

Educational Exhibit**Abstract No. 360****Troubling tumors: complicating findings during hepatic tumor embolization**

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Learning Objectives: The learning objectives include a detailed review of angiographic findings discovered during hepatic tumor embolization that either require a change in the procedural approach or even make the procedure impossible or unsafe to complete.

Background: Hepatocellular carcinoma (HCC) is the fifth most common cancer and the third most common cause of cancer-related death in the world. Embolization of HCC and hepatic metastatic disease is expanding with gradually increased frequency. Furthermore, embolization can be technically difficult with potential for complications. Advanced knowledge of congenital variations of arterial anatomy that may be seen in hepatic arterial supply is of great importance to the Interventional Radiologist in order to avoid partial or nontarget embolization. Additionally, careful assessment of portal vasculature is crucial to avoid complications from portal vein occlusion or arteriportal shunting. Parasitized arterial supply may require additional embolization of separate vessels not initially targeted to achieve a favorable result. Reviewing factors complicating successful hepatic tumor embolization is an essential foundation to training interventionalists, in order to avoid hazardous techniques and potentially fatal complications.

Clinical Findings/Procedure Details: This educational poster will provide a detailed review of angiographic findings discovered during hepatic tumor embolization that may alter procedural approach, such as variant vascular anatomy, arteriportal shunting, parasitization of blood supply by tumor, or thrombosis of portal vasculature.

Conclusion and/or Teaching Points: This review of angiographic findings discovered during hepatic tumor embolization will ultimately serve to demonstrate possible complications that may require a change in the procedural approach or premature termination to maintain patient safety.

Abstract No. 361**Cryoablation under real-time CT fluoroscopic guidance in renal cell carcinoma: factors affecting local tumor control**

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Purpose: To retrospectively evaluate factors affecting local tumor control in cryoablation of renal cell carcinomas (RCCs).

Materials and Methods: Fifty-nine patients with single RCC who underwent percutaneous cryoablation under real-time CT fluoroscopic guidance were included in this study. Feasibility, initial therapeutic response, complications, local tumor progression, and survival were evaluated. Factors affecting local tumor control were analyzed by univariate and multivariate analyses.

Results: Cryoablation was completed with a planned protocol after probes were placed in the planned sites of the tumor in all patients. Tumor enhancement disappeared after initial cryoablation in 55 patients (93.3%), but residual tumors were found in the other 4 patients. Local tumor progression developed in 3 of 55 patients (5.6%) in whom tumor enhancement disappeared after initial cryoablation during the mean follow-up of 9.2 ± 3.9 (range, 3.2-19.2 months). The univariate analysis identified the maximum tumor diameter larger than 4cm ($p=0.002$) and ice-ball margin less than 3mm ($p<0.001$) as risk factors of local tumor control, and ice-ball margin ($p=0.001$) still remained its significance in the multivariate analysis. Tumor enhancement of uncontrolled RCCs disappeared after the second cryoablation in 6 patients and arterial embolization in 1 patient. There was no major complication but one patient (1.7%, 1/59) who required temporary dialysis due to acute renal failure. All patients are still alive with the 1-year survival rate of 100%.

Conclusion: Although cryoablation is a feasible, safe, and useful therapeutic option for the treatment of RCCs, tumor size and ice-ball margin affect local tumor control.

Abstract No. 362**Dodecafluoropentane (DDFP) tissue distribution following IV administration in New Zealand white rabbits**

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Purpose: IV injection of Dodecafluoropentane emulsion (DDFPe) (NuvOx Pharma, Tucson, AZ) increases oxygen transportation and reduces brain infarct volume in rabbit stroke models. Many potential applications in stroke, blood loss, ischemic states, and high risk angiography are yet undefined. Organ distribution of chemical DDFPe is not known but critical to understanding DDFPe mechanism and efficacy in treating ischemia. Previous studies indicate a blood half-life of <2 min but therapeutic effects last >90 min after injection and rapid overdose can cause pulmonary edema. This points to a need for comprehensive tissue pharmacokinetics. We describe DDFPe disposition in 9 dosing regimens.

Materials and Methods: New Zealand white rabbits, N=27, were divided into 9 treatment groups ($n=3/\text{group}$). Groups received 1, 4 or 15 doses (0.6ml/kg, 0.3ml/kg, 0.1ml/kg, or 0.01ml/kg per dose) of 2% DDFPe every 90 min. A one dose group was sacrificed 2 min after a 0.6ml/kg dose. Eight multi-dose groups were sacrificed 90 min after the final dose. Tissues were harvested, flash frozen, and analyzed with headspace sampling/GC-MS. DDFPe disposition was determined in brain, heart, kidney, liver, spleen, and lung.

