



BÖLÜM 14

Hepatoselluler Karsinom

Ayşe KEFELİ¹

ÖZET

Hepatoselluler Karsinom (HSK), karaciğer en sık primer tümörüdür ve tüm kanserler arasında 6. sıklıkta, kansere bağlı ölümler arasında 4. sırada yer alır. Hepatoselluler Karsinom, sıklıkla sirotik karaciğerden kaynaklansa da siroz olmadan da HSK gelişebilir. Erken dönemde semptomu neden olmaması nedeniyle sıklıkla geç tanı konulur. Küratif tek tedavi seçeneği cerrahi rezeksiyon ve karaciğer nakli olması ve ileri hastalıkta kür şansı olmaması nedeniyle yüksek riskli hastalara tarama önerilir. Sirotik hastalar ve diğer yüksek riskli hastalar ultrasonografi (USG) ile nodül varlığı açısından taranırlar. Bazı kılavuzlar USG ile AFP bakılmasını da önerir. Tanı sıklıkla USG’de tespit edilen nodülün kontrastlı görüntüleme tipik boyanma özelliği göstermesi ile konulur. Nadiren biyopsi gereklidir. Hepatoselluler Karsinom tanısı alan hastalarda tedavi kararı, hastanın performans durumu, kitlenin morfolojik özellikleri, karaciğer fonksiyonlarına göre verilir. Uygun hastada cerrahi rezeksiyon küratif tedavidir. Cerrahi rezeksiyon yapılmadığından nakil kriterlerini karşılayan hastalara karaciğer nakli yapılabilir böylelikle altta yatan karaciğer hastalığı da tedavi edilebilir. Cerrahi ya da karaciğer nakli için uygun olmayan hastalara lokal ablasyon ya da embolizasyon tedavileri uygulanabilir. Radyofrekans ablasyon ve transarteryal embolizasyon gibi tedavilerin başarıları oldukça iyidir. Tüm bu seçenekler uygun olmadığında sistemik tedavi verilebilir ancak sistemik tedavi ile kür elde edilemez ancak sağ kalım süresi uzatılabilir.

¹ Doç. Dr. Ayşe KEFELİ, Tokat Gaziosmanpaşa Üniversitesi Tıp Fakültesi İç Hastalıkları AD. Gastroenteroloji BD. aysekefeli@hotmail.com

Sorafenib: PDGF, VEGF reseptör kinaz inhibitörüdür Sorafenib, radyolojik tedavilere dahi uygun olmayan ve Child-A karaciğer fonksiyonuna sahip ileri evre vakaların (makrovasküler invazyon veya ekstrahepatik metastaz) ilk basamak tedavisi için önerilmektedir. Child-B’de hepatik dekompanseasyon gelişebileceği için dikkatle kullanılmalıdır. Bu nedenle genellikle Child-Pugh skoru 7’nin üzerinde veya dekompanse sirozu olan vakalar için önerilmez. Tedavinin kesilmesi veya doz azaltımının en yaygın nedenleri el-ayak deri reaksiyonu, döküntü ve ishaldir (124).

Regorafenib: Yeni bir multikinaz inhibitörü olup çoklu anjiyogenik yolaklara (VEGFR, PDGFR, TIE2 ve FGFR) ve onkojenik yolaklara (RET, KIT, c-RAF / RAF-1 ve BRAF) karşı sorafenibden daha güçlü inhibitör aktivitelere sahiptir. En sık görülen yan etkileri hipertansiyon, el-ayak cilt reaksiyonu, yorgunluk ve ishaldir (1).

Lenvatinib: Özellikle sorafenib tolere edemeyen veya edemeyeceklerde ilk seçenek tedavidir. Viral etyolojiler dışındaki sebeplerle kronik karaciğer hastalığında sorafenib yerine tercih edilmesi konusunda görüşler net değildir.

Atezolizumab ve bevacizumab: Child Pugh A sirozluda ve performans durumu iyi olanlarda ilk seçenek tedavi olarak tercih edilebilir.

