Uterine artery embolization has been available as a treatment option for symptomatic fibroids since 1995. In that time, there have been four European based randomized controlled trials (RCT) comparing it with hysterectomy and two reported RCTs comparing it with uterine sparing myomectomy. In total, 268 women were recruited to RCTs comparing UAE with myomectomy and 448 women recruited to RCTs comparing UAE with hysterectomy.

As women are increasingly delaying childbearing to their third and fourth decades, when fibroids are more likely to be symptomatic, hysterectomy is inappropriate. Even should there be no desire for fertility, many women wish to maintain their uterus, not only to avoid the long term complications associated with hysterectomy but also to maintain their body image and these considerations should be respected.

The RCTs comparing UAE with hysterectomy, report a higher reintervention rate after UAE with more minor and delayed complications but hysterectomy has a higher major complication rate. The reintervention rate following hysterectomy was reported as high as 10% in the EMMY trial and these were for major indications such as adhesiolysis, vesicovaginal fistula and reconstructive surgery. Following UAE, the reintervention rate is as much as 32% usually for recurrent fibroids which may be treated by repeat UAE or hysterectomy. However, a comparison of reintervention rates between UAE and myomectomy is more appropriate.

The two RCTs comparing UAE and myomectomy reported on quite different populations. The first trial was from the Czech Republic and the majority of women had single fibroids, many of which were suitable for laparoscopic myomectomy. The second trial involved a different population of women who had very large multifibroid uteruses. The surgical arm of this RCT was open myomectomy. These trials report that symptom control and complication rates were similar in the myomectomy and embolization groups. Recovery time and hospital stay was significantly shorter in the UAE group but there was a higher reintervention rate. A third (FEMME) trial comparing UAE with myomectomy has recently finished recruiting in the UK. 260 women have been recruited and randomized between UAE or myomectomy by any approach. This trial will look at quality of life outcomes as well as ovarian reserve and cost, but is not powered to report on fertility outcomes.

All trials report a high clinical success rate for UAE but many clinicians still believe that pressure symptoms due to fibroids may not respond to UAE as the bulk of fibroids remains. However many of the trials have shown a beneficial effect of UAE even when compared with hysterectomy and studies reporting outcomes of urinary and bowel symptoms as well as sexual function seem to confirm this.
### Uterine artery embolization for symptomatic adenomyosis: where we stand?

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Adenomyosis is characterized by the presence of heterotopic endometrial glands and stroma in the myometrium and is often associated with local myometrial hypertrophy and hyperplasia. The frequency of adenomyosis reported in the literature ranges widely, from 8.8–31%. About one-third of women are symptomatic with menorrhagia, pelvic pain and bulk-related symptoms such as urinary frequency or pelvic heaviness due to uterine enlargement. Hysterectomy is considered the only definitive treatment of adenomyosis.

In view of the short-term results, most patients with pure or dominant adenomyosis had a positive outcome after UAE with respect to clinical symptoms and junctional zone thickness. However, controversy still exists regarding its effectiveness in terms of mid-term or long-term durability. According to the study of Pelage et al., only 56% of patients had persistent resolution of symptoms at two-year follow up, whereas Kim’s study demonstrated only 38% recurred at mean 4.9 years follow up, which is regarded as very high success rate. One of the possible explanations of the discrepancy between the two studies was the embolic material and the size of polyvinyl alcohol (PVA) particles. Pelage et al., used PVA 355–500 μm in size or trisacryl gelatin microspheres with a diameter of 500–900 μm, and meanwhile Kim et al. predominantly used PVA particles 250–355 μm at the beginning of embolization. Kim’s study demonstrated that UAE for patients with small size of PVA particle 150–250 μm at the beginning of embolization (1-2-3 protocol) induced significantly higher rate complete necrosis of adenomyosis than those embolized with 355–500 μm. And patients with complete necrosis of adenomyosis revealed lower recurrence rate than those without necrosis at long-term follow up.

### References

Uterine artery embolization (UAE) is a well-known radiologic intervention for treating symptomatic uterine fibroids or adenomyosis (1, 2). Pain is a major concern after UAE both for patients and physicians. According to the previous reports, more than 92% of patients experienced postprocedural pain and 99% of patients required intravenous patient-controlled analgesia with opioids (3). The mechanisms of pain are not only ischemia of the fibroids but also a transient myometrial ischemia due to the occlusion of bilateral uterine arteries (4). The pain usually worsen during the first 2 to 3 hours after the procedure, remaining at this level for 8 to 12 hours, after which the pain is rapidly decreasing (5). The intensity of cramping pain is often severe and needs adequate management.

There are various strategies to treat post-UAE pain according to the previous studies. Non-Steroidal Anti-Inflammatory Drug (NSAID), including ketorolac, oral rofecoxib, and ibuprofen, has been described to reduce pain after UAE (6). Morphine patient-controlled analgesia has been reported to be more effective than fentanyl patient-controlled analgesia in one study (3). Furthermore, remifentanil patient-controlled analgesia has been shown to reduce pain intensity significantly compared to the morphine patient-controlled analgesia during the first 4 hours after UAE (7). However, the addition of ketamine to the morphine patient-controlled analgesia did not reduce the pain intensity and morphine requirements (8). Moreover, the addition of preprocedural oral oxycodone of 20 mg to morphine patient-controlled analgesia did not reduce the pain intensity but increase the incidence of nausea and vomiting (4). The single-dose intravenous dexamethasone of 10 mg reduced the pain at 12 to 24 hours after UAE when using with fentanyl patient-controlled analgesia, while the overall fentanyl consumption and pain scores during the first 12 hours after UAE did not reduce (9). The intravenous dexmedetomidine infusion of 0.2–0.4 μg/kg/h reduced pain scores and the need for additional analgesics during the first 1 hour after UAE (10). In addition, the fentanyl consumption of fentanyl patient-controlled analgesia reduced during the first 6 hours after UAE and the incidence of nausea and vomiting also reduced during 24 hours after UAE. In this study, dexmedetomidine infusion was started at 30 minutes before the start of the UAE and maintained for 6 hours after the end of UAE. In other previous studies, the superior hypogastric nerve block using ropivacaine was shown to reduce the opioid consumption (11, 12). Likewise, thoracic epidural analgesia targeting T11 and T12, which are associated with the major sensory fibers for the uterus, was shown to be effective method for the pain control after UAE (13).

As described above, different techniques and medications can be employed to manage the postprocedural pain (5). The physician should determine the methods to minimize pain considering the hospital's environment and this enables physicians to perform UAE in an outpatient basis and improve the tolerance.

References


In hospital maternal death from postpartum hemorrhage after elective caesarean section is on the core list of events that should never happen in the National Health Service (NHS) of England and Wales. This is because it is entirely preventable if existing national guidelines and safety recommendations are implemented.

The role of Interventional Radiology (IR) in treating catastrophic postpartum bleeding was acknowledged in a report in 2006 investigating 10 maternal deaths in a London teaching hospital and the Healthcare Commission recommended that delivery units should discuss the formation of networks to provide emergency IR.

IR has an accepted role in the treatment of PPH and agreement of the timing of referral to IR should be agreed between the relevant teams and clearly stated in hospital protocols. IR has an 86% primary success rate in stopping hemorrhage after a single UAE session. If hemorrhage recurs, a second embolization has a success rate of approximately 75%. There are a variety of reasons why embolization may fail. These include failure to recognize an alternative arterial supply, arterial spasm, unilateral embolization and disseminated intravascular coagulation. The overall complication rate of UAE in PPH is low and most complications are minor, but major ischemic complications and pulmonary embolization have been described.

Latterly, there is increasing interest in IR methods to avoid PPH in high risk patients. These are patients with morbidly adherent placenta and women with placenta previa who cannot be given blood products. Measures to reduce blood loss in such women include the placement of occlusion balloons either into the internal iliac, common iliac arteries or in the abdominal aorta. This may be performed either with planned caesarean hysterectomy or with uterine conservation. UAE may be performed prophylactically or in response to hemorrhage. There is as yet no consensus as to which management combination gives the best results and the procedures are not without complications to the mother and baby e.g. ischemic complications of the lower limbs have been reported in mothers and radiation exposure of the baby inevitably occurs and should be kept as low as possible.

All maternity units should be aware of the role of IR in the treatment and prevention of PPH and make arrangements for the transfer of women to units with 24/7 IR facilities if not available locally.
Surgical techniques of liver transplantation: what interventional radiologists need to know

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Standard procedure of adult-to-adult living donor liver transplantation (LDLT)

Usually, in Korea, most centers prefer modified extended right graft (right hemiliver with preservation of V5 and/or V8 branch of middle hepatic vein) for adult-to-adult LDLT.

On the back table, the segment V hepatic vein (V5) was anastomosed to the proximal end of an ePTFE graft in an end-to-end fashion with 6–0 prolene. In cases of double V5s, venoplasty of the V5s to achieve a single orifice was performed, or 1 of the V5s was anastomosed to ePTFE in an end-to-side fashion. The segment VIII hepatic vein (V8) was anastomosed to the ePTFE graft in an end-to-side fashion or to the graft right hepatic vein (RHV) in an end-to-end fashion with 6–0 prolene. When V8 could be directly anastomosed to the graft RHV, the ePTFE graft draining V5 was directly anastomosed to the recipient inferior vena cava (IVC) so that the main outflow tract would not be made complex.

After removal of recipient’s diseased liver, the donor right hepatic vein can be anastomosed end to end either to the right hepatic vein. The donor right portal vein is then anastomosed end to end to the recipient’s portal vein. Because we do not perform a temporary portocaval shunt or use venovenous bypass, we prefer to reperfuse the graft as soon as the portal vein anastomosis is complete. Intraoperative Doppler ultrasonography (US) was performed to immediately assess the patency of the middle hepatic vein branches after hepatic artery anastomosis. For biliary anastomosis, a duct-to-duct reconstruction was usually performed.

Bile duct complication

Bile duct complication is still common in LDLT, especially after separate two bile duct reconstruction or ductoplasty. Early intervention is treatment of choice and sometimes intervention with endoscopic stenting is required.

Nonanastomotic biliary strictures occur after LT in patients with hepatic artery thrombosis, chronic ductopenic rejection, ABO blood group incompatibility, and frequently in patients received LT from China. For this kind of bile duct complication, long standing stent, multiple stents, and repeated intervention are required but prognosis is worse compared to usual anastomotic stricture.
Liver transplantation: vascular complication

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Liver transplantation: nonvascular complication

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Biliary complication including anastomotic or non-anastomotic biliary stricture, bile leak or biliary cast syndrome, is still remains the most common causes of post-transplant morbidity. Endoscopic treatment is the best initial method for treating biliary complication in patients who have duct-to-duct (DD) anastomosis. However, endoscopic cannulation is not easy in patients with complete DD anastomotic occlusion. Endoscopic treatment is also nearly impossible in patients who have previously undergone hepaticojejunal anastomosis.

