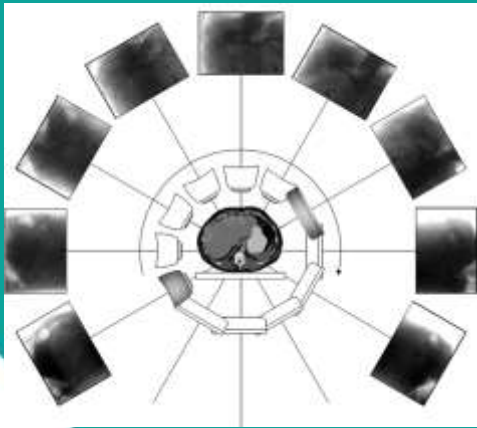




臺北市立萬芳醫院 - 委託臺北醫學大學辦理

Taipei Municipal Wanfang Hospital (Managed by Taipei Medical University)

CBCT vs MDCT: Technical and Clinical Comparison



Angio journal club

報告人: 王鈞右

2025/05/28

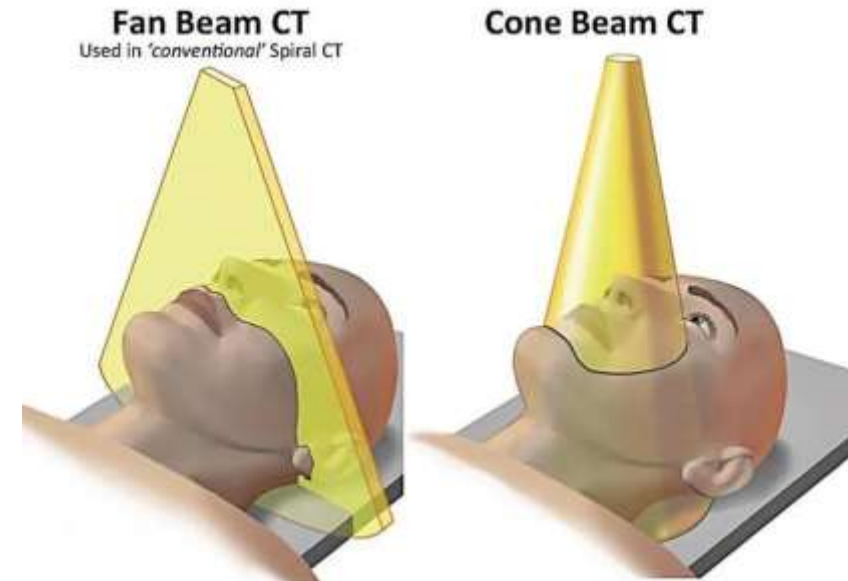
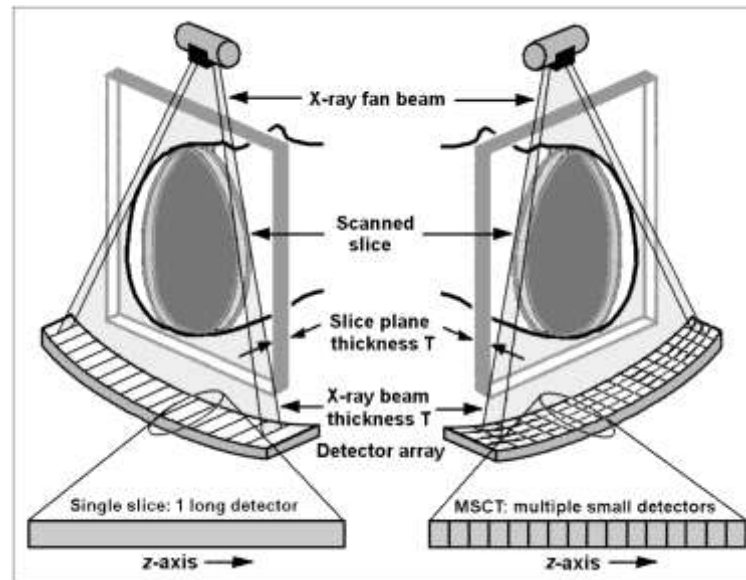


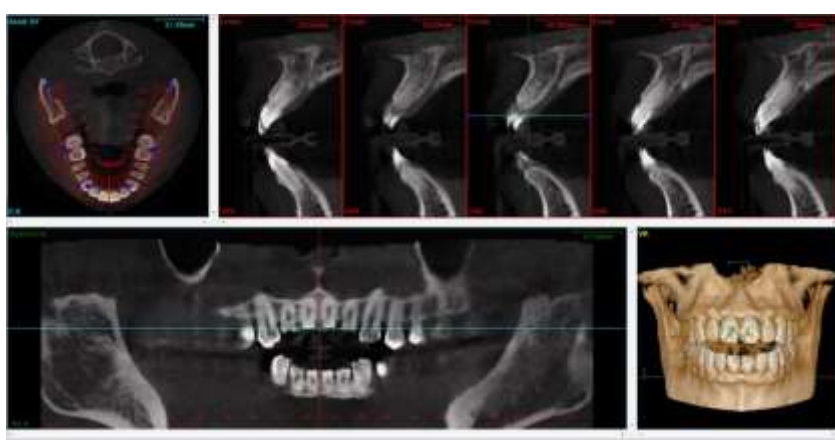
MDCT vs CBCT

- FBCT (Fan-Beam CT)
- MDCT (Multi-Detector CT): Equipped with multiple detector rows for whole-organ volume imaging in single rotation.
- CBCT (Cone-Beam CT): Utilizes cone-shaped X-ray beam with flat-panel detector; designed for small FOV regions and interventional suites.

