

Drug-eluting beads (DEB-TACE)

Hyo-Cheol Kim, M.D.
angiointervention@gmail.com
Clinical Associate Professor
Department of Radiology
Seoul National University Hospital

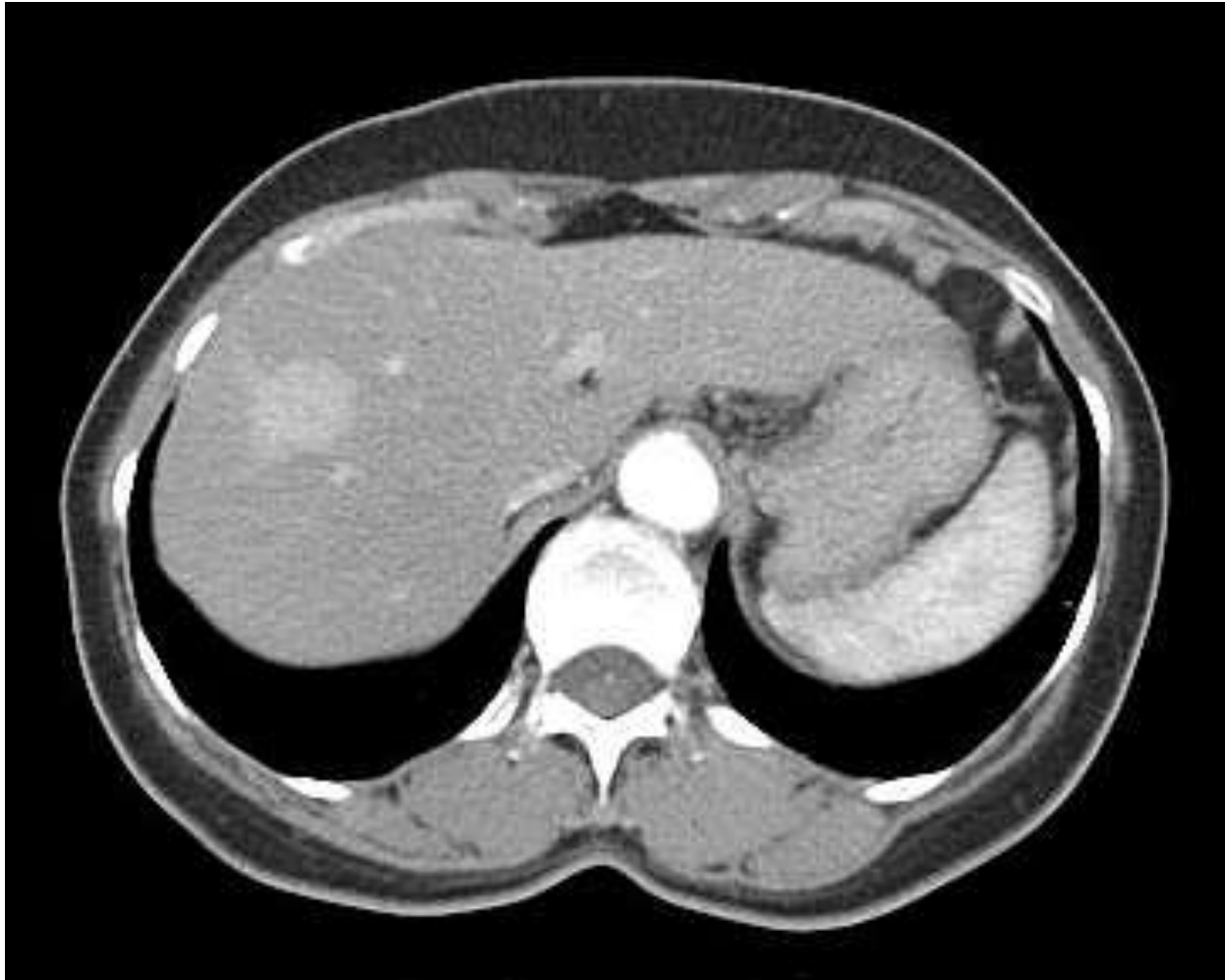
SNUH  **RADIOLOGY**

SEOUL NATIONAL UNIVERSITY
HOSPITAL

Contents

- Drug-eluting beads
 - DC bead (BTG)
 - Hepasphere (Merit Medical)
- DC bead
 - Characteristics (DC bead vs Lipiodol)
 - Technical difference (DC bead vs Lipiodol)
 - Clinical outcome (DEB-TACE vs cTACE)
 - Indication (DEB-TACE vs cTACE)

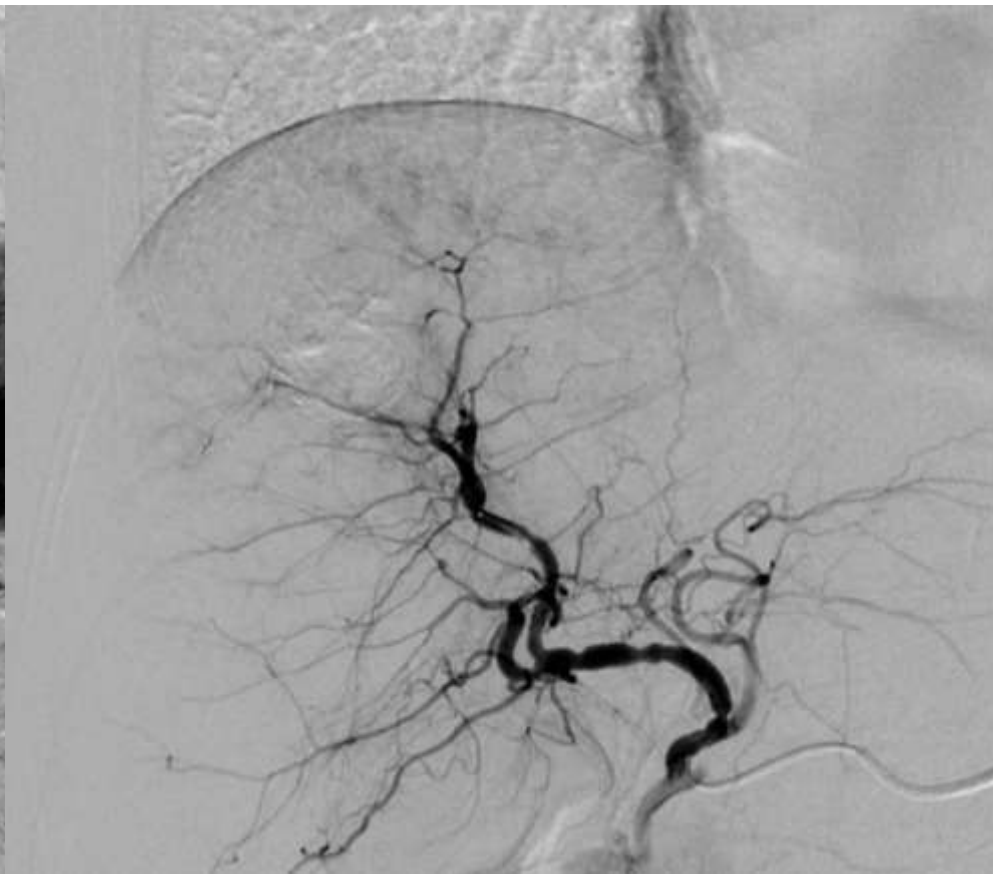
Small tumor $\leq 3\text{cm}$



Small tumor $\leq 3\text{cm}$

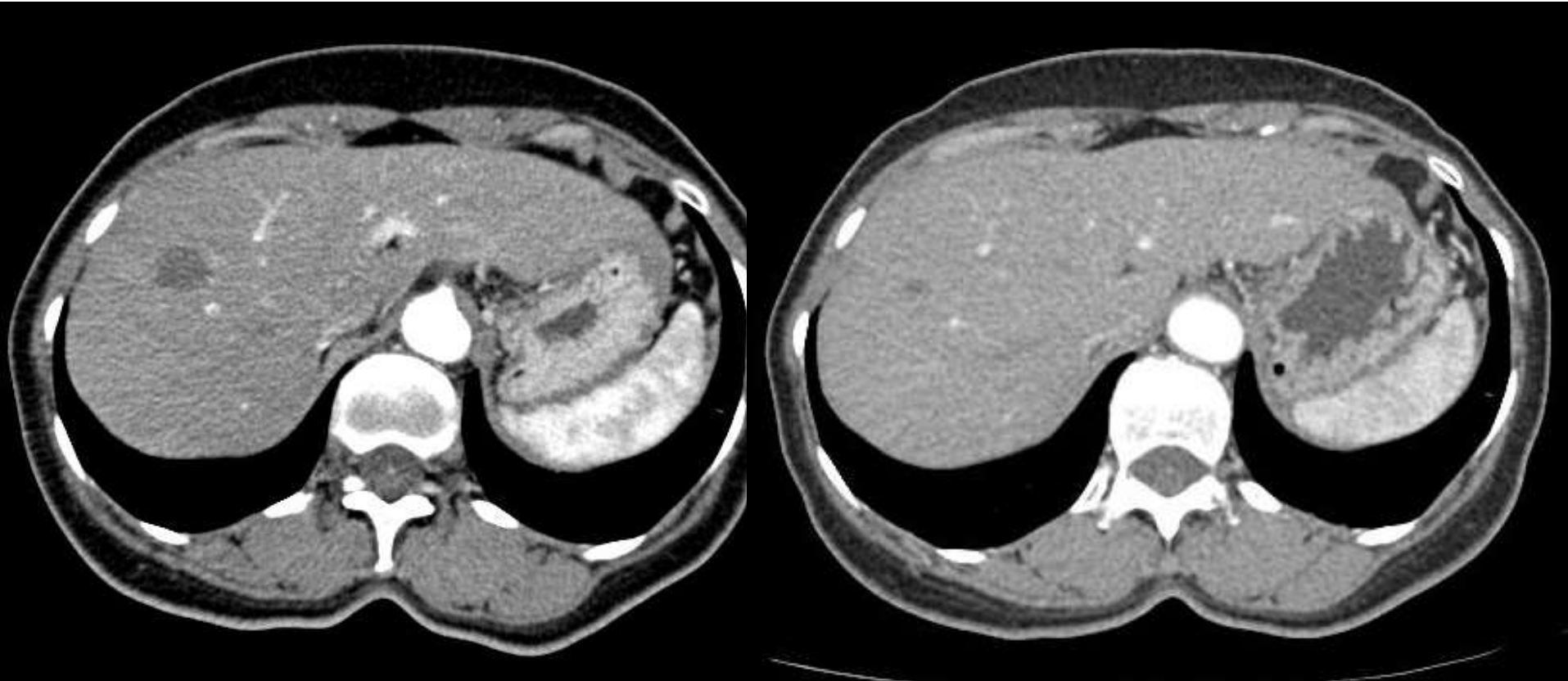


Before DEB-TACE



After DEB-TACE (100-300)

Small tumor $\leq 3\text{cm}$



1 month

13 months

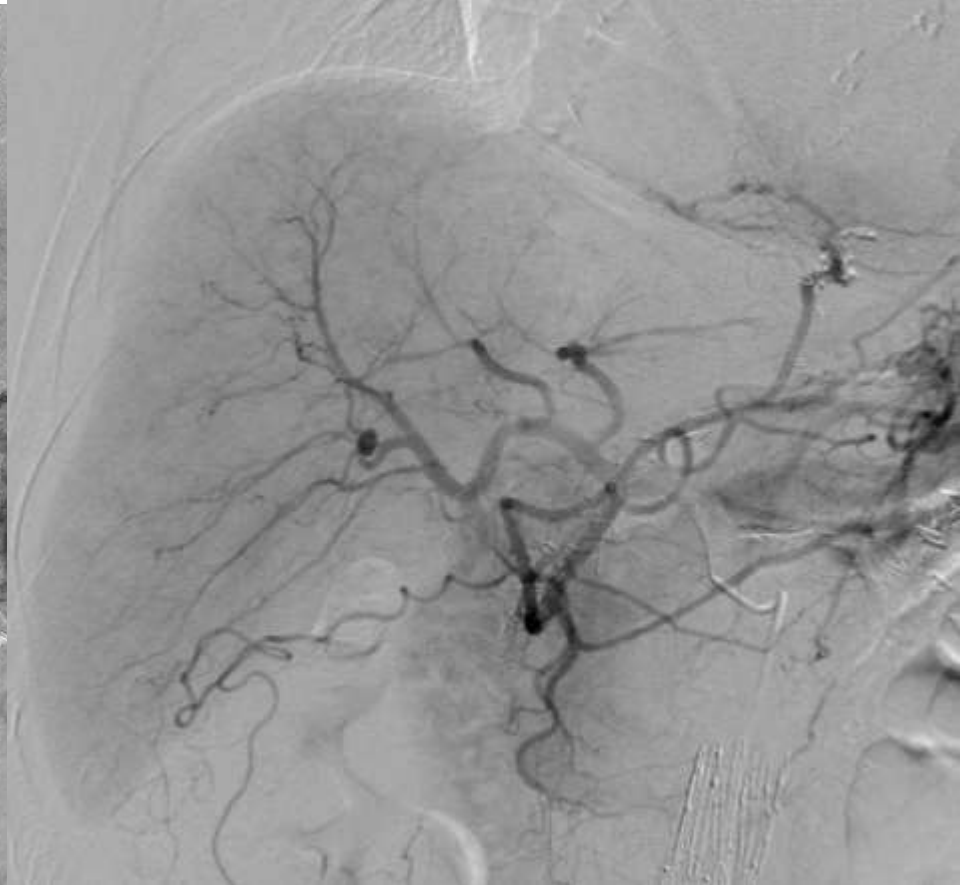
Small tumor $\leq 3\text{cm}$



Small tumor $\leq 3\text{cm}$



Before DEB-TACE



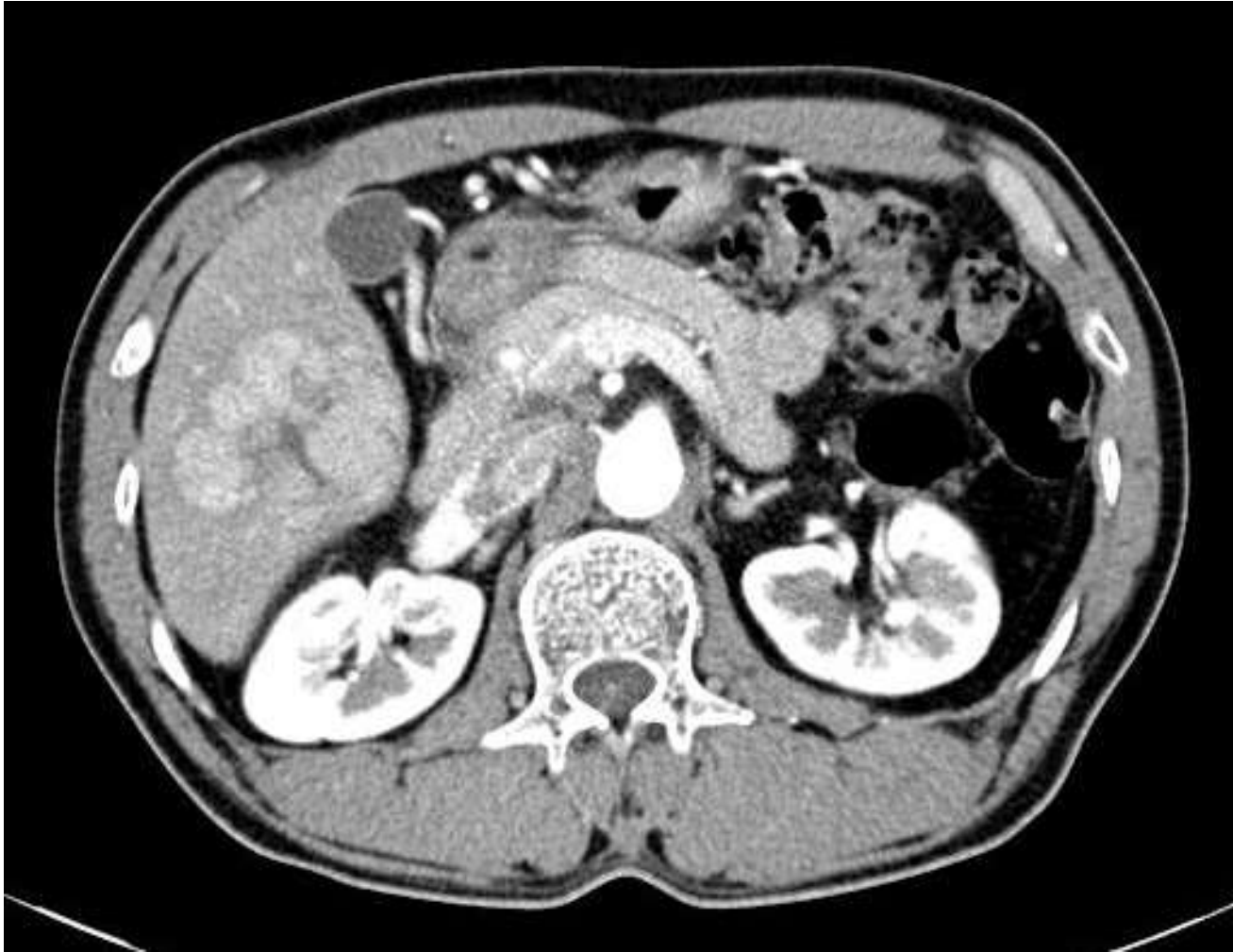
After DEB-TACE (100-300)