In such situation, percutaneous transhepatic treatment may be good alternative. Percutaneous transhepatic biliary drainage (PTBD) followed by balloon dilation and indwelling catheter placement (14 F or 14 & 8.5F dual) for several months, is effective for treating DD or hepaticojejunal biliary stricture following liver transplantation. Covered retrievable stent also can be applied to treat anastomotic stricture in selected patients.
Interventional treatment of renal transplant complication

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**SS 01 IR-01 08:00**

Prospective intraindividual comparison of time-resolved MRA with interleaved stochastic trajectories (TWIST) with continuous table movement and CTA: in patients with critical limb ischemia

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**PURPOSE:** To compare 3D contrast-enhanced lower extremity MR angiography (MRA) with continuous table movement in combination with TWIST and CT angiography (CTA) in the same patients with diabetic critical limb ischemia (CLI) for assessment of the lower extremity peripheral arteries, with digital subtraction angiography (DSA) as the standard of reference.

**MATERIALS AND METHODS:** This prospective study included 30 consecutive patients (70.5 years; M:F = 16:14) with diabetic CLI who underwent 64 or 128-slice CTA and scheduled endovascular treatment using DSA. All patients also underwent 3D contrast-enhanced lower extremity TWIST MRA with continuous table movement before endovascular treatment. Two expertise radiologists reviewed enhanced MRA and CTA for significant stenotic lesions (> 50%) by quantitative and visual analysis with agreement and interobserver agreement was determined with generalized k statistics. The diagnostic performance (Sensitivity, Specificity, Positive predictive value, Negative predictive value) of MRA and CTA was determined using DSA as the gold standard. Interpretation disagreements were resolved by consensus and McNemar test was used to prove significant differences between CTA and MRA findings. Evaluation of DSA images was performed separately by independent interventional radiologist during angioplasty procedure.

**RESULTS:** A total of 391 arterial segments were evaluated with excellent agreement with between two readers (k = 0.953, 0.935 to 0.971 in MRA; k = 0.924, 0.897 to 0.952 in CTA). For detection of hemodynamically significant stenosis (> 50%), the sensitivity and specificity were as follows: MRA ~94.5% and 92.6%; CTA ~85.4% and 90.6%, respectively (on a segment-based analysis). Positive predictive value (PPV) and Negative predictive value (NPV) of CTA were ~90.4%, 85.7% and MRA were ~93.1%, 94.1%, respectively. There was statistically significant difference between CTA and MRA (p < 0.05, McNemar test) and the sensitivity of MRA was superior to CTA.

**CONCLUSION:** 3D contrast-enhanced lower extremity TWIST MRA with continuous table movement is comparable to DSA and shows good diagnostic performance in diabetic CLI patients.

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**SS 01 IR-02 08:10**


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**PURPOSE:** To evaluate and compare the treatment of iatrogenic femoral and radial arterial pseudo-aneurysms by using ultrasonogram (US) guided direct thrombin injection with US-guided compression repair.

**MATERIALS AND METHODS:** Ten patients with iatrogenic femoral and radial arterial pseudo-aneurysms were treated with direct thrombin injection. With US guidance, a 20-gauge needle was placed at the pseudo-aneurysm neck and thrombin (mean volume, 0.35 mL; range, 0.10-0.60 mL) was injected with continuous color Doppler US guidance. Demographics, clinical variables, pseudo-aneurysm characteristics, and results in these patients were compared with those in 21 consecutive patients who underwent US-guided compression repair.

**RESULTS:** The success rate of thrombin injection was 100% (10 of 10 patients), which was significantly higher than that of compression, 67% (14 of 21 patients), (p = 0.013). All patients required a single injection. Mean thrombosis time for thrombin injection was 6 seconds, compared with 43.5 minutes for compression. For thrombin injection, there were no complications, foot pulses did not change and no patients required conscious sedation. Follow-up US at 24 hours showed no recurrent pseudo-aneurysms.

**CONCLUSION:** For the treatment of iatrogenic arterial pseudo-aneurysms, thrombin injection with US guidance appears to be superior to compression repair.
Retrograde popliteal arterial access for recanalization of lower extremity chronic total occlusion (CTO)

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PURPOSE: Traditionally, lower extremity arterial lesions are addressed through a retrograde approach via the contralateral common femoral artery, otherwise known as the "upandover" technique. However, this approach may not be feasible in patients with difficult contralateral access with failure rates up to 20%. Patients with occluded contralateral arteries or aortoiliac grafts may also be precluded from this approach. For these cases, retrograde popliteal access provides an alternative to traditional approaches. The goal of this study is to demonstrate the efficacy and safety of retrograde popliteal access as a suitable alternative to traditional access techniques for addressing lower extremity chronic total occlusion (CTO).

MATERIALS AND METHODS: Twenty patients with superficial femoral artery (SFA) occlusions underwent percutaneous recanalization via retrograde popliteal artery access. Patients were primarily selected for previously failed or unfeasible contralateral retrograde femoral approaches. Ultrasound guided popliteal access was obtained in prone position, followed by recanalization. Hemostasis was achieved through ultrasound guided compression. Followup ultrasonography determined postprocedural vessel patency.

RESULTS: Popliteal arterial access was successfully obtained in all cases. Successful recanalization was achieved in 80% (16/20) of cases via popliteal intervention. Failures were due to inability to fully traverse SFA lesions. Complications included two instances of distal embolization; one resolved without intervention, while the other resolved following thrombolysis. Postprocedural ultrasound follow-up demonstrated one occlusion (10 months) and one stenosis (11 days) but otherwise patent vessels were seen. No complications associated with access site bleeding.

CONCLUSION: Our study demonstrates that ultrasound guided popliteal arterial access can be safely and effectively used to reanalyze the SFA. Retrograde popliteal access should be a tool for interventionalists in the management of peripheral vascular disease.
intimal tears on abdominal aorta was the only independent risk factor of postoperative abdominal aortic dilatation.

**SS 01 IR-05 08:40**

Hybrid treatment of infected aortic and iliac aneurysms: a single center experience

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**PURPOSE:** To investigate the safety and efficacy of hybrid treatment for infected aortic and iliac aneurysms.

**MATERIALS AND METHODS:** Between July 2007 and May 2011, hybrid treatment was performed in seven consecutive patients (6 men; mean age, 67.7 years, range, 57-76). Hybrid treatment consisted of extraneous treatment to subsequent surgery for secondary infected aneurysms and serve as a bridge therapy to subsequent surgery for secondary infected aneurysms.

**RESULTS:** The infrarenal abdominal aorta was affected in four patients, the common iliac artery in two and the external iliac artery in one. The hybrid treatment went successful in all seven patients. For primary infected aneurysms, no further treatment was required, whereas the excision of the infected graft and the new graft interposition was done in two of four patients with secondary infected aneurysms. No 30-day mortality or complications were reported. During the median follow-up of 42.7 months (range, 4-75.8 months), two patients with secondary infected aneurysms did not receive additional surgery and expired (28.6%). One patient died of progression of underlying malignancy and the other patient died of hypovolemic shock due to recurrent aorto-enteric fistula after 4 and 32 months after hybrid treatment, respectively. Cumulative survival was 100%, 86%, 71% and 43% at 3 months, 1, 3 and 5 years. EAB graft occlusion occurred in two patients without any limb losses.

**CONCLUSION:** The hybrid treatment by means of endovascular exclusion of infected aneurysms and EAB appears to be a stand-alone, curative treatment for primary infected aneurysms and serve as a bridge therapy to subsequent surgery for secondary infected aneurysms.

**SS 01 IR-06 08:50**

The experiment study of renal denervation in treatment of type 2 diabetes mellitus

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**PURPOSE:** Recently, the efficacy of renal denervation (RDN) has been debated, not only for resistant hypertension, but also for insulin resistance and type 2 diabetes mellitus (T2DM). It is discussed whether RDN is able to adequately target the renal nerves and reduce sympathetic nerve activity and insulin resistance, and then improve glycemic control. In this study, we sought to determine the effects of RDN on insulin resistance and glycemic control in canines with T2DM.

**MATERIALS AND METHODS:** Ten beagles were randomly divided into a SHAM group (n = 5) and RDN group (n = 5). At 16-week after high-fat diet feeding, animals received one dose of streptozotocin (STZ) by intravenous injection and were fed a high-fat diet for an additional 4 weeks. Then RDN group underwent bilateral renal artery ablation while SHAM group just underwent bilateral renal arteriography. After that, beagles were fed a high-fat diet for another 12 weeks. Blood samples collected from renal arteries and veins as well as renal arteriography were performed on all animals at 20-week and 32-week to evaluate the effects of RDN on the levels of fasting glucose, fasting insulin, renal function and homeostasis model assessment-insulin resistance (HOMA-IR) as well as the pathological changes of renal arteries.

**RESULTS:** High-fat diet feeding and STZ injection succeeded leading to canine models of T2DM (4.21 ± 0.87 mmol/L vs. 9.98 ± 2.53 mmol/L for fasting glucose, p < 0.001; 2.69 ± 0.53 mmol/L vs. 18.43 ± 3.62 mmol/L for fasting insulin, p < 0.001; 0.54 ± 0.21 vs. 8.74 ± 2.02 for HOMA-IR, p < 0.001) at 20-week. Compared with SHAM group, fasting glucose, fasting insulin and HOMA-IR in RDN group had significantly decreased at 3 months post-surgery (5.02 ± 0.98 mmol/L vs. 7.64 ± 1.01 mmol/L for fasting glucose, p < 0.001; 3.43 ± 0.69 mmol/L vs. 9.76 ± 2.14 mmol/L for fasting insulin, p < 0.001; 2.69 ± 0.53 mmol/L vs. 18.43 ± 3.62 mmol/L for HOMA-IR, p < 0.001), while in terms of renal function the two groups showed no statistical significance. Renal arteriography showed no renal artery stenosis or renal atrophy in both group during the follow-up. Histopathological analysis showed significantly peripheral sympathetic nerve damage in the renal arteries and no reinnervation of renal nerves at 3-month follow-up.

**CONCLUSION:** The results suggest that RDN could effectively remove peripheral renal sympathetic nerves and improve insulin resistance in canines with T2DM, thus facilitating glycemic control in canines.
Development of rabbit iliac artery stenosis model with controlled hypercholesterolemia and endothelial denudation: degree of stenosis using different balloon injury technique

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PURPOSE: To create rabbit iliac artery stenosis model with controlled hypercholesterolemia and to assess whether different types of mechanical endothelial denudation technique may alter the degree of iliac artery stenosis.

MATERIALS AND METHODS: With Institutional Animal Care and Use Committee approval, three New Zealand White rabbit bilateral iliac artery stenosis models were created: an hypercholesterolemia with wide pull-over balloon injury (group A, n = 4), hypercholesterolemia with localized balloon dilatation injury (group B, n = 5) and normocholesterolemia with wide pull-over balloon injury (group C, n = 3). Twelve animals underwent baseline angiography and atherogenic diet consisting of 0.5% cholesterol and 6% corn oil was given. One week after high-cholesterol feeding, bilateral iliac artery of rabbits were injured with a 3 mm*10 mm noncompliant balloon using either wide pull-over technique (groups A and C) or localized balloon dilatation technique (group B). After arterial injury, animals were continued on an atherogenic diet for another 4 weeks and then switched to a diet lower in cholesterol (0.025%) for the remainder of the study. Follow-up angiography was performed at 9 weeks after lipid-rich diet and iliac arteries were harvested. Serum lipid profile were monitored in biweekly manner, and angiographic lumen diameter at each time point and late lumen loss were measured. Iliac artery samples were analyzed histologically.

