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# 관상동맥 조영술 중 분절된 혈관내초음파 카테터의 내과적 제거 1예

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**서론:** 혈관내초음파(Intravascular ultrasound, IVUS)는 관상동맥 질환 환자에서 중재적 시술 전, 풍선확장술 후, 스텐트 삽입술 후와 같은 여러 과정에서 시행될 수 있다. 관상동맥 내 IVUS 카테터의 분절은 매우 드물지만 일어났을 경우 급성관상동맥폐쇄, 혈전증, 혈관 손상, 감염 등의 발생 위험이 있어 신속한 제거가 이루어져야 한다. 저자들은 ST분절비상승 심근경색 환자에서 관상동맥 조영술 중 분절된 IVUS 카테터의 내과적 제거 성공 1예를 경험하여 보고하고자 한다. **증례:** 특이병력 없는 37세 남자 환자로 한달전부터 간헐적인 흉통이 있어 내원하였다. 심전도상 II,III,aVF 유도의 T파 역위를 보이고, 혈액검사상 심근효소수치 상승(CK-MB 5.3 ng/ml, troponin I 0.725 ng/ml)을 보여 관상동맥 조영술을 시행하였다. 우관상동맥 중위부에 95% 폐쇄 보여 풍선확장술 시행 후 스텐트 삽입술 전 IVUS를 시행하였다. 카테터 진입 중 더이상 카테터가 진입되지 않았고, 투시검사 상 카테터 끝부분이 분절되어 우관상동맥 중위부에 남아있는 것이 관찰되었다. 우선 기존 폐쇄부위에 스텐트 삽입술 시행하였고, 일부 혈관내 혈전이 발생하여 Abciximab 연속정맥주입과, 혈전흡인술을 시행하였다. 조금더 원위부로 이동한 분절된 IVUS 카테터 끝부분은 2mm micro loop snare(ev3, Amplatz GOOSE NECK, Medimark)를 이용해 덮어씌우는 방법으로 제거하였다. 이후 환자는 합병증 없이 퇴원 후 외래에서 경과관찰 중이다. **결론:** 관상동맥 중재술 시 사용되는 장비의 분절에 의한 합병증은 드물지만 중요한 합병증이며, 탈락된 스텐트, 유도철선과 풍선도자의 분절 등이 보고되고 있다. IVUS 카테터의 분절은 매우 드물며 그 원인으로 스텐트의 혈관내 부착이 나쁜경우, 유도철선의 위치가 잘못된 경우, 카테터 재사용에 의한 변형 등이 있다. 이를 제거하기 위한 내과적 방법으로 loop snare나 basket을 사용하는 방법이 높은 성공률과 낮은 합병증을 보인다. 생검겸자는 혈관벽손상, 천공의 위험으로 잘 사용되지 않는다. 본 증례에서는 loop snare 를 사용하여 안전하게 제거하였다.

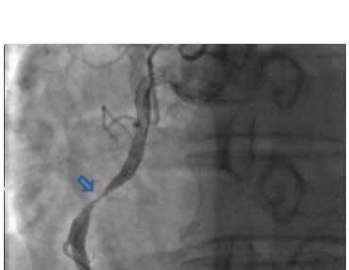

**Fig.1** Baseline coronary angiography shows mRCA diffuse 95% stenosis(arrow).

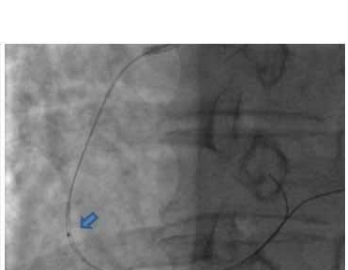

**Fig.2** Fractured tip of IVUS catheter remained in mRCA (arrow).

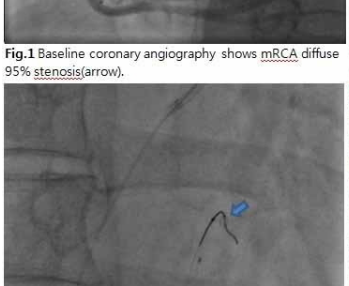

**Fig.3** Tip of IVUS catheter was extracted by using micro loop snare(arrow).

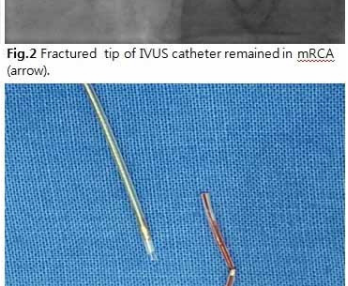

**Fig.4** Photo of IVUS catheter tip which was extracted.

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# Old age and Myocardial injury in ST-segment Elevation Myocardial Infarction: Cardiac MR Study