Small tumor $\leq 3\text{cm}$



1 month

Medium tumor 3cm ~ 7cm



Medium tumor 3cm ~ 7cm



Before DEB-TACE

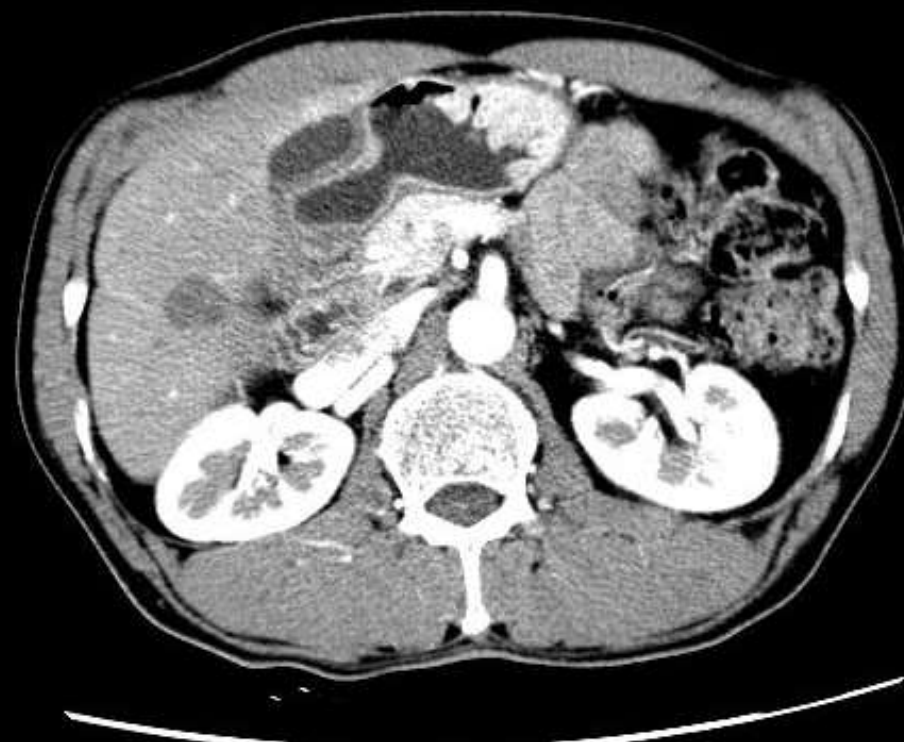


After DEB-TACE
(100-300 & 300-500)

Medium tumor 3cm ~ 7cm

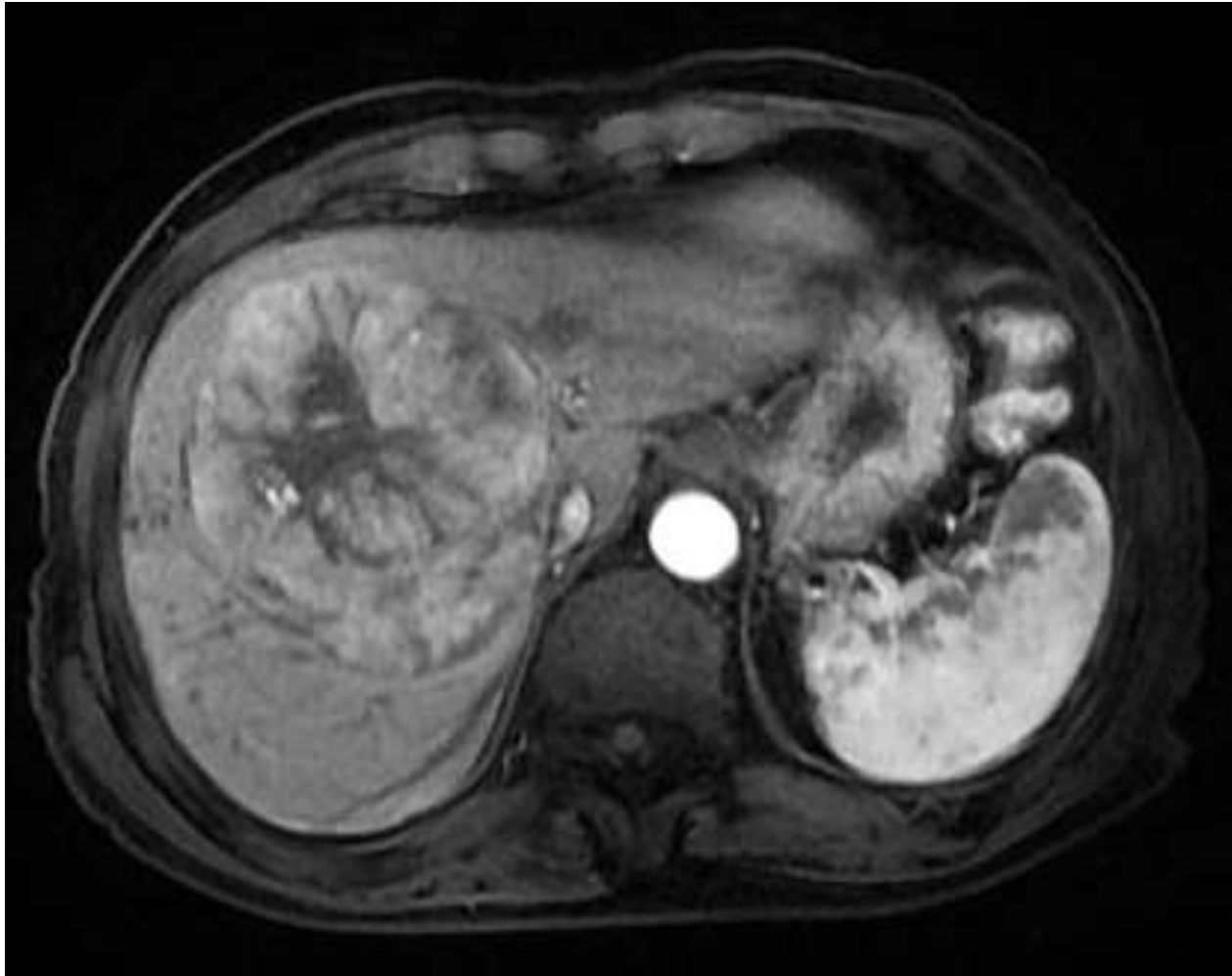


1 month

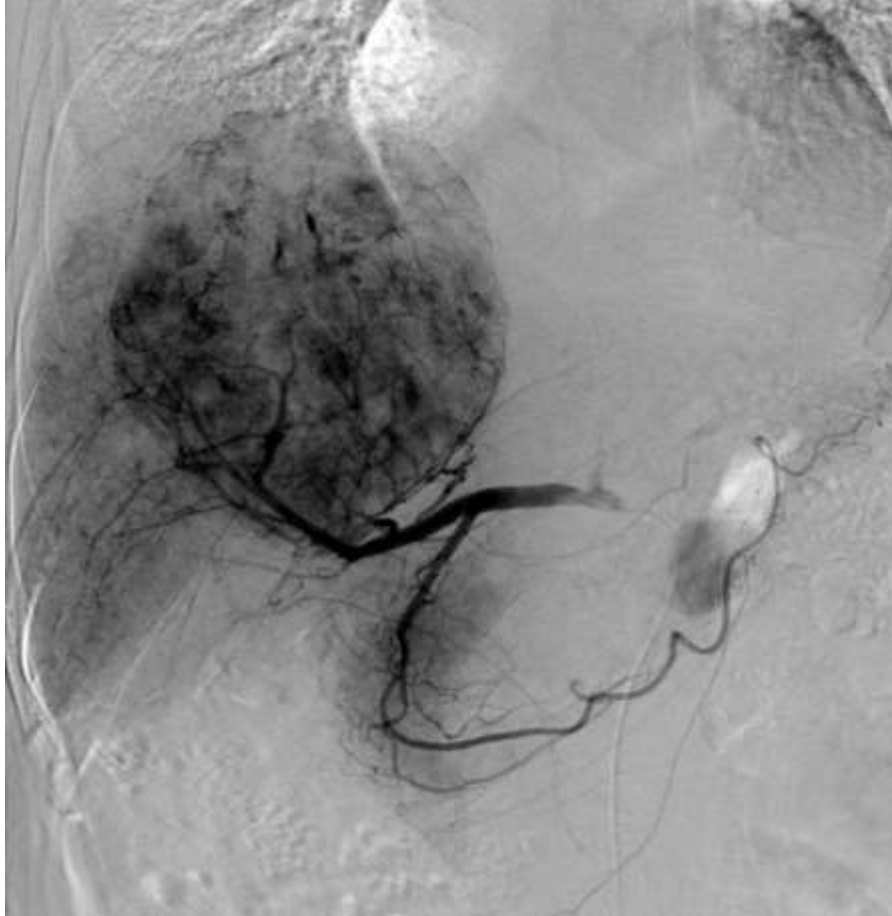


2.5 Year

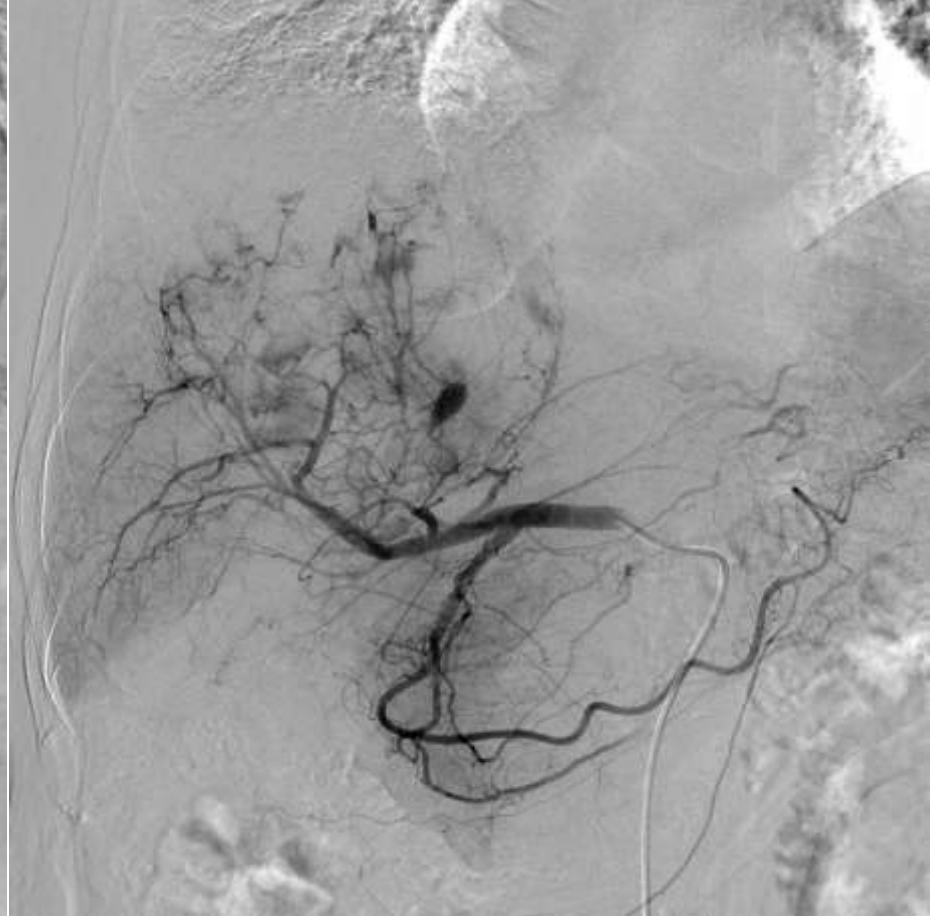
Large tumor $\geq 7\text{cm}$



Large tumor $\geq 7\text{cm}$



Before DEB-TACE



After DEB-TACE
(100-300 & 300-500)

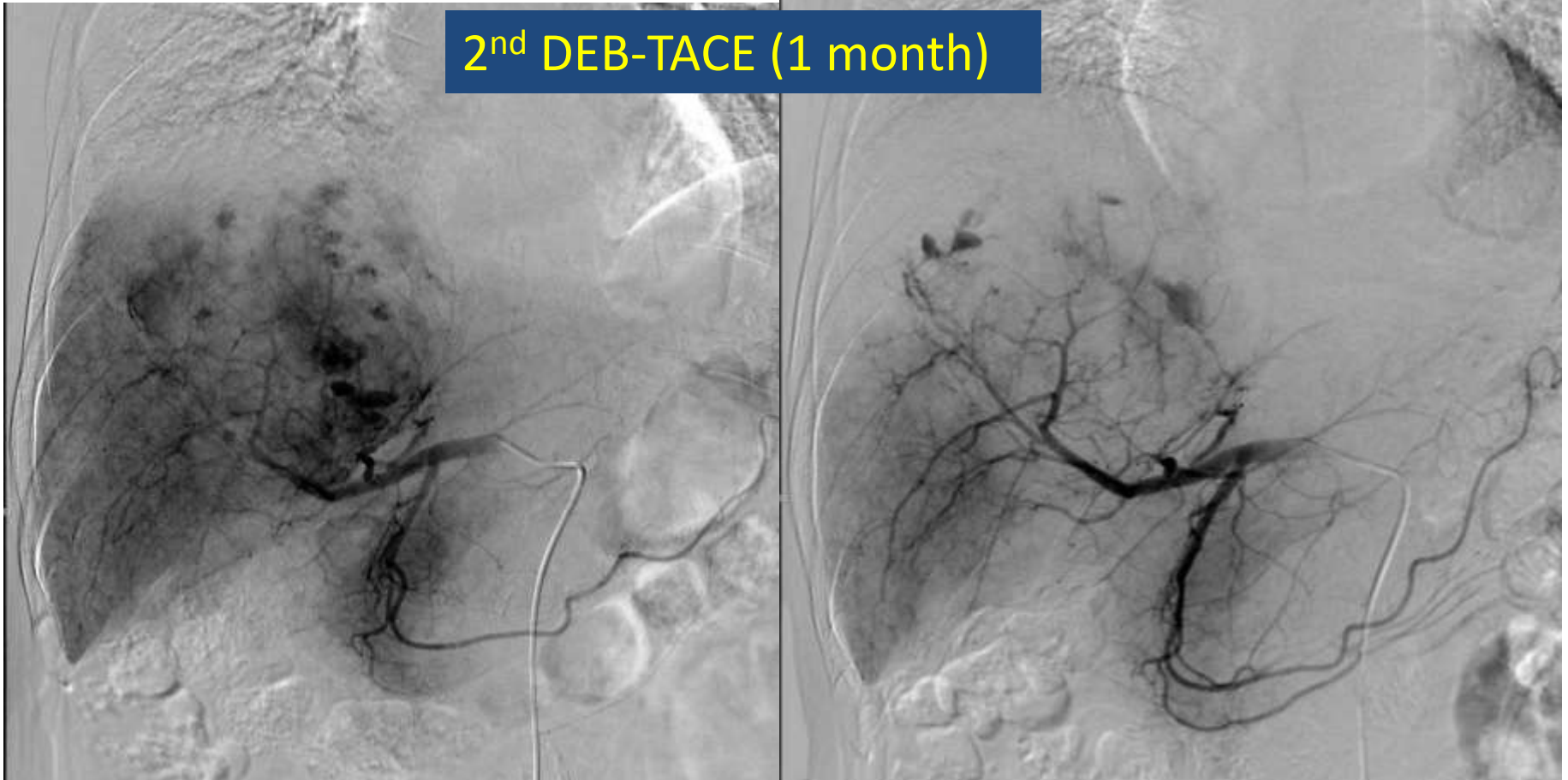
Large tumor $\geq 7\text{cm}$



1 month

Large tumor $\geq 7\text{cm}$

2nd DEB-TACE (1 month)



Before DEB-TACE

After DEB-TACE
(100-300 & 300-500)

Large tumor $\geq 7\text{cm}$

s/p 3rd DEB-TACE



s/p 3rd DEB-TACE, 4th cTACE



Conclusion

- Better tumor response ?
- Indication of DC bead ?

