physics of proton therapy. Dalam *Physics in Medicine and Biology* (Vol. 60, Nomor 8, hlm. R155–R209). Institute of Physics Publishing. <https://doi.org/10.1088/0031-9155/60/8/R155>.
- Noha E. Ibrahim, Wael M. Aboulthana, dan Ram Kumar Sahu. (2018). Hepatocellular Carcinoma: Causes and Prevention. *Pharmaceutical and Biosciences Journal*, 48–55. <https://doi.org/10.20510/ukjpb/6/i5/177354>.
- Nystrom, H., Jensen, M. F., dan Nystrom, P. W. (2020). Treatment planning for proton therapy: what is needed in the next 10 years? *The British Journal of Radiology*, 93(1107), 20190304. <https://doi.org/10.1259/bjr.20190304>.
- Obodovskiy, I. (2019). Effect of Radiation on Biological Structures. Radiation Mutagenesis. Dalam *Radiation* (hlm. 447–471). Elsevier. <https://doi.org/10.1016/b978-0-444-63979-0.00035-5>.
- Oh, D. (2019). Proton therapy: the current status of the clinical evidences. *Precision and Future Medicine*, 3(3), 91–102. <https://doi.org/10.23838/pfm.2019.00058>
- Paganetti, H. (2012). *PROTON THERAPY PHYSICS Edited by*. <http://www.taylorandfrancis.com/>.
- Parisi, A., Olko, P., Swakoń, J., Horwacik, T., Jabłoński, H., Malinowski, L., Nowak, T., Struelens, L., dan Vanhavere, F. (2020). Modeling the radiation-induced cell death in a therapeutic proton beam using thermoluminescent detectors and radiation transport simulations. *Physics in Medicine and Biology*, 65(1). <https://doi.org/10.1088/1361-6560/ab491f>.
- Park, M. Y., dan Jung, S. E. (2016). Patient dose management: Focus on practical actions. *Journal of Korean Medical Science*, 31, S45–S54. <https://doi.org/10.3346/jkms.2016.31.S1.S45>.

- PAULY, H. (1962). Principles of radiobiology. *Der Radiologe*, 2, 369–379. <https://doi.org/10.1016/b978-0-323-73349-6.00010-8>.
- Qin, B., Liu, X., Chen, Q. S., Li, D., Han, W. J., Tan, P., Zhang, Z. Q., Zhou, C., Chen, A. te, Liao, Y. C., dan Wang, W. (2021). Design and development of the beamline for a proton therapy system. *Nuclear Science and Techniques*, 32(12). <https://doi.org/10.1007/s41365-021-00975-y>.
- Rumgay, H., Arnold, M., Ferlay, J., Lesi, O., Cabasag, C. J., Vignat, J., Laversanne, M., McGlynn, K. A., dan Soerjomataram, I. (2022). Global burden of primary liver cancer in 2020 and predictions to 2040. *Journal of hepatology*. <https://doi.org/10.1016/j.jhep.2022.08.021>.
- Sato, T., Iwamoto, Y., Hashimoto, S., Ogawa, T., Furuta, T., Abe, S. ichiro, Kai, T., Tsai, P. E., Matsuda, N., Iwase, H., Shigyo, N., Sihver, L., dan Niita, K. (2018). Features of Particle and Heavy Ion Transport code System (PHITS) version 3.02. *Journal of Nuclear Science and Technology*, 55(6), 684–690. <https://doi.org/10.1080/00223131.2017.1419890>.
- Sekarutami, S. M., dan Handoko. (2019). The future of radiotherapy and immunotherapy concomitantly in cancer management. Dalam *Medical Journal of Indonesia* (Vol. 28, Nomor 4, hlm. 391–395). Faculty of Medicine, Universitas Indonesia. <https://doi.org/10.13181/mji.v28i4.3211>.
- Siegel, R. L., Miller, K. D., Fuchs, H. E., dan Jemal, A. (2022). Cancer statistics, 2022. *CA: A Cancer Journal for Clinicians*, 72(1), 7–33. <https://doi.org/10.3322/caac.21708>.
- Slater, J. M., Slater, J. D., Kang, J. I., Namihas, I. C., Jabola, B. R., Brown, K., Grove, R., Watt, C., dan Bush, D. A. (2019). Hypofractionated Proton Therapy in Early Prostate Cancer: Results of a Phase I/II Trial at Loma Linda University. *International Journal of Particle Therapy*, 6(1), 1–9. <https://doi.org/10.14338/ijpt-19-00057>.
- Sonke, J. J., Aznar, M., dan Rasch, C. (2019). Adaptive Radiotherapy for Anatomical Changes. Dalam *Seminars in Radiation Oncology* (Vol. 29, Nomor 3, hlm. 245–257). W.B. Saunders. <https://doi.org/10.1016/j.semradonc.2019.02.007>.
