Real Practical Process before and during Treatment for HCC:
Transarterial therapy

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Contents

- Transarterial therapy: cTACE, DEB-TACE, TARE
- Why superselective TACE?
- Real process of superselective TACE
  - CBCT guided TACE
- Post TACE management: complications of TACE
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- Post TACE management: complications of TACE
Conventional TACE

- Lipiodol
  - Iodized poppy seed oil
  - Lymphangiography (1920s~)
    - Contrast media \(\rightarrow\) Cheap
  - TACE for HCC (1980s~)
    - Uptake in HCC
    - Semi-fluid embolic material
    - Occlusion of hepatic arteriole at 10\(\mu\)m level
Conventional TACE

- Lipiodol as a drug-delivery system
  - Mixed with anti-cancer drug
  - Water-in-oil emulsion
    - Doxorubicin (water) in Lipiodol (oil) droplet
Lipiodol as a drug-delivery system

- Mixed with anti-cancer drug
- Water-in-oil emulsion
  - Doxorubicin (water) in Lipiodol (oil) droplet

→ Drug delivery vehicles !!!
Conventional TACE

- **Infusion of Lipiodol-based emulsion**
  - Hepatic artery $\rightarrow$ peribiliary vascular plexus & tumor drainage vein $\rightarrow$ portal vein
  - **Dual embolization!!!**
    - Medical hepatectomy effect
    - Angiographical subsegmentectomy
Drug-eluting bead (DEB)

- Non-absorbable embolic microsphere
- Negative charges to ionically bind positively charged drugs → Loading and release of the drug
Advantage in pharmacokinetics

No significant difference in the therapeutic outcome
- OS, PFS, TTP

Advantage in postembolization syndrome
- Less pain, shorter hospitalization

Controversy in hepatotoxicity & systemic side effect

Radioembolization (TARE)

❖ Y-90 (Yttrium) microsphere
  ▪ 20–60 micron, pure beta emitter

❖ Anticancer effect: high dose tumor radiation
  ▪ Not embolization…misnomer?
    – Selective Internal Radiation Therapy (SIRT)
    – Microsphere brachytherapy implantation

Internal RT = Brachytherapy
Radioembolization (TARE)

- **SR and meta-analysis: vs TACE**
  - No phase III RCT
  - Small phase II RCT, retrospective series
  - Consensus
    - Overall survival: TACE = TARE
    - TTP: TACE ≤ TARE
    - Quality of life, PES: TACE < TARE

- **Disadvantage**
  - Less feasible
    - Complicated process of preparing TARE
    - Radiation pneumonitis
  - Limitation of cumulative lung dose in multi-sessions
  - Very expansive
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Two landmark RCT: cTACE vs Control

- Unresectable, non-metastasis
  - BCLC: Intermediate HCC (BCLC staging Ver.1, 1999)
  - Hong Kong: Including branch portal vein invasion
- 2-year overall survival: 63% (BCLC), 31% (Hong Kong)

BCLC vs Hong Kong

HCC in cirrhotic liver

Intermediate stage (B)
- Multinodular, unresectable
- Preserved liver function\(^1\), PS 0

Advanced stage (C)
- Portal invasion/extrahepatic spread
- Preserved liver function\(^1\), PS 1\(^2\)-2

Terminal stage (D)
- Not transplantable HCC
- End-stage liver function
- PS 3-4

Locally Advanced HCC

- Chemoembolization
  - >2.5 years
- Systemic therapy\(^5\)
  - ≥10 months
- BSC
  - 3 months

TACE is a double-edged sword!!!

- **Pro:** tumor control
- **Con:** deterioration of liver function, complications
Why Superselective TACE?

❖ HCC compared to other solid tumors
  - Underlying liver cirrhosis
  → Frequent recurrence, liver function decrease

❖ Major determinants of long-term survival

Local tumor control
(Tumor number and size) VS Preserving liver function
(Child–Pugh class, portal HT)
Why Superselective TACE?

- Superselective TACE through tumor-feeding artery
  - Maximize therapeutic efficacy
    - Locally aggressive chemoembolization
  - Minimize normal parenchyma injury

→ Superselective TACE is considered as an advanced therapeutic procedure for radical treatment!!!
Why Superselective TACE?

Technical Advances for Selective TACE

- Non-selective TACE of the whole liver parenchyma
  → Subsegmental approach with microcatheter system

- Conventional 2D angiography guidance
  → 3D imaging navigation with CBCT angiography
Superselective TACE

- M/63 with 3.8cm HCC, Lipiodol, gelfoam particles
Superselective TACE for Small HCC

- M/60 with 1cm HCC

Immediate | 13 months
Superselective TACE for Large HCC

- M/55 with 10.6cm HCC

1 month after TACE #1: AFP : 1395.7 → 22.1ng/ml

1 month after TACE #2: AFP : 22.1 → 3.9ng/ml
Extended right hemihepatectomy:

Totally necrotic nodule with

1) post-chemoembolization status with no residual tumor
2) size: 8.0x7.5x7.0cm
3) clear resection margin (safety margin: 0.8cm)
Superselective TACE for Multiple HCCs

- M/61 with <2.7 cm, 5 tumors
Superselective TACE for Multiple HCCs

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M/49, Large infiltrative HCC with MPV invasion
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M/62
- HBV-LC, three nodular tumors on CT

PMHx
- s/p S8 segmentectomy
  Pathology: 3cm single HCC without vascular invasion
- s/p TACE #1