- Less pain during TACE
- Less post-embolization syndrome
- Shorter hospitalization period

- Increased complication (biliary, non-target)

Drug-eluting bead: DC Bead™

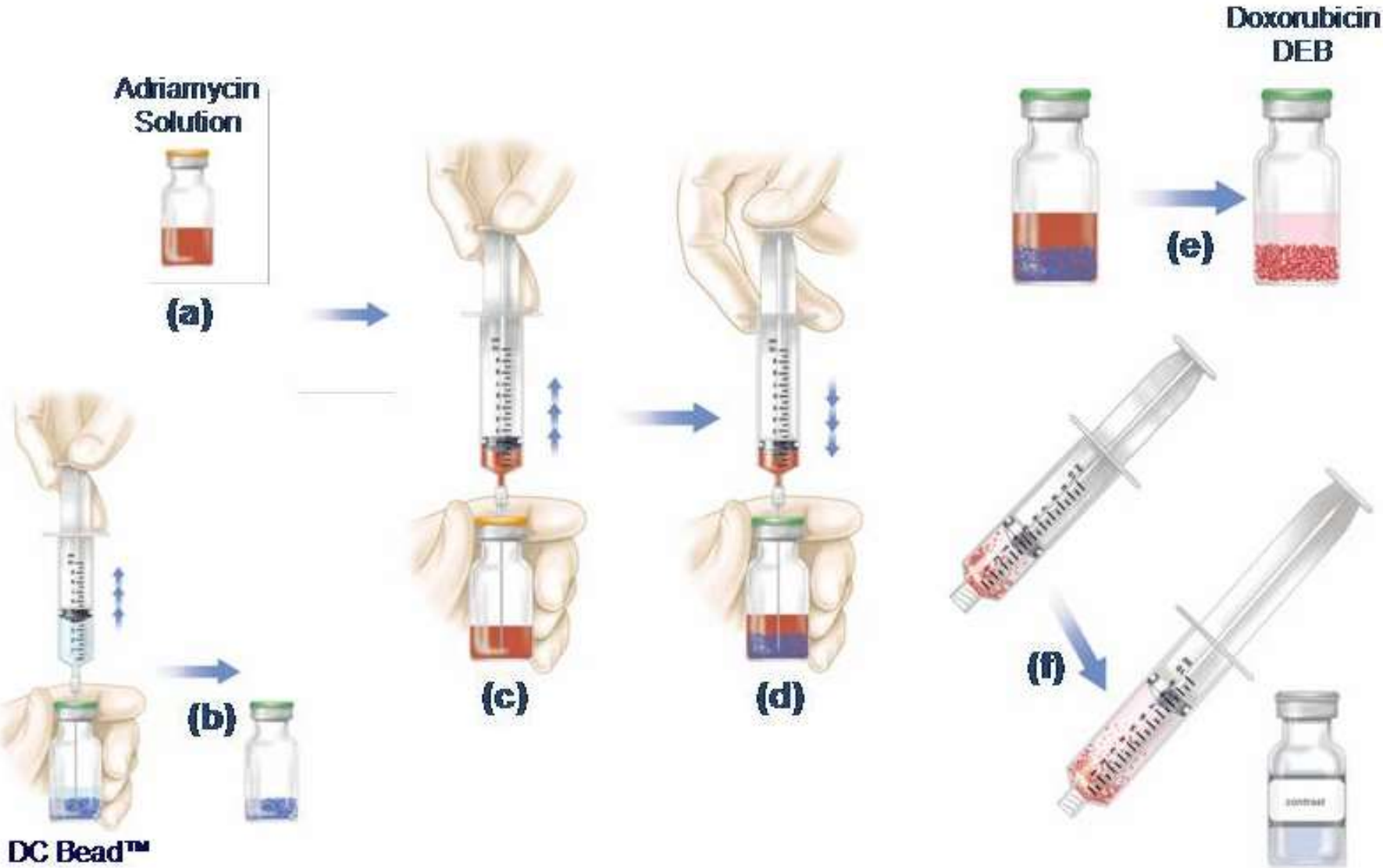


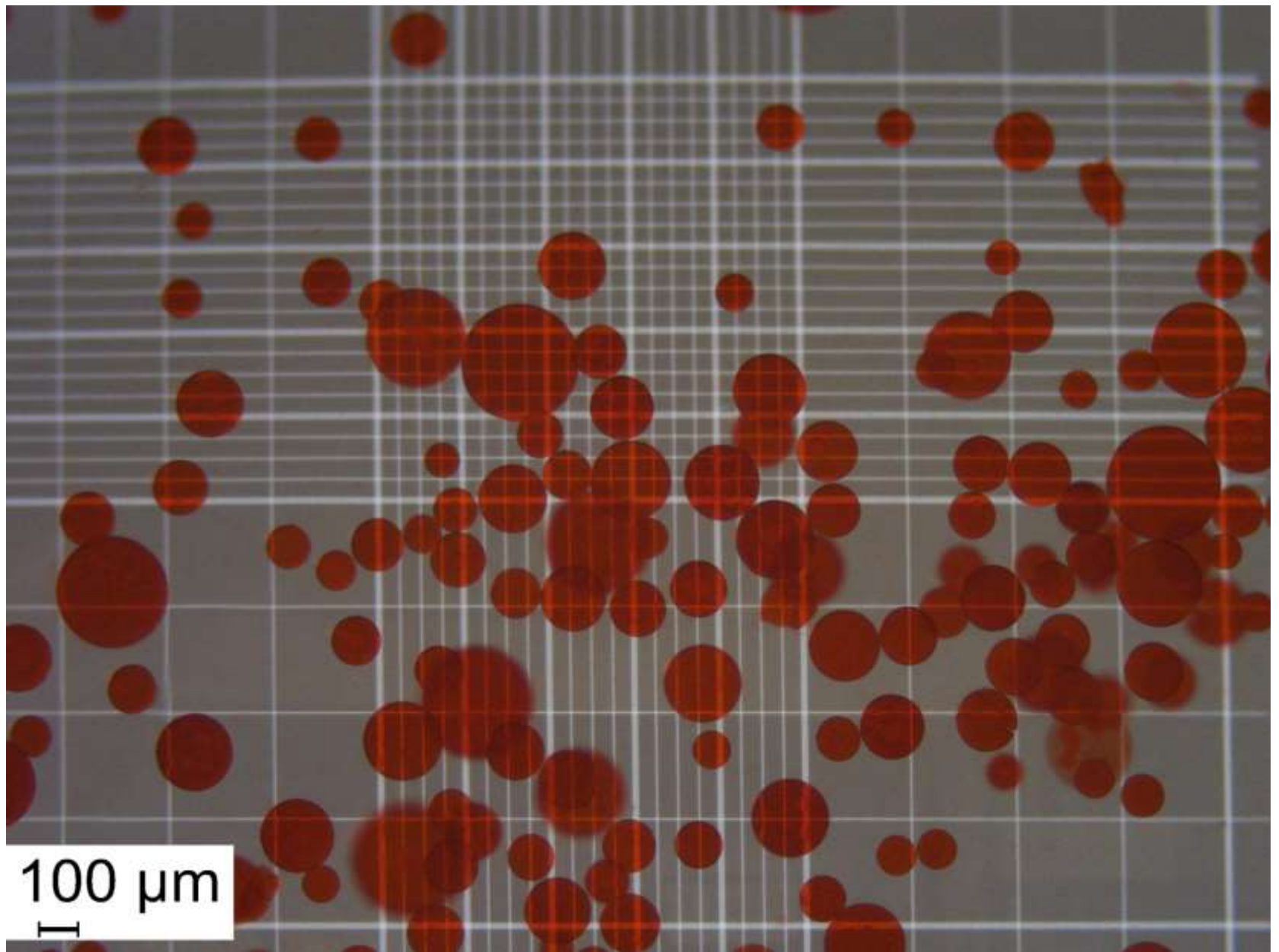
DEB-TACE : Drug-Eluting Bead

- DC bead® (=LC bead®) :

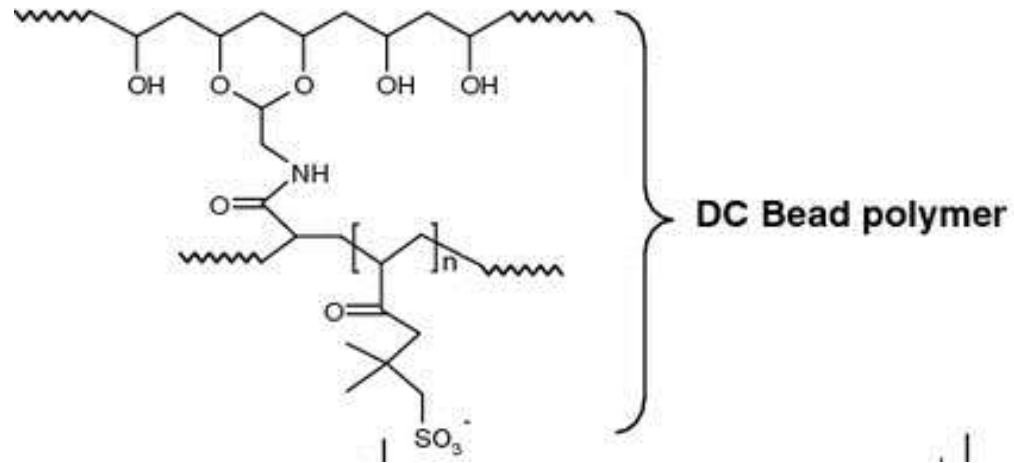
- 100-300µm, 300-500µm,
- Dox 50-75mg/vial loading, 1~2병/TACE

DC Bead: A Drug Delivery Embolization System

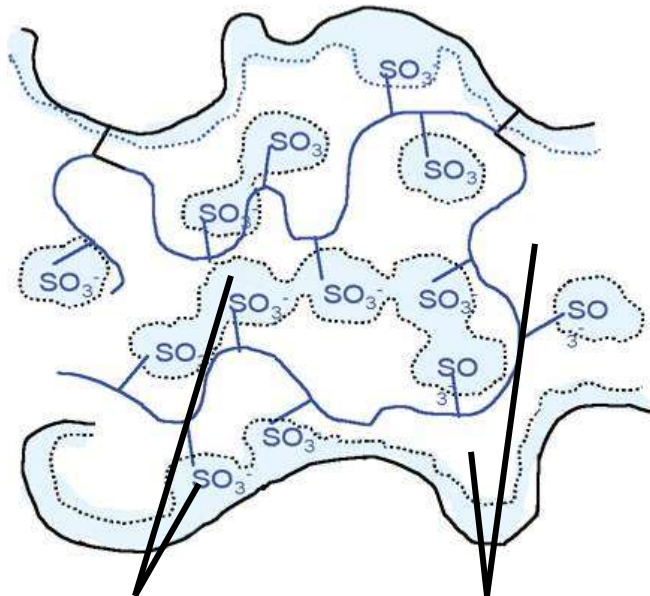




100 μm



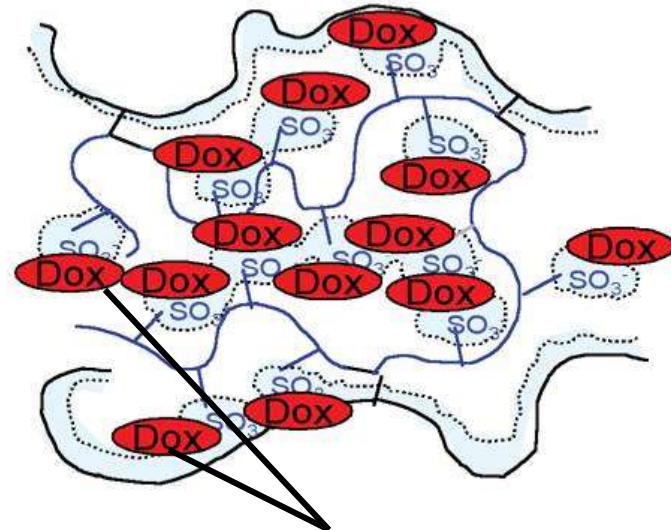
Hydrated Beads



Hydration shell associated with PVA and ionic groups

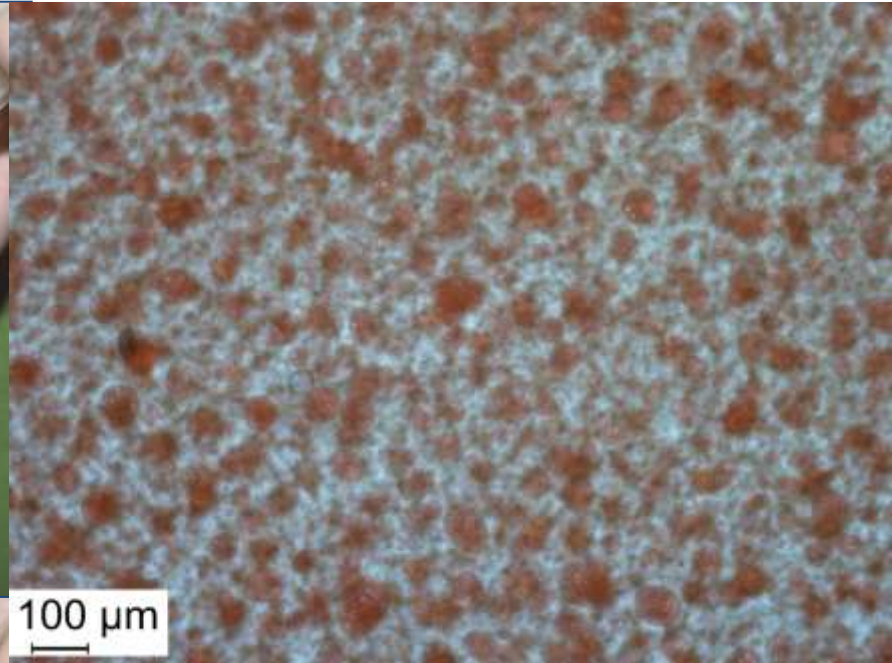
Bulk (non-bound) water

Loaded Beads



Interaction of doxorubicin with SO₃ groups displaces water from the hydration shells