İkinci Basamak Tedavi

Tedavi altında iken büyüyen tümörlerde veya birinci basamak tedaviyi tolere edemeyenlerde ikinci basamak tedavi uygulanır. En iyi rejim oluşturulmamıştır ve bir ajanın diğerine tercih edilmesine rehberlik edecek hiçbir biyo-belirteç yoktur. Tirozin kinaz inhibitörleri (yani, sorafenib [birinci basamak tedavi için uygulanmadıysa] veya regorafenib) veya immün kontrol noktası inhibitörleri nivolumab veya pembrolizumab kullanılabilir. İlerlemiş karaciğer hastalığı ve/veya yaşam beklentisi kısa olan hastalarda her bir rejimin yan etki profili dikkatle değerlendirilmelidir. Lenvatinib, sorafenib başarısızlığından sonra başka bir tedavi seçeneğidir (126,127,128). Ancak sorafenib başarısız olduktan sonra lenvatinibin işe yarayıp yaramayacağı bilinmemektedir. Birinci

basamak olarak kullanılan atezolizumab artı bevacizumabın başarısızlığından sonra ikinci basamak tedaviyi inceleyen hiçbir çalışma yoktur.

Mevcut veriler, çeşitli geleneksel sitotoksik ajanlar ve/veya kombinasyon ilaç rejimleri için orta düzeyde bir antitümör etkinliği olduğunu göstermektedir. Bununla birlikte, özellikle moleküler hedefli tedaviler ve immünoterapideki gelişmeler ışığında sitotoksik kemoterapi için uygun hasta seçimi net değildir.

Hepatit B virüs reaktivasyonu — Sistemik kemoterapi gören HSK hastalarında viral hepatit reaktivasyonu meydana gelebilir, bu nedenle antiviral ilaçları sürdürmek önemlidir.

Kaynaklar

1. Llovet JM, Villanueva A, Marrero JA, et al. AASLD Panel of Experts on Trial Design in HCC. Trial Design and Endpoints in Hepatocellular Carcinoma: AASLD Consensus Conference. *Hepatology*. 2021;73
2. Kanwal F, Singal AG. Surveillance for Hepatocellular Carcinoma: Current Best Practice and Future Direction. *Gastroenterology*. 2019;157(1):54.
3. Ganne-Carrié N, Nahon P. Hepatocellular carcinoma in the setting of alcohol-related liver disease. *J Hepatol*. 2019;70(2):284
4. Kudo M. Management of Hepatocellular Carcinoma in Japan as a World-Leading Model. *Liver Cancer* 2018;7:134–147
5. Singal AG, Lampertico P, Nahon P. Epidemiology and surveillance for hepatocellular carcinoma: New trends. *J Hepatol* 2020; 72:250.
6. Wolf E, Rich NE, Marrero JA, et al. Use of Hepatocellular Carcinoma Surveillance in Patients With Cirrhosis: A Systematic Review and Meta-Analysis. *Hepatology* 2021; 73:713.
7. <https://gco.iarc.fr/today/data/factsheets/cancers/11-Liver-fact-sheet.pdf> (Accessed on January 27, 2020).
8. Marrero JA, Kulik LM, Sirlin CB, et al. Diagnosis, staging, and management of hepatocellular carcinoma: practice guidance by American Association for the Study of Liver Disease. *Hepatology* 2018;68(2):723-750
9. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer Statistics, 2021. *CA Cancer J Clin* 2021; 71:7.
10. Kulik L, El-Serag HB. Epidemiology and Management of Hepatocellular Carcinoma. *Gastroenterology* 2019; 156:477.
11. Maucort-Boulch D, de Martel C, Franceschi S, Plummer M. Fraction and incidence of liver cancer attributable to hepatitis B and C viruses worldwide. *Int J Cancer* 2018; 142:2471.
12. Sangiovanni A, Prati GM, Fasani P, et al. The natural history of compensated cirrhosis due to hepatitis C virus: A 17-year cohort study of 214 patients. *Hepatology* 2006; 43:1303.