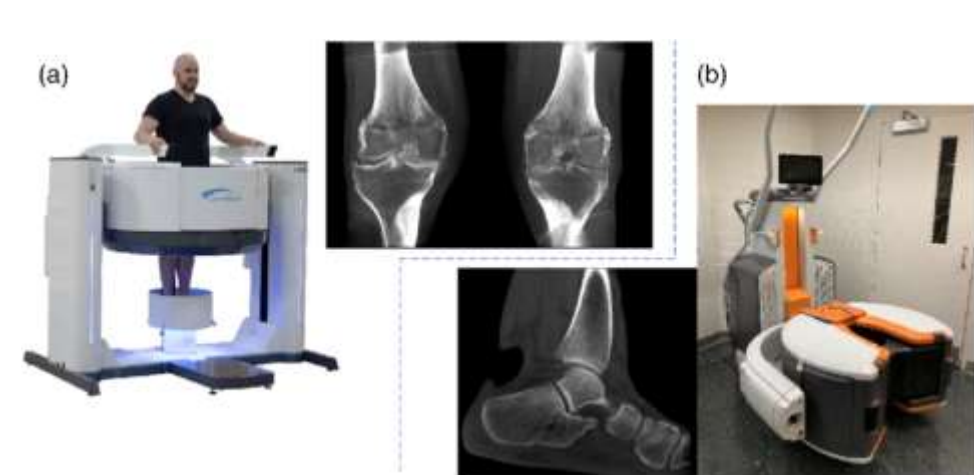


© Koninklijke Philips N.V.

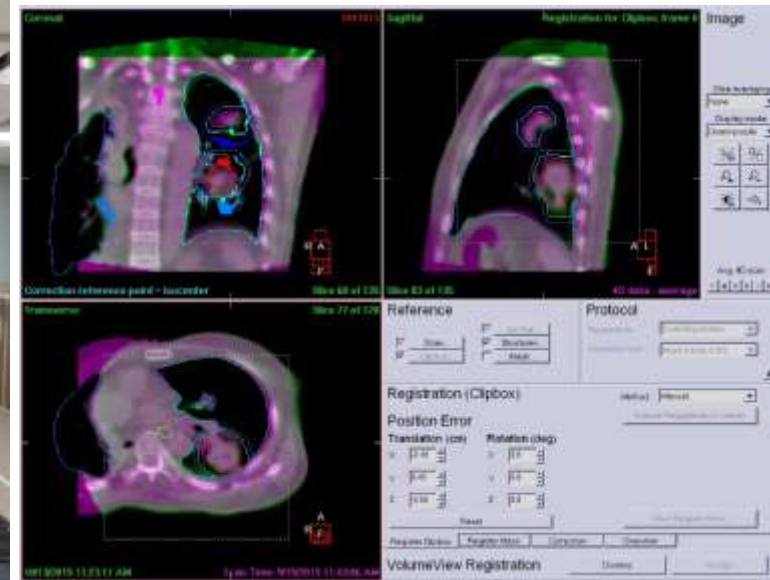
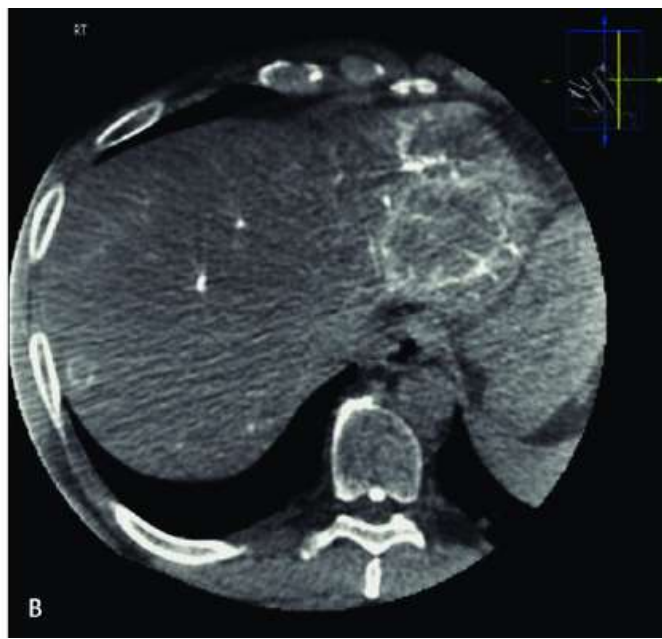