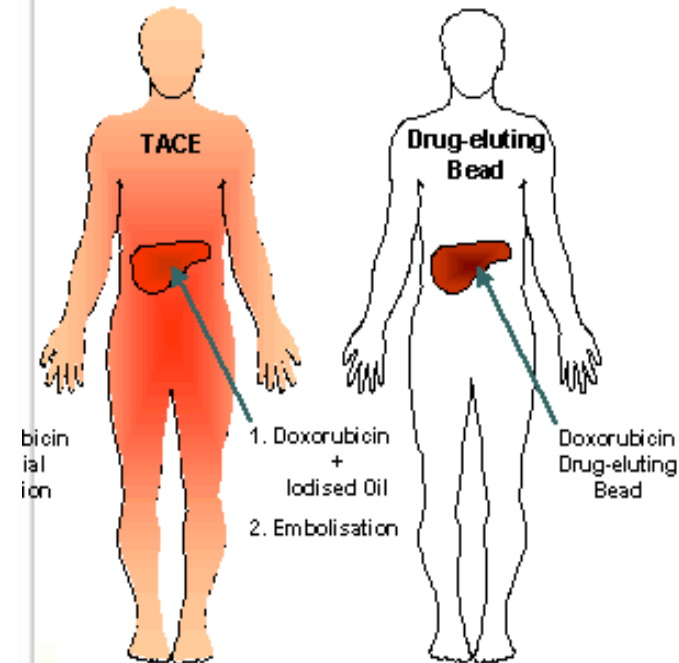
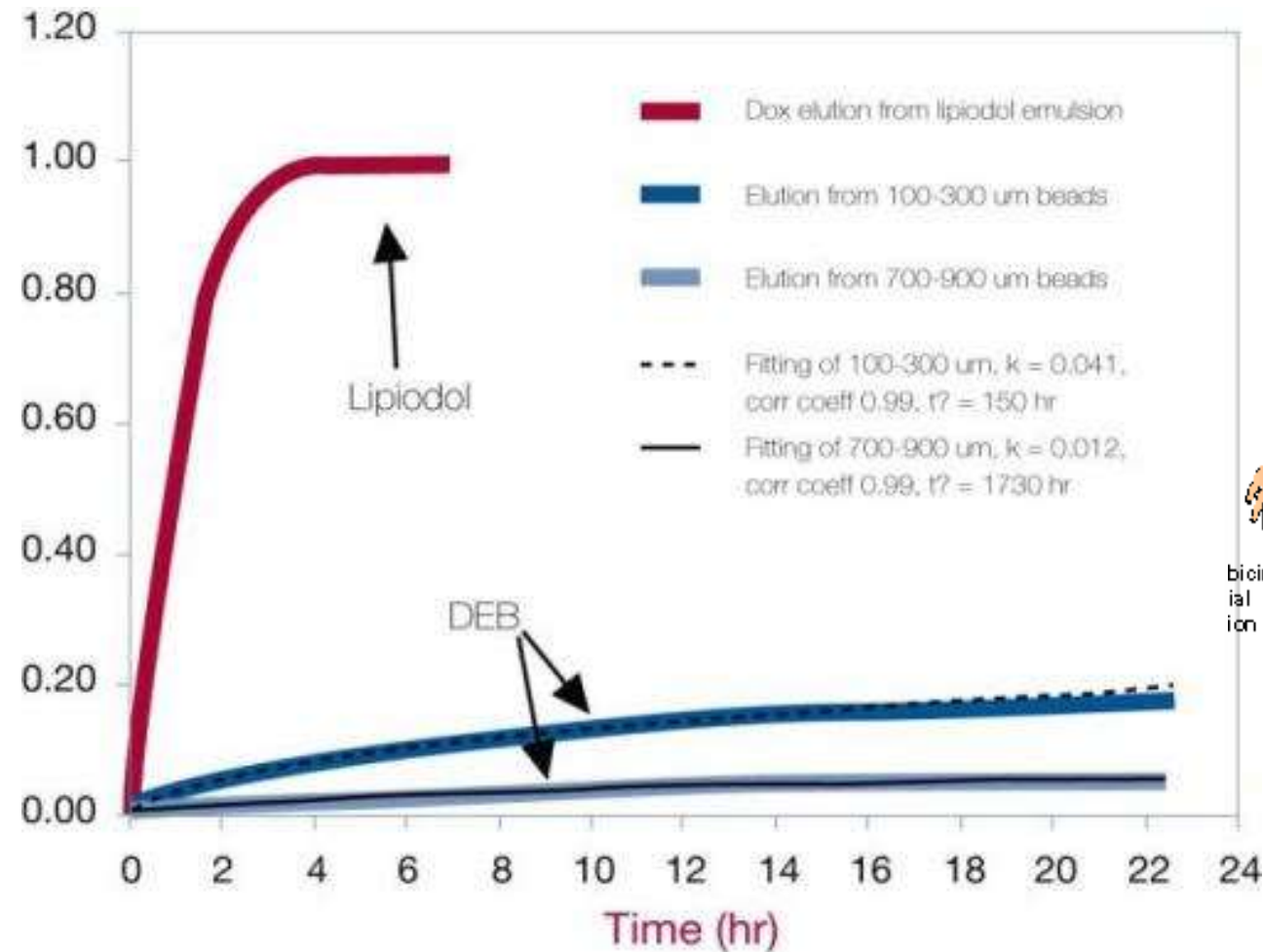
cTACE (Lipiodol + Gelfoam)



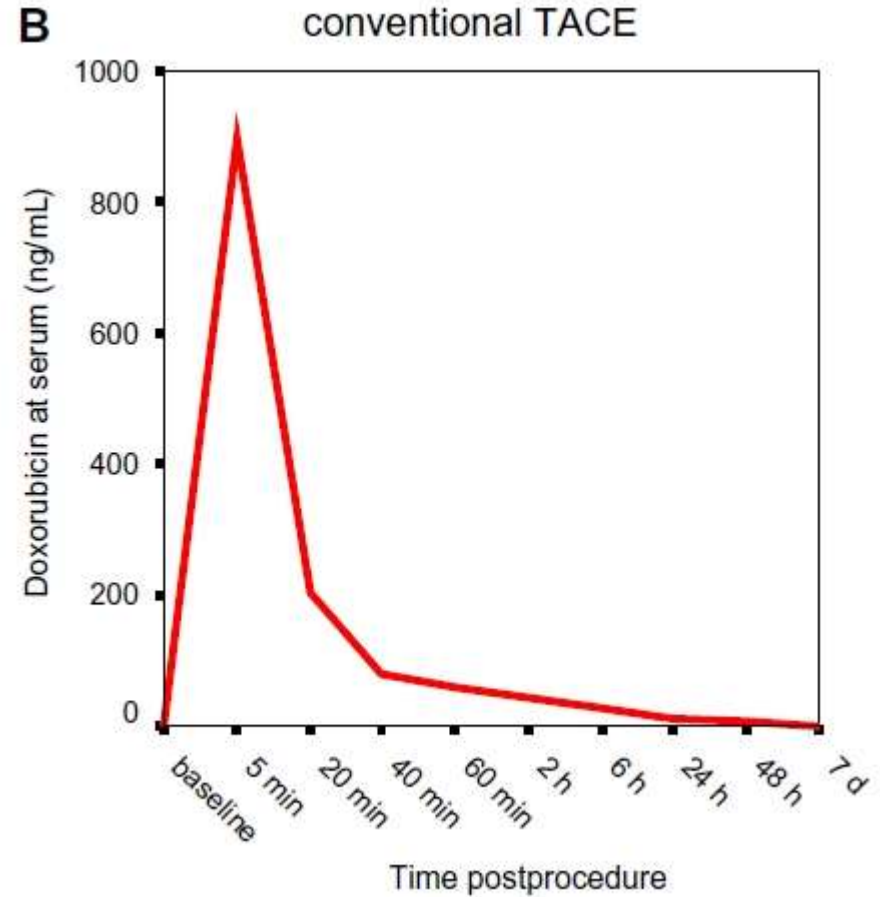
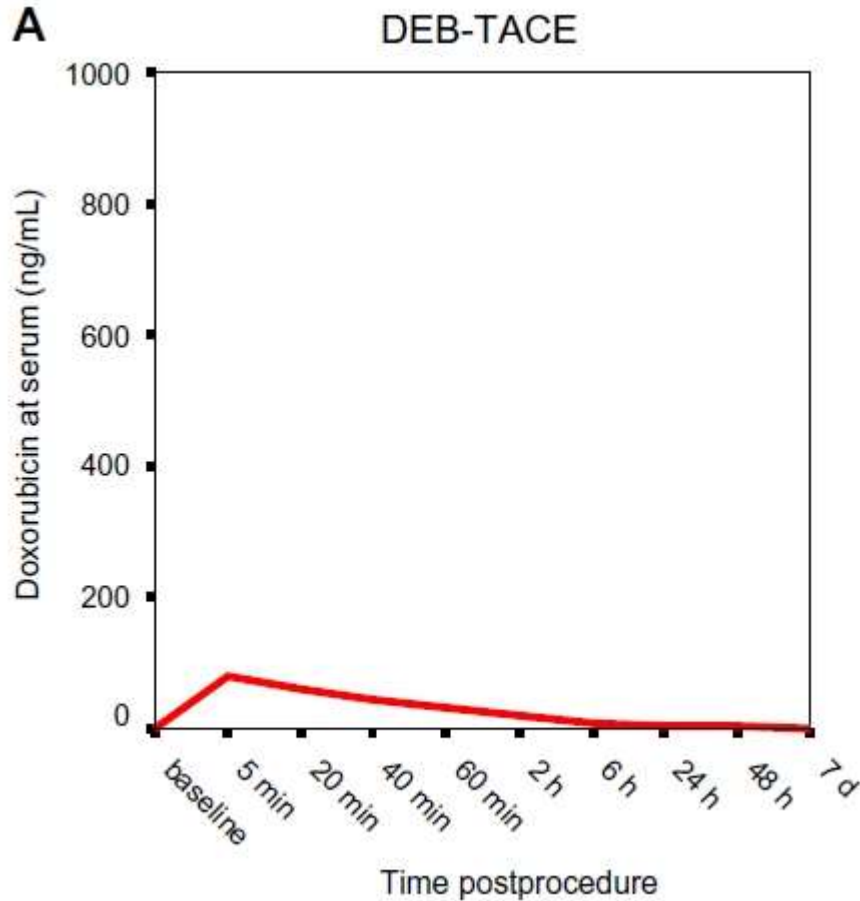
DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid

In vitro drug release

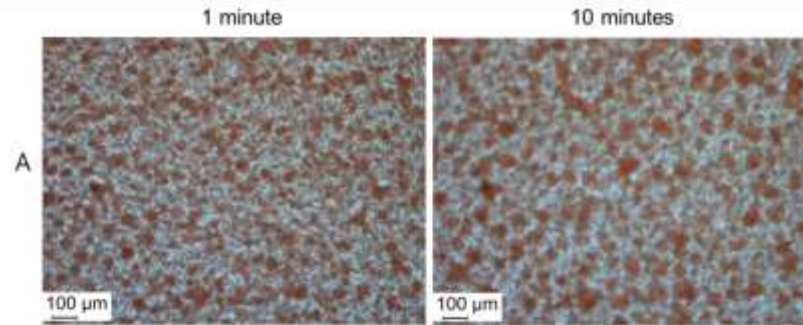


Human : Pharmacokinetics



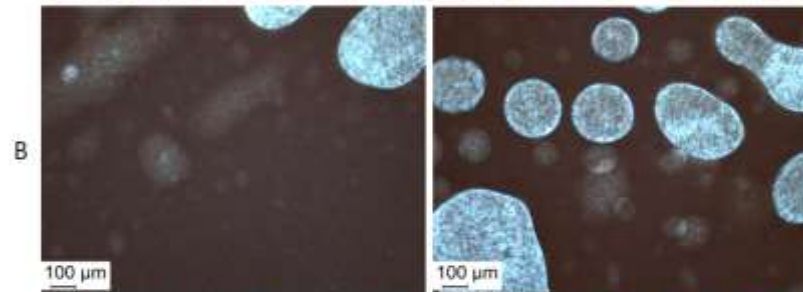
Lipiodol Emulsion

Dox(조영제):Lipiodol = 1:4



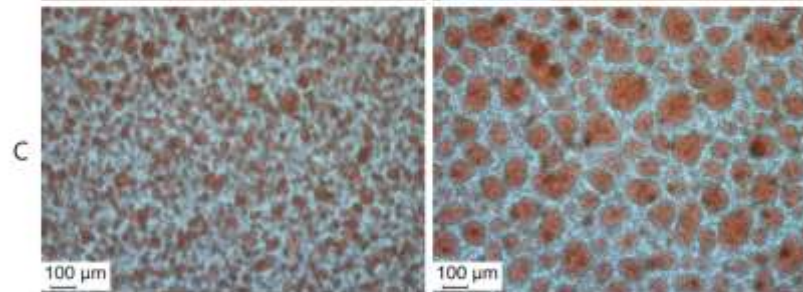
SNUH

Dox(조영제):Lipiodol = 1:1

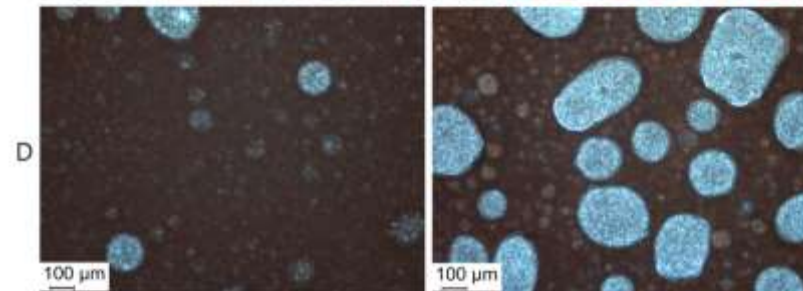


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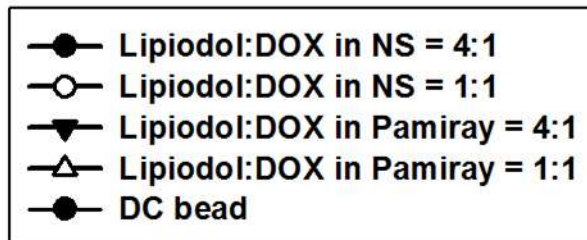
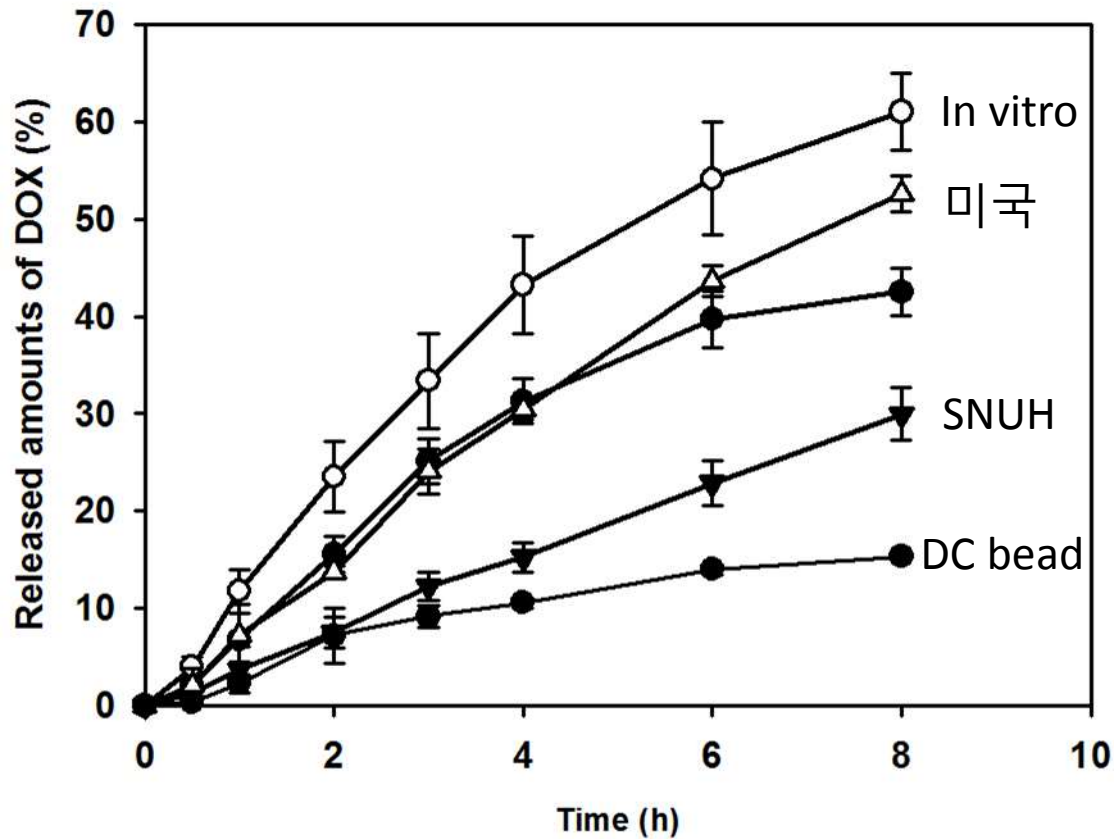
Dox(N/S):Lipiodol = 1:1