13. Ioannou GN, Splan MF, Weiss NS, et al. Incidence and predictors of hepatocellular carcinoma in patients with cirrhosis. *Clin Gastroenterol Hepatol* 2007; 5:938.
14. Beasley RP. Hepatitis B virus. The major etiology of hepatocellular carcinoma. *Cancer* 1988; 61:1942.
15. Chen CJ, Yang HI, Su J, et al. Risk of hepatocellular carcinoma across a biological gradient of serum hepatitis B virus DNA level. *JAMA* 2006; 295:65.
16. Yang HI, Lu SN, Liaw YF, et al. Hepatitis B e antigen and the risk of hepatocellular carcinoma. *N Engl J Med* 2002; 347:168.
17. Yu MW, Yeh SH, Chen PJ, et al. Hepatitis B virus genotype and DNA level and hepatocellular carcinoma: a prospective study in men. *J Natl Cancer Inst* 2005; 97:265.
18. Tseng TC, Liu CJ, Yang HC, et al. High levels of hepatitis B surface antigen increase risk of hepatocellular carcinoma in patients with low HBV load. *Gastroenterology* 2012; 142:1140.
19. Tong MJ, Blatt LM, Kao JH, et al. Basal core promoter T1762/A1764 and precore A1896 gene mutations in hepatitis B surface antigen-positive hepatocellular carcinoma: a comparison with chronic carriers. *Liver Int* 2007; 27:1356.
20. Simonetti J, Bulkow L, McMahon BJ, et al. Clearance of hepatitis B surface antigen and risk of hepatocellular carcinoma in a cohort chronically infected with hepatitis B virus. *Hepatology* 2010; 51:1531.
21. Benvegnù L, Fattovich G, Noventa F, et al. Concurrent hepatitis B and C virus infection and risk of hepatocellular carcinoma in cirrhosis. A prospective study. *Cancer* 1994; 74:2442.
22. Lok AS, Seeff LB, Morgan TR, et al. Incidence of hepatocellular carcinoma and associated risk factors in hepatitis C-related advanced liver disease. *Gastroenterology* 2009; 136:138.
23. Raimondi S, Bruno S, Mondelli MU, Maisonneuve P. Hepatitis C virus genotype 1b as a risk factor for hepatocellular carcinoma development: a meta-analysis. *J Hepatol* 2009; 50:1142.
24. Alfaïate D, Clément S, Gomes D, et al. Chronic hepatitis D and hepatocellular carcinoma: A systematic review and meta-analysis of observational studies. *J Hepatol* 2020; 73:533.
25. Bressac B, Kew M, Wands J, Ozturk M. Selective G to T mutations of p53 gene in hepatocellular carcinoma from southern Africa. *Nature* 1991; 350:429.
26. Unsal H, Yakicier C, Marçais C, et al. Genetic heterogeneity of hepatocellular carcinoma. *Proc Natl Acad Sci U S A* 1994; 91:822.
27. Chen J, Zhu J, Wang G, et al. Qidong: a crucible for studies on liver cancer etiology and prevention. *Cancer Biol Med* 2019; 16:24.
28. Tsai JF, Jeng JE, Chuang LY, et al. Habitual betel quid chewing as a risk factor for cirrhosis: a case-control study. *Medicine (Baltimore)* 2003; 82:365.
29. Yu SZ. Primary prevention of hepatocellular carcinoma. *J Gastroenterol Hepatol* 1995; 10:674.
30. Omata M, Cheng AL, Kokudo N, et al. Asia-Pacific clinical practice guidelines on the management of hepatocellular carcinoma: a 2017 update. *Hepatol Int* 2017; 11(4):317-370.