RESULTS: Group A showed significant late lumen loss at 9-week follow-up after balloon injury (43.2% ± 5.9 in group A vs. 12.1% ± 18.5 and 5.4% ± 22.7 in groups B and C, respectively; p < 0.05). In a histologic analysis, abundant macrophage infiltration with intimal hyperplasia was observed in group A and B.

CONCLUSION: Mechanical endothelial denudation using wide-pull over balloon injury technique can induce significant iliac artery stenosis in controlled hypercholesterolemia rabbits, and pathologic findings shares similarities to the human atherosclerosis. Thus, this preclinical model may be useful for developing novel therapies of arterial stenosis including claudication.
SS 01 IR-09 09:20
Multidetector CT angiography of the infrapopliteal arterial occlusive disease: a retrospective comparison with digital subtraction angiography
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PURPOSE: To determine the diagnostic accuracy of multidetector CT angiography in the evaluation of patients with infrapopliteal arterial occlusive disease using digital subtraction angiography as the standard of reference.

MATERIALS AND METHODS: Institutional Review Board approval was obtained; the requirement for informed consent was waived. 46 patients with infrapopliteal arterial occlusive disease underwent both digital subtraction angiography (DSA) and CT angiography were included in this study. For data analysis, the infrapopliteal arterial system was divided into 10 segments, including both side of anterior, posterior tibial artery and peroneal artery, plantar and dorsalis pedis artery. DSA was performed by 12 year experienced intervention radiologist and described angiography findings. Another 4 year experienced general radiologist who were blinded to DSA result, assessed for patency of arterial segments, presence of a faint trace or stenosis and occlusion of each arterial segments in CT angiography. Findings were determined according to four categories: 1. patent (0–49% stenosis); 2. stenosis (50–79% stenosis); 3. faint trace (80–99% stenosis); 4. occlusion (100% stenosis). CT angiography findings were compared retrospectively with DSA findings for each infrapopliteal arterial segments.

RESULTS: During the study, 261 arterial segments of 46 patients were assessable on both digital subtraction angiography and CT angiography. We found agreement for the degree of stenosis in 75.9–86.7% of the both side anterior tibial arteries, 75.9–76.7% of posterior tibial arteries, 69–80% of the peroneal arteries when all categories were considered. Below the ankle level, agreement for the degree of stenosis in 60–63.6% of the both side dorsalis pedis arteries, 60–81.8% of plantar arteries, retrospectively.

CONCLUSION: Multidetector CT angiography of the infrapopliteal arterial occlusive disease is useful and the short examination time and non-invasiveness is a significant advantage, compared with conventional digital subtraction angiography. Multidetector CT angiography shows particular accuracy in infrapopliteal arterial occlusive disease, but limited evaluation in below the ankle level, in our study.
**SS 06 IR-02  09:50**

**Combined transarterial chemoembolization and radiofrequency ablation for perivascular hepatocellular carcinomas: long-term results**

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**PURPOSE:** To retrospectively evaluate the long-term results of combined transarterial chemoembolization (TACE) and radiofrequency ablation (RFA) in the treatment of perivascular hepatocellular carcinoma (HCC).

**MATERIALS AND METHODS:** This retrospective study was approved by our Institutional Review Board and the requirement for informed consent was waived. Between March 2000 and February 2014, 106 perivascular HCCs were selected among 635 HCCs treated by combined TACE and RFA. The perivascular HCC is defined as a tumor located less than 3 mm away from the large vessel which diameter measuring ≥ 3 mm in axial CT/MR images. 107 perivascular HCCs were from 105 patients consisting of 71 men and 34 women; mean age 59.4, range 29–83 years. Technical success, overall adverse event rates, recurrence rates and local tumor progression within 24 months were assessed.

**RESULTS:** The mean diameter of tumors was 1.9 cm (range, 0.6–4.5). The median follow-up time was 45.6 months (range, 3.0–158.4). The technical success of RFA was achieved in 103 out of 106 cases (97.2%). The overall, 12- and 24-month local tumor progression rates are respectively 13.4%, 1.2%, and 6.0%. The overall recurrence rate within 24-month is 32.9% and the adverse event rate within 24-month is 36.5%. In addition, there is no immediate or delayed major complication including vessel or bile duct injury.

**CONCLUSION:** Combined TACE and RFA seems to be effective and safe for the treatment of the perivascular HCC in terms of local tumor progress, overall recurrence, and disease free survival on long-term follow-up.

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**SS 06 IR-03  10:00**

**Combined TACE with one-stop of CT guided intra-tumor iodine-125 brachytherapy and P53 gene therapy for the treatment of hepatocellular carcinoma survival after one course of TACE**

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**PURPOSE:** To evaluate the feasible, safety and efficacy of combining transarterial chemoembolization (TACE) with one-stop of CT guided intra-tumor iodine-125 brachytherapy and P53 gene therapy in treatment hepatocellular carcinoma survival after one course of TACE.

**MATERIALS AND METHODS:** It was approved by ethical committee and institutional review board of Zhejiang Cancer hospital, China. All patients gave written informed consent before beginning the study. A total of 40 advanced HCC patients with HCC survival after one course of transarterial chemoembolization (TACE) treatment indicated by multiple imaging examination (CT or MRI) were included from January 2011 to October 2013 (20 for experiment group: TACE + one stop of I\(^{125}\) seeds implantation and intra-tumor Adv-p53 injection, 20 for control group: TACE only). The primary endpoint was 6-months treatments effects and the second endpoint was 2-year treatment response and 2-years overall survival (OS). In addition, comparison of complications related to the procedure and adverse events were also performed.

**RESULTS:** Baseline characteristics showed no significant different between experiment group and control group. The size of Tumor in experiment group decreases significantly in experiment group (p = 0.000). No obvious tumor shrink observed in control group (p > 0.05). For 6-months tumor treatment response rate (TTR, CR+PR/all patients), it showed more TTR in experiment group (60%) than control group (15%), the difference was significant (χ\(^2\) = 8.64, p = 0.003). For tumor survival at 6-months after treatment, it showed less tumor survival in experiment group when compared with control group, although the difference was not significant (15% vs. 45%, χ\(^2\) = 4.286, p = 0.038). For 2-years OS, it showed no significant between experiment group and control group (90% vs. 75%, χ\(^2\) = 1.558, p = 0.212). No serious complications were observed in all included patients and the differences between two groups was not significant (p > 0.05).

**CONCLUSION:** Although several limitation still exist, this study showed that treatment HCC survival with TACE combined with one-stop of CT guided I\(^{125}\) brachytherapy and P53 gene therapy was associated with better local...
and intrahepatic tumor control and long-term survival compared with treatment of TACE alone. It showed feasible, safe and effective, however, prospective and controlled studies with larger sample size and longer follow-up periods are required to verify these results.

**SS 06 IR-04** 10:10

Korean multi-center registry of transcatheter arterial chemoembolization with drug-eluting beads for nodular hepatocellular carcinomas: 2-year outcome analysis

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**PURPOSE:** To assess efficacy and survival of transcatheter arterial chemoembolization with drug-eluting beads (DEB-TACE) for nodular hepatocellular carcinomas (HCC).

**MATERIALS AND METHODS:** The study was designed as a prospective multi-center registry-based, single-arm phase 4 clinical trial and patient recruitment was performed from May 2011 to April 2013. The DEB-TACE procedures were performed with DC Bead (biocompatibles UK, Farnham, UK) loaded with doxorubicin solution. Per-patient and per-lesion tumor response was assessed by mRECIST. Overall survival (OS), progression-free survival (PFS), and local tumor progression (LTP)-free survival were assessed. Per-lesion time to progression (TTP) was assessed. Predictors of survival were searched in statistical model.

**RESULTS:** The study population consisted of 152 patients (M:F = 125:27; mean age 61; range, 34-86). The most common functional status of the liver was Child-Pugh score A5 (n = 105, 69.1%), performance status was 0 (n = 114, 75.0%), Barcelona-Clinic Liver Cancer stage was A (n = 77, 50.7%). Twenty-five patients (16.4%) completed two-year study protocol. In tumor response assessment, patients who were dropped out in non-PD status was excluded, and total 107 patients (70.4%) were assessed. There were 21 (13.8%) and 86 (80.3%) patients in CR and PD status, respectively. Cumulative PFS rate was 22.4% and median PFS was 284 days. Cumulative LTP-free survival rate was 28.8% and median LTP-free survival was 349 days. Cumulative OS rate was 79.7%. In multivariate analysis with Cox proportional hazards model, Child-Pugh score, tumor size, and tumor multiplicity were independent predictors of PFS (p = 0.004, p = 0.018, and p < 0.001, respectively), and Child-Pugh score and tumor multiplicity were independent predictors of LTP-free survival (p = 0.001 and p = 0.006, respectively). Child-Pugh score and embolization endpoint were independent predictors of OS (p = 0.002 and p = 0.002, respectively). In per-lesion analysis, among total 207 target lesions, 141 lesions (68.1%) were assessed for 2-year follow-up analysis. There were 47 (33.3%) and 94 (66.7%) lesions in CR and PD status, respectively. Cumulative progression-free rate was 36.2% and median TTP was 429 days.

**CONCLUSION:** In 2-year follow-up assessment, DEB-TACE for nodular HCCs showed 79.7% OS rate and 22.4% PFS rate. Child-Pugh score was included in independent predictors of OS, PFS and LTP-free survival in common.

**SS 06 IR-05** 10:20

Radioembolization with Therasphere for the treatment of hepatocellular carcinoma in Korea: a single center experience

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**PURPOSE:** To evaluate early outcomes of radioembolization with Yttrium-90 loaded glass microsphere (Therasphere) for the treatment of hepatocellular carcinoma (HCC) in Korea.

**MATERIALS AND METHODS:** From November 2015 to March 2016, sixteen patients with HCC were underwent radioembolization with Therasphere combined with / without chemoembolization in our institution. We reviewed their electronic medical records and images to evaluate demographic factors, hepatic function, tumor characteristics, factors associated with radioembolization, and treatment response.

**RESULTS:** The patients consisted of eleven men and five women, and their mean age was 63.3 years (range, 41–85). Thirteen patients had chronic hepatitis B and the other three had non-viral hepatitis. Child-Pugh classification was A in fifteen and B in one. Barcelona Clinic Liver Cancer stage was A in two, B in ten, and C in four. Four patients had lobar or segmental portal vein invasion. Mean delivered activity was 2.05 GBq. Five patients underwent combined chemoembolization for the small nodule(s) of contralateral lobe during planning angiography. There was no major complication and no patient complained pain during procedure. The target lesion showed stable disease (SD) in eight, partial response (PR) in seven,
and complete response (CR) in one patient at 1 month after treatment, and progressive disease (PD) in three, SD in one, PR in five, and CR in three patients at 3 months after treatment. 3-months disease control rate and response rate was 75.0% and 66.7%, respectively.