Wikipedia



Journal of Medical Imaging 8(05)



雙和

Varian, A Siemens Healthineers Company

Journal of Vascular and Interventional Radiology, Volume 20, Issue 7, S538 - S544

MDCT vs CBCT

項目	CBCT (Angio、Cath、OR中)	MDCT (診斷型CT機器)
● 使用情境	介入攝影室中即時使用 (如TACE、RFA)	通常用於術前規劃或術後評估
□ 定位與導引功能	可即時獲得3D影像，用於導引針路、血管定位	無法即時導引，需來回移動病人
□ 即時性	即掃即看，減少手術中斷	需移動病人至CT室掃描
▲ 解析度	空間解析度高，適合細小血管與病灶評估	對比解析度高，適合軟組織與大範圍掃描
📺 視野 (FOV)	視野較小，適用於區域性影像 (如肝臟某區)	可涵蓋全腹、胸腹等大範圍
☢️ 輻射劑量	相對較低，但重複掃描時仍需注意	通常較高，尤其是dynamic
👁️ 射束硬化	更易受射束硬化影響(ex:金屬假影)	通常此類假影影響較小
✂️ 應用實例	TACE治療中定位腫瘤、導引導管、治療後立即評估殘存血流	評估肝腫瘤大小、栓塞效果、整體器官變化



Radiology

Impact factor: 6.79 (2015)

Latest Articles | All Issues | Collections ▾ | For Authors ▾ | Diagnosis Please | Multim

Home > Radiology > Vol. 274, No. 2

< PREVIOUS

NEXT >

Reviews and Commentary

How I Do It

How I Do It: Cone-Beam CT during Transarterial Chemoembolization for Liver Cancer

Vania Tacher, Alessandro Radaelli, MingDe Lin, Jean-François Geschwind ✉

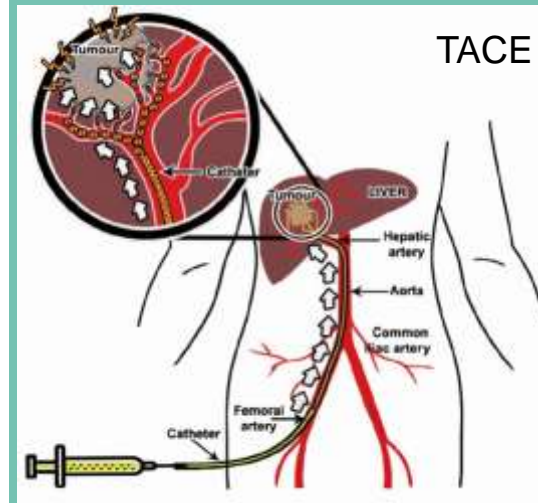
Author Affiliations

- From the Russell H. Morgan Department of Radiology and Radiological Science, Division of Vascular and Interventional Radiology, The Johns Hopkins Hospital, 1800 Orleans St, Baltimore, MD 21287 (V.T., J.F.G.); Department of Interventional X-ray, Philips Healthcare, Best, the Netherlands (A.R.); and Department of Clinical Informatics, Interventional, and Translational Solutions, Philips Research North America, Briarcliff Manor, NY (M.L.).
- **Address correspondence to** J.F.G. (e-mail: jfg@jhmi.edu).

Published Online: Jan 27 2015 | <https://doi.org/10.1148/radiol.14131925>



Vania Tacher, MD



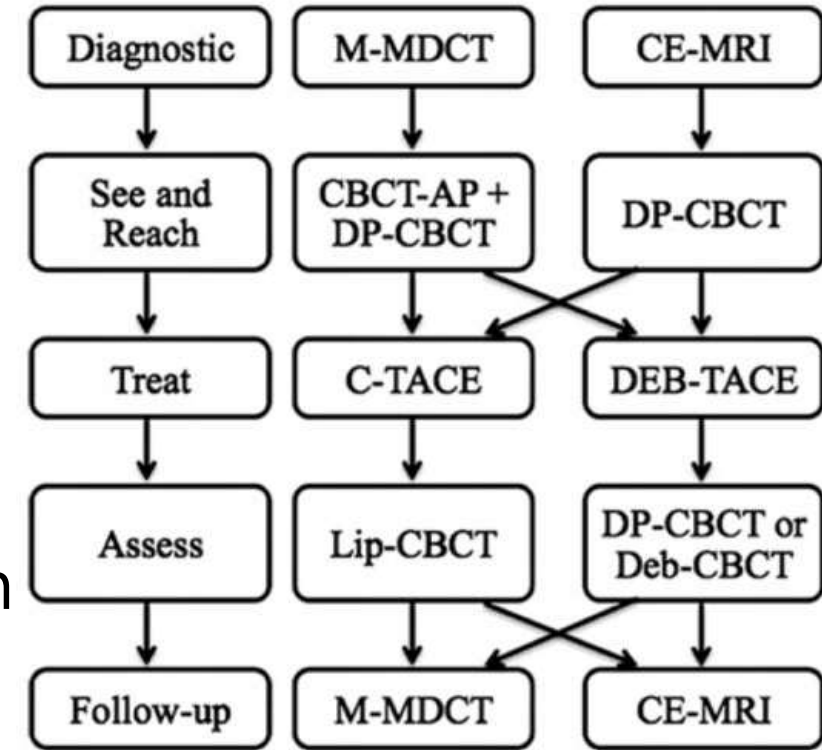
Chin J Cancer Res 2015;27(2):96-121.