31. Trichopoulos D, Bamia C, Lagiou P, et al. Hepatocellular carcinoma risk factors and disease burden in a European cohort: a nested case-control study. *J Natl Cancer Inst* 2011; 103:1686.
32. Lee YC, Cohet C, Yang YC, et al. Meta-analysis of epidemiologic studies on cigarette smoking and liver cancer. *Int J Epidemiol* 2009; 38:1497.
33. Younossi Z, Stepanova M, Ong JP, et al. Nonalcoholic Steatohepatitis Is the Fastest Growing Cause of Hepatocellular Carcinoma in Liver Transplant Candidates. *Clin Gastroenterol Hepatol* 2019; 17:748.
34. Kanwal F, Kramer JR, Mapakshi S, et al. Risk of Hepatocellular Cancer in Patients With Non-Alcoholic Fatty Liver Disease. *Gastroenterology* 2018; 155:1828.
35. Lai SW, Chen PC, Liao KF, et al. Risk of hepatocellular carcinoma in diabetic patients and risk reduction associated with anti-diabetic therapy: a population-based cohort study. *Am J Gastroenterol* 2012; 107:46.
36. Salmon D, Bani-Sadr F, Loko MA, et al. Insulin resistance is associated with a higher risk of hepatocellular carcinoma in cirrhotic HIV/HCV-co-infected patients: results from ANRS CO13 HEPAVIH. *J Hepatol* 2012; 56:862.
37. Li Q, Li WW, Yang X, et al. Type 2 diabetes and hepatocellular carcinoma: a case-control study in patients with chronic hepatitis B. *Int J Cancer* 2012; 131:1197.
38. Arase Y, Kobayashi M, Suzuki F, et al. Effect of type 2 diabetes on risk for malignancies includes hepatocellular carcinoma in chronic hepatitis C. *Hepatology* 2013; 57:964.
39. Chen HP, Shieh JJ, Chang CC, et al. Metformin decreases hepatocellular carcinoma risk in a dose-dependent manner: population-based and in vitro studies. *Gut* 2013; 62:606.
40. Wang P, Kang D, Cao W, et al. Diabetes mellitus and risk of hepatocellular carcinoma: a systematic review and meta-analysis. *Diabetes Metab Res Rev* 2012; 28:109.
41. Yang WS, Va P, Bray F, et al. The role of pre-existing diabetes mellitus on hepatocellular carcinoma occurrence and prognosis: a meta-analysis of prospective cohort studies. *PLoS One* 2011; 6:e27326.
42. Wang C, Wang X, Gong G, et al. Increased risk of hepatocellular carcinoma in patients with diabetes mellitus: a systematic review and meta-analysis of cohort studies. *Int J Cancer* 2012; 130:1639.
43. Seyda Seydel G, Kucukoglu O, Altinbasv A, et al. Economic growth leads to increase of obesity and associated hepatocellular carcinoma in developing countries. *Ann Hepatol* 2016; 15:662.
44. Koh JC, Loo WM, Goh KL, et al. Asian consensus on the relationship between obesity and gastrointestinal and liver diseases. *J Gastroenterol Hepatol* 2016; 31:1405.
45. Larsson SC, Wolk A. Overweight, obesity and risk of liver cancer: a meta-analysis of cohort studies. *Br J Cancer* 2007; 97:1005.
46. Elmberg M, Hultcrantz R, Ekblom A, et al. Cancer risk in patients with hereditary hemochromatosis and in their first-degree relatives. *Gastroenterology* 2003; 125:1733.
47. Atkins JL, Pilling LC, Masoli JAH, et al. Association of Hemochromatosis HFE p.C282Y Homozygosity With