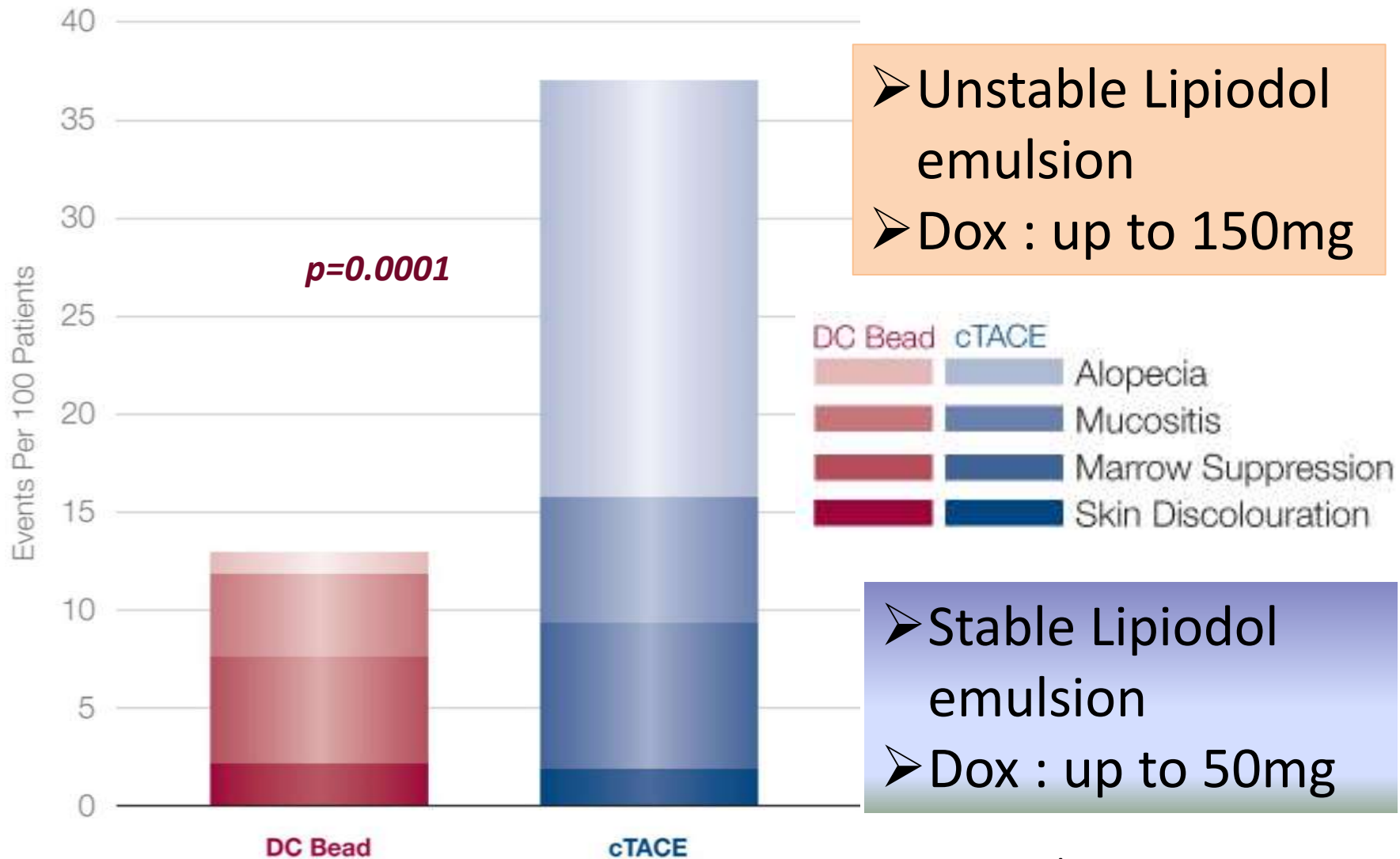
In vitro



In vitro drug release

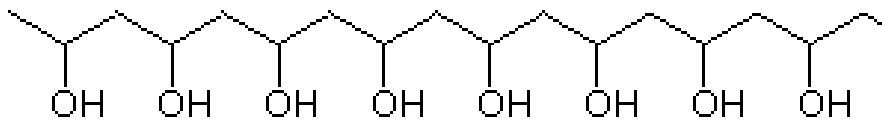
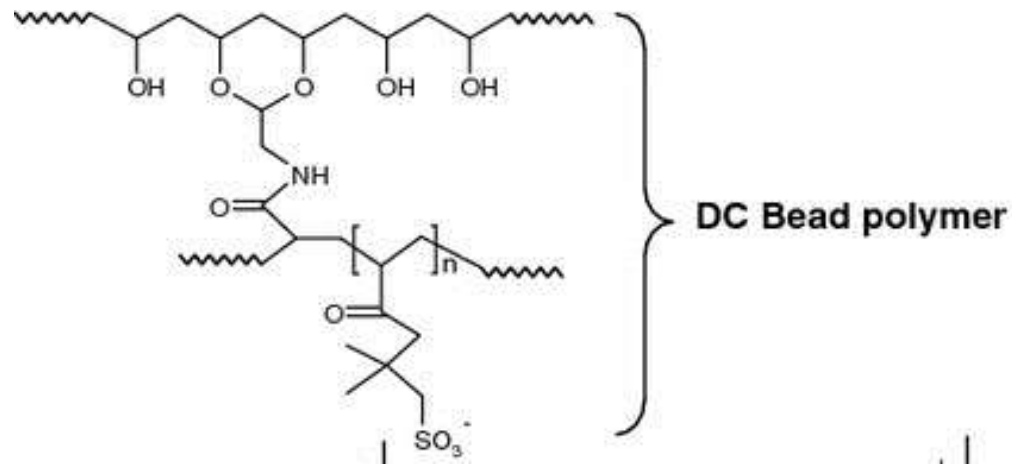


Doxorubicin-Related Side Effects

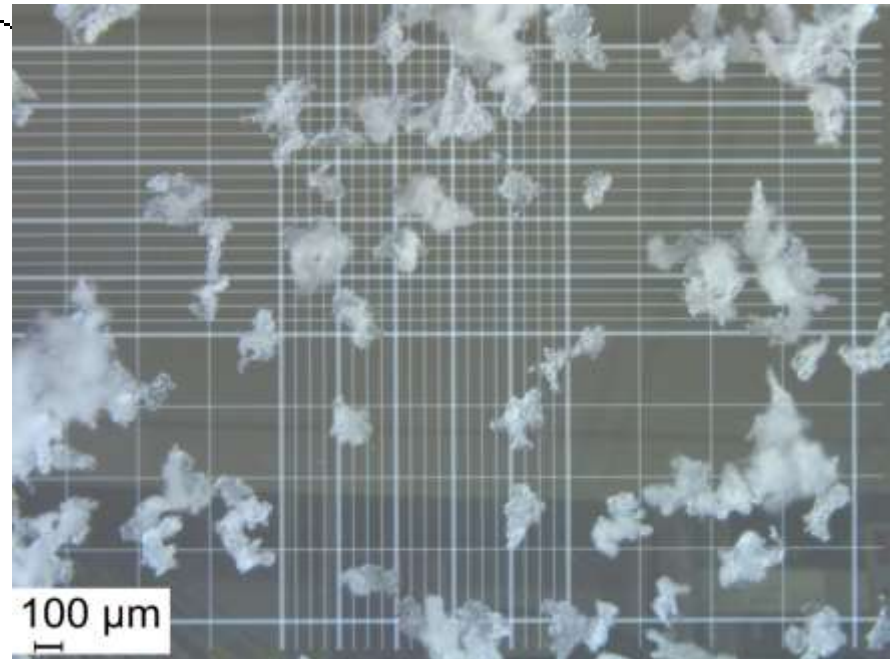


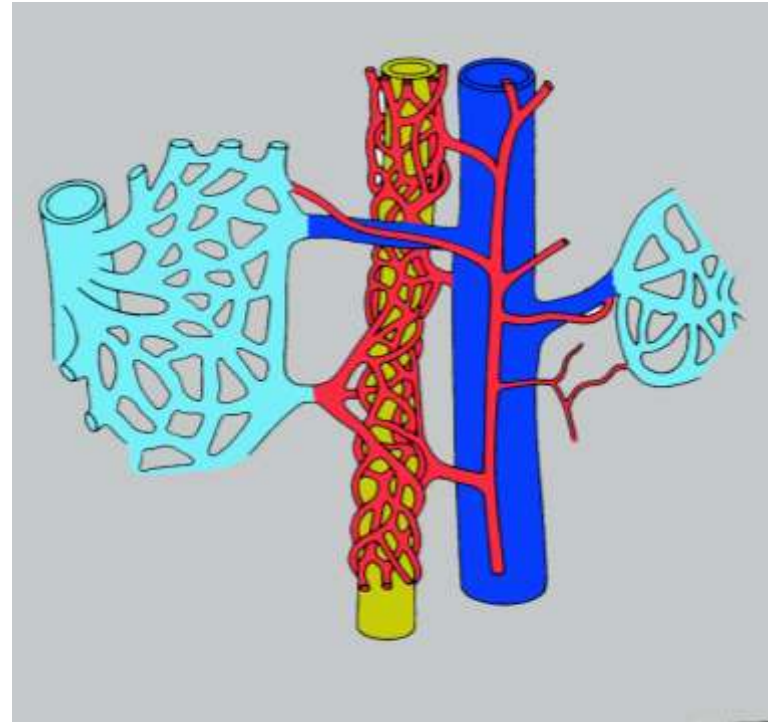
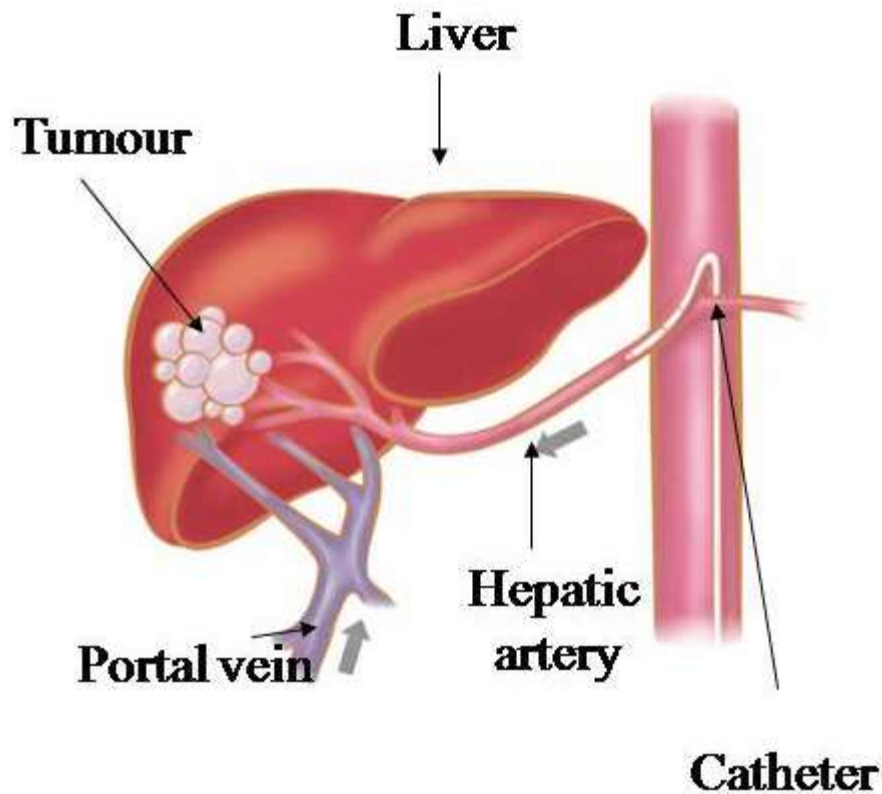
DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid
Material	Permanent	Temporary



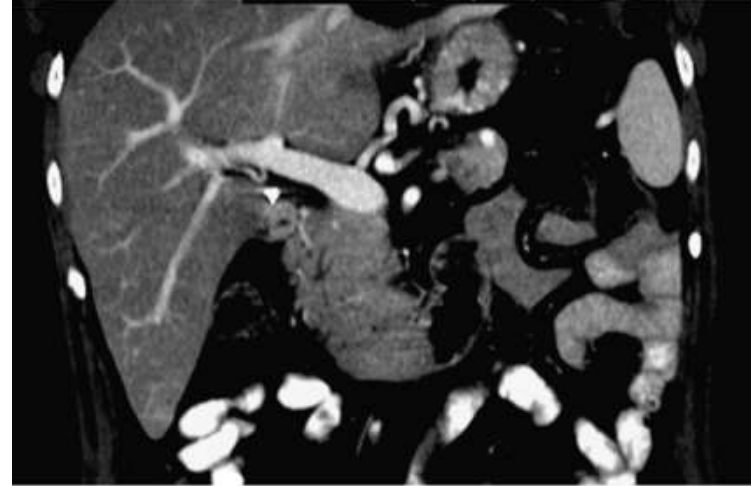
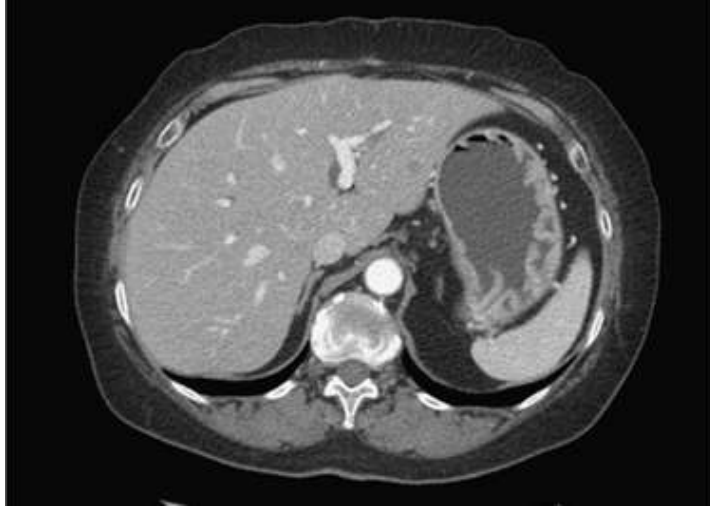
- ✓ Polyvinyl alcohol
- ✓ Contour® (Boston Scientific)
- ✓ **Permanent embolic material**
- ✓ Bronchial artery embolization (hemoptysis)





- ✓ Liver dual blood supply
- ✓ Bile duct – dominantly fed by peribiliary plexus (artery)
- Hepatic artery occlusion by permanent embolic material
→ biliary complication!!