**CONCLUSION:** Radioembolization with Therasphere is an effective treatment modality for the treatment of advanced HCC.

**SS 06 IR-06**

**10:30**

Comparative evaluation of radiofrequency ablation and transcatheter arterial chemoembolization as first line treatment for isolated hepatocellular carcinoma in transplanted livers

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**PURPOSE:** To evaluate the efficacy of radiofrequency ablation (RFA) and transcatheter arterial chemoembolization (TACE) as a first-line treatment for isolated intrahepatic recurrent hepatocellular carcinoma (HCC) after liver transplantation (LT).

**MATERIALS AND METHODS:** This retrospective study was approved by the Institutional Review Board. Twenty-seven patients with isolated intrahepatic recurrent HCCs after LT who were treated with RFA (n = 6) or TACE (n = 21) as a first-line treatment were retrospectively included in this study. Disease-free and overall survival rates were estimated using the Kaplan-Meier method. Risk factors affecting these outcomes were assessed with Cox regression models.

**RESULTS:** Except for the total number of recurrent tumors and time-to-tumor recurrence after LT, baseline characteristics were not significantly different between the groups. The 2-year disease-free survival rates for RFA and TACE (20% vs. 14%, respectively; p = 0.180) and 4-year overall survival rates (33% vs. 25%, respectively; p = 0.065) were not significantly different between groups. In addition, the types of treatment were not associated with disease-free or overall survival in multivariate analyses.

**CONCLUSION:** Choice of treatment modality between RFA and TACE may not affect the disease-free or overall survival of patients with isolated intrahepatic recurrent HCC after LT.

**SS 06 IR-07**

Evaluate detection of marginal recurrence after transcatheter arterial chemoembolization of hepatocellular carcinoma: comparison between parenchymal blood volume mapping using DynaCT and dynamic CT

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**PURPOSE:** To evaluate the usefulness of parenchymal blood volume (PBV) mapping using cone beam computed tomography (DynaCT) compare to multiphase dynamic CT for detecting local marginal recurrence after transcatheter arterial chemoembolization of hepatocellular carcinoma.

**MATERIALS AND METHODS:** This retrospective study was approved by the IRB. From March 2015 to January 2016, we included 20 patients with 28 HCC lesions who previously underwent TACE and considered recurrent tumor on follow-up CT. We compared with multiphase dynamic CT within 1 month prior to receive TACE and parenchymal blood volume (PBV) mapping using cone beam CT during TACE to detect local marginal recurrence of HCC. We considered presence of viable or recurred tumor by dense accumulation of oil during chemoembolization.

**RESULTS:** All patients were successfully completed TACE without complication. The sensitivity, specificity, and predictive value of PBV mapping using cone beam CT (DynaCT) was better than multiphase dynamic CT. In two cases, PBV mapping was able to demonstrate that lesions unidentified at multiphase dynamic CT due to beam hardening artifact, were in fact viable marginal tumor. On the other hand, 5 cases which considered recurrent HCC on multiphase dynamic CT were proven to be negative lesions by observing no uptake of iodized oil during chemoembolization.

**CONCLUSION:** Multiphase dynamic CT has limitation in interpretation after chemoembolization because of beam hardening artifact from iodized the oil. Otherwise, parenchymal blood volume (PBV) mapping using cone beam CT (DynaCT) is free from beam hardening artifact. In addition, this method applies quantitative assessment of tumor angiogenesis, easy to get images during chemoembolization, and exposure to radiation is less than that of CT.
SS 06 IR-08 10:50
2D perfusion angiography of hepatocellular carcinoma before and after chemoembolization
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PURPOSE: To evaluate the quantifiable changes of 2D perfusion angiography for transarterial chemoembolization (TACE) in patients with hepatocellular carcinoma (HCC).

MATERIALS AND METHODS: This prospective study included 70 TACE patients for diagnosed HCC from November 20, 2015 to March 31, 2016. Intraprocedural 2D perfusion angiography (Allura Xper FD20, Philips Healthcare) was performed in a single session, before and after TACE. Multiphasic pre procedural and post procedural CT scans were reviewed. Index lesions were defined as all discrete lesions ≥ 1.5 cm. Tumor response was assessed using RECIST 1.1 criteria. The pre and post area under curve (AUC) analysis utilized regions of interest of representative portions of the tumor obtained on a workstation and then compared using paired t-tests. The correlation between change in AUC and objective response was evaluated for significance using Kruskal-Wallis H tests (one way ANOVA on ranks).

RESULTS: 80 lesions meeting inclusion criteria were identified in 70 patients. All patients had follow up CT within 3 months of treatment. A statistically significant change in average tumoral AUC (ΔAUC) was identified after chemoembolization (ΔAUC = 10795.7 ± 9631.1, p < 0.001). The largest ΔAUC was present in the tumors which had complete response (CR) to treatment on follow up imaging (16816.1 ± 10128.4). The lesions which remained partial response (PR), stable (SD) or progressed (PD) had a smaller ΔAUC (PR = 9445.6 ± 6539.5, SD = 5373.1 ± 4838.8, PD = 2602.8 ± 2395.3). The ΔAUC were significant in the CR, PR and SD groups (p < 0.01). Amongst all lesions evaluated, a significant relationship was identified between the ΔAUC and tumor response according to RECIST 1.1 criteria, using one way ANOVA testing on ranks (p < 0.001).

CONCLUSION: 2D perfusion angiography demonstrates quantifiable changes in physiologic parameter. Assessment of these changes may be used for point of care analysis of treatment efficacy and suggest need for additional on-table treatment.

SS 06 IR-09 11:00
Sorafenib-loaded Theranostic microspheres for the transarterial chemoembolization of a liver tumor
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PURPOSE: To develop poly(lactic-co-glycolic acid) (PLGA) microspheres that can co-encapsulated sorafenib and triiodobenzoic acid (TIBA) for simultaneous transarterial embolization (TAE) and local delivery of sorafenib.

MATERIALS AND METHODS: Sorafenib- and TIBA-loaded PLGA microspheres (SOF/TIBA/PLGA) were fabricated using a modified oil-in-water method. After fabrication, the microspheres were characterized for size, biodegradability, drug release profiles, CT imaging properties in vitro. After these initial in vitro characterization, a rat hepatoma model was employed to enable in vivo studies investigating pharmacokinetics, tumor responses after TAE, and CT-monitoring capability.

RESULTS: The mean diameter of developed MSs was 28.5 ± 2.1 μm and the average of sorafenib encapsulation efficiency was 58.20% in this study. The mean contents of sorafenib and iodine in MSs were 5.11% and 23.15%, respectively. In vitro drug release study demonstrated that sorafenib release on day 1, 4, and 28 were 35.07 ± 0.59%, 46.64 ± 1.32%, and 67.41 ± 5.00%, respectively. According to the in vivo studies, PLGA MSs were detectable on post-procedural CT images. Both tumor concentration of sorafenib and tumor-to-liver drug concentration ratio were significantly higher in the SOF/TIBA/PLGA group compared with the sorafenib oral administration group (p < 0.05). Tumor growth rate, addressed one week after the procedure, was significantly lower in the SOF/TIBA/PLGA group compared with the blank PLGA MSs group and control group (no treatment) (p < 0.05).

CONCLUSION: SOF/TIBA/PLGA was promising materials for TAE of liver tumors, as providing sufficient anticancer effect, angiogenesis inhibition, and image ability.
SS 11 IR-01 16:00
Safety and efficacy of a new designed retrievable covered expandable metallic stent for the treatment of malignant and benign esophageal strictures
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PURPOSE: To investigate the technical feasibility and clinical efficacy of a newly designed retrievable covered self-expandable metallic stent (CSEMS) in 81 patients with malignant and benign esophageal strictures.

MATERIALS AND METHODS: The records of 81 patients who underwent the newly designed retrievable CSEMS placement in the esophagus between October 2010 and June 2015 were retrospectively reviewed. Data were collected for patient characteristics, technical and clinical success, patency, survival, and complications.

RESULTS: Indication for CSEMS placement included esophageal cancer (n = 50), gastric cancer (n = 13), extrinsic malignant compression (n = 7), refractory benign esophageal stricture (n = 9), and benign esophagorespiratory fistula (n = 2). Technical success was achieved in all patients (100%). The dysphagia score improved from 3.3 ± 0.6 to 1.1 ± 0.7 after treatment (p < 0.001). In malignant strictures, stent malfunction occurred in 15 patients (21.4%), including migration in five (7.1%), tumor overgrowth in eight (11.4%), stent collapse in one (1.4%) and food impaction in one patient (1.4%). In benign strictures, stents malfunction occurred in five patients (45.5%), including migration in four (36.4%), and tissue granulation in one patient (9.1%). Other major complications occurred in 6 patients (8.6%) with malignant strictures and 1 patient (9.1%) with benign strictures, including aspiration pneumonia (n = 4), esophagorespiratory fistula (n = 2), intractable vomiting (n = 1). The median survival was 135 days in malignant strictures, and was 670 days in benign strictures.

CONCLUSION: The newly designed CSEMS was safe and effective in the management of malignant and benign esophageal strictures. Although further studies are needed, the stent seems to contribute to decreasing the rates of membrane separation, stent migration, and tumor overgrowth with better conformability in malignant and benign esophageal strictures.

SS 11 IR-02 16:10
EW-7197, a novel TGF-β inhibitor: suppression of granulation tissue formation after bare metallic stent placement in a rat esophageal model
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PURPOSE: To investigate the effectiveness of EW-7197 in preventing granulation tissue formation caused by bare metallic stent placement in a rat esophageal model.

MATERIALS AND METHODS: All experiments were approved by the committee of animal research. In 24 Sprague-Dawley male rats, a self-expanding metallic bare stent was placed in the esophagus under fluoroscopic guidance. The rats were divided into two groups; group A received control treatment, group B received orally EW-7197 (20 mg/kg) once daily for 4 weeks after stent placement. All rats were sacrificed after 4 weeks. The therapeutic effectiveness of EW-7197 was assessed by comparing the results of esophagographic and histologic examination among the two groups. Inhibition of Smad signaling of EW-7197 was assessed by Western blot analysis.

RESULTS: The stent procedures were technically successful in all rats. The average luminal diameter of the stented esophagus in group A was significantly lower compared with that of in group B at 4 weeks after stent placement. The mean percentage of granulation tissue area, the mean number of epithelial layers, and the mean thickness of submucosal fibrosis were significantly higher in group A compared with group B. The mean density grade of inflammatory cell infiltration was not different among the two groups. EW-7197 inhibited TGF-β induced phosphorylation of Smad in rat stented esophageal tissues.

CONCLUSION: EW-7197 was effective for the prevention of granulation tissue hyperplasia after bare metallic stent placement in a rat's esophagus.
Transgastric stent placement for malignant gastroduodenal obstruction: an alternative route after unsuccessful transoral approach

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PURPOSE: To evaluate the technical feasibility and clinical efficacy of transgastric stent placement after failure of transoral attempts in patients with malignant gastroduodenal obstruction.