- Hepatic Malignancy. *JAMA* 2020; 324:2048.
48. Stewart MF. Review of hepatocellular cancer, hypertension and renal impairment as late complications of acute porphyria and recommendations for patient follow-up. *J Clin Pathol* 2012; 65:976
 49. Tansel A, Katz LH, El-Serag HB, et al. Incidence and determinants of hepatocellular carcinoma in autoimmune hepatitis: a systematic review and meta-analysis. *Clin Gastroenterol Hepatol* 2017;15(8):1207-1217
 50. Baravelli CM, Sandberg S, Aarsand AK, Tollånes MC. Porphyria cutanea tarda increases risk of hepatocellular carcinoma and premature death: a nationwide cohort study. *Orphanet J Rare Dis* 2019; 14:77.
 51. Shen YC, Hsu C, Cheng CC, et al. A critical evaluation of the preventive effect of antiviral therapy on the development of hepatocellular carcinoma in patients with chronic hepatitis C or B: a novel approach by using meta-regression. *Oncology* 2012; 82:275.
 52. Singal AK, Salameh H, Kuo YF, Fontana RJ. Meta-analysis: the impact of oral anti-viral agents on the incidence of hepatocellular carcinoma in chronic hepatitis B. *Aliment Pharmacol Ther* 2013; 38:98.
 53. Waziry R, Hajarizadeh B, Grebely J, et al. Hepatocellular carcinoma risk following direct-acting antiviral HCV therapy: A systematic review, meta-analyses, and meta-regression. *J Hepatol* 2017; 67:1204.
 54. Kaplan DE, Serper MA, Mehta R, et al. Effects of Hypercholesterolemia and Statin Exposure on Survival in a Large National Cohort of Patients With Cirrhosis. *Gastroenterology* 2019; 156:1693.
 55. Simon TG, Duberg AS, Aleman S, et al. Association of Aspirin with Hepatocellular Carcinoma and Liver-Related Mortality. *N Engl J Med* 2020; 382:1018.
 56. Donadon V, Balbi M, Mas MD, et al. Metformin and reduced risk of hepatocellular carcinoma in diabetic patients with chronic liver disease. *Liver Int* 2010; 30:750.
 57. Freedman ND, Cross AJ, McGlynn KA, et al. Association of meat and fat intake with liver disease and hepatocellular carcinoma in the NIH-AARP cohort. *J Natl Cancer Inst* 2010; 102:1354.
 58. Bamia C, Lagiou P, Jenab M, et al. Fruit and vegetable consumption in relation to hepatocellular carcinoma in a multi-centre, European cohort study. *Br J Cancer* 2015; 112:1273.
 59. Matthews CE, Moore SC, Arem H, et al. Amount and Intensity of Leisure-Time Physical Activity and Lower Cancer Risk. *J Clin Oncol* 2020; 38:686.
 60. Trevisani F, Cantarini MC, Wands JR, Bernardi M. Recent advances in the natural history of hepatocellular carcinoma. *Carcinogenesis* 2008; 29: 1299- 305.
 61. van Malenstein H, van Pelt J, Verslype C. Molecular classification of hepatocellular carcinoma anno 2011. *Eur J Cancer* 2011; 47: 1789-97. [CrossRef]
 62. Palmer WC, Patel T. Are common factors involved in the pathogenesis of primary liver cancers? A meta-analysis of risk factors for intrahepatic cholangiocarcinoma. *J Hepatol* 2012; 57: 69-76.
 63. International Working Party. Terminology of nodular hepatocellular lesions. *Hepatology* 1995; 22: 983-93. [CrossRef]