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**Background/Aims:** Little is known about causality and pathological mechanism underlying association of old age with myocardial injury in patients with ST-segment elevation myocardial infarction (STEMI). We evaluate association of advanced age with myocardial injury in STEMI patients undergoing primary percutaneous coronary intervention (PCI) using cardiovascular magnetic resonance imaging (CMR). **Methods:** In patients undergoing primary PCI for STEMI, CMR was performed a median of 3.3 days (interquartile range, 2.8-4.2) after the index procedure. Patients were divided into two groups according to STEMI occurred over 70 years-old or not. Primary outcome was myocardial infarct size as assessed by cardiac magnetic resonance imaging. Secondary outcomes were extent of area at risk (AAR), myocardial salvage index (MSI) and microvascular obstruction area. Inverse probability of treatment weighting (IPTW) was also performed. **Results:** Of 279 patients, 52 patient occurred STEMI over 70 years (Age ≥70 group) and 227 patients before the age of 70 years (Age <70 group). Myocardial infarct size was not significantly different between the two groups (21.2[11–31.4]% in Age ≥70 group, 19.5[8.4–30.6]% in Age <70 group P=0.072). Extent of AAR was higher in Age ≥70 group than Age <70 group, and the difference was significant (37.1[19.4–54.8]% versus 34.2[18.9–49.5]%; P=0.039). MVO area was similar between the two groups (4.6[0.2–9.0]%, 4.2[0–10.4]%; P=0.402). MSI was higher in Age <70 group compared to Age ≥70 group, but the difference was not significant (44.3[25–63.6]% versus 42.2[25.5–58.9]%; P=0.166; Figure2). In IPTW analysis, myocardial infarct size was significantly larger in Age ≥70 group compared with the Age <70 group (22.6[12.2–33.0]% versus 19.6[8.5–30.7]%; P=0.001). Extent of AAR (38.8[21.0–56.6]% versus 34.3[19.0–49.6]%; P=0.001) and MSI (44.4[25.3–63.5]% versus 40.4[24.5–56.3]%; P=0.007) was higher in Age <70 group compared to Age ≥70 group. **Conclusions:** Old age could predict advanced myocardial infarct size and less salvaged myocardium in STEMI patients undergoing primary PCI.

**Figure 1. Schematic of study cohort selection**

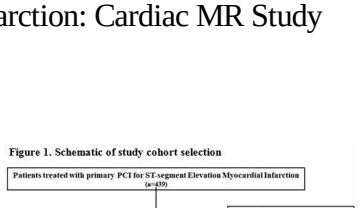


**Table 1. Baseline, Angiographic and Procedural Characteristics (n=279)**

| | Age ≥70 (n=52) | Age <70 (n=227) | P value |
|---|---|---|---|
| Male | 41 (78.8) | 185 (81.5) | 0.660 |
| BMI, kg/m² | 23.3 ± 3.4 | 25.1 ± 3.4 | 0.017 |
| Current smoker | 12 (23.1) | 132 (58.2) | <0.001 |
| Hypertension | 30 (57.7) | 95 (41.9) | 0.038 |
| Diabetes mellitus | 14 (26.9) | 46 (20.3) | 0.292 |
| Dyslipidemia | 8 (15.4) | 42 (18.5) | 0.597 |
| Previous MI | - | - | - |
| Previous PCI | 1 (1.9) | 5 (2.2) | >0.999 |
| Previous CVA | 4 (7.7) | 6 (2.6) | 0.094 |
| Times, min | | | |
| Symptom onset-to-balloon time | 243.3 ± 145.0 | 201.1 ± 134.0 | 0.059 |
| Door-to-balloon time | 66.63± 18.0 | 60.8 ± 17.4 | 0.018 |
| LVEF (%) | 51.6 ± 12.3 | 53.6 ± 10.4 | 0.266 |
| NT-proBNP, pg/mL | 1055.4 ± 1986.6 | 277.2 ± 543.8 | 0.015 |
| Peak CK-MB, ng/mL | 242.1 ± 415.5 | 208.3 ± 161.5 | 0.566 |
| Concomitant medications | | | |
| Aspirin | 52 (100.0) | 225 (99.1) | >0.999 |
| P2Y12 inhibitors | 52 (100.0) | 225 (99.1) | >0.999 |
| Statins | 50 (98.2) | 218 (96.5) | >0.999 |
| Beta blockers | 47 (90.4) | 208 (91.6) | 0.785 |
| ACE inhibitors/ARB | 39 (75.0) | 191 (83.9) | 0.054 |
| Killip score (≥2) | 4 (8.9) | 17 (7.4) | 0.732 |
| Infarct-related artery | | | 0.863 |
| LAD | 26 (50.0) | 112 (49.3) | |
| LCx | 4 (7.7) | 25 (11.0) | |
| RCA | 22 (42.3) | 88 (38.8) | |
| Left main | 0 (0.0) | 2 (0.9) | |
| Multi-vessel disease | 31 (59.6) | 93 (41.0) | 0.015 |
| TIMI flow grade before PCI | | | 0.899 |
| 0 | 39 (75.0) | 176 (77.5) | |
| 1 | 4 (7.7) | 14 (6.2) | |
| 2-3 | 9 (17.3) | 37 (16.3) | |
| Presence of Collateral flow | 23 (52.3) | 104 (51.5) | 0.925 |
| Final TIMI flow grade 3after PCI | 49 (94.2) | 212 (94.7) | 0.889 |
| Angiographic no reflow phenomenon | 0 (0.0) | 14 (6.2) | 0.080 |
| Myocardial blush grade | | | <0.001 |
| 1 | 1 (2.2) | 1 (0.5) | |
| 2 | 11 (24.4) | 9 (4.4) | |
| 3 | 33 (73.3) | 193 (95.1) | |
| Aspiration Thrombectomy | 32 (61.5) | 142 (62.6) | 0.891 |
| Use of GPIIb/IIIa inhibitor | 2 (4.4) | 41 (20.2) | 0.009 |
| PCI using Stent | 48 (92.3) | 218 (96.0) | 0.272 |
| No. of implanted Stent | 1.3 ± 0.6 | 1.2 ± 0.6 | 0.320 |
| Stent diameter, mm | 3.3 ± 0.4 | 3.2 ± 0.6 | 0.031 |
| Stent length, mm | 32.3 ± 17.0 | 29.6 ± 14.4 | 0.321 |