MATERIALS AND METHODS: From August 2008 to April 2016, nine patients (M:F = 4:5; mean age, 66 years) with malignant gastroduodenal obstruction underwent stent placement via gastrostomy tract. They had pancreatic cancer in five patients, stomach cancer in two, metastasis in two. All patients were failed to deliver gastroduodenal stent via transoral approach due to severe gastric ptosis or distension, despite of sufficient decompression. After percutaneous radiologic gastrostomy, dual expandable stents (diameter, 18 mm; length range, 6–10 cm; mean length, 8 cm) are deployed at the obstructed site. The technical and clinical success rates, as well as complications were evaluated during the follow-up period.

RESULTS: Stents were successfully inserted in eight patients (88%). One patient was failed to insert the stent, due to failure of guide wire negotiation through the obstruction. After stent placement, symptoms improved in all eight patients. Gastrostomy tube was removed 9 to 20 days (mean, 12 days) after stent insertion. During the mean follow-up of 136 days (range, 3–387 days), no procedure related major complications were seen. Two patients died within 1 month after the procedure because of rapid progression of the underlying malignancy. The only risk factor of secondary biliary obstruction was the length of the stent.

CONCLUSION: Transgastric placement of gastroduodenal stent seems to be technically feasible and clinically effective in patients who was failed with transoral approach.

Predictive factors for secondary biliary obstruction after covered stent placement in 38 patients with malignant gastroduodenal obstruction

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PURPOSE: To evaluate predictive factors for secondary biliary obstruction after gastroduodenal stent placement when the stent covered second portion of the duodenum.

MATERIALS AND METHODS: From August 2008 to April 2016, 263 consecutive patients (179 men and 84 women; mean age, 62 years) with malignant gastroduodenal obstruction underwent fluoroscopic guided gastroduodenal stent placement. Among them 46 stent insertions were covered second portion of the duodenum. Except for eight patients who had jaundice prior to the procedure, 38 patients were enrolled in this study. We evaluated pre- and post-procedural serum bilirubin level. We defined secondary biliary obstruction as elevation of serum bilirubin level more than 3 mg/dl, with symptoms of jaundice. Stent related secondary biliary obstruction was defined as the biliary obstruction occurred within 7 days after the procedure. Logistic regression analysis was used to identify risk factors (age, sex, type of cancer, length and diameter of the stent, initial serum bilirubin level, initial CBD diameter, and ampulla of Vater involvement) associated with secondary biliary obstruction.

RESULTS: Stent placement was technically successful in all patients (100%). During the mean follow-up of 119 days (range, 11–1233 days), secondary biliary obstruction after gastroduodenal stent placement were occurred in 17 patients (44.7%). The mean duration from stent placement to secondary biliary obstruction was 96 days (range, 1–1070 days). In five patients (13.2%), secondary biliary obstruction was stent related (range, 1–4; mean, 3days). Seven patients underwent PTBD insertion for the treatment of secondary biliary obstruction. In logistic regression analysis, length of the stent (odds ratio, 1.586; 95% CI, 1.007–2.497; p = 0.047) was the only independent predictive factor for secondary biliary obstruction.

CONCLUSION: Secondary biliary obstruction seems to be common complication of gastroduodenal stent placement when the stent covered second portion of the duodenum. The only risk factor of secondary biliary obstruction was the length of the stent.
RESULTS: Primary and overall technical success rates were 86.7% and 94.9%, respectively. Stent removal-related complication rate was 7.1% (7/98) and all were bleeding after stent removal. All bleeding complications were minor and managed conservatively. Primary technical success rate for benign strictures was significantly lower compared with that for malignant strictures (80.9% vs. 97.1%, \( P = 0.029 \)), but overall technical success rate (93.7% vs. 97.1%, \( P = 0.652 \)) did not differ between two groups. Granulation tissue formation was identified as an independent predictor of primary technical success (odds ratio: 0.249, 95% CI: 0.071–0.874, \( P = 0.030 \)).

CONCLUSION: Fluoroscopic stent placement under respiratory support with VV ECMO in patients with benign and malignant tracheobronchial strictures is safe and technically feasible. Granulation tissue formation was the only independent predictor of primary technical success.

**SS 11 IR-06**

**Respiratory support with venovenous extracorporeal membrane oxygenation during stent placement for the palliation of critical airway obstruction**

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**BACKGROUND:** Venovenous extracorporeal membrane oxygenation (VV ECMO) is used for the ventilation of patients suffering from respiratory failure during various procedures. The purpose of this study was to evaluate the technical feasibility and safety of fluoroscopic stent placement under respiratory support with VV ECMO in patients with critical airway obstructions.

**MATERIALS AND METHODS:** We reviewed the records of 17 patients (14 male and 3 female; mean age: 63 years; range: 30–82 years) who underwent self-expandable metallic stent placement under VV ECMO respiratory support for critical airway obstruction caused by malignant (\( n = 16 \)) or benign (\( n = 1 \)) etiology between December 2009 and December 2015.

**RESULTS:** Fluoroscopic placement of SEMS was successful in all patients (100%) with no procedure-related complications. During a mean follow-up of 83 days (range: 10–367 days), 15 (88.2%) of 17 patients showed improvement of Hugh-Jones grades (from 4.7 ± 0.4 to 3.1 ± 0.9, \( P < 0.001 \)). Removal of the endotracheal tube was possible in 11 (84.6%) of 13 patients. Weaning off ECMO was successful in all patients. The ECMO-related and stent-related complication rates were 11.7% (\( n = 2 \)) and 29.4% (\( n = 5 \)), respectively, all successfully managed by additional interventions. Indications for VV ECMO included failure of mechanical ventilation in 13 (76.5%) patients, and orthopnea in 4 (23.5%) patients.

**CONCLUSION:** Fluoroscopic stent placement under VV ECMO respiratory support is technically feasible and safe in patients with critical airway obstruction, especially in cases of respiratory distress despite ventilation support and an inability to lie in a supine position.
which was comparable to the primary patency of these stents (4.8 months). This extended period of stent patency ensured administration of additional cycles of chemotherapy in these patients coupled with objective improvement in the quality of life.

SUMMARY: Progressive tumor in growth through the openings between the struts of the stents can lead to stent block, thereby significantly reducing their primary patency. Till date little progress has been made in terms of improving the duration of stent patency for malignant strictures. Endobiliary RF ablation is a recently developed option in the management of such patients. Stent patency achieved after RFA is comparable to the developed option in the management of such patients.

CONCLUSION: Our experience suggests that endobiliary-RFA with balloon-sweep maneuver can be a safe and useful technique for re-establishing the patency of occluded MBS. Reopened stent with good short term patency offers medical oncologist a chance of administering additional chemotherapy which may improve patient’s survival.

SS 11 IR-08 17:10
Biliary stenting for the treatment of malignant biliary obstruction: a comparison of biliary stenting outcomes between bismuth type 1 and type 2, 3, 4
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PURPOSE: To compare the biliary stenting outcomes of bismuth type 1 with those of bismuth type 2, 3, 4 in patients with malignant biliary obstruction.

MATERIALS AND METHODS: From January 2011 to December 2014, we retrospectively reviewed 64 patients who underwent percutaneous biliary stent insertion. We divided into two groups. Group 1 is composed of bismuth type 1 patients (mean age, 69.9 years; range, 48–89 years) and group 2 is composed of bismuth type 2, 3, and 4 patients (mean age, 71.3 years; range, 48–91 years) with malignant biliary obstruction. Group 1 patients underwent biliary stenting in CBD or from CBD to duodenum. Group 2 patients underwent biliary stenting in biliary tree including biliary hilar portion (bilateral or unilateral). The medical record was reviewed to evaluate the clinical outcomes and courses. To compare the outcomes between two groups, we checked total bilirubin, direct bilirubin, alkaline phosphatase (ALP) serum levels 3 times (pre intervention, a week after, a month after) and time to re-obstruction. To compare the outcomes of biliary stenting in group 1 with those in group 2 statistically, we used independent t-test and Kaplan-Meier method.

RESULTS: In group 1 (n=34), the causes of biliary obstruction were pancreatic head cancer (n=12), gastric cancer (n=10), biliary duct cancer (n=6) and GB cancer (n=6). In group 2 (n=30), the causes of biliary obstruction were bile duct cancer (n=19), GB cancer (n=5), gastric cancer (n=3), rectal cancer liver metastasis (n=2) and HCC (n=1). T-bilirubin reduction rates in a week & a month were 59%, 76% (group 1) and 57%, 79% (group 2) with a p-value 0.656 and 0.520. D-bilirubin reduction rates in a week & a month were 58%, 78% (group 1) and 59%, 83% (group 2) with a p-value 0.896 and 0.429. ALP reduction rates in a week & a month were 51%, 60% (group 1) and 29%, 32% (group 2) with a p-value 0.013 and 0.028. Mean estimate times to re-obstruction were 13 months (group 1) and 8 months (group 2) with a p-value 0.360.

CONCLUSION: Total bilirubin and direct bilirubin serum level were reduced almost equally in two groups. But ALP serum level reduction rate was superior in group 1 to group 2 in a week and a month. Time to re-obstruction in 2 groups, there was no statistically significant difference.

SS 11 IR-09 17:20
Percutaneous metallic stent placement in patients with malignant hilar biliary obstruction
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PURPOSE: To investigate the outcomes of percutaneous stent placement in patients with malignant hilar obstruction.

MATERIALS AND METHODS: From January 2007 to December 2014, 415 patients (men, 261; mean age, 65 years; range, 29–92 years) with malignant hilar obstruction were included in this retrospective study. All patients were treated with bilateral (n = 296) or unilateral (n = 119) stent placement using uncovered (n = 292) or covered (n = 123) stents.

RESULTS: A total of 784 stents were successfully placed in 415 patients. Forty-six patients had complications including hemobilia (n = 19), cholecystitis (n = 11), bilomas (n = 10), cholangitis (n = 4), peritonitis (n = 1), and hepatic vein-duct fistula (n = 1). Removal of temporary drainage catheter as a result of successful internal drainage was achieved in 372 patients. Fifty-four patients were lost to follow-up. Stent dysfunction occurred in 154 of 318 patients; tumor ingrowth (n = 107), sludge incrustation (n = 44), and other causes (n = 3). The median stent patency and patient survival
times were 141 days (95% confidence interval [CI], 126–156 days) and 212 days (95% CI, 186–237 days), respectively. In terms of stent patency, there were no statistical differences in age, sex, underlying disease, Bismuth type, stent type, or stent configuration. Stent type and configuration did not affect technical success, complications, successful internal drainage, patient survival, or stent patency.

**CONCLUSION:** Percutaneous stent placement is technically safe and effective for successful internal drainage in patients with malignant hilar obstruction.

**SS 11 IR-10 17:30**

*Radiation-induced esophageal strictures treated with fluoroscopic balloon dilation: long-term clinical outcomes and factors influencing recurrence in 62 patients*

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**PURPOSE:** To evaluate the long-term outcomes of balloon dilation in patients with radiation-induced esophageal stricture (RIES) and to identify factors associated with its recurrence.

**MATERIALS AND METHODS:** The medical records of 62 consecutive patients who had undergone fluoroscopic balloon dilation for RIES at our institution between December 1998 and December 2015 were reviewed.

