operatively determined to have resectable pancreatic cancer except one, who was found to have borderline resectable pancreatic cancer. R0 resection was achieved in all patients. Forty-five patients (78.9%) received postoperative adjuvant chemotherapy with or without radiation therapy. Median overall disease-free survival was 12.8 months with a median overall disease-specific survival of 25.1 months. SUVmax did not correlate with radiologic tumor size (p=0.501); however, MTV2.5 (p=0.001) and TLG (p=0.009) were significantly associated with radiologic tumor size. In addition, MTV2.5 (p<0.001) and TLG (p<0.001) were significantly correlated with tumor differentiation. There were no significant differences in TLG and SUVmax according to LNR (lymph node ratio); only MTV2.5 was related to LNR with marginal significance (p=0.055). In multivariate analysis, LNR (Exp (β)=2.425, p=0.025) and MTV2.5 (Exp (β)=2.273, p=0.034) were identified as independent predictors of tumor recurrence following margin-negative resection. **(Conclusion)** Most clinically available parameters for the prediction of tumor biology and oncologic outcome are based on pathologic examination. However, a preoperatively determined volume-based PET parameter, MTV2.5, can potentially be used as a surrogate marker to estimate tumor biology. Thus, more effective treatment strategies for pancreatic cancer can be determined based on the results of preoperative MTV2.5.

KAHBPS-O-2-1

Tumor size-dependent long-term prognosis after resection of solitary hepatocellular carcinoma: Single-institution experience with 2558 patients

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Korea

Shin Hwang*, Young-Joo Lee, Ki-Hun Kim, Chul-Soo Ahn, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Sung-Gyu Lee

(Purpose) According to 7th AJCC staging system, solitary hepatocellular carcinoma (HCC) is classified as T1 or T2 according to microvascular invasion (MVI) regardless of tumor size. This study intended to evaluate the prognostic value of tumor size on long-term patient survival after curative resection of solitary HCCs. **(Methods)** A cohort of 2558 patients who underwent R0 resection of solitary HCC (<10 cm) were selected for the study population, with all patient follow-up period ≥24 months or until death with no patient censored during survival analysis. **(Results)** HCC lesion was incidentally detected in 2054 (80.3%) during regular health screening or routine follow-up and hepatitis B virus infection was associated in 2127 (83.2%). Mean patient age was 47.8±10.8 years. Preoperative locoregional treatments were performed in 513 (20.1%). Anatomical resection was performed in 1686 (65.9%). MVI was identified in 408 (16.0%), thus became stage T2 and other 2150 patients became stage T1. Overall 5-year patient survival rates were 85.0% in tumor size <2 cm (n=490; 86.1% and 61.1% without and with MVI), 78.3% in tumor size 2.0~3.9 cm (n=1092; 80.4% and 67.6% without and with MVI), 68.9% in tumor size 4.1~5.9 cm (n=573; 74.0% and 52.6% without and with MVI), 60.0% in tumor size 6.1~7.9 cm (n=267; 64.9% and 49.2% without and with MVI), and 62.6% in tumor size

8.1~9.9 cm (n=140; 69.7% and 46.8% without and with MVI), showing stepwise incremental deterioration of long-term survival outcomes along the tumor size as well as MVI. **(Conclusion)** The results of this study showed that the traditional concept of tumor size as a significant prognostic factor was too much underestimated in the current version of AJCC staging, thus further validation and revision are necessary for next version.

KAHBPS-O-2-2

Positive immunostaining of sal-like protein 4 (SALL4) is associated with poor patient survival outcome in the large and undifferentiated Korean hepatocellular carcinoma

Department of Surgery, [1]Pathology, College of Medicine, Hanyang University, [2]Department of Surgery, Hallym University Kangnam Sacred Heart Hostpital, Korea

Yun Kyung Jung, Ki Seok Jang[1], Seung Sam Paik[1], Yong Jin Kwon[2], Han Jun Kim, Kyeong Geun Lee, Hwon Kyum Park, Dongho Choi*