**Liver/biliary injuries following chemoembolisation
of endocrine tumours and hepatocellular carcinoma:
Lipiodol vs. drug-eluting beads**



	<u>NET-group (n = 278)</u>		<u>HCC-group (n = 198)</u>	
	Lipiodol-TACE (n = 152)	DEB-TACE (n = 126)	Lipiodol-TACE (n = 142)	DEB-TACE (n = 56)
<u>Dilated bile duct (n = 48)</u>	10 (6.6)	25 (19.8)	3 (2.1)	10 (17.9)
Lobar (n = 4)				
Sectorial (n = 1)				
Segmental/subsegmental (n = 43)				
Unique (n = 34)/Multiple (n = 14)				
<u>Portal vein narrowing (n = 19)</u>	4 (2.6)	9 (7.1)	2 (1.4)	4 (7.1)
Lobar (n = 1)				
Sectorial (n = 6)				
Segmental/subsegmental (n = 12)				
Unique (n = 15)/Multiple (n = 4)				
<u>Portal vein thrombosis (n = 23)</u>	1 (0.7)	15 (11.9)	2 (1.4)	5 (8.9)
Lobar (n = 0)				
Sectorial (n = 2)				
Segmental/subsegmental (n = 21)				
Unique (n = 21)/Multiple (n = 2)				
<u>Biloma/liver infarct (n = 17)</u>	3 (2)	13 (10.3)	1 (0.7)	0
Mean size, cm (SD): 3.9 (1.9)				
Sessions with at least one liver/biliary injury, n	14 (7.2)	45 (35.7)	6 (4.2)	17 (30.4)

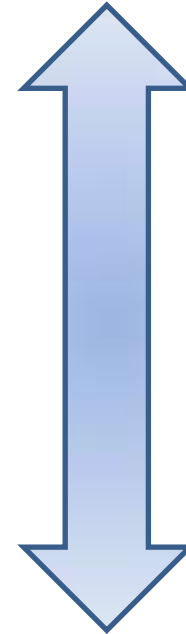
DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid
Material	Permanent	Temporary
Size	medium	Small + Large

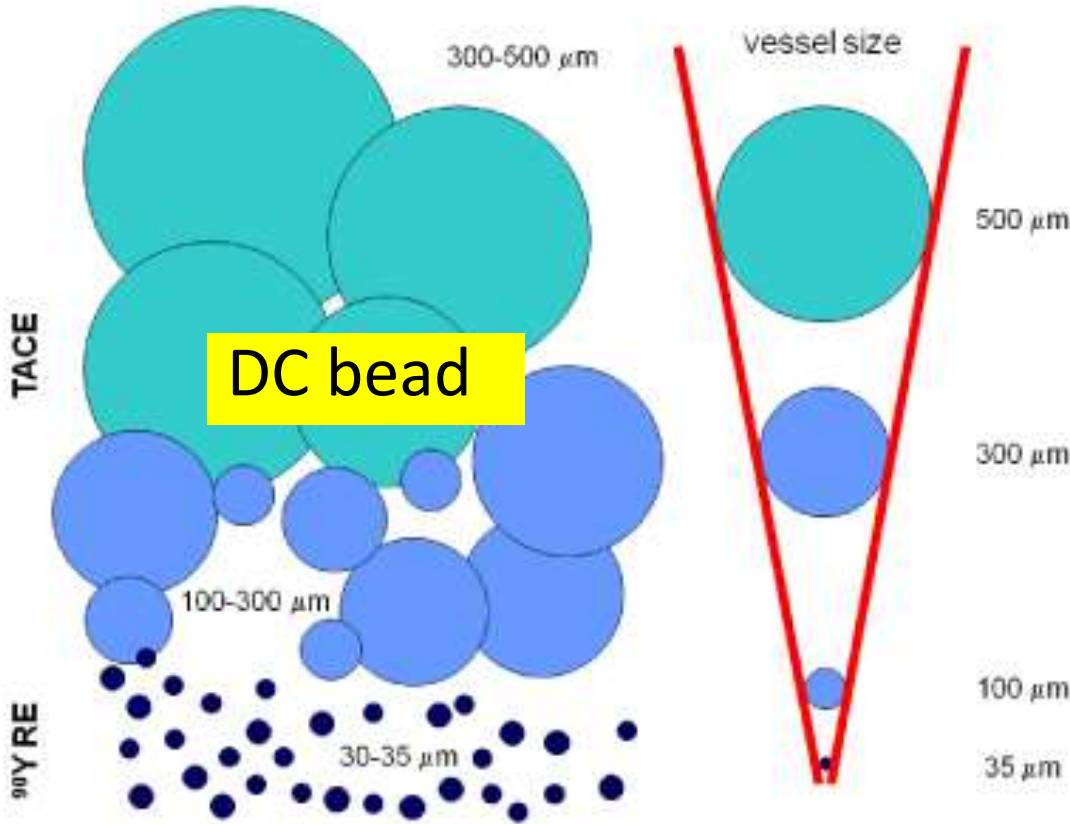
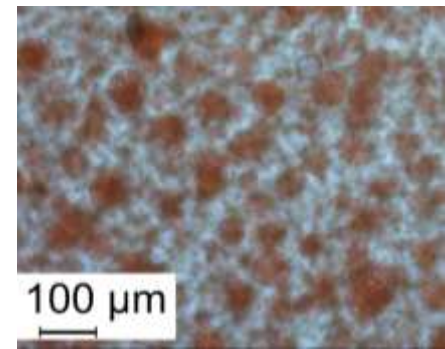
Size



Gelfoam particle



Lipiodol

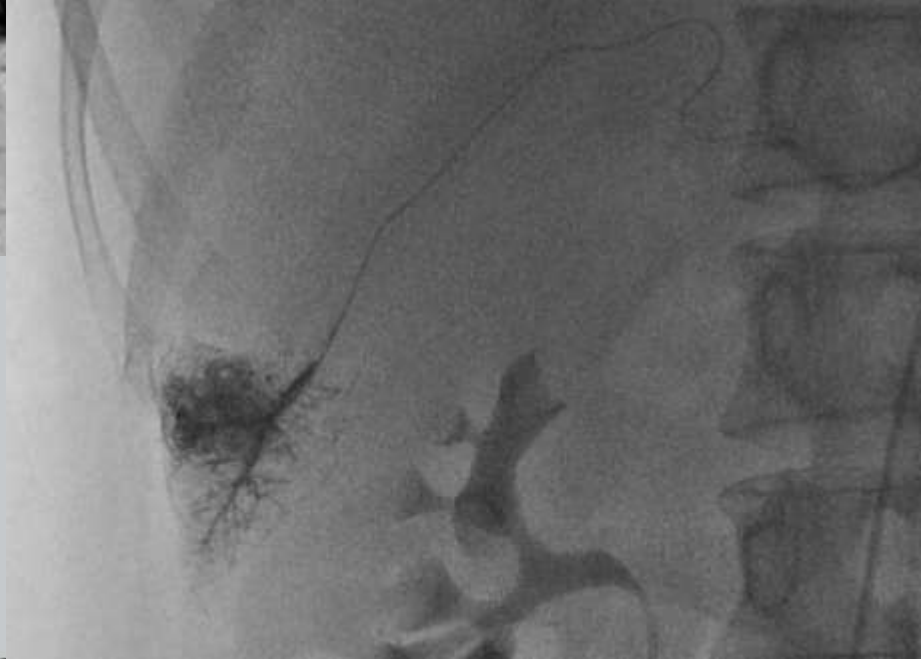
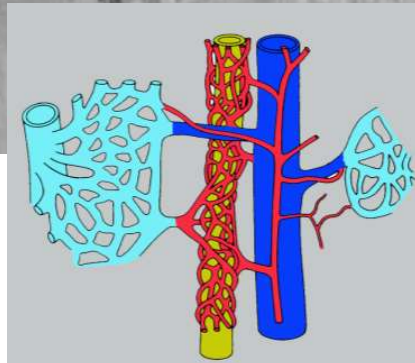
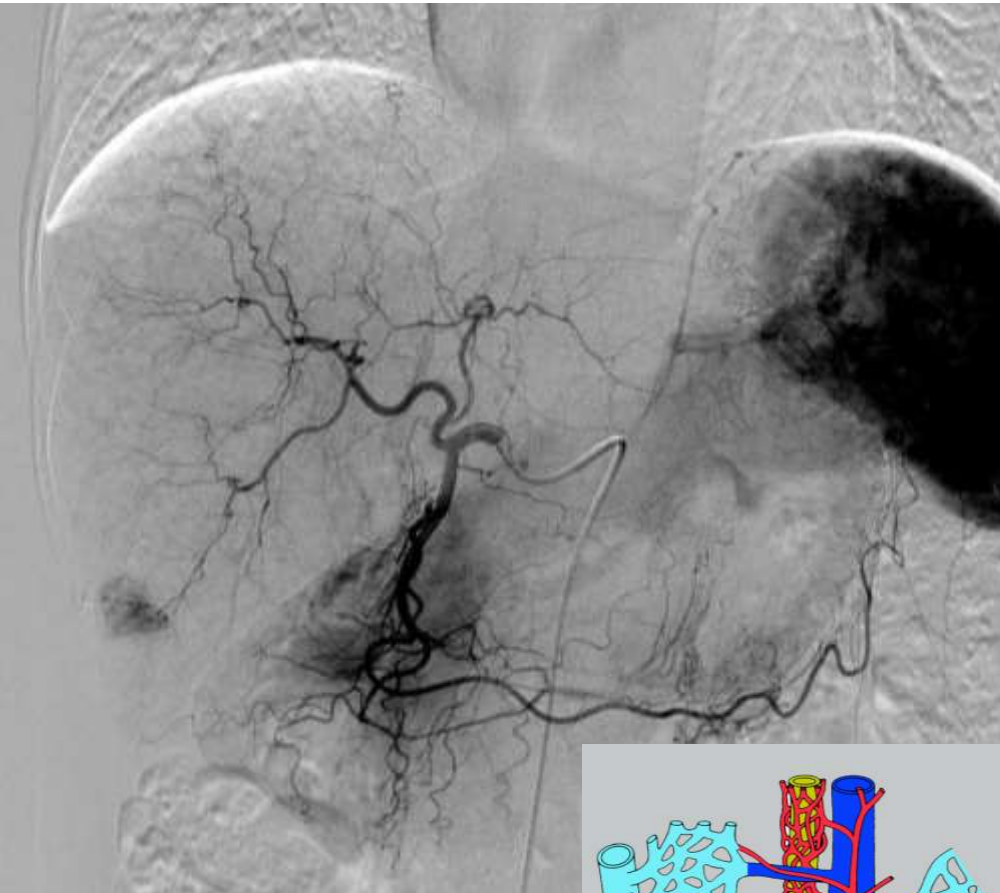


DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid
Material	Permanent	Temporary
Size	medium	Small + Large
Embolized vessel	Artery	Artery + PV

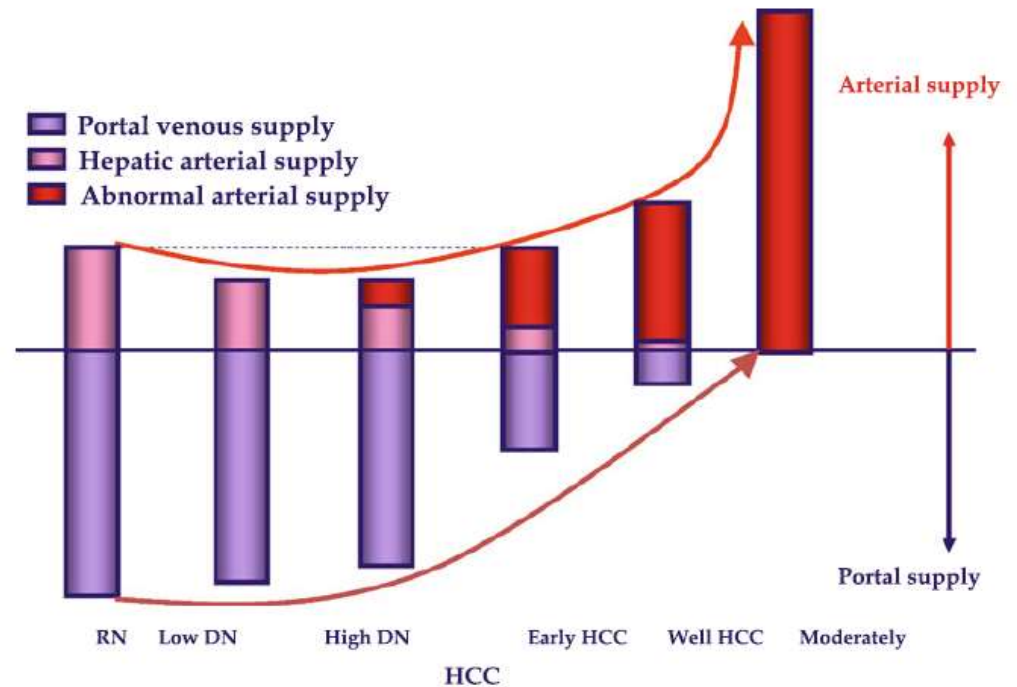
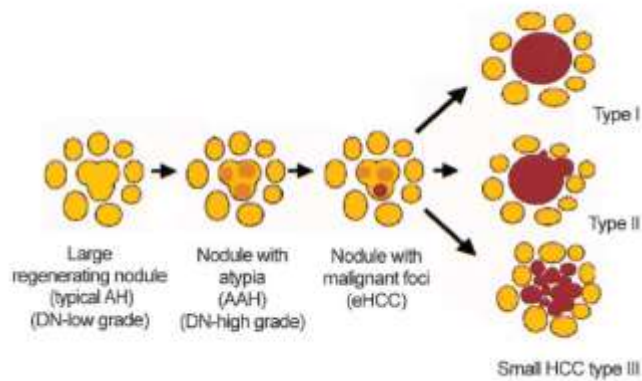
- Embolized Vessel

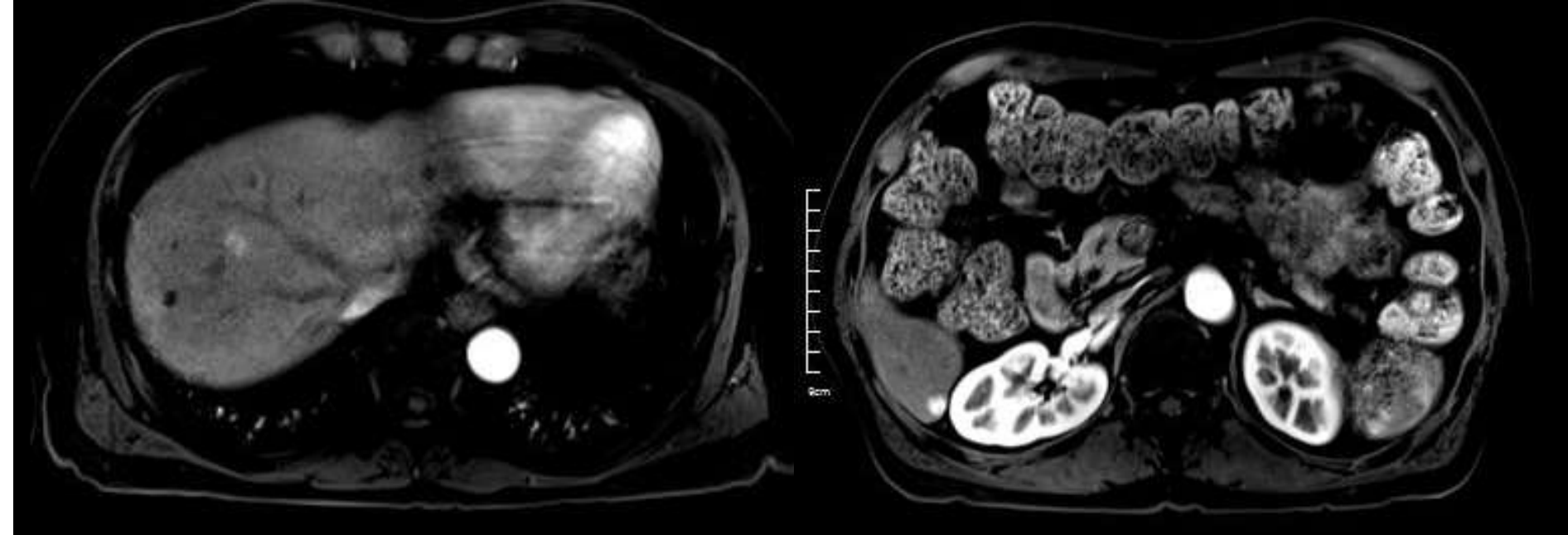
- cTACE : hepatic artery + portal vein
- DEB-TACE : hepatic artery