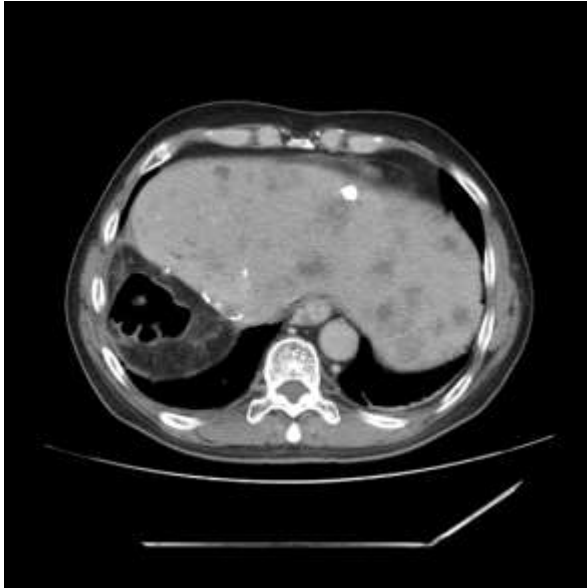
CBCT in TACE Procedures

Key Aspects of CBCT in TACE

- **Intraprocedural 3D Imaging:**
Volumetric images of liver and vasculature
- **"See, Reach, Assess":**
Enhances visualization, navigation, and evaluation
- **Benefits:**
Identifies small lesions; aids in mapping arteries
- **Clinical Impact:**
Linked to enhanced control and improved survival rates
- **Limitation:**
low CNR, metal artifact, small FOV