**RESULTS:** 120 balloon dilation sessions were performed in 62 patients (mean, 1.9 sessions per patient; range, 1 to 15 sessions). During the follow-up period (mean, 38.1 months; range, 2.2 to 156 months), clinical success was achieved in 53 (85.5%) patients after single (n = 37) or multiple (n = 16) dilation sessions. Complications occurred in 26.7% of the dilation sessions with 2 cases requiring invasive treatment. The primary patency rates at 1, 2, 3, and 5 years were 60%, 56%, 52%, and 52%, respectively. Secondary patency rates at 1, 2, 3, and 5 years were 87%, 85%, 85%, and 80%, respectively. Multivariate logistic regression analysis identified an interval from radiation therapy (RT) to stricture of ≥ 6 months (hazard ratio [HR], 0.205; p < 0.001), strictures located at the cervical esophagus (HR, 5.846; p < 0.001), and stricture length of ≥ 2 cm (HR, 2.923; p = 0.006) as significant predictors of recurrence.

**CONCLUSION:** Balloon dilation is safe and effective for treating RIES, with favorable long-term outcomes. An interval from RT to stricture of ≥ 6 months, strictures located at the cervical esophagus, and stricture length of ≥ 2 cm appear to be associated with recurrence.

**SS 11 IR-11 17:40**

*Clinical significance of stent abutment in gastroduodenal stent placement for gastric outlet obstructions: clinical experience in 318 patients*

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**PURPOSE:** To evaluate the clinical significance of stent abutment after gastroduodenal stent placement in 318 patients with gastric outlet obstruction (GOO) due to unresectable gastric cancer.

**MATERIALS AND METHODS:** A retrospective study was performed in a single, tertiary-referral, university hospital to identify the incidence and clinical significance for stent abutment in patients who underwent placement of a self-expandable metallic stent (SEMS). Stent abutment was defined as abutment of the distal end of the stent to the duodenal wall and/or superior duodenal flexure. Outcomes analyzed included technical and clinical success, complications, re-intervention, stent patency, and survival.

**RESULTS:** A total of 318 patients met our inclusion criteria, including 107 patients in stent abutment (SA) group and 211 patients in non-stent abutment (NSA) group. Stent abutment occurred partially (n = 64, 59.8%) and completely (n = 43, 40.2%). The technical, clinical outcomes and survival were similar in the two groups. Complication and re-intervention rates were higher in the SA than in the NSA group (p = 0.001 and p = 0.008, respectively). Food impaction rate was higher in the SA than in the NSA group (p < 0.001) and was associated with complete SA (p = 0.007). Stent patency rate was lower in the SA than in the NSA group (p = 0.001) and was associated with complete SA (p = 0.007). Stent patency ratio was better in the SA than in the NSA group (p = 0.003).

**CONCLUSION:** Stent abutment was associated with increased food impaction, resulting in higher stent malfunction and shorter stent patency compared with non-stent abutment. The novel concept of stent abutment may be useful in improving the stent patency and avoiding food impaction.
**SS 16 IR-01** 08:00

**Distinct interventional procedures for hemodynamic management of hepatic encephalopathy according to type of portosystemic shunts**

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**PURPOSE:** To describe various techniques for reduction/occlusion of the blood flow in gastrorenal/lieno-renal shunts for controlling the arterial ammonia level causing hepatic encephalopathy and suggesting the best technique according to individual patient needs and anatomical variant.

**MATERIALS AND METHODS:** In 11 patients, different technique of blood flow reduction in shunt was used according to size, shape and position of the shunt. Out of 11 patients, 7 underwent for shunt obliteration, 2 underwent for splenic artery embolization and 1 underwent for lienorenal shunt reduction 1 for splenic vein stenting. For obliteration of shunts, Catheter was positioned deep inside the varix and after inflating the balloon sclerosing agent in the form of foam was infused with the goal of filling the full extent of varices. For lienorenal shunt reduction, a stent (preformed hour glass shape) was deployed in shunt and multiple coils of varying sizes were deployed in the space between stent and shunt wall. For reduction of flow in shunt, polyvinyl alcohol particles were infused in lower pole branches of spleen. It causes decrease blood in splenic vein. last was covered stenting of splenic vein across the lienorenal shunt.

**RESULTS:** 7/8 shunt obliteration, 1/1 shunt reduction and 2/2 partial splenic artery embolization 1/1 of splenic vein stenting showed significant reduction in arterial ammonia level.

**CONCLUSION:** Ammonia level can be controlled by controlling blood flow through the shunts. Various interventional methods are available and have to select according to the size, shape, and position of shunt.
patients (mean age, 31 years; range, 15–36 years) who had complete or severe thrombosis of the splenic vein or superior mesenteric vein seen on postoperative computed tomography.

RESULTS: Successful evacuation of PGVT was possible in six of seven patients; the thrombus was partially evacuated in one patient. In this patient, subsequent anticoagulation salvaged the graft, rendering primary and secondary technical success rates as 86% and 100%, respectively. As pancreas grafts were successfully functioning in all seven patients within 1 month after endovascular treatment, the clinical success rate was 100%. There were no procedure-related complications. At the last follow-up evaluation, all seven patients were alive with no graft loss (mean follow-up time, 9.4 mo; range, 3.6–22.2 mo).

CONCLUSION: Endovascular treatment may be considered in patients with severe PGVT to prevent early graft loss.

SS 16 IR-04 08:30

The impact of venous access site for re-stenosis of native arteriovenous fistula after percutaneous transluminal angioplasty

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PURPOSE: To evaluate the impact of venous access site for re-stenosis of native arteriovenous fistula (AVF) after percutaneous transluminal angioplasty (PTA).

MATERIALS AND METHODS: A retrospective study was conducted on 88 patients referred for PTA of native AVF stenosis between August 2008 and December 2015. 51 of them were follow up lossed, 2 of them were expired. Each patient was categorized into two groups according to the venous access site at PTA: group A (19 patients with venous side of AVF approach group. We compared the patency of AVF between groups A and B).

RESULTS: A total of 52 PTA procedures were performed. For 16 patients with femoral vein approach, 24 PTA procedures were performed. For 19 patients with venous side of AVF approach, 28 PTA procedures were performed. The mean patency in group A was longer than that of group B (255 days vs. 165 days; p = 0.014).

CONCLUSION: In patients with native AVF stenosis, femoral vein approach PTA showed significantly improved AVF patency than venous side of AVF approach PTA.

SS 16 IR-05 08:40

Flat spectral Doppler waveform of left internal jugular vein: the relationship with left brachiocephalic vein stenosis

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PURPOSE: To evaluate the presence and causes of left brachiocephalic vein (BCV) stenosis in patient with flat spectral waveforms in Doppler ultrasound of the left internal jugular vein (IJV).

MATERIALS AND METHODS: We performed the Doppler ultrasound of both IJV in patients who underwent long-term venous catheter placement via the central vein from July 2013 to February 2016. Among them, 90 patients showed flat spectral Doppler waveforms of the left IJV. There were 46 men and 44 women with mean age of 61.7 ± 11.2 years. Flat spectral Doppler waveform was defined as damping or loss of respiratory phasicity and cardiac pulsatility. We retrospectively analyzed the presence and causes of the left BCV stenosis from contrast enhanced chest or neck CT images of the patients with flat spectral Doppler waveforms of the left IJV.

RESULTS: Among the 90 patients, there were 73 patients (81.1%) with left BCV stenosis from known causes. The causes of left BCV stenosis were anatomic structures (n = 63, 86.3%) and tumorous lesions (n = 10, 13.7%). The anterior anatomic structures to the left BCV causing stenosis were as follows: bony structures such as sternum, clavicle (n = 33), mediastinal fat (n = 19), and right upper lobe of the lung (n = 11). The posterior anatomic structures to the left BCV resulting in stenosis were as follows: right brachiocephalic artery (n = 53), aortic arch (n = 6), left common carotid artery (n = 3), and left subclavian artery (n = 1). The tumorous lesions resulting in stenosis were as follows: mediastinal lymph node (n = 5), lung cancer (n = 2), thymoma (n = 1), thymic cyst (n = 1), and intrathoracic goiter (n = 1).

CONCLUSION: It is essential to suspect stenosis of the left BCV from various causes and be cautious to perform central venous catheterization when spectral Doppler waveform of the left IJV appears flat.
**Purpose:** To evaluate effect of catheter size on left innominate vein stenosis in breast cancer patients after placement of the totally implantable venous access port (TIVAP).

**Materials and Methods:** TIVPs were placed in 241 women with right breast cancer via the internal jugular vein (IJV) from January 2010 to December 2014 (mean age, 51.5 years; range, 19–83 years) by left-side approach. There were 67 TIVAPs with 6.5 Fr catheter size and 142 TIVAPs with 8 Fr catheter size, respectively. Medical records were retrospectively reviewed. The presence of significant left innominate vein stenosis, tip location of the catheter, and retrosternal space were evaluated chest CT images. Statistical analysis was performed.

**Results:** Left innominate vein stenosis developed 1 and 13 patients after placement with 6.5 Fr and 8 Fr, respectively. Differences in the cumulative incidence of left innominate vein stenosis were statistically significant between 6.5 Fr and 8 Fr catheter size groups (log rank test p-value: 0.002). In Cox regression analysis, the hazard ratio for left innominate vein stenosis was 20.766 (p = 0.005) in the TIVP with 8 Fr catheter size. The distance between the sternum and the left innominate vein was found to be significantly and independently related to the development of left innominate vein stenosis, the hazard ratio was 0.781 (p = 0.003).

**Conclusion:** The incidence of left innominate vein stenosis in breast cancer patients was higher after placement of TIVPs with 8 Fr catheter size. When left-side placement of TIVP in a patient with right breast cancer, TIVP with 6.5 Fr catheter size was more helpful for preventing of left innominate vein stenosis.

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**SS 16 IR-07 09:00**

**Acquired adverse reaction to iodine contrast media in patients with arteriovenous fistula for hemodialysis and feasibility of carbon dioxide fistulography**

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**Purpose:** To evaluate the pattern of adverse reaction to iodine contrast media (ICM) developed in patients with arteriovenous fistula (AVF) and feasibility of fistulography and percutaneous transluminal angioplasty (PTA) using carbon dioxide (CO₂).

**Materials and Methods:** From August 2015 through March 2016, total 24 patients received CO₂ fistulography with or without subsequent PTA. Thirteen patients (54%) underwent CO₂ fistulography/PTA from the beginning due to the known adverse reaction to ICM or experienced the adverse reaction at their first conventional fistulography/PTA. Other 11 patients (46%) who did not have the adverse reaction initially experienced the adverse reaction after consecutive conventional fistulography/PTA. We compared clinical characteristics of the adverse reaction between the two groups and assessed image quality of CO₂ fistulography by using 3-point scoring (good = 2, diagnostic = 1 and poor = 0) in 13 patients who had conventional fistulography for comparison.

**Results:** The most common symptom of the adverse reaction was urticaria or skin rash with itching (n = 20) and mostly improved spontaneously. However, 2 patients experienced shock and needed emergent care. Among the patients having the acquired adverse reaction, the mean interval from the first fistulography/PTA to their first CO₂ study was 1811 days (range, 243–4494 days) and the mean number of conventional PTA/fistulography was 10 (range, 3–26). Mean image quality scores of CO₂ fistulography in 13 patients was 1.77. Limitations of CO₂ fistulography/PTA found during assessment were in case of aneurysm, severely dilated vein or central venous lesion. Also fistulography/PTA is inapplicable to percutaneous mechanical thrombectomy.