Blood Supply of HCC

- Multi-step hepatocarcinogenesis

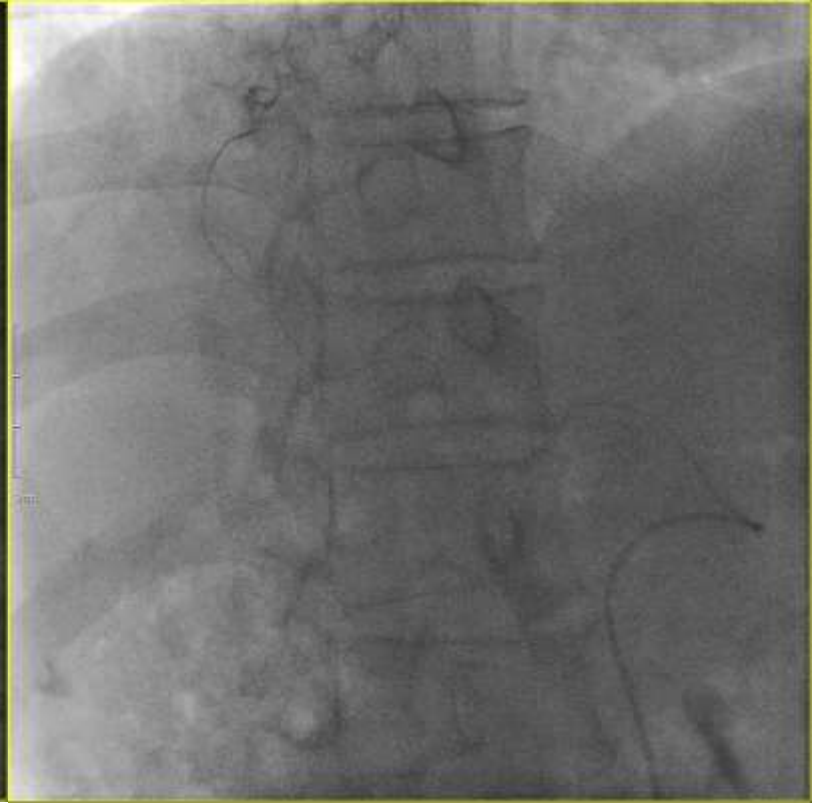
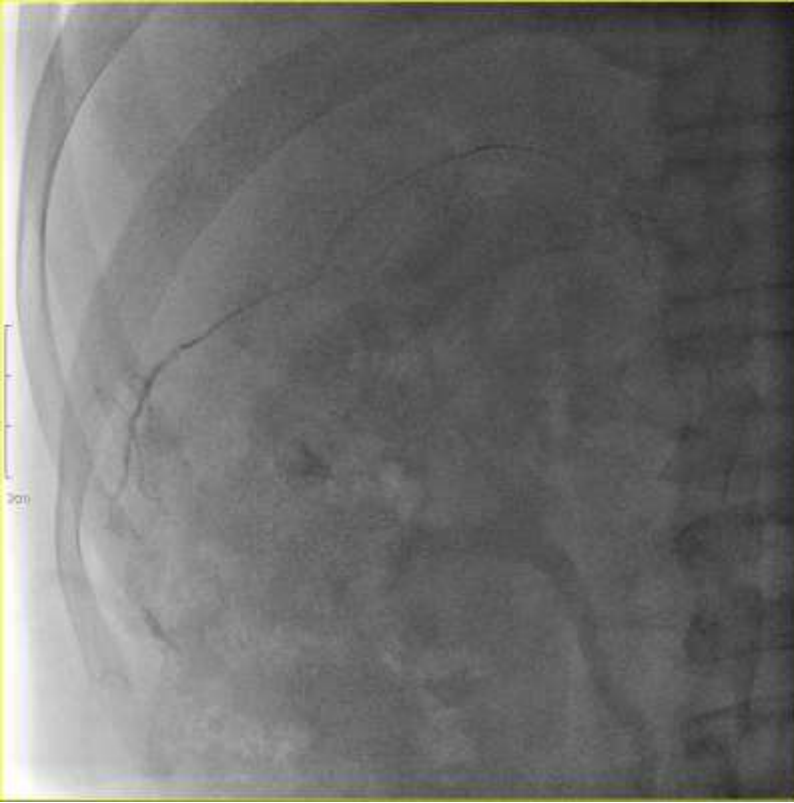


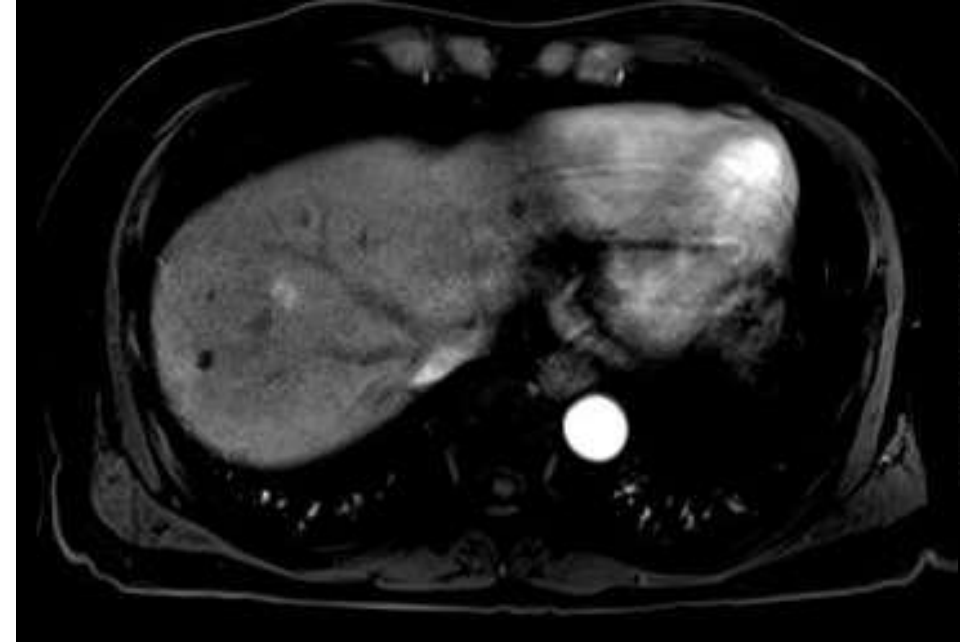


- 61/M, Child-Pugh A5
- Small Two nodules on MR

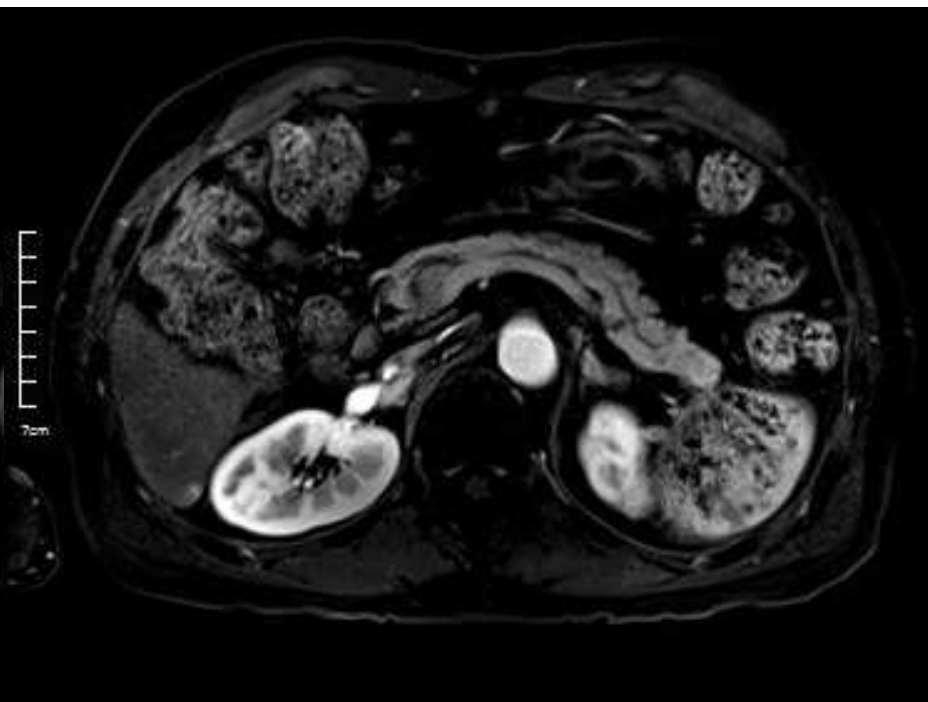
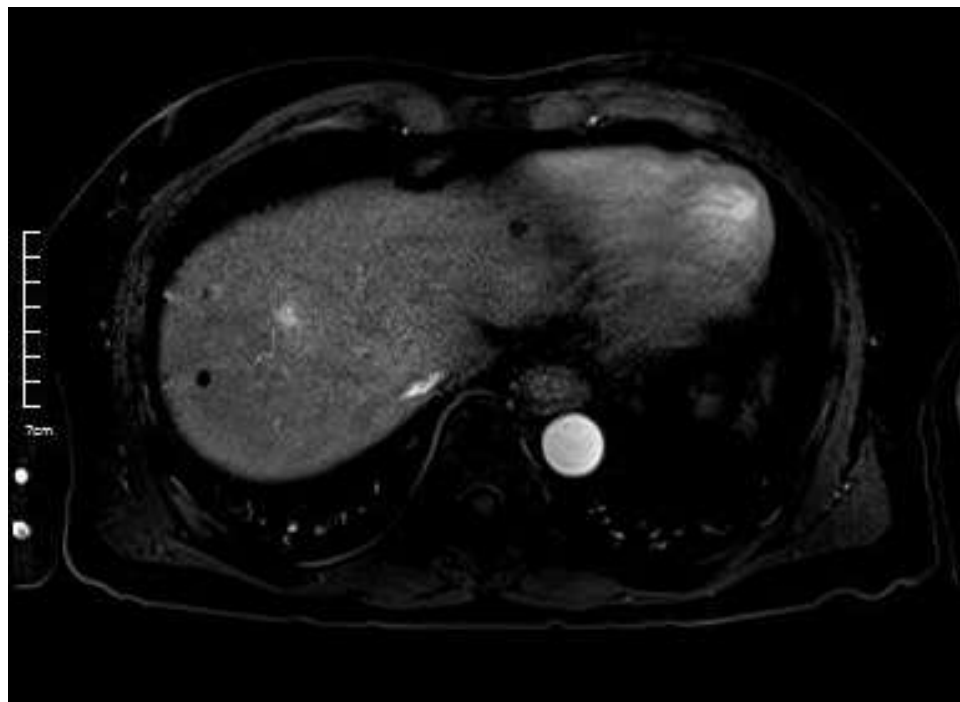


- DC bead 100-300





➤ 3 months later

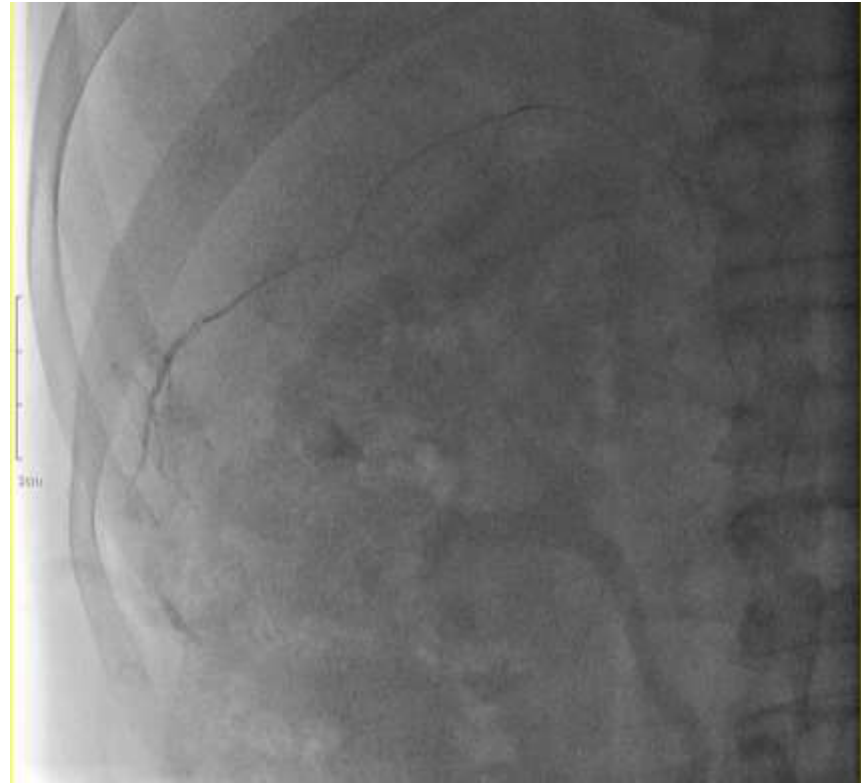


DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid
Material	Permanent	Temporary
Size	medium	Small + Large
Embolized vessel	Artery	Artery + PV
Target vessel	Up to subsegmental	Up to sub-subsegmental

➤ DC bead

- Avoid catheter wedging
- Target artery $>$ microcatheter



➤ Lipiodol

- catheter wedging doesn't matter
- Target artery \geq microcatheter



DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	rapid
Material	Permanent	Temporary
Size	medium	Small + Large
Embolized vessel	Artery	Artery + PV
Target vessel	Up to subsegmental	Up to sub-subsegmental
End-point	Near-stasis	Complete stasis

PostEmbolization Syndrome(PES)

- DC bead << Lipiodol



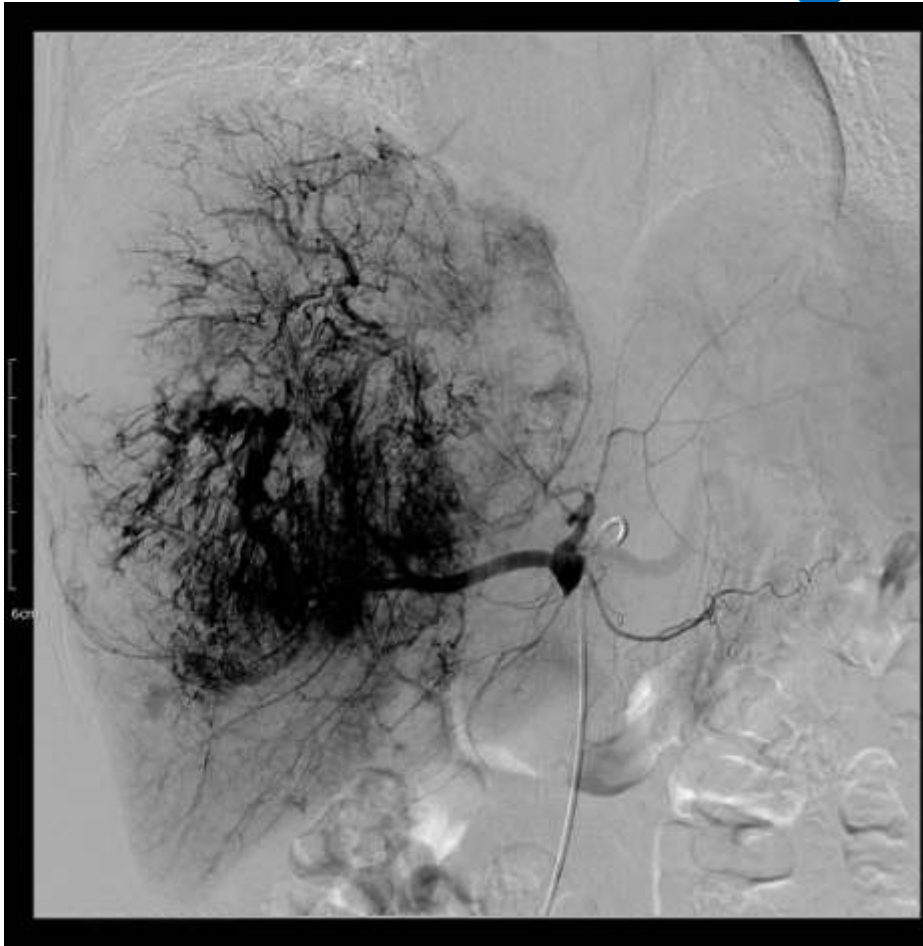
DC Bead vs Lipiodol

	DC bead	Lipiodol + Gelfoam
Drug release	sustained	Rapid
Material	Permanent	Temporary
Size	medium	Small + Large
Embolized vessel	Artery	Artery + PV
Target vessel	Up to subsegmental	Up to sub-subsegmental
End-point	Near-stasis	Complete stasis
Dose limit	2 vial	Lipiodol (15cc) Gelfoam (no limit)

Large tumor



Large tumor



Before DEB-TACE



After DEB-TACE
(300-500 & 500-700)

Large tumor



2 weeks

Tumor response?

