Usefulness of First Pass Dynamic Contrast-Enhanced MRI for Evaluation of Cardiac Tumors

Ho NamKoong, RT (R)(MR)

Seoul National University Hospital, Korea
Background

First-Pass Perfusion

< 1 min

Delayed Enhancement

> 5 min

Normal Myocardium

Infarced Myocardium

Ischemic Myocardium

Signal intensity

contrast injection

time

<ref>Background time Normal Myocardium Infarcted Myocardium Ischemic Myocardium First-Pass Perfusion Delayed Enhancement < 1 min > 5 min Signal intensity contrast injection time</ref>
## Background

- **Cardiac Tumor Protocol in SNUH**

<table>
<thead>
<tr>
<th>Pre-CM</th>
<th>Post-CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scout – Ax, Sa, Cor</td>
<td>Venc Study – Aorta, MPA, ES-AVV, ED-AVV</td>
</tr>
<tr>
<td>T2 HASTE Ax</td>
<td>T1 TSE db – 4CH, 2CH, SA (Ax)</td>
</tr>
<tr>
<td>Scout – 4CH, 2CH, SA</td>
<td>Delayed CE – PSIR 4CH, 2CH, SA (Ax)</td>
</tr>
<tr>
<td>Cine (TFL) – 4CH, 2CH, LVIO(3CH), SA, (RV2CH, Ax)</td>
<td>T1 TSE db – 4CH, 2CH, SA (Ax)</td>
</tr>
<tr>
<td>T2 TSE db – 4CH, 2CH, SA (Ax)</td>
<td>Delayed CE – PSIR 4CH, 2CH, SA (Ax)</td>
</tr>
<tr>
<td>T1 TSE db – 4CH, 2CH, SA (Ax)</td>
<td>Long TI – PSIR SA</td>
</tr>
</tbody>
</table>

**First Pass DCE**
Purpose

- Time-intensity curve
- Semi-quantitative analysis of perfusion patterns
- Cine images
- Blood flow surrounding tumors
Materials & Methods

• 28 cardiac examinations in 19 patients
  (10 males, 9 females, mean age: 46.6 years old)
• March 2010 to September 2011
• 1.5T MRI Scanner (Magnetom Sonata, Siemens, Germany)
Materials & Methods

• First Pass Dynamic T1-Weighted with ECG triggering (Turbo FLASH with non-selective Saturation Recovery)

• Scanning Parameters:
  TR/TE = 174/0.96ms, FA = 15°, FOV = 300-350mm, matrix = 128 x 96, Scan time: 0.9sec/slice, 34-40seconds

• Images: 40 phase / slice
Materials & Methods

• Injection of Contrast Media
  - intravenous administration of 0.2mmol/Kg DTPA
  - 25ml of saline flushing
  - flow rate of 4ml/sec
• Auto-injector (Spectris Solaris EP, MEDRAD, USA)
Materials & Methods

• Evaluation

Time-intensity curve from ROIs

Image reviewer (RT and CV radiologist)
Materials & Methods

- Evaluation (Time-intensity Curve)
Results

• DCE MRI: 20 of 28 examinations (71%)
• Cardiac tumor examination rate 0.032% (28/86,909 exams) during same period for 19 months in SNUH

Malignancy (35.5%)
  • 1 osteosarcoma, 2 lymphomas, 3 metastatic involvements

Benign (23.5%)
  • 1 lipoma, 3 fibromas

Non tumor (41.2%)
  • 5 throumbuses, 2 empyemas
Results

• Distribution of tumors

19 patients
Results

- Location of tumors

RA, 5
RV, 2
LA, 3
LV, 4
RA-LA, 2
RPA, 1
Pericardial, 2

19 patients
Results
Results

Time-intensity curve

- Lymphoma – steep enhancement
- Others – slightly enhancement or not
Results

Cine images - thrombosis
Results

Cine images - thrombus
Results

Cine images - Aneurysm
Results

Cine images - fibroma
Results

Cine images - Lymphoma
Results

Cine images - Sarcoma
Results

Cine images - Metastasis
Results

Cine images – meta-osteosarcoma
Results

Cine images

- Blood circulation surrounding tumors
- Aneurysm sac, rupture by aniosarcoma
Results

• First pass DCE MRI could not distinguish all different cardiac tumors due to complicated enhancement patterns and few cases.

• Some malignant tumors have different enhancement patterns compared benign tumors.
Discussion

• Diagnosis of Cardiac Tumor

Delayed Enhancement

- No
  - Non Tumor
    - Thrombus
  - Benign
    - Low SI on T2, late enhancement
  - Malignancy
    - Aggressiveness, Shape, Clinical finding

- Yes
  - Fibroma
  - Lipoma (fat signal)
  - Sarcoma
  - Lymphoma
  - Metastasis
Discussion

• Limited cases

• Incorrect ROIs in different phase images

• Incorrect time between scanning and injection of contrast media
Discussion

- Moderate and strong enhancement is more predictive of malignant processes, although mild enhancement will be found in 40-50% of benign tumors. – Hoffmann U, Am J Cardiol 2003;92:890-895.

- Fast T1-weighted spoiled gradient-echo first-pass perfusion may also be useful for demonstrating areas of heterogeneous enhancement due to regional variation in vascularity and distribution volumes within a tumor. – Kim RJ, N Engl J Med 2000;343:1445-1453.
Discussion

• Martin Libicher, Eur Radiol (2006) 16:1858-1859
  
  • Gain further information about vascularization of tumor tissue
  • Analysis of time-intensity curves (up/down slope, time-to-peak) and regional tumor perfusion might be of diagnostic relevance.)
Conclusions

• Useful to understand the enhancement patterns in highly vascular mass such as aneurysm, AVM, vascular hemangioma, and other vascular tumors.
Acknowledgement

• I deeply appreciate the big help of Eun-Ah Park, MD.
Thank you for listening