**Conclusion:** Patients with the acquired adverse reaction to ICM during consecutive conventional fistulography/PTA tended to have mild adverse reaction. The mean interval between first conventional fistulography/PTA to CO₂ study was about 5 years. CO₂ fistulography/PTA are safe and provide high diagnostic value in patients with AVF, despite several limitations.
SS 16 IR-08 09:10
Angioplasty of collateral veins in hemodialysis patients with obliterated outflow vein
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PURPOSE: To evaluate the outcome of angioplasty of collateral vein when the outflow veins were totally obliterated in hemodialysis patient.

MATERIALS AND METHODS: Eighteen angioplasties of collateral veins performed for failing hemodialysis fistulas with totally obliterated outflow veins from 2008 to March 2015 were retrospectively reviewed. Fistulas were native radiocephalic (n = 10), brachiocephalic fistula (n = 7), and brachio-antecubital graft (n = 1). The mean diameter of collateral vein was 2.3 mm (range, 1-4 mm). Gradual dilatation was performed in 14 patients with multiple balloons. The mean diameter of maximal balloon was 6.5 mm. Bare-metal stent was placed in one patient.

RESULTS: Technical and clinical success rates were 100% and 100%, respectively. In two patients, reverse flow vein was dilated. Multiple vessel rupture not controlled with balloon tamponade was developed in two patient and it was treated with stent-graft. There was no major complication.

CONCLUSION: Angioplasty of the collateral vein is effective in restoring function of failing hemodialysis fistula with obliterated outflow vein.

SS 16 IR-09 09:20
Usefulness of transjugular intrahepatic portosystemic shunt using VIABAHN® endoprosthesis in the management of bleeding ectopic varices in liver cirrhosis
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PURPOSE: To evaluate the safety and efficacy of transjugular intrahepatic portosystemic shunt (TIPS) using VIABAHN® endoprosthesis in the control of bleeding from ectopic varices.

MATERIALS AND METHODS: From 2012 to 2015, 9 patients, bleeding from ectopic varices, mean age 50.4 years (range, 34–73), were treated by TIPS. The etiology of liver cirrhosis was alcoholic in 4 patient and viral in 5 patients. The location of the varices was duodenal (n = 7) and anorectal (n = 2).

RESULTS: TIPS controlled the bleeding in all patients with (n = 5) or without (n = 4) embolization. The size of VIABAHN® was 8 or 9 mm in diameter and 5 or 10 cm in length. Portosystemic pressure gradient (mean) decreased from 18.3 to 11 mmHg. There were no significant postoperative complications. Mean follow-up was 11.5 months. Rebleeding occurred in one patient without embolization. Two patients were died by deterioration of hepatic function during follow-up.

CONCLUSION: TIPS using VIABAHN® is safe and effective to manage ectopic variceal bleeding.

SS 25 IR-01 16:00
Transcatheter arterial embolization of gastrointestinal bleeding with N-Butyl cyanoacrylate: a systematic review
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PURPOSE: To conduct a systematic review to determine the safety and efficacy of transcatheter arterial embolization (TAE) with n-butyl cyanoacrylate (NBCA) for the treatment of gastrointestinal (GI) bleeding.

MATERIALS AND METHODS: A literature search was conducted in MEDLINE/PubMed and EMBASE databases for the period January 1990 to March 2016. The inclusion criterion was patients with GI bleeding treated with TAE using NBCA with or without other embolic agents. The exclusion criteria were non-English language, missing key data, and data included in subsequent articles or duplicated patients.

RESULTS: A total of 460 patients (mean age, 63.7 ± 13.8 years; sex, 333 males and 127 females) from 20 studies were included. Technical success was achieved in 98.7% of patients, respectively. Recurrent bleeding occurred in 16.5% of patients. Major complication occurred in 3.7% of patients, most commonly ulcer (41.1%) followed by bowel infarction (35.3%). The 30-day mortality rate was 20.9%. Individual-level regression analysis identified coagulopathy (odds ratio [OR], 2.029; 95% confidence interval [CI], 1.064–3.868; P = 0.032) and hematologic malignancy (OR, 8.626; 95% CI, 2.013–36.968; P = 0.004) as the independent predictors.
Intervention

of recurrent bleeding, and identified site of bleeding (OR, 4.379; 95% CI, 1.676–11.441; \( P = 0.003 \)), coagulopathy (OR, 2.348; 95% CI, 1.265–4.357; \( P = 0.007 \)) and hematologic malignancy (OR, 43.785; 95% CI, 7.298–262.680; \( P < 0.001 \)) as the independent predictors of 30-day mortality.

CONCLUSION: TAE with NBCA is safe and effective for the treatment of GI bleeding.

SS 25 IR-02  16:10
Factors associated with outcomes after transcatheter embolization for gastrointestinal bleeding associated with advanced gastric cancer
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PURPOSE: To evaluate outcomes of transcatheter arterial embolization (TAE) for gastric cancer-related gastrointestinal (GI) bleeding and factors associated with successful TAE and improved survival after TAE

MATERIALS AND METHODS: A total of 43 patients (34 men; mean age, 60.6 years ± 13.6) with acute gastrointestinal (GI) bleeding related to pathology-proven advanced gastric carcinoma (AGC) treated with TAE at a single, tertiary center between January 2000 and December 2015 were included in this retrospective study. Review of electronic medical records, laboratory findings, endoscopic/radiologic features, and TAE characteristics were done. Post-embolization clinical course and survival data were collected for each patient. Univariate analyses were performed to identify risk factors for clinical failure of TAE and 90-day mortality after TAE. Log rank tests were done to compare survival plots obtained with Kaplan-Meier method.

RESULTS: Overall technical and clinical success rates were 85.0% (34/40) and 67.6% (23/34), respectively. Rebleeding within 1 month occurred in 5 patients with initial clinical success, all of whom had undergone TAE with gelatin sponge particles. Two patients developed splenic infarction after TAE. During a median follow up of 85 days, the median survival of the patients was 85 days (95% confidence interval, 23.0–147.1 days). Bleeding-related mortality occurred in 5 patients (12.5%, 5/40). There were no risk factors associated with clinical failure of TAE. Larger tumor diameter, history of previous chemotherapy, and no subsequent curative resection were found to be associated with 90-day mortality. None of the patients without subsequent curative resection survived longer than 462 days after TAE.

CONCLUSION: TAE for gastrointestinal bleeding associated with advanced gastric cancer is a viable treatment option with intermediate technical and clinical success and low rebleeding rates. Despite the poor outcome of the patients who were not candidates for curative resection, bleeding- and rebleeding-related mortality was low.

SS 25 IR-03  16:20
Outcome of hemorrhoidal arterial embolization for rectal bleeding: a single institution’s experience with 30 patients over 14 years
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PURPOSE: To evaluate the efficacy and safety of hemorrhoidal arterial embolization (HAE) for the treatment of rectal bleeding and to determine the prognostic factors related to rebleeding.

MATERIALS AND METHODS: This was a retrospective review of 30 patients who underwent HAE for treatment of rectal bleeding. Embolization details, technical and clinical success, rebleeding, treatment failure, and complications were evaluated.

RESULTS: Technical success rate was 93% (28/30). Clinical success rates of the first HAE session and of both initial and repeat sessions, were achieved in 63% (15/24) and 71% (17/24), respectively. The most common bleeding focus was superior hemorrhoidal artery in 21 patients, followed by middle hemorrhoidal artery in 4 patients. Treatment failure occurred in 11 patients; nine with rebleeding and two with technical failure. The most common reasons of treatment failure were rebleeding due to incomplete initial angiography (55%) and technical failure due to failure to access bleeding focus (18%). There was one case of punctured common femoral artery thrombosis as a major complication (3%). Massive transfusion of more than 10 RBC units (odds ratio 4.0, \( p=0.012 \)), more than one embolized artery (odds ratio 13.0, \( p=0.021 \)), and whether NBCA was used or not (odds ratio 0.4, \( p<0.01 \)) were significantly related to rebleeding.

CONCLUSION: HAE was technically feasible and safe, however, low clinical success rate, mainly resulted from rebleeding related to incomplete initial angiography. Massive transfusion, multiple embolized arteries, and whether NBCA was used or not, were significant factors related to rebleeding.
Incidence and imaging findings of aberrant origin of bronchial artery

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PURPOSE: Although bronchial arteries and collateral arteries are common sites of hemoptysis, aberrant origins of bronchial artery (AOBA) can be another source of hemorrhage. The purpose of this study is to investigate the incidence and imaging findings of AOBA.

MATERIALS AND METHODS: From March 2005 to September 2014, total 409 patients with hemoptysis referred for bronchial arterial embolization and performed angiography before embolization. The incidence, origin artery, and imaging findings of AOBAs were evaluated retrospectively via angiograms and CT images.

RESULTS: Among 409 patients, 32 AOBAs were found in 27 patients (6.6%). One patient had three AOBAs and 3 patients had two AOBAs. Most common origin of aberrant bronchial artery was subclavian artery, which occurred in 18 (66.6%) ones. Nine (33.3%) bronchial arteries originated from aortic arch, 2 (7.4%) from innominate artery, 2 (7.4%) from internal mammary artery and one (3.7%) from lower descending thoracic aorta. Seventeen (53.1%) were left AOBAs and 15 (46.9%) were right AOBAs. Three aberrant arteries were originated from contralateral side and crossed midline. Recurrence rate of hemoptysis was much higher in the patients with AOBAs (44.4%) than the patients with normal origin of bronchial arteries (29.6%).

CONCLUSION: AOBA is not a rare condition and various forms of anomalies are possible. It is associated with high risk of recurrent hemoptysis after embolization. Therefore, we must understand fully about the characteristics of AOBAs.

Outcomes and risk factors of recurrent hemoptysis after bronchial artery embolization: a retrospective observational study of 395 patients

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PURPOSE: To assess the outcomes and risk factors of recurrent hemoptysis after bronchial artery embolization (BAE).

MATERIALS AND METHODS: From March 2005 to August 2014, 395 patients underwent BAE for hemoptysis. We retrospectively evaluated the outcomes of BAE including recurrent hemoptysis, clinical and technical success, and analyzed risk factors of recurrent hemoptysis after BAE through multivariate analysis.

RESULTS: 116 (29.4%) of 395 patients experienced recurrent hemoptysis after BAE. Of 116 recurrent hemoptysis patients, 34 (29.4%) patients had re-bleeding within one month and 60 (51.8%) patients had re-bleeding within six months after BAE. Technical and clinical success rate of BAE was 88.4% and 93.4%, respectively. The TB sequelae and aspergilloma were risk factors of recurrent hemoptysis after BAE in multivariate analysis. 74 (63.8%) patients of 116 were performed second BAE and 16 (13.8%) patient were performed lobectomy to control the re-bleeding. In second BAE, both technical and clinical success rate was 90.5% and rate of recurrent hemoptysis was 55.4% (41 of 74 cases). 41.5% of recurrent hemoptysis (17 of 41 patients) occurred during admission and 46.8 % (20 of 41 patients) occurred within 1 months after second BAE.