(Purpose) Recent outstanding studies have suggested SALL4, an oncofetal gene, as prognosis biomarker in hepatocellular carcinoma (HCC). Given the debates in study group difference in terms of etiologic factors between the Asian and Western HCC and immunostaining method, we tried to determine the prevalence of SALL4 immunoreactivity and its clinical relevance in Korean HCC patients. **(Methods)** We made tissue microarrays (TMAs) consisting of 213 surgically resected tissue of HCCs patients with germ cell tumor as an positive control group at the Hanyang University Hospital. SALL4 immunohistochemistry was scored in semi-quantitative scoring system with immunoreactive score (IRS) and the results correlated with overall survival, in addition to general demographics and clinical characteristics. **(Results)** The average of patients' age of our TMAs were approximately 55.39 years (range:15-87), 167 were men, and mean tumor size was 4.76cm (range:0.7-22). SALL4 immunoreactivity was expressed in 17 cases. By univariate analysis, the SALL4-positive cases had significantly higher tumor grade (p=0.007). On the clinicopathologic analyses, correlations between SALL4 and clinicopathologic factors were not seen in microscopic and macroscopic vessel invasions, perineural invasions, but SALL4 and alpha-fetoprotein (AFP) was correlated significantly. (P=0.003) The survival analysis showed positive correlation with largest tumor size (p=0.005) and SALL4 immunoreactivity in T3 and T4 HCC was correlated with poor prognosis. **(Conclusion)** Here, we found that positive immunostaining of SALL4 is associated with poor patient survival outcome in the large and undifferentiated Korean hepatocellular carcinoma. SALL4 expression showed close relationship with clinical outcomes of HCCs in Korean patients. Further careful well designed study for SALL4 stem cell marker should be done with multinational studies for universal application of SALL4 as a biomarker for HCCs.

KAHBPS-O-2-3

Importance of anatomical resection and recurrence type in hepatocellular carcinoma patients with portal vein tumor thrombosis

Department of Surgery, Hepato-Biliary Surgery and Liver Transplantation, Asan Medica[1] Center, University of Ulsan College of Medicine, Korea

Deok-Bog Moon*, Sung-Gyu Lee, Young-Joo Lee, Kwang-Min Park, Shin Hwang, Ki-Hun Kim, Chul-Soo Ahn, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Hwa Kang, Bo-Hyun Jung, Min-Ho Shin, Wan-Jun Kim, Young-In Yun, Suk-Hwan Kim, Tae-Hwan Lim, Wo

(Purpose) Recently nonsurgical treatment for hepatocellular carcinoma (HCC) with portal vein tumor thrombus (PVTT) including transarterial chemoembolization (TACE), radiotherapy, and chemotherapy using Sorafenib is preferred by many doctors due to high recurrence rate and poor long-term survival even after surgery. As a result, the role of surgical resection and thrombectomy for hepatocellular carcinoma with PVTT might be controversial. However, surgery is the unique treatment method to eradicate tumor and to achieve cure. This study aimed to evaluate the effect of the extent of PVTT and curative resection on the long-term outcomes of surgical treatment for HCC. In addition, we evaluated clinicopathological variables to affect on the long-term survival and try to suggest ideal approaches to achieve favorable outcomes. **(Methods)** A total of 225 patients with HCC and PVTT underwent hepatic resection with or without thrombectomy. These 225 patients were divided into 4 groups according to the level of PVTT: in PV1, PVTT was located at subsegmental PV (25 patients), in PV2, PVTT is located at sectional PV (58 patients), in PV3, PVTT is located at right or left PV (114 patients), in PV4, PVTT extended into main PV (28 patients). In addition, PVTT patients were divided into 3 groups according to marginal status of resection: in R0 (173 patients), in R1 (40 patients), in R2 (12 patients).). We reviewed clinicopathogical variables and analyzed overall survival. **(Results)** The cumulative 1-, 2-, 3-, and 5 year overall survival rates were 61.1%, 45.5%, 37.0%, and 31.2%, respectively. The overall survival rates between PV1, 2, 3, and 4 groups were not different, and the 5-year overall survival rate were 38.9%, 33.8%, 31.1%, and 29.4%, respectively. Meanwhile, the overall survival rates between R0, 1, and 2 groups were significantly different, and the 5-year overall survival rates were 36.9%, 19.2%, and 0%, respectively. Other significant variables on univariate analysis are presence of esophageal varix, total bilirubin, albumin, PIVKA-II level, tumor size and location, presence of satellite nodules, hepatic vein or bile duct invasion, anatomical hepatectomy, recurrence type and locoregional treatment, occurrence of Clavien grade 3, 4 complications. On multivariate analysis, the overall survival was significantly affected by anatomical hepatectomy and recurrence type. **(Conclusion)** For better outcomes, we should perform anatomical resection to obtain R0 resection for HCC with PVTT, and also perform aggressive locoregional treatment for the recurrence.