 64. Park YN. Update on precursor and early lesions of hepatocellular carcinomas. *Arch Pathol Lab Med* 2011; 135: 704-15.
 65. International Consensus Group for Hepatocellular Neoplasia. Pathologic diagnosis of early hepatocellular carcinoma: a report of the international consensusgroup for hepatocellular neoplasia. *Hepatology* 2009; 49: 658-64.
 66. Choi JY, Lee JM, Sirlin CB. CT and MR imaging diagnosis and staging of hepatocellular carcinoma. Part I: development, growth, and spread: key pathologic and imaging aspects. *Radiology* 2014; 272: 635-54.
 67. Park YM, Kim MJ. Hepatocarcinogenesis: imaging-pathologic correlation. *Abdom Imaging* 2011; 36: 232-43.
 68. Roskams T, Kojiro M. Pathology of early hepatocellular carcinoma: conventional and molecular diagnosis. *Semin Liver Dis* 2010; 30: 17-25.
 69. Kitao A, Zen Y, Matsui O, Gabata T, Nakanuma Y. Hepatocarcinogenesis: multistep changes of drainage vessels at CT during arterial portography and hepatic arteriography-radiologic-pathologic correlation. *Radiology* 2009; 252: 605-14.
 70. Takayama T, Makuuchi M, Hirohashi S, Sakamoto M, Okazaki N, Takayasu K, et al. Malignant transformation of adenomatous hyperplasia to hepatocellular carcinoma. *Lancet* 1990; 336: 1150-3.
 71. Terada T, Kadoya M, Nakanuma Y, Matsui O. Iron-accumulating adenomatous hyperplastic nodule with malignant foci in the cirrhotic liver. Histopathologic, quantitative iron, and magnetic resonance imaging in vitro studies. *Cancer* 1990; 65: 1994-2000.
 72. Kitao A, Matsui O, Yoneda N, Kozaka K, Shinmura R, Koda W, et al. The uptake transporter OATP8 expression decreases during multistep hepatocarcinogenesis: correlation with gadoteric acid enhanced MR imaging. *Eur Radiol* 2011; 21: 2056-66.
 73. Kogita S, Imai Y, Okada M, Kim T, Onishi H, Takamura M, et al. Gd-EOB-DTPA-enhanced magnetic resonance images of hepatocellular carcinoma: correlation with histological grading and portal blood flow. *Eur Radiol* 2010; 20: 2405-13.
 74. Kefeli A, Basyigit S, Yeniova O. Diagnosis of hepatocellular cancer. *Liver cancer Intech open* 2018. First edition 3505137;3-19
 75. Kim YS, Lim HK, Rhim H, et al. Ten-year outcomes of percutaneous radiofrequency ablation as first-line therapy of early hepatocellular carcinoma: analysis of prognostic factors. *J Hepatol* 2013;58:89-97.
 76. Shibata T, Iimuro Y, Yamamoto Y, et al. Small hepatocellular carcinoma: comparison of radiofrequency ablation and percutaneous microwave coagulation therapy. *Radiology* 2002;223:331-337
 77. Kang WH, Hwang S, Song GW, et al. Prognostic effect of transarterial chemoembolization-induced complete pathological response in patients undergoing liver resection and transplantation for hepatocellular carcinoma. *Liver Transplant* 2017;23:781-790.
 78. Bialecki ES, Di Bisceglie AM. Diagnosis of hepatocellular carcinoma. *HPB (Oxford)* 2005; 7:26.
 79. Tietge UJ, Schöfl C, Ocran KW, et al. Hepatoma with severe non-islet cell tumor hypoglycemia. *Am J Gastroenterol* 1998; 93:997.