CONCLUSION: BAE was effective treatment of hemoptysis and second BAE showed high technical and clinical success rate as well. However, high recurrence rate is still a problem to resolve. The TB sequelae and aspergilloma were major risk factors for the recurrence of hemoptysis after BAE.

Outcome of selective arterial prostatic embolization for advanced prostate cancer-related hematuria and voiding difficulty

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PURPOSE: To evaluate superselective embolotherapy for the management of hematuria and voiding difficulty in advanced prostate cancer patients after failed conservative treatment.

MATERIALS AND METHODS: Nine consecutive patients with advanced prostate cancer underwent superselective embolization for hematuria. Four patients simultaneously required an indwelling Foley catheter due to voiding difficulty. Technical success was defined as elimination of tumor staining on the post-embolization angiogram, and clinical success was defined as cessation of hematuria without recurrence within two weeks following embolization.

RESULTS: All of these patients had prominent tumor staining and only one of them showed contrast extravasation on angiograms. All patients underwent
superselective embolization of the tumor-feeding arteries using a microcatheter. Both the technical and clinical success rates were 88.9% (8/9). All of the patients decreased or maintained no transfusion requirement after embolotherapy, including the only clinically failed patient with a huge prostate tumor and coagulopathy. Two of the four patients with voiding difficulty could spontaneously urinate on post-treatment days two and three after removal of the Foley catheter.

**CONCLUSION:** Selective arterial prostatic embolization had a high success rate in stopping advanced prostate cancer-related hematuria, and thus lowering the transfusion requirement as well as having the possible palliative benefit of voiding difficulty relief.

**SS 25 IR-07 17:00**

**Digital subtraction cone-beam computed tomography in preoperative embolization for pelvic bone tumors**

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**PURPOSE:** To evaluate the usefulness of digital subtraction cone-beam computed tomography (DS-CBCT) in the preoperative embolization of hypervascular tumors located in the pelvic bone.

**MATERIALS AND METHODS:** This retrospective study included 42 patients with hypervascular pelvic bone tumors who underwent preoperative embolization between January 2013 and February 2016. From among the 42 patients, a DS-CBCT scan was taken in a total of 13 patients (DS-CBCT group), whereas only a series of digital subtraction angiographies (DSAs) was taken in the remaining 29 patients (DSA group). The devascularization rate, number of angiographic runs, total dose-area product (DAP), fluoroscopy time, interventional procedure time, and estimated blood loss were compared between the two groups.

**RESULTS:** The devascularization rate, interventional procedure time, operative time, and estimated blood loss were not statistically different between the two groups. On the other hand, the number of angiographic runs in the DS-CBCT group was significantly lower than that in the DSA group (p < 0.001). Moreover, the fluoroscopy time in the DS-CBCT group was significantly shorter than that in the DSA group (p=0.019). When the total DAP of the Siemens machine was compared between two groups, it was found to be significantly higher in the DS-CBCT group (mean, 15256.4 μGym²) than the DSA group (mean, 7987.0 μGym²) (p=0.005).

**CONCLUSION:** The use of DS-CBCT during the preoperative embolization of hypervascular pelvic bone tumors significantly reduces the number of angiographic runs and fluoroscopy time at the cost of an increased radiation dose.

**SS 25 IR-08 17:10**

**Role of prophylactic internal iliac artery balloon occlusion in the management of women with placenta abnormalities before cesarean section**

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**PURPOSE:** To examine the efficacy of prophylactic internal iliac artery balloon occlusion (PIIABO) before cesarean section (CS) in the patients with placental abnormalities (placenta previa and/or increta) because of high risk of postpartum hemorrhage.

**MATERIALS AND METHODS:** Between December 2012 and January 2016, 23 women who had placental abnormalities and enrolled in the study group underwent PIIABO before CS. Additional embolization or operation was not needed in 14 (61%) patients (Group A) and performed in 9 (39%) patients (Group B). Between June 2006 and February 2016, 34 women (Group C) who had placental abnormalities and enrolled in the control group underwent uterine artery embolization (UAE) after CS for postpartum hemorrhage. The amount of transfusion and estimated blood loss (EBL) during peripartum and postpartum periods were compared between three groups.

**RESULTS:** In the group A, B, C, the mean numbers of packed red blood cells transfused were 1.7, 1.9, 2.2 units, respectively (p=0.354). The mean EBL was 489 mL, 4533 mL and 1844 mL, respectively (p < 0.01).

**CONCLUSION:** PIIABO before CS was effective in about two thirds of the patients with placental abnormalities to reduce requirement of transfusion and blood loss during peripartum and postpartum periods.

**SS 25 IR-09 17:20**

**The safety and effectiveness of embolisation in the treatment of post-gastrectomy haemorrhages**

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**PURPOSE:** Internal haemorrhage after gastrectomy can be fatal, but only few relevant studies have been conducted on the safety and efficacy of embolisation because of poor collateral vascularities. The aim of the present study was to evaluate the safety and effectiveness of embolic therapy for bleeding in pati-
Among 13,427 patients who underwent ST or T gastrectomy between 2004 and 2015, 34 (21 ST and 13 T gastrectomy cases) were retrospectively analyzed. Computed tomographic scans, offending arteries on angiography, type of surgery, and clinical outcomes after embolisation were thoroughly reviewed based on medical records. The most common embolic material used was glue, followed by coil and gelfoam. Statistical analysis was performed.

RESULTS: In the 34 patients, 36 bleeding events that required embolisation were identified on the angiographies. Overall, the clinical success rate was 73.5%. The more significantly common cause of bleeding was gastroduodenal artery (GDA; n = 11/21; 52.4%) in the ST gastrectomy group and splenic artery (7/11; 63.6%) in the T gastrectomy group (p < 0.05). One ST gastrectomy patient demonstrated total infarction of the stomach after embolisation for splenic artery bleeding. The mortality rates when splenic artery embolisation was performed were 50% and 42% in the ST and T gastrectomy groups, respectively. No significant difference in clinical outcomes was observed between early- (<30 days) and delayed-onset bleeding.

CONCLUSION: Embolisation for post-gastrectomy bleeding was safe and effective. GDA and splenic artery were common in the ST and T gastrectomy groups, respectively. Splenic artery embolisation conferred a high risk of mortality in both groups. In patients who had undergone ST gastrectomy, splenic artery embolisation may result in total stomach infarction. Thus, stent-graft placement instead of embolisation or secondary surgery for T gastrectomy may be considered for these patients.

SS 25 IR-10 17:30
Endovascular management in high-grade renal trauma: a single trauma center experience on the safety, efficacy, and clinical outcomes
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PURPOSE: To report experience with endovascular intervention of high-grade renal trauma
MATERIALS AND METHODS: A retrospective review of high-grade renal injury (grade III or higher) was performed in a single trauma institution. A total of 27 patients (male:female, 18:9; mean age, 39 years, age range, 3–80 y) who underwent 28 endovascular interventions between 2005 and 2015 were included in the study. Medical records, imaging studies and procedure reports were reviewed to assess the type of injury, angiographic findings, and procedure outcomes. Associated injuries were present in the majority of patients.

RESULTS: The mean time from injury to intervention was 10 hours (range, 1.5–50 h). All endovascular interventions were technically successful. The procedure efficacy was 96% (26/27); one patient (4%) had a recurrent hemorrhage requiring a secondary intervention. Out of the 27 patients, 26 patients with grade III (n=10) or IV (n=16) renal injury were treated with superselective transarterial embolization. In the remaining one patient with grade V renal injury, recanalization of the occluded renal artery with stent placement was successfully achieved. Mean clinical follow-up was 22.5 months (range, 3–104 m). There was no procedure-related death. No procedure-related or delayed onset of renal insufficiency occurred. Three patients died within 30 days of intervention, all of whom had severe associated injuries including head or intestinal injuries.

CONCLUSION: Endovascular management is a safe and effective method for high-grade renal trauma.

SS 25 IR-11 17:40
Empiric embolization of arterial stump for postoperative hemorrhage without definite bleeding focus in the radiographs after gastrointestinal surgery: radiologic findings and outcomes
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PURPOSE: To evaluated the feasibility of endovascular management of arterial hemorrhage after major abdominal surgery without definite bleeding focus in the radiographs.

MATERIALS AND METHODS: Between November 2009 and June 2015, a total of 473 patients underwent TAE for the delayed postoperative bleeding at our interventional unit. Among these patients, 11 patients shown no evidence of active bleeding in radiographs and underwent conservative therapy first. Due the clinical worsening, all of 11 patients underwent an angiography and empiric embolization was performed at the arterial stump. Technical success of the TAE procedure was defined as complete embolization of the stump without newly detected contrast extravasation. Clinical success was defined as the cessation of clinical symptoms and
Intervention

bleeding from drain tubes after TAE without any further surgical intervention during follow-up period.

**RESULTS:** The interval from initial surgery to hemorrhage ranged from 2 to 30 days, with a median of 10 days. Except the acute hematoma surrounding the stump, active bleeding signs, such as active contrast extravasation or pseudoaneurysm, were not identified on CT angiograms and conventional angiography. TAE was technically successful in 11 patients (100%). Clinical success was achieved in 8 (72%) of 11 patients. 3 patients were died within 1 week after TAE procedure. Postembolization complications such as bowel infarction or liver infarction did not occurred in all patients during follow-up period.

**CONCLUSION:** Empiric embolization of arterial stump for postoperative hemorrhage can be an effective treatment method when definite bleeding focus was not detected in radiographs.

**SS 25 IR-12 17:50**

The safety and efficacy of embolization using N-butyl cyanoacrylate for arterial upper gastrointestinal bleeding: a single center experience with 166 patients

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**PURPOSE:** To evaluate the safety and efficacy of embolization for arterial upper gastrointestinal bleeding (UGIB) and to identify predictive factors for clinical outcomes.

**MATERIALS AND METHODS:** Consecutive UGIB patients who were confirmed to have positive angiographic findings for arterial bleeding underwent selective embolization during the period between 2006 and 2015 in this single-center retrospective study. Technical success, rebleeding, clinical success (primary/secondary), in-hospital mortality and major complication rates were determined. Statistical analysis was performed to identify predictive factors for clinical outcomes.

**RESULTS:** 80 gastric bleeding and 86 duodenal bleeding patients were included. Technical success rate was 98.7% (164/166). N-butyl cyanoacrylate (NBCA) was used as the main embolic agent in 92.6% (152/164). Rebleeding, clinical success, and in-hospital mortality rates for gastric bleedings were 21%, 76% (primary), 82% (secondary) and 19% for and those for duodenal bleedings were 37%, 60% (primary), 72% (secondary) and 28%, respectively. Clinical outcomes were significantly different between gastric and duodenal bleeding subgroups (P<.05). There was no major complication. Duodenal origin, prolonged prothrombin time and use of IV inotropes at the time of embolization are significant predictive factors for rebleeding and in-hospital mortality, respectively.

**CONCLUSION:** Embolization using NBCA is safe and effective for UGIB.