CBCT TACE: Our Hospital Experience



Non-Contrast MDCT after TACE



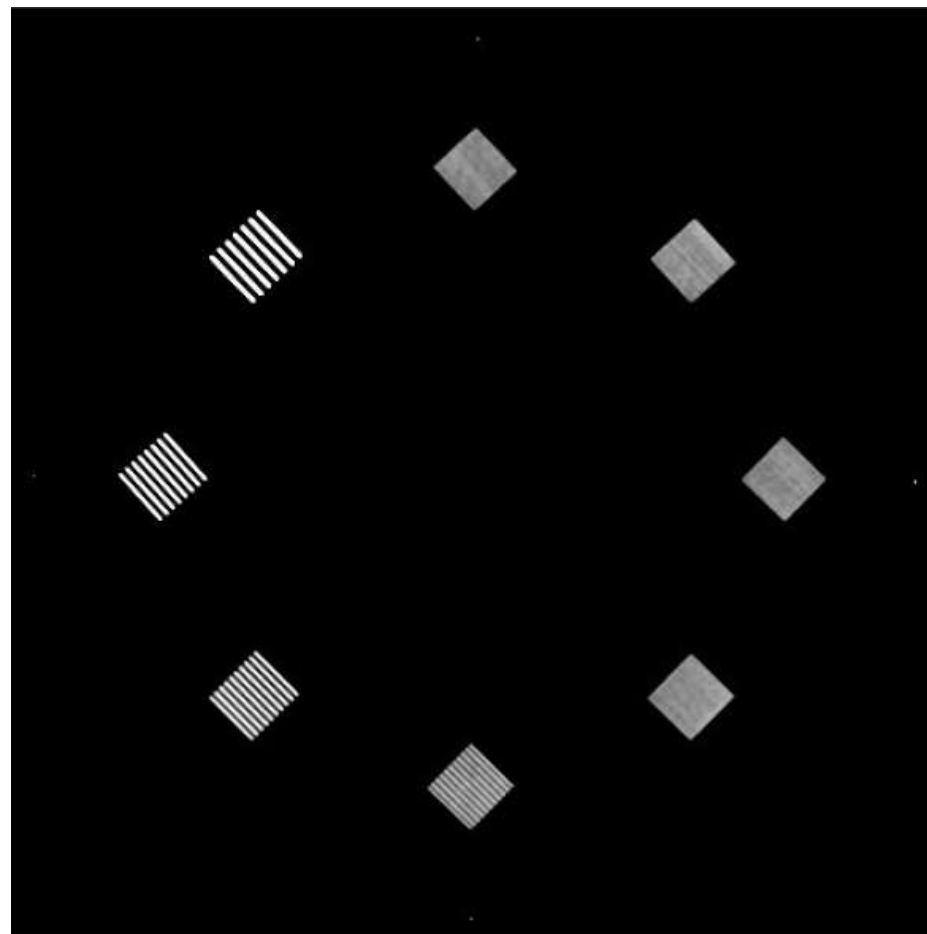
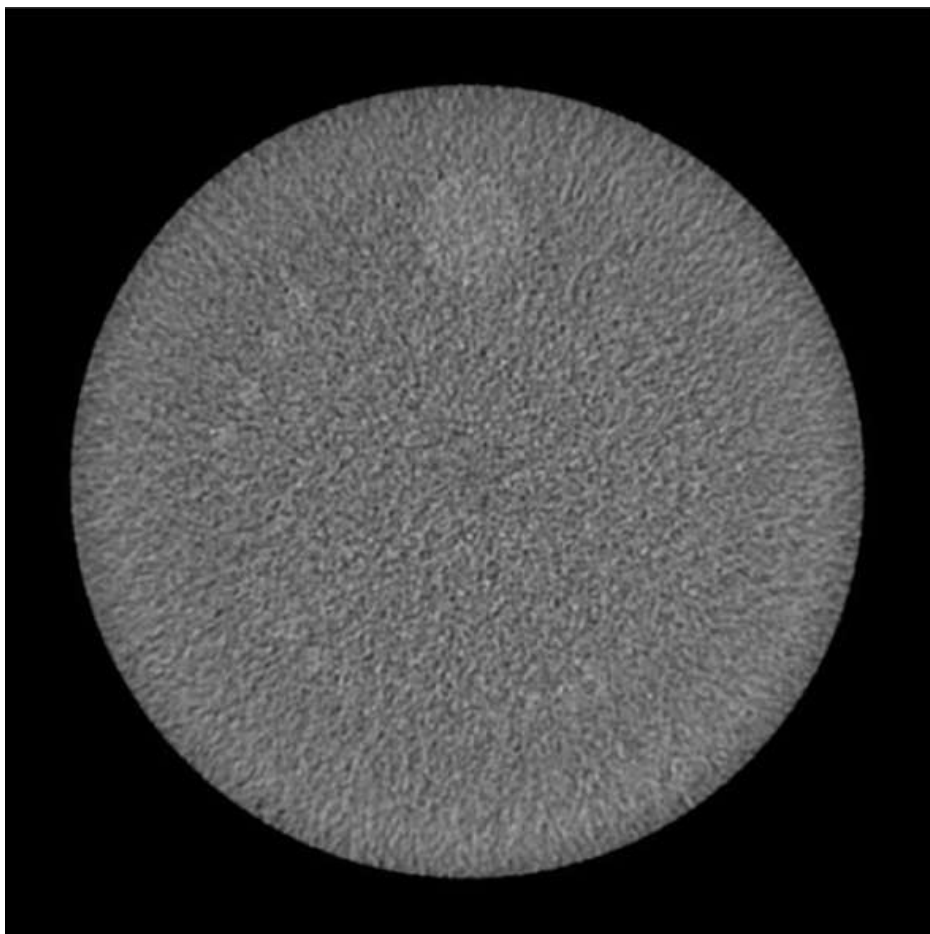
Non-Contrast CBCT during TACE



CBCT-HA

- Abbreviations:**
- CBCT = cone-beam CT
 - CBCT-A = CBCT during arteriography of an extrahepatic branch
 - CBCT-AP = CBCT during arterial portography
 - CBCT-HA = CBCT during hepatic arteriography
 - Deb-CBCT = unenhanced CBCT after DEB-TACE
 - DEB-TACE = TACE with drug-eluting beads
 - DP-CBCT = dual-phase CBCT during hepatic arteriography
 - DSA = digital subtraction angiography
 - HCC = hepatocellular carcinoma
 - Lip-CBCT = unenhanced CBCT after conventional TACE
 - TACE = transcatheter arterial chemoembolization
 - 3D = three-dimensional
 - 2D = two-dimensional