80. Sakisaka S, Watanabe M, Tateishi H, et al. Erythropoietin production in hepatocellular carcinoma cells associated with polycythemia: immunohistochemical evidence. *Hepatology* 1993; 18:1357.
81. Kew MC, Fisher JW. Serum erythropoietin concentrations in patients with hepatocellular carcinoma. *Cancer* 1986; 58:2485.
82. Steiner E, Velt P, Gutierrez O, et al. Hepatocellular carcinoma presenting with intractable diarrhea. A radiologic-pathologic correlation. *Arch Surg* 1986; 121:849.
83. Berkowitz I, Hodkinson HJ, Kew MC, DiBisceglie AM. Pityriasis rotunda as a cutaneous marker of hepatocellular carcinoma: a comparison with its prevalence in other diseases. *Br J Dermatol* 1989; 120:545.
84. DiBisceglie AM, Hodkinson HJ, Berkowitz I, Kew MC. Pityriasis rotunda. A cutaneous marker of hepatocellular carcinoma in South African blacks. *Arch Dermatol* 1986; 122:802.
85. Choi BG, Park SH, Byun JY, et al. The findings of ruptured hepatocellular carcinoma on helical CT. *Br J Radiol* 2001; 74:142
86. Lin YT, Liu CJ, Chen TJ, et al. Pyogenic liver abscess as the initial manifestation of underlying hepatocellular carcinoma. *Am J Med* 2011; 124:1158.
87. Harding JJ, Abu-Zeinah G, Chou JE, et al. Frequency, Morbidity, and Mortality of Bone Metastases in Advanced Hepatocellular Carcinoma. *J Natl Compr Canc Netw* 2018; 16:50.
88. Choi HJ, Cho BC, Sohn JH, et al. Brain metastases from hepatocellular carcinoma: prognostic factors and outcome: brain metastasis from HCC. *J Neurooncol* 2009; 91:307.
89. European Association for the Study of the Liver. Electronic address: easloffice@easloffice.eu, European Association for the Study of the Liver. EASL Clinical Practice Guidelines: Management of hepatocellular carcinoma. *J Hepatol* 2018; 69:182.
90. Korean Liver Cancer Study Group-National Cancer Center;
91. Kanmaniraja D, Chernyak V. Liver imaging reporting and data system and CT/MRI diagnosis of hepatocellular carcinoma. *Hepatoma Res* 2020;6:51. <http://dx.doi.org/10.20517/2394-5079.2020.46>
92. Kudo M, Kawamura Y, Hasegawa K, et al. Management of Hepatocellular Carcinoma in Japan: JSH Consensus Statements and Recommendations 2021 Update. *Liver Cancer* 2021;10:181–223
93. Marrero JA, Feng Z, Wang Y, et al. Alpha-fetoprotein, des-gamma-carboxyprothrombin, and lectin-bound alpha-fetoprotein in early hepatocellular carcinoma. *Gastroenterology* 2009; 137:110.
94. Lok AS, Sterling RK, Everhart JE, et al. Des-gamma-carboxy prothrombin and alpha-fetoprotein as biomarkers for the early detection of hepatocellular carcinoma. *Gastroenterology* 2010; 138:493.
95. Tsukuma H, Hiyama T, Tanaka S, et al. Risk factors for hepatocellular carcinoma among patients with chronic liver disease. *N Engl J Med* 1993; 328:1797.
96. Oka H, Tamori A, Kuroki T, et al. Prospective study of alpha-fetoprotein in cirrhotic patients monitored for development of hepatocellular carcinoma. *Hepatology* 1994; 19:61.
97. Lok AS, Sterling RK, Everhart JE, et al. Des-gamma-carboxy prothrombin and alpha-fetoprotein as biomarkers for the early detection of hepatocellular carcinoma. *Gastroenterology* 2010; 138:493.
98. Tsukuma H, Hiyama T, Tanaka S, et al. Risk factors for hepatocellular carcinoma among patients with chronic liver disease. *N Engl J Med* 1993; 328:1797.
99. Oka H, Tamori A, Kuroki T, et al. Prospective study of alpha-fetoprotein in cirrhotic patients monitored for development of hepatocellular carcinoma. *Hepatology* 1994; 19:61.
100. Oda K, Ido A, Tamai T, Matsushita M, Kumagai K, et al. Highly sensitive lens culinaris agglutinin-reactive α -fetoprotein is useful for early detection of hepatocellular carcinoma in patients with chronic liver disease. *Oncol Rep.* 2011;26(5):1227–1233.
101. Aoyagi Y, Oguro M, Yanagi M, Mita Y, Suda T, et al. Clinical significance of simultaneous determinations of alpha-fetoprotein and des-gamma-carboxyprothrombin in monitoring recurrence in patients with hepatocellular carcinoma. *Cancer.* 1996;77(9): 1781.
102. Yao M, Yao DF, Bian YZ, Zhang CG, Qiu LW, et al. Oncofetal antigen glypican-3 as a promising early diagnostic marker for hepatocellular carcinoma. *Hepatobiliary Pancreat Dis Int.* 2011;10:289–294.
103. Yu NC, Chaudhari V, Raman SS, et al. CT and MRI improve detection of hepatocellular carcinoma, compared with ultrasound alone, in patients with cirrhosis. *Clin Gastroenterol Hepatol* 2011; 9:161.
104. PJ, Pirrie SJ, Cox TE, et al. The detection of hepatocellular carcinoma using a prospectively developed and validated model based on serological biomarkers. *Cancer Epidemiol Biomarkers Prev* 2014; 23:144.
105. Wang M, Devarajan K, Singal AG, et al. The Doylestown Algorithm: A Test to Improve the Performance of AFP in the Detection of Hepatocellular Carcinoma. *Cancer Prev Res (Phila)* 2016; 9:172.
106. D'Onofrio M, Faccioli N, Zamboni G, et al. Focal liver lesions in cirrhosis: value of contrast-enhanced ultrasonography compared with Doppler ultrasound and alpha-fetoprotein levels. *Radiol Med* 2008; 113:978
107. Wang G, Zhu S, Li X. Comparison of values of CT and MRI imaging in the diagnosis of hepatocellular carcinoma and analysis of prognostic factors. *Oncol Lett* 2019; 17:1184
108. Wang G, Zhu S, Li X. Comparison of values of CT and MRI imaging in the diagnosis of hepatocellular carcinoma and analysis of prognostic factors. *Oncol Lett* 2019; 17:1184
109. Hanna RF, Miloushev VZ, Tang A, et al. Comparative 13-year meta-analysis of the sensitivity and positive predictive value of ultrasound, CT, and MRI for detecting hepatocellular carcinoma. *Abdom Radiol (NY)* 2016; 41:71.
110. Abd Alkhalik Basha M, Abd El Aziz El Sammak D, El Sammak AA. Diagnostic efficacy of the Liver Imaging-Reporting and Data System (LI-RADS) with CT imaging in categorising small nodules (10-20 mm) detected in the cirrhotic liver at screening ultrasound. *Clin Radiol* 2017;72:901.e1-901.e11.