➤ DEB-TACE \approx cTACE

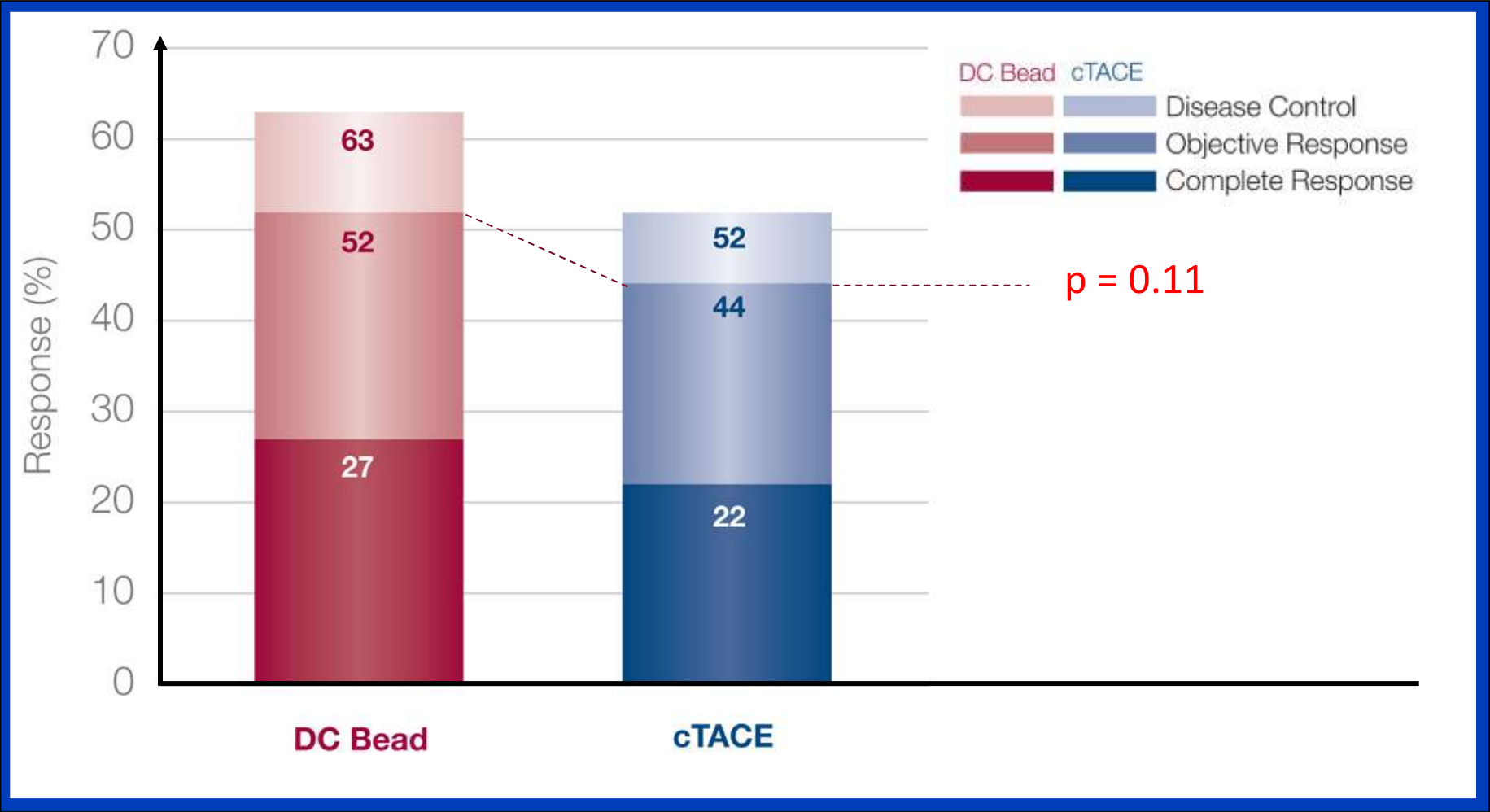
- Lammer J, et al. Prospective randomized study of doxorubicin-eluting-bead embolization in the treatment of hepatocellular carcinoma: results of the PRECISION V study. *Cardiovasc Intervent Radiol*. 2010 Feb;33(1):41-52.
- Sacco R, et al. Conventional versus doxorubicin-eluting bead transarterial chemoembolization for hepatocellular carcinoma. *J Vasc Interv Radiol*. 2011 Nov;22(11):1545-52.
- Gao S, et al. Doxorubicin-eluting bead versus conventional TACE for unresectable hepatocellular carcinoma: a meta-analysis. *Hepatogastroenterology*. 2013 Jun;60(124):813-20

➤ DEB-TACE > cTACE

- Song MJ, et al. Comparative study between doxorubicin-eluting beads and conventional transarterial chemoembolization for treatment of hepatocellular carcinoma. *J Hepatol*. 2012 Dec;57(6):1244-50.
- Song MJ, et al. Drug-eluting bead loaded with doxorubicin versus conventional Lipiodol-based transarterial chemoembolization in the treatment of hepatocellular carcinoma: a case-control study of Asian patients. *Eur J Gastroenterol Hepatol*. 2011 Jun;23(6):521-7.

Precision V

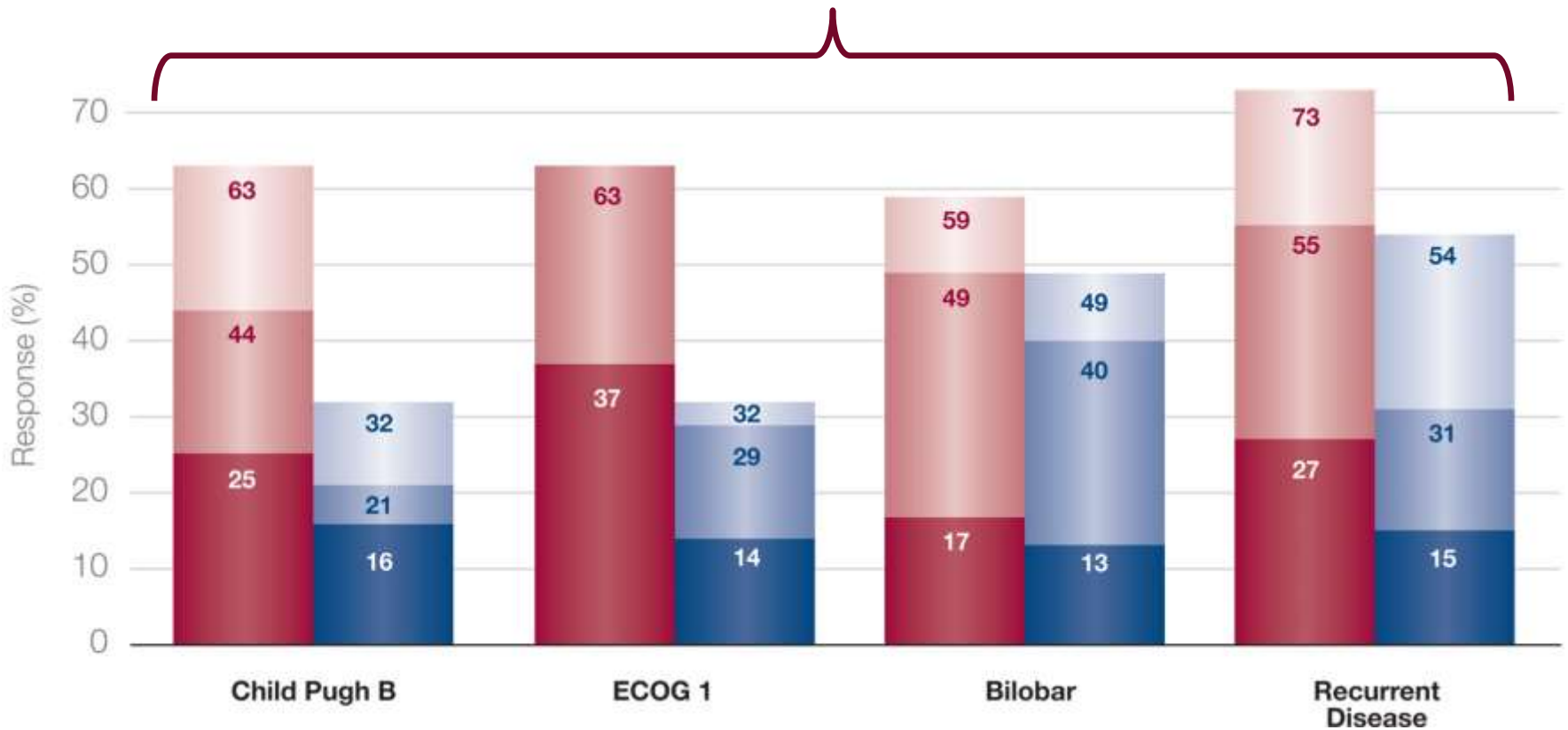
Tumor Response at 6 Months



Precision V

Tumor Response: Subgroup Analysis

DC Bead showed significant advantage in patients with negative prognostic factors for objective response ($p=0.038$) and disease control ($p=0.026$)



Tumor response?

➤ DEB-TACE \approx cTACE

- Lammer J, et al. Prospective randomized study of doxorubicin-eluting-bead embolization in the treatment of hepatocellular carcinoma: results of the PRECISION V study. Cardiovasc Intervent Radiol. 2010 Feb;33(1):41-52.
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- ✓ -->Non-randomized study.
- ✓ -->Further study is needed.

DC Bead Indication

➤ 보험 기준

- Tumor size \leq 10cm
- Child-Pugh B
- NOT infiltrative
- Vascular invasion (-)
- Massive AP shunt (-)
- Biloenteric anastomosis (-)

➤ Relative Contraindication

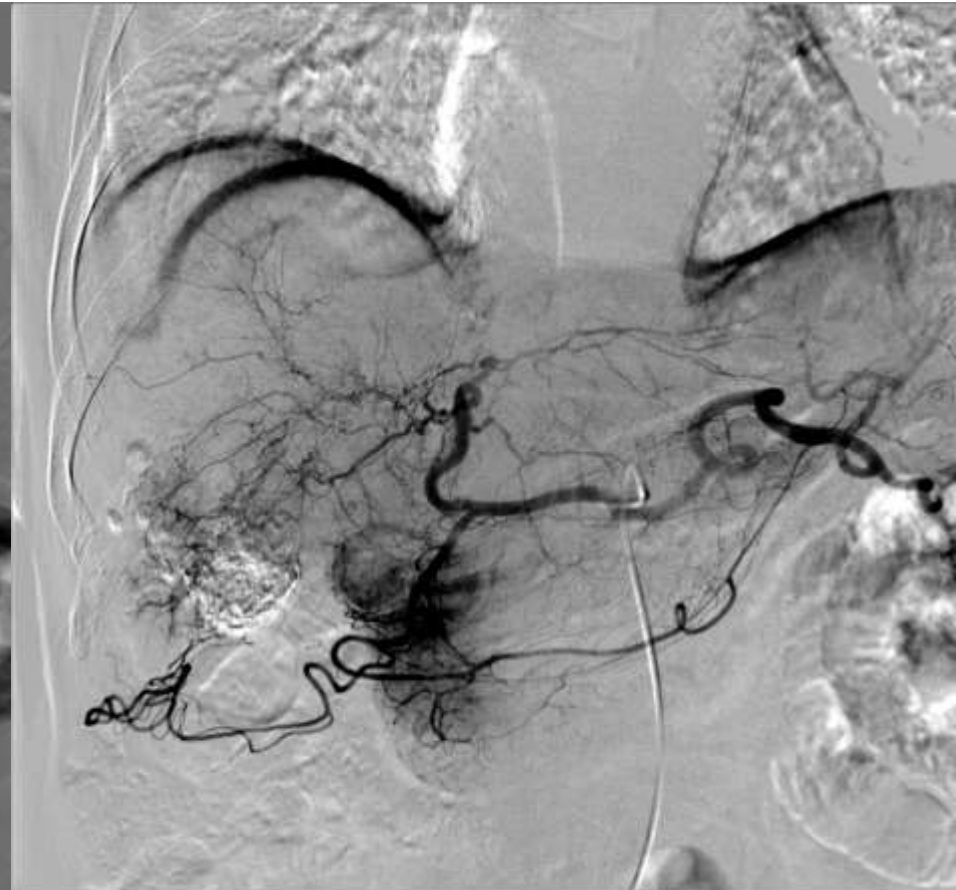
- Progression after cTACE
- Hepatic artery injury by repeated TACE

78/M, HCC rupture at initial presentation

1st TACE : Lipiodol

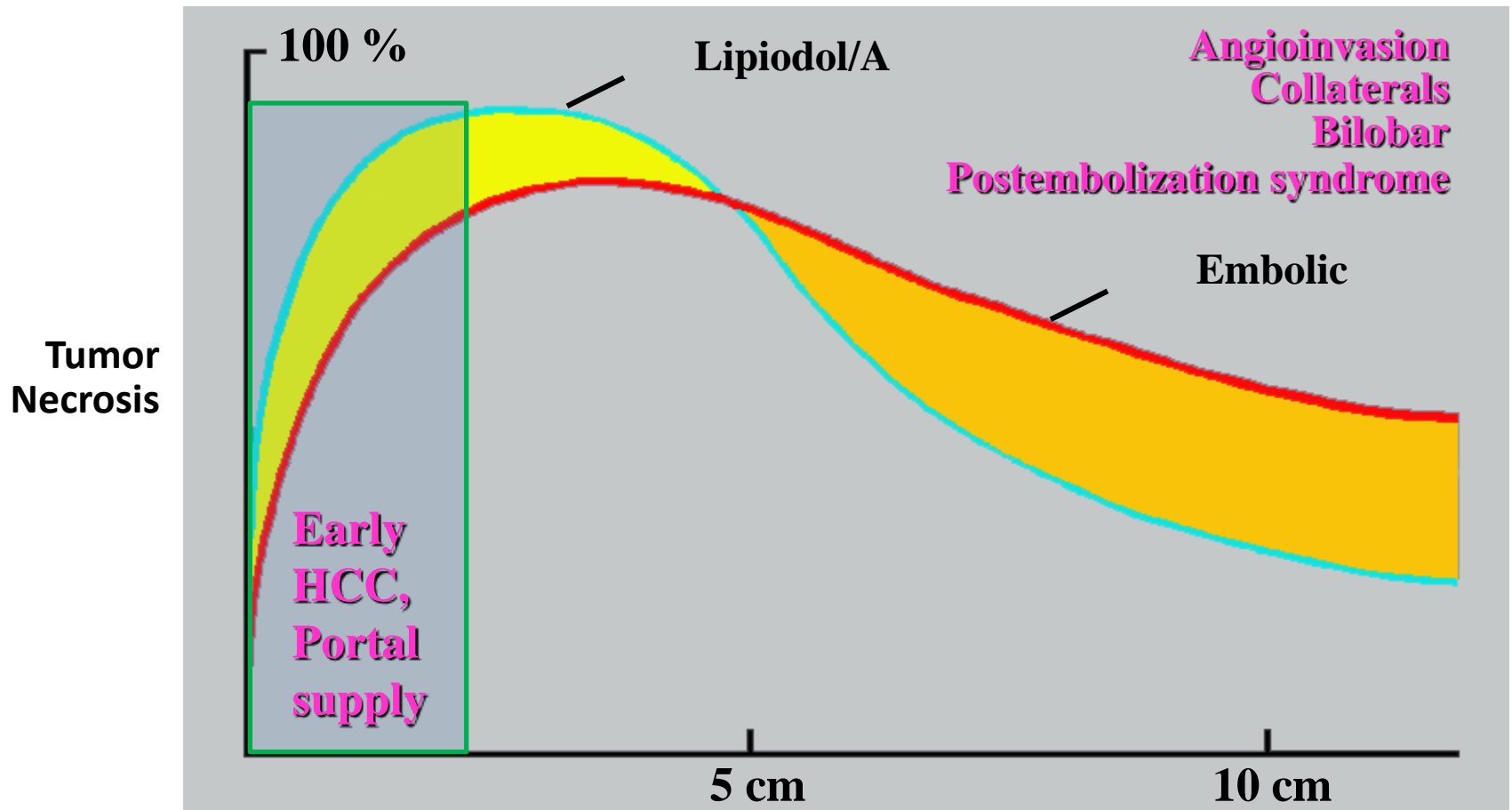


2nd TACE : Rt HA occlusion



DC bead : can not reach tumor via fine collateral vessel,
may cause biliary Cx

Cytotoxic Effect vs Ischemic Effect



DC bead vs cTACE

	Small <3cm	Medium 3 – 7cm	Large >7cm
	cytotoxic	Cytotoxic/Ischemic	Ischemic
Cytotoxic effect	Lipiodol >= DC bead	DC bead > Lipiodol	DC bead > Lipiodol
Ischemic effect	DC bead > Gelfoam	DC bead >= Gelfoam	Gelfoam > DC bead
DC bead indication	Not recommend	Better outcome Less PES	Less PES

Most Important Factor



**Thank you
for your attention !**