空間解析度 vs 對比解析度



105年第一次醫事放射師高等考試

Undergraduate Year Training Final Report

Comparing CBCT and DSCT for image quality and effective dose

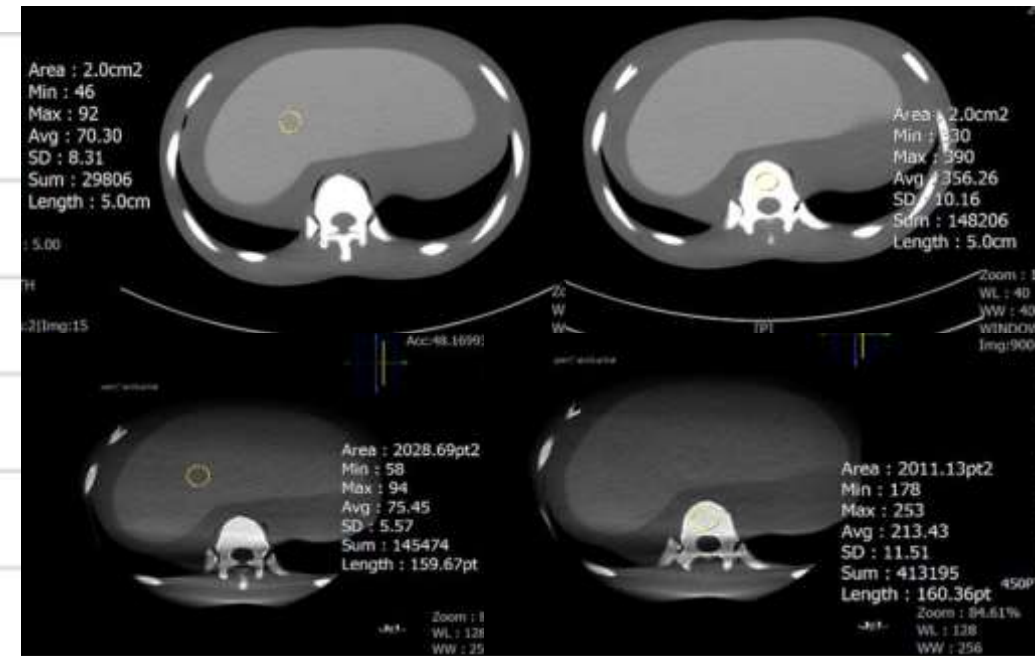
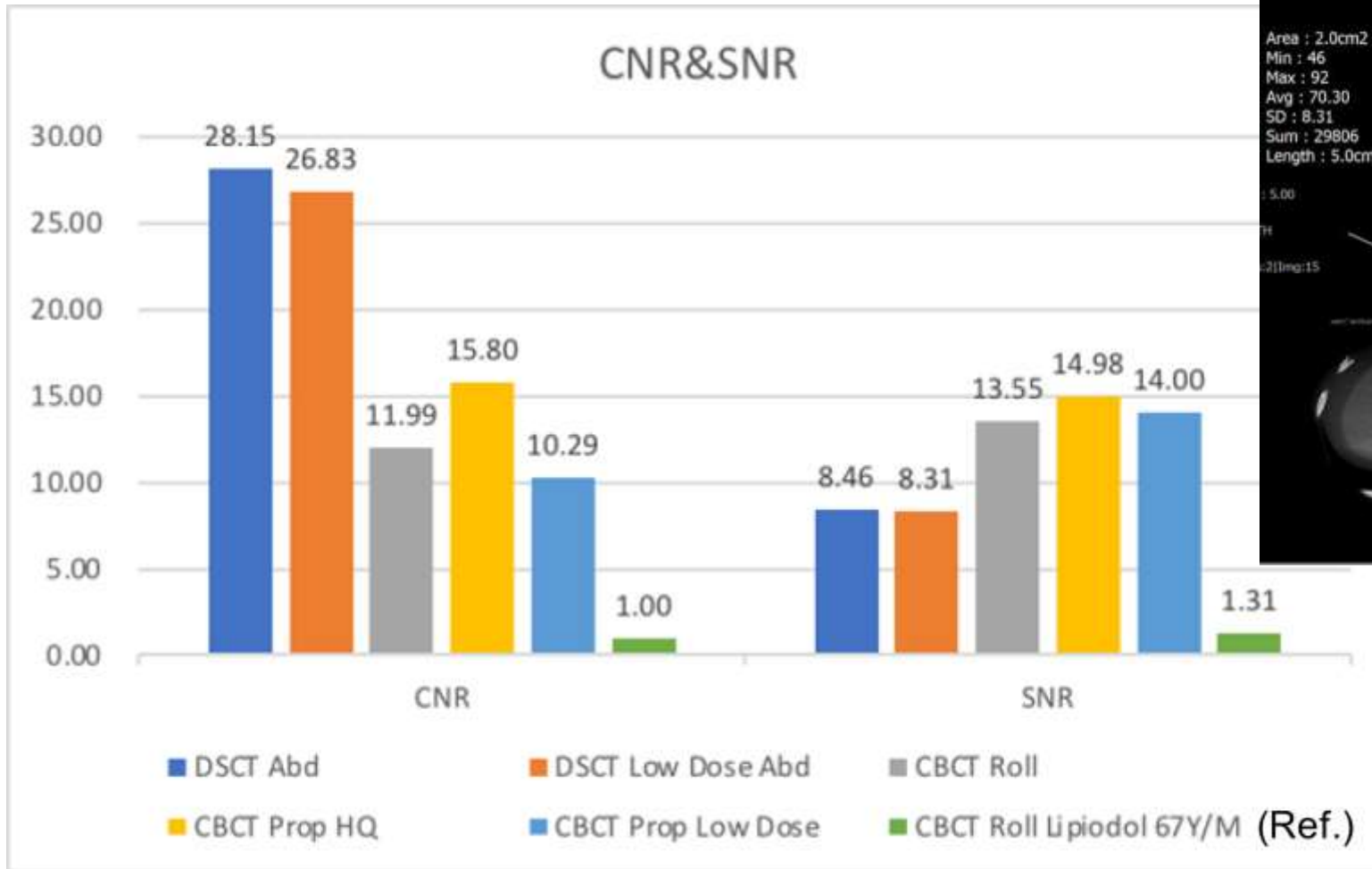
報告日期：2024/01/10