Liver function, tumor marker
- Child A5, AFP 2.9
Real Process of Superselective TACE

- Preparing for TACE
  - CT/MR image review
    - Location of the HCC → segmental anatomy
    - Access route → vascular anatomy
Real Process of Superselective TACE

❖ Preparing for TACE
  - Informed consent
  - Skin prep: Inguinal area (Rt CFA)

❖ Premedication
  - Antiemetic: Ondansetron
  - Pain control: Fentanyl, Midazolam
  - Antibiotics: High risk of biliary complication
  - Steroid (western country)
Real Process of Superselective TACE

- Vascular access
  - Rt CFA (m/c)
Real Process of Superselective TACE

- Vascular access
  - Trans-radial approach
Real Process of Superselective TACE

- Angiography of celiac trunk & SMA
  - Delineation of anatomical variation
  - SMA portography
Real Process of Superselective TACE

- Selective angiography
  - Coaxial technique
  - Rotation of C-arm: AP, RAO, LAO, Cranial, Caudal
  - Demonstration of tumors and tumor feeders
Real Process of Superselective TACE

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Real Process of Superselective TACE

- Selective TACE
  - Lipiodol/Adriamycin mixture
  - Gelfoam particles
Real Process of Superselective TACE

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Real Process of Superselective TACE

- Checking Lipiodol uptake
  - Spot image
  - Lipiodol CT
CBCT Guided Superselective TACE

- M/59
  - s/p TACE #1~#4
  - s/p RFA, PEIT, Proton Tx
CBCT Guided Superselective TACE

- CBCT scanning
  - Rotational hepatic arteriography
  → 3D image acquisition
CBCT Guided Superselective TACE

- Rotational hepatic arteriography
- 3D image acquisition
CBCT Guided Superselective TACE

- Image review
CBCT Guided Superselective TACE

- Image review
CBCT Guided Superselective TACE

- Real time navigation system
CBCT Guided Superselective TACE

- Real time navigation system
CBCT Guided Superselective TACE

- Microcatheter navigation
CBCT Guided Superselective TACE

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- Microcatheter navigation
CBCT Guided Superselective TACE

- Chemoembolization
CBCT Guided Superselective TACE

- Lipiodol CT
Process of TARE

- **Treatment**
  - Catheter positioning
    - Considering the simulation using 99mTc-MAA
  - Infusion of Y-90 microsphere
Process of TARE

- Post-treatment imaging
  - Y90 PET (better resolution), bremsstrahlung scan
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Complications of TACE

- Iatrogenic vascular injury by catheter manipulation
- Toxicity of chemotherapeutic agent vs. DEB-TACE
- Lipiodol: pulmonary oil embolism, paradoxical embolism
- Post-embolization syndrome
- Biliary injury and ascending infection
- Acute liver failure, hepatic infarction

- Reflux of chemoembolic materials into nontarget organ
  - Nonhepatic arteries originating from hepatic artery (Gastric artery, cystic artery, falciform ligament artery)
  - Extrahepatic collateral supply
Complications of TACE

- Iatrogenic vascular injury by catheter manipulation
- Toxicity of chemotherapeutic agent vs. DEB-TACE
- Lipiodol: pulmonary oil embolism, paradoxical embolism

Complications of TACE

- **Post-embolization syndrome**
  - Causes: parenchymal ischemia, capsular irritation
  - Symptoms: nausea, vomit, abdominal pain, fever → Self-limiting
  - DEB-TACE and TARE have advantage over cTACE.
Complications of TACE

- **Biliary injury and ascending infection**
  - The bile ducts are supplied by the hepatic artery only.
  - Biloma, liver abscess
  - Risk factors: Bilio-enteric anastomosis, biliary obstruction
  - Be careful in Pts with old age, poor performance, or DM

- **Acute liver failure, hepatic infarction**
  - Most serious complication
  - Risk factors: poor liver function, hyperbilirubinemia

M/56

Two weeks later, Fever(+)

Five months
Non-target Embolization

- Nonhepatic arteries originating from hepatic artery
  - Gastric artery, cystic artery, falciform ligament artery
Non-target Embolization

- TACE through the falciform artery
  - Tumors around the falciform ligament
  - Supraumbilical skin rash, fat necrosis

→ Coil embolization before TACE in large falciform artery
Non-target Embolization

- **TACE through the cystic artery**
  - Supply to the tumor at the gallbladder bed
  - Frequently local tumor recurrence
  - Complication
    - Severe abdominal pain, post-embolization syndrome
    - Cholecystitis, gallbladder infarction

→ Superselective TACE through tumor feeder
Non-target Embolization

- **Extrahepatic collateral supply**
  - Isolated hepatic artery and capsular arterial plexus
  - Potential collateral pathway


s/p NBCA

Stenosis of RIPA os
Non-target Embolization

- **TACE through the RIPA**
  - Most common: 60% of TACE through EHCA in NCC

- **Location**
  - Bare area, near diaphragm
  - Caudate lobe
  - IVC tumor thrombi

- **Complications**
  - **Shoulder pain** – m/c
  - **Pulmonary oil embolism**
    - Systemic-to-pulmonary shunt
Non-target Embolization

- **TACE through the intercostal artery**
  - Tumor feeder – ascending vertical limb
    - Distal to the diaphragmatic insertion
    - Typical hairpin turn around the costochondral junction
  - **Cutaneous complication**
Non-target Embolization

- The RIPA anastomoses with the RIMA...
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THANK YOU