Results: DDFPe quickly distributed to all tissues sampled with the highest concentration in the spleen immediately following a single dose. Following 4 doses, and to a greater degree after 15 doses, DDFPe concentrations rose in all organs. They were lowest in brain and heart (8-10 $\mu\text{g/g}$) and highest in lung (100 $\mu\text{g/g}$). DDFPe increased in brain, heart, and lung with increasing dose (0.1, 0.3, and 0.6 ml/kg) suggesting linear pharmacokinetics in these tissues. A more complex relationship between

dose and tissue level was observed in liver, kidney, and spleen. Non-linear disposition is suggested there. DDFP lung concentrations were consistently higher than in any other tissue. These data suggest that lung DDFP levels may cause adverse effects and limit DDFP dose.

Conclusion: DDFP promptly reaches the brain and concentrations rise in all tissues with multiple doses. Future studies will develop a dosing regimen to optimize a wide range of therapeutic effects in ischemic states and minimize toxicity.

Educational Exhibit

Abstract No. 363

Protecting the runoff during lower extremity arterial interventions using embolic protection devices

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Learning Objectives: 1. Identifying lesions and procedures at risk for distal embolization. 2. Discussing the risks and benefits in using protection devices during lower limb interventions.

Background: Embolic protection devices were first introduced in 1990 to prevent cerebral infarcts during carotid artery stenting. The routine use of protection devices significantly decreased stroke risk and have also been implemented in other vascular beds. Percutaneous endovascular lower limb arterial interventions are increasingly being done for the treatment of peripheral arterial disease. Identifying vulnerable lesions and high risk procedures more likely to cause distal embolization is important to minimize periprocedural complications, maximize procedural success and minimize re-interventions.

Clinical Findings/Procedure Details: Distal embolization during lower extremity interventions is a variably reported complication with incidence varying from 1.5% to 19% for clinically significant embolic events depending on the case series of patients. Unstable lesions more at risk for distal embolization include intervening on chronic total occlusive disease, in-stent lesions, complex long complex lesions, heavily calcified lesions, ulcerated friable atheromatous plaque or thrombus-laden/occluded bypass grafts. High risk procedures include catheter-directed pharmacomechanical thrombolysis, use of atherectomy devices and recanalization of occluded stents and bypass grafts. Subclinical microemboli are near ubiquitously dislodged even during simplest interventions including crossing the target lesion with a wire or during balloon/stent angioplasty. It is important to note that protection devices are not complication free nor do they completely negate the risk of distal embolization. The profile of individual devices can limit the crossability past certain lesions which in of itself may propagate distal emboli during manipulation or allow emboli to pass unhindered if there is an incomplete seal against the vessel.

Conclusion and/or Teaching Points: Embolic protection devices can prevent embolic debris during lower limb interventions. Knowledge of at-risk lesions and interventions can assist the interventionalist in choosing to employ these devices on a case-by-case basis.

Abstract No. 364

Hepatic Yttrium-90 radioembolization for neuroendocrine malignancy: a meta-analysis

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Purpose: Yttrium-90 radioembolization (RE) has emerged as a favored treatment in patients with liver dominant neuroendocrine metastases (mNET). In the absence of level I data, the aim of this study was to evaluate the efficacy of this modality in a meta-analysis of the published literature.

Materials and Methods: A comprehensive review protocol screened all reports in the literature. Strict selection criteria were applied to ensure consistency among the selected studies: human subjects, response or survival data, resin microspheres, >5 patients, not a review article, abstract, or presentation, English language, and separate and complete data for mNET if the study included multiple tumor types. Selected studies were critically appraised on 54 study criteria, in accordance with the Research Reporting Standards for RE. Response data at 3 months (RECIST) were extracted and analyzed using both fixed and random-effects meta-analyses.

Results: A total of 145 studies were screened; 11 were selected, totaling 428 procedures (408 patients). Funnel plots showed no evidence of publication bias ($p=0.876$). Critical appraisal revealed an average of 71% of desired criteria included in selected studies. Very high between-study heterogeneity ($I^2=75-78\%$; $p<0.0001$) ruled out a fixed-effects model. The random-effects weighted average response rate (CR and PR) was 48% (95% CI: 35% - 62%) and weighted average disease control rate (CR, PR and SD) was 86% (95% CI: 74% - 92%). Percentage of patients with islet cell mNET was marginally associated with poorer response ($p=0.063$), accounting for approximately 22% of the heterogeneity among studies. Percentage of carcinoid histology, however, did not have a significant effect ($p=0.228$), although histology data were incompletely provided by the studies. The percent response correlated with median survival ($R=0.85$; $p=0.008$).

Conclusion: This meta-analysis confirms RE to be a valuable treatment option for patients with mNET. The pooled data demonstrated a weighted response rate of 48% and a disease control rate of 86%, as well as an increase in survival for patients responding to therapy. Most studies were incompletely compliant with reporting standards.

Educational Exhibit

Abstract No. 365

How to determine absorbed dose following radioembolization using Y90 PET/CT: a clinician's guide

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Learning Objectives: The process of converting Yttrium-90 (Y90) PET/CT images into 3D absorbed dose maps will be