指導老師：陳佳生

報告學生：曾玉筑



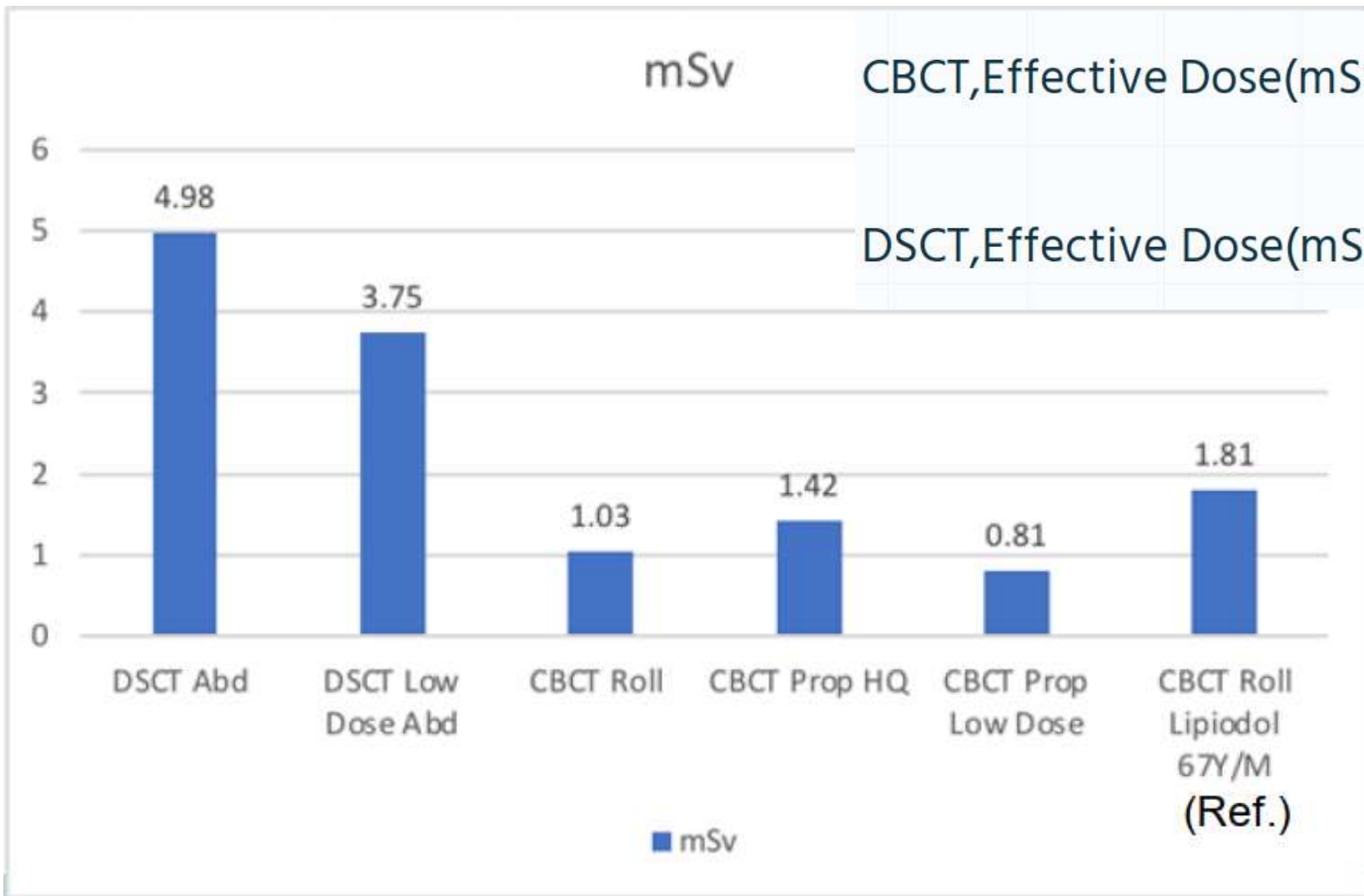
CNR & SNR



$$CNR = \frac{(LIVER - BACKGROUND)_{AVG}}{BACKGROUND_{SD}}$$

$$SNR = \frac{LIVER_{AVG}}{LIVER_{SD}}$$

Effective Dose



$$\text{CBCT, Effective Dose (mSv)} \approx k \left(\frac{\text{mSv}}{\text{mGy} \cdot \text{cm}^2} \right) \times \text{DAP (mGy} \cdot \text{cm}^2)$$

$$\text{DSCT, Effective Dose (mSv)} \approx k \left(\frac{\text{mSv}}{\text{mGy} \cdot \text{cm}} \right) \times \text{DLP (mGy} \cdot \text{cm)}$$