KAHBPS-O-2-4

Everolimus provides hepatic protective effects by way of enhancing autophagy and of reducing apoptosis during hepatic ischemia/reperfusion injury

Department of Surgery, Daejeon St. Mary's Hospita[1], College of Medicine, The Catholic University of Korea, Korea

Say-June Kim*, Sang Kuon Lee, Sang Chul Lee, Youngkyoung You, Dong-Goo Kim

(Purpose) Autophagy is an intracellular process responsible for damaged or unnecessary protein and organelle degradation. Autophagy is enhanced in both ischemia and reperfusion phase during ischemia/reperfusion (IR) injury in various organs. In addition, everolimus pretreatment has been reported to be useful in preserving organ function following IR injury. However, no definite data are available concerning its effect on autophagy during hepatic IR injury. In this study, we were intended to investigate the overall effects of everolimus on the autophagy during hepatic IR injury. **(Methods)** This work investigated the effect of everolimus on hepatic I/R injury using in vitro and in vivo IR injury models. In vitro IR model was established by incubating AML12 hepatocyte cells with KH buffer, and reperfusion was certified by Annexin V/PI FACs. Autophagy was identified by LC3B, GFP-LC3, and Acridine orange stain. Moreover, in vivo effects of everolimus was assessed following intravenous administration of everolimus to mice with hepatic IR injury. Liver enzyme measurements, tunnel assay, Western blot analysis, together with immunohistochemistry, were used to compare the extent of hepatic IR injury. **(Results)** The western blot of PARP, cleaved caspase 3, 8, 9 demonstrated that apoptosis was accelerated during hepatic IR injury. The inverse relationship between autophagy and apoptosis was also observed. Everolimus increased autophagy in the concentration-dependent manner, thereby resulting in reduction in apoptosis. The protective effects of everolimus on the hepatic IR injury was also displayed through improvement of autophagy and suppression of apoptosis in vivo models; everolimus infusion significantly attenuated hepatic enzymes with reduced hepatic histopathologic lesions and higher expression of LC3B compared with non-preconditioned IR group. **(Conclusion)** Everolimus infusion reduced hepatic IR injury with decreased markers of cellular apoptosis and enhanced autophagy. Everolimus medication thus may provide a useful hepatic protection during liver surgery.

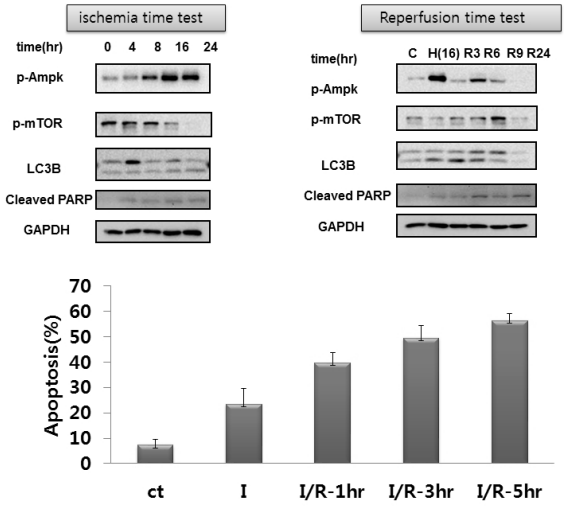

Fig. The correlation between hepatic ischemia/reperfusion injury and the markers for autophagy.

KAHBPS-O-2-5

AROS is a significant biomarker for non-cirrhotic hepatocellular carcinoma

[1]Cbs Bioscience Inc, [2]Keimyung University Dongsan Medical Center, [3]Ajou University School of Medicine [4]Pohang University of Science and Technology, [5]Pukyung National University, [6]Samsung Medical Center, Korea

Keun Soo Ahn[2], Jung-Hee Kwon[1], Young Ho Moon[1], Jin Young Park[1], Hee Jung Wang[3], Kwan Yong Choi[4], Gundo Kim[5], Jae Won Joh[6], Koo-Jeong Kang[2]*

(Purpose) Despite a low risk of liver failure and preserved liver function, non-cirrhotic HCC has poor prognosis. To improve clinical outcomes of the curative-intent treatment in non-cirrhotic HCC, identification of prognostic factors accompanied by new treatment strategies are needed. In the current study, we evaluated AROS as a prognostic biomarker in non-cirrhotic HCC. **(Methods)** mRNA levels of AROS was measured in tumor and non-tumor tissues derived from 283 non-cirrhotic HCC patients. Relationships between clinical characteristics and AROS expression were analyzed using Chi square and Fisher's exact test. The prognostic significance of AROS expression was analyzed using Kaplan-Meier curves and Cox regression models. **(Results)** AROS was significantly up-regulated in tumors irrespective of tumor stage and BCLC stage. Additionally, recurrent tissues revealed higher average levels of AROS than non-recurrent tissues for follow-up times of 2 years and 5 years and the differences were statistically significant. High mRNA levels of AROS were associated with tumor stage, BCLC stage, AFP level, vascular invasion, tumor size, and portal vein invasion. HCC patients with higher AROS levels showed higher recurrence and shorter DFS for both short-term and long-term compared to those with AROS-low group. Cox regression analysis demonstrated that AROS is a significant predictor for recurrence and DFS along with large tumor size, tumor multiplicity, vascular invasion, and poor tumor differentiation which are the known prognostic factors. **(Conclusion)** Our findings on AROS as a prognostic biomarker could be helpful for designing a strategy for the effective treatment and management of non-cirrhotic HCC.