111. Maharaj B, Bhoora IG. Complications associated with percutaneous needle biopsy of the liver when one, two or three specimens are taken. *Postgrad Med J* 1992; 68:964.
112. Silva MA, Hegab B, Hyde C, et al. Needle track seeding following biopsy of liver lesions in the diagnosis of hepatocellular cancer: a systematic review and meta-analysis. *Gut* 2008; 57:1592.
113. Morgan, M., Di Muzio, B. Liver cancer (BCLC staging). Reference article, Radiopaedia.org. (accessed on 21 Dec 2021) <https://doi.org/10.53347/rID-34362>
114. Liu CL, Fan ST, Lo CM, et al. Management of spontaneous rupture of hepatocellular carcinoma: single-center experience. *J Clin Oncol* 2001; 19:3725.
115. Forner A, Reig M, Bruix J. Hepatocellular carcinoma. *Lancet* 2018; 391:1301.
116. Torzilli G, Belghiti J, Kokudo N, et al. A snapshot of the effective indications and results of surgery for hepatocellular carcinoma in tertiary referral centers: is it adherent to the EASL/AASLD recommendations?: an observational study of the HCC East-West study group. *Ann Surg* 2013; 257:929.
117. A new prognostic system for hepatocellular carcinoma: a retrospective study of 435 patients: the Cancer of the Liver Italian Program (CLIP) investigators. *Hepatology* 1998; 28:751
118. Vauthey JN, Dixon E, Abdalla EK, et al. Pretreatment assessment of hepatocellular carcinoma: expert consensus statement. *HPB (Oxford)* 2010; 12:289.
119. Sapisochin G, et al. The extended Toronto criteria for liver transplantation in patients with hepatocellular carcinoma: a prospective validation study. *Hepatology* 2016;64(6):2077-2088.
120. Shiina S, Tateishi R, Imamura M, et al. Percutaneous ethanol injection for hepatocellular carcinoma: 20-year outcome and prognostic factors. *Liver Int* 2012;32:1434-1442.
121. Kim YS, Lim HK, Rhim H, et al. Ten-year outcomes of percutaneous radiofrequency ablation as first-line therapy of early hepatocellular carcinoma: analysis of prognostic factors. *J Hepatol* 2013;58:89-97.
122. Shibata T, Iimuro Y, Yamamoto Y, et al. Small hepatocellular carcinoma: comparison of radiofrequency ablation and percutaneous microwave coagulation therapy. *Radiology* 2002;223:331-337
123. Kang WH, Hwang S, Song GW, et al. Prognostic effect of transarterial chemoembolization-induced complete pathological response in patients undergoing liver resection and transplantation for hepatocellular carcinoma. *Liver Transplant* 2017;23:781-790.
124. Bruix J, Chan SL, Galle PR, et al. Systemic treatment of hepatocellular carcinoma. An EASL position paper. *J Hepatol* 2021;75:960
125. Galle PR, Finn RS, Qin S, et al. Patient-reported outcomes (PROs) from the Phase III IMbrave150 trial of atezolizumab (atezo) + bevacizumab (bev) vs sorafenib (sor) as first-line treatment (tx) for patients (pts) with unresectable hepatocellular carcinoma (HCC). *J Clin Oncol* 2020; 38S: ASCO #476.
126. El-Khoueiry AB, Sangro B, Yau T, et al. Nivolumab in patients with advanced hepatocellular carcinoma (CheckMate 040): an open-label, non-comparative, phase 1/2 dose escalation and expansion trial. *Lancet* 2017; 389:2492.
127. Yau T, Kang YK, Kim TY, et al. Efficacy and Safety of Nivolumab Plus Ipilimumab in Patients With Advanced Hepatocellular Carcinoma Previously Treated With Sorafenib: The CheckMate 040 Randomized Clinical Trial. *JAMA Oncol* 2020; 6:e204564.