- Sørensen, B. S., Pawelke, J., Bauer, J., Burnet, N. G., Dasu, A., Høyer, M., Karger, C. P., Krause, M., Schwarz, M., Underwood, T. S. A., Wagenaar, D., Whitfield, G. A., dan Lühr, A. (2021). Does the uncertainty in relative biological effectiveness affect patient treatment in proton therapy? *Radiotherapy and Oncology*, 163, 177–184. <https://doi.org/10.1016/j.radonc.2021.08.016>.
- Sun, L., dan Hui, L. (2020). Progress in human liver organoids. Dalam *Journal of Molecular Cell Biology* (Vol. 12, Nomor 8, hlm. 607–617). Oxford University Press. <https://doi.org/10.1093/jmcb/mjaa013>.
- Tanguturi, S. K., Niemierko, A., Wo, J. Y., Nguyen, K. N., Prichard, H., Zhu, A. X., Wolfgang, J. A., dan Hong, T. S. (2017). Gallbladder toxicity and high-dose ablative-intent radiation for liver tumors: Should we constrain the dose? *Practical Radiation Oncology*, 7(5), e323–e329. <https://doi.org/10.1016/j.prro.2017.02.001>.

- The 2007 Recommendations of the International Commission on Radiological Protection. ICRP publication 103. (2007). *Annals of the ICRP*, 37(2–4), 1–332. <https://doi.org/10.1016/j.icrp.2007.10.003>.
- Tsang, D. S., dan Patel, S. (2019). Proton beam therapy for cancer. Dalam *CMAJ* (Vol. 191, Nomor 24, hlm. E664–E666). Canadian Medical Association. <https://doi.org/10.1503/cmaj.190008>.
- Turner, J. E. (2007). *Atoms, Radiation, and Radiation Protection*.
- Usmani, A., Siddiqui, M. A., Siddiqui, H., dan Mishra, A. (2018). EPIDEMIOLOGY OF HEPATOCELLULAR CARCINOMA Development and evaluation of doxorubicin self nanoemulsifying drug delivery system with Nigella sativa oil against human hepatocellular carcinoma View project EPIDEMIOLOGY OF HEPATOCELLULAR CARCINOMA. *Article in International Journal of Pharmaceutical Sciences and Research*, 9(12), 5050. [https://doi.org/10.13040/IJPSR.0975-8232.9\(12\).5050-59](https://doi.org/10.13040/IJPSR.0975-8232.9(12).5050-59).
- Vedelago, J., Karger, C. P., dan Jäkel, O. (2022). A review on reference dosimetry in radiation therapy with proton and light ion beams: status and impact of new developments. *Radiation Measurements*, 157. <https://doi.org/10.1016/j.radmeas.2022.106844>.
- Vitale, A., Farinati, F., Finotti, M., Di Renzo, C., Brancaccio, G., Piscaglia, F., Cabibbo, G., Caturelli, E., Missale, G., Marra, F., Sacco, R., Giannini, E. G., Trevisani, F., Cillo, U., Bhoori, S., Borzio, M., Burra, P., Casadei Gardini, A., Carrai, P., ... Zoli, M. (2021). Overview of prognostic systems for hepatocellular carcinoma and ITA.LICA external validation of MESH and CNLC classifications. Dalam *Cancers* (Vol. 13, Nomor 7). MDPI AG. <https://doi.org/10.3390/cancers13071673>.
- Vitti, E. T., dan Parsons, J. L. (2019). The radiobiological effects of proton beam therapy: Impact on DNA damage and repair. Dalam *Cancers* (Vol. 11, Nomor 7). MDPI AG. <https://doi.org/10.3390/cancers11070946>.
- Yoo, G. S., Yu, J. il, dan Park, H. C. (2018). Proton therapy for hepatocellular carcinoma: Current knowledges and future perspectives. *World Journal of Gastroenterology*, 24(28), 3090–3100. <https://doi.org/10.3748/wjg.v24.i28.3090>.
- Zarifi, S., Ahangari, H. T., Jia, S. B., Tajik-Mansoury, M. A., Najafzadeh, M., dan Firouzjaei, M. P. (2020). Bragg peak characteristics of proton beams within therapeutic energy range and the comparison of stopping power using the GATE Monte Carlo simulation and the NIST data. *Journal of Radiotherapy in Practice*, 19(2), 173–181. <https://doi.org/10.1017/S1460396919000554>.
- Zhou, J., Sun, H., Wang, Z., Cong, W., Wang, J., Zeng, M., Zhou, W., Bie, P., Liu, L., Wen, T., Han, G., Wang, M., Liu, R., Lu, L., Ren, Z., Chen, M., Zeng, Z., Liang, P., Liang, C., ... Fan, J. (2020). Guidelines for the Diagnosis and Treatment of Hepatocellular Carcinoma (2019 Edition). Dalam *Liver Cancer* (Vol. 9, Nomor 6, hlm. 682–720). S. Karger AG. <https://doi.org/10.1159/000509424>.