KAHBPS-O-2-6

The effect of preoperative transarterial chemoembolization for resectable hepatocellular carcinoma

The Division of Hepato-Biliary-Pancreatic Surgery, Department of Surgery, Asan Medical Center, Ulsan University, Korea

Jung Woo Lee, Young Joo Lee*, Kwang Min Park, Dae Wook Hwang, Jae Hoon Lee, Ki Byung Song, Dong Joo Lee, Sang Hyun Shin, Eun Sung Jun, Hyoung Eun Kim

(Purpose) To evaluate the effect of preoperative transarterial chemoembolization (TACE) for resectable hepatocellular carcinoma (HCC). **(Methods)** A retrospective study was conducted on 1022 patients who underwent hepatectomy for HCC at the Division of Hepatobiliary and Pancreatic Surgery, Asan Medical Center, Seoul, Korea, between December 1999 and December 2009. Among 1022 patients, 96 patients underwent multiple preoperative TACE, 128 patients underwent single preoperative TACE, and 798 patients did not. We compared disease-free survival (DFS) and overall survival (OS) between the three groups, as well as between subgroups, stratified with regard to TACE response grade (complete necrosis : n=51, in-

complete necrosis : n=173). **(Results)** The 1-,3-, and 5-year DFS rates were 74.4%, 53.8%, and 44.2%, respectively, in the non-TACE group and 68.0%, 52.2%, and 42.5%, respectively, in the single preoperative TACE group and 66.0%, 34.1%, and 29.8%, respectively, in the multiple preoperative TACE group. The 1-,3-, and 5- OS rates were 93.1%, 80.6%, and 70.4% respectively, in the non-TACE group and 93.8%, 78.9%, and 69.5%, respectively, in the single-TACE group and 90.6%, 73.7%, and 53.5%, respectively, in the multiple preoperative TACE group. The multiple preoperative TACE group were significantly more likely to show a poor prognosis in both DFS and OS (p=0.018, p=0.002). The1-,3-, and 5-year DFS rate were 62.0%, 38.0%, and 33.2%, respectively, in the incomplete necrosis group, and 84.3%, 66.5%, and 50.3%, respectively, in the complete necrosis group (p=0.001). The 1-,3-, and 5-year OS rate were 90.1%, 71.5%, and 58.1%, respectively, in the incomplete necrosis group and 100%, 94.1%, and 78.4%, respectively, in complete necrosis group (p=0.002). The complete necrosis group was significantly smaller tumor size, single tumor, negative macro-vascular invasion, old age, and, low AFP level in comparison to the incomplete necrosis group. **(Conclusion)** Preoperative single TACE did not significantly improve the disease free survival and overall survival, rather, preoperative multiple TACE worsen the disease free survival and overall survival after curative resection of HCC. Therefore, surgical resection should be preferentially considered in resectable HCC. Even though, surgical outcome was improved in the complete necrosis group, the complete necrosis group was not advanced stage: only 4 patients in 51 complete necrosis group was advanced stage (III or IV). Therefore, preoperative TACE has not therapeutic benefits in patients with resectable HCC.

KAHBPS-O-3-1

Suppressive effect of combining sorafenib with vitamin K on migration of hepatocellular carcinoma cells by inhibition of the HGF/c-Met pathway

Department of Surgery, Kosin University College of Medicine, Departments of [1]Anatomy and Cell Biology, [2]Surgery, Asan Medical Center, University of Ulsan College of Medicine, Korea

Young-Il Choi, Hea-Nam Hong[1], Sung-Gyu Lee[2], Shin Hwang[2]*

(Purpose) Vitamin K plays a role in controlling cell growth, including inhibition of growth of hepatocellular carcinoma cells. In the absence of vitamin K, des-gamma-carboxy prothrombin (DCP) is released into the blood and DCP levels reflect worse tumor behavior and prognosis for patients with HCC. However, DCP was reported to increase in patients treated with sorafenib, despite its therapeutic efficacy. Antiangiogenic effects of sorafenib lead to impair vitamin K uptake and to induce DCP in HCC. Here, we examined the sorafenib and vitamin K individually and combination of two agents on the inhibition of migration and metastic potential of HCC cells. **(Methods)** HepG2 cells (HCC cell line) were cultured and then treated with hepatocyte growth factor (HGF). E-cadherin expression, phospho-Met and phospho-extracellular signal-regulated kinase (ERK) levels were measured by using special immunohistochemical stains and Western Blot and cell migration was also measured by Oris cell migration assay and scratch assay. **(Results)** We found that combining sorafenib with vitamin K significantly increased expression of E-cadherin compared to the single agent treatment. With the Oris invasion assay and scratch assay, HGF stimulated HepG2 cells treated with combining sorafenib with vitamin K showed greatly com-