Data are presented as n (%), mean ± SD, or median (interquartile range)
*Data of Killip class was available for 248 (88.9%) patients.
†Data of NT-proBNP was available for 225 (80.6%) patients.
ACE = angiotensin converting enzyme; ARB = angiotensin receptor blocker; BMI = body mass index; CK-MB = creatine kinase-myocardial band; CVA = cerebrovascular accident; GP = glycoprotein; LAD = left anterior descending artery; LCx = left circumflex artery; LVEF = left ventricular ejection fraction; MI = myocardial infarction; NT-proBNP = N-terminal prohormone of brain natriuretic peptide; PCI = percutaneous coronary intervention; RCA = right coronary artery; TIMI = thrombolysis in myocardial infarction.

**Table 2. Analysis of Cardiac Magnetic Resonance findings (n=279)**

| | Age ≥70 (n=52) | Age <70 (n=227) | P value |
|---|---|---|---|
| Myocardial Infarct size (%, of LV) | 21.2 ± 10.2 | 19.5 ± 11.1 | 0.072 |
| Area at risk (%, of LV) | 37.1 ± 17.7 | 34.2 ± 15.3 | 0.039 |
| Myocardial salvage index | 42.2 ± 16.7 | 44.3 ± 19.3 | 0.166 |
| MVO area (%, of LV) | 4.6 ± 4.4 | 4.2 ± 6.2 | 0.402 |
| Hemorrhagic infarction | 145 (52.0) | 127 (45.5) | 0.127 |
| LV end diastolic volume (mL) | 156.2 ± 47.9 | 146.3 ± 32.3 | 0.003 |
| LV end systolic volume (mL) | 69.1 ± 50.0 | 69.5 ± 26.9 | 0.894 |
| LV ejection fraction (%) | 52.4 ± 12.1 | 53.5 ± 9.7 | 0.248 |
| LV stroke volume (mL) | 87.1 ± 13.4 | 76.9 ± 16.4 | <0.001 |
| LV cardiac output (L/min) | 4.6 ± 0.8 | 5.2 ± 1.1 | <0.001 |

Data are presented as n (%) or median (interquartile range).
LV = left ventricle (-cular); MVO = microvascular obstruction.

**Table 3. Analysis of Cardiac Magnetic Resonance findings by IPTW (n=559)**

| | Age ≥70 (n=280) | Age <70 (n=279) | P value |
|---|---|---|---|
| Myocardial Infarct size (%, of LV) | 22.6 ± 10.4 | 19.6 ± 11.1 | 0.001 |
| Area at risk (%, of LV) | 38.8 ± 17.8 | 34.3 ± 15.3 | 0.001 |
| Myocardial salvage index | 40.4 ± 15.9 | 44.4 ± 19.1 | 0.007 |
| MVO area (%, of LV) | 5.0 ± 4.4 | 4.2 ± 6.2 | 0.082 |
| Hemorrhagic infarction | 163(58.4) | 125(44.8) | 0.001 |
| LV end diastolic volume (mL) | 138.5 ± 47.5 | 145.9 ± 32.8 | 0.032 |
| LV end systolic volume (mL) | 71.7 ± 49.8 | 69.7 ± 27.4 | 0.520 |
| LV ejection fraction (%) | 51.2 ± 11.9 | 53.4 ± 9.7 | 0.020 |
| LV stroke volume (mL) | 66.8 ± 13.2 | 76.4 ± 16.5 | <0.001 |
| LV cardiac output (L/min) | 4.4 ± 0.8 | 5.2 ± 1.1 | <0.001 |

Data are presented as n (%) or median (interquartile range).
LV = left ventricle (-cular); MVO = microvascular obstruction.