Our Clinical Poster Presentation



CT



Angio 3D


臺北市立萬芳醫院 臺北醫學大學附屬醫院
 Taipei Municipal Wanfang Hospital, Affiliated Taipei Medical University

應用血管攝影釐清金屬材質在CT所產生的假影之干擾 - 案例報告






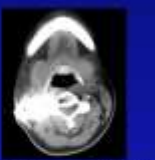
陳盈佑¹ 林明芳¹ 王鈞右¹ 葉怡君²

¹臺北萬芳醫院-遠東附屬法醫及醫學大學附屬醫院-影像醫學部 ²台灣遠東利通



前言
 病患頸部遭弓形射入(如圖一),為了釐清受損情況,入院後先執行CT檢查,但CT影像受金屬材質干擾產生嚴重假影(如圖六),造成醫師無法正確判斷血管、骨質受損情況,於手術室閉刀前,為確認患部的血管狀況,術前透過血管攝影DSA技術降低金屬假影干擾,提升血管走向判讀。

材料與方法
 使用GE Brightspeed Elite Select - Computed Tomography(CT)與Philips Azurion 7 M20 血管攝影儀收集影像,兩種影像以用切面條件去比較後,提供不同影像之結果協助醫師完成手術。

結果
 CT與血管攝影的影像對比後發現金屬假影造成的干擾程度完全不一,從而轉影像不同角度方式比對後(如圖三、四),從血管攝影的影像發現(如圖四、五),影像因未受假影太多干擾可清楚確認血管與頸椎骨的情形。


 圖一:病患頸部遭弓形射入

 圖二:手術取出之合金箭頭

 圖三:CT-冠狀切面影像

 圖四:血管攝影-冠狀切面影像

 圖五:血管攝影-DSA影像

 圖六:CT圖-金屬假影嚴重

討論與結論
 CT影像受金屬假影干擾下無法精確判斷是否受干擾地方的情況,使得醫師無法得到精確的資訊;而血管攝影的影像幾乎未受到金屬假影干擾,藉由攝影劑注射後確認血管只是受壓造成狹窄而未受損。
 血管攝影的影像呈現上為何未受到金屬假影的影響,是因為影像的擷取條件以及後續影像條件主要以閉隔血管成像為主,因此,金屬假影不是完全消失,是使用DSA技術將細微血管的資訊,金屬、肌肉、脂肪,等消除,故血管呈現為主軸。
 兩種影像在同切面,3D影像的多方位比下(如圖七、八),可發現血管攝影是盡可能避免非血管的部分或是使用DSA技術,又得以血管為主之影像,進而給予手術醫師快速、正確資訊去決定手術方案,以避免造成移除體內金屬造成的二次傷害,使手術順利完成。


 圖七:CT-3D影像

 圖八:血管攝影-3D影像
 確認血管只受到壓迫造成狹窄

In this Case

- **Case Summary:** Patient sustained neck injury from metal arrow.
- **MDCT Findings:** Significant streak artifacts obscured vascular structures.
- **CBCT Findings:** Intraoperative CBCT revealed clear cervical vasculature.
- **Implication:** CBCT effective for visualizing vessels near metal.

Conclusion

- CBCT, MDCT are utilized for distinct clinical functions.
- CBCT offers **high-spatial resolution**, three-dimensional guidance **during procedures**.
- While it has limitations such as low contrast-to-noise ratio (CNR) and metal artifacts, CBCT enhances the accuracy of treatment at a **lower radiation dose**.
- Beam hardening can be reduced by **subtraction** and high-resolution **3D reconstruction**.
- The role of technologists is crucial in optimizing image quality and ensuring patient safety.

Reference

1. Principles of CT: Multi-slice CT Lee W. Goldman. Journal of Nuclear Medicine Technology June 2008, 36 (2) 57-68
2. C-arm Cone-beam CT: General Principles and Technical Considerations for Use in Interventional Radiology Orth, Robert C. et al. Journal of Vascular and Interventional Radiology, Volume 20, Issue 7, S538 – S544
3. Tumor Vascularity Does Not Predict Response to Yttrium-90 Radioembolization for Hepatic Metastases from Colorectal Cancer. Alipi V. Naydenov. et al Journal of Clinical Interventional Radiology ISVIR 02(01)
4. Simple Calculator for Effective Dose in CT (DLP -> Eff Dose): Radiologic Technologist' s guide to Effective Dose (mSv) in CT from Dose Length Product (mGy cm) By Brian Nett, PhD / Calculators
5. Comparing CNR, SNR, and Image Quality of CT Images Reconstructed with Soft Kernel, Standard Kernel, and Standard Kernel plus ASIR 30% TechniquesInt. Priya Bhosale et al. Journal of Radiology 2015 December 2(2): 60-65
6. Cone Beam CT vs. Fan Beam CT: A Comparison of Image Quality and Dose Delivered Between Two Differing CT Imaging Modalities. Lawrence Lechuga et al. Cureus. 2016 Sep 12;8(9):e778.



敬請指導

