

# Coronary Computed Tomographic Angiography for Rapid Discharge of Low-Risk Patients With Potential Acute Coronary Syndromes

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PhDAnnals of Emergency Medicine (March 2009)

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99年05月18日

## 前言

- 根據統計,目前每年約有 600萬患者在急診 (ED) 的主訴有胸痛或其他症狀, 意示著有心肌缺血的情形, 但**55%至85%**的人不是心臟病導致的.
- 雖然在過去幾年中認定高危險群患者有所改善, 迅速有效的評估和準確證明**低危險群患者**依然是有問題的.
- 電腦斷層冠狀動脈血管造影 (Coronary computed tomographic angiography) 和心臟導管(cardiac catheterization) 具有良好的相關性, 研究表示它具有鑑定冠狀動脈狹的**敏感度(Sensitivity)為 93%至100%**, **特異性(Specificity)為 75%至98%**.

## 研究目的

- 我們探討急診病患條件並須符合潛在性的急性冠狀動脈症候群症狀, 以及低**TIMI**危險評分, 以及非缺血心電圖結果, 陰性反應的冠狀動脈血管造影的結果是否可以讓病患安全的返家, 並且定義為**30**天內心血管疾病死亡或非致命性的心肌梗塞的風險性必須小於**1%**。

## 實施方法1/3

- 前瞻性(**Prospective**), 觀察性(**observational**)的世代(**cohort**)研究
- 於**城市大學醫院**(Hospital of University of Pennsylvania), 研究日期從**2005/01/01至2007/10/01**.
- 選擇收案的條件;
  - 收案對象
    - 急診病患症狀顯示急性冠狀動脈症候群、以及低**TIMI**危險評分, 和接受冠狀動脈血管造影檢查.
  - 排除
    - 如有局部創傷引起的胸痛、放射影像異常.
    - 高危險病人為初步心電圖結果異常, 心肌酵素異常, 反覆性缺血性胸痛, 或生命跡象不穩定者。
    - 對碘顯影劑過敏, 或無法使用CT血管造影之病患

## 實施方法2/3

- Coronary CTA 檢查擬定對象包括**TIMI**危險評分為**0**到**2** ( ~60%-70%的ACS患者) 與 Creatinine小於或等於 **1.5** mg/dl, 無哮喘, 懷孕, 或碘顯影劑過敏
- Coronary CTA
  - 使用碘影劑
  - 64-slice or 64-slice dual source scanners
  - > = 70%狹窄並為**陽性**結果, 建議入院
  - <50%狹窄和鈣化評分 <100並為**陰性**結果, 不建議進一步的評估
  - 中度 (50%-69%) 狹窄或鈣化評分 >100, 按醫生的處置
  - 鈣化評分> 400, 不注射顯影劑

## 實施方法3/3

- 醫療記錄或出院後聯繫至少30天
- 於急診立即使用Coronary CTA (285 patients)或9-12小時觀察期後(283 patients), 包括心肌酵素測驗 (total 568)
- 主要臨床結果是**30**天心血管疾病死亡或非致命性心肌梗塞

## 結果1/4

**Table 1. Demographic, historical and presenting characteristics of study patients.**

| Characteristic                          | Delayed CTA, n=283 | Immediate CTA, n=285 | Whole Cohort, n=568 |
|-----------------------------------------|--------------------|----------------------|---------------------|
| Age, mean (SD)                          | 46.3 (8.5)         | 47.0 (8.9)           | 47.0 (8.9)          |
| Male (%)                                | 112 (40)           | 140 (49)             | 252 (44)            |
| Race (%)                                |                    |                      |                     |
| Black                                   | 189 (67)           | 169 (59)             | 358 (63)            |
| White                                   | 65 (24)            | 75 (26)              | 140 (25)            |
| Asian                                   | 9 (3)              | 7 (2)                | 16 (3)              |
| Hispanic                                | 3 (1)              | 4 (1)                | 7 (1)               |
| Other unknown                           | 15 (5)             | 28 (10)              | 43 (8)              |
| Cardiac risk factors (%) <sup>a</sup>   |                    |                      |                     |
| Hypertension                            | 137 (48)           | 114 (40)             | 251 (44)            |
| Hypercholesterolemia                    | 139 (49)           | 109 (38)             | 248 (43)            |
| Family history of CAD                   | 48 (17)            | 56 (20)              | 104 (18)            |
| Diabetes mellitus                       | 45 (16)            | 35 (12)              | 80 (14)             |
| Current tobacco use                     | 379 (136)          | 37 (14)              | 756 (133)           |
| Cocaine use in last week                | 36 (13)            | 10 (4)               | 46 (8)              |
| Number of cardiac risk factors (%)      |                    |                      |                     |
| 0                                       | 64 (23)            | 73 (26)              | 137 (24)            |
| 1                                       | 106 (37)           | 109 (38)             | 215 (38)            |
| 2                                       | 71 (25)            | 75 (26)              | 146 (26)            |
| 3                                       | 36 (13)            | 20 (7)               | 56 (10)             |
| 4                                       | 12 (4)             | 8 (3)                | 20 (4)              |
| Final medical problems (%) <sup>b</sup> |                    |                      |                     |
| Undiagnosed chest pain                  | 14 (5)             | 30 (11)              | 44 (8)              |
| Myocardial infarction                   | 3 (1)              | 5 (2)                | 8 (1)               |
| Congestive failure                      | 3 (1)              | 2 (1)                | 5 (1)               |
| Arrhythmias                             | 9 (3)              | 1 (0)                | 10 (2)              |

**Chest pain characteristics (%)**

| Location                    | Delayed CTA, n=283 | Immediate CTA, n=285 | Whole Cohort, n=568 |
|-----------------------------|--------------------|----------------------|---------------------|
| Substernal                  | 149 (53)           | 133 (47)             | 282 (50)            |
| Left chest or arm           | 96 (34)            | 110 (39)             | 206 (37)            |
| Right-sided                 | 13 (5)             | 15 (5)               | 28 (5)              |
| Epigastric                  | 5 (2)              | 3 (1)                | 8 (1)               |
| Other unknown               | 17 (6)             | 24 (8)               | 41 (7)              |
| Quality                     |                    |                      |                     |
| Crushing/pressure/tightness | 147 (52)           | 140 (49)             | 287 (51)            |
| Sharp/stabbing              | 57 (20)            | 65 (23)              | 122 (21)            |
| Aching/slow                 | 29 (10)            | 26 (9)               | 55 (10)             |
| Burning/indigestion         | 10 (4)             | 17 (6)               | 27 (5)              |
| Tearing                     | 2 (1)              | 0                    | 2 (1)               |
| Other unknown               | 29 (10)            | 37 (13)              | 66 (12)             |
| Associated symptoms (%)     |                    |                      |                     |
| Shortness of breath         | 145 (51)           | 123 (43)             | 268 (47)            |
| Diaphoresis                 | 57 (20)            | 48 (17)              | 105 (18)            |
| Pallor/pale                 | 35 (12)            | 30 (11)              | 65 (12)             |
| Nausea                      | 75 (27)            | 63 (22)              | 138 (24)            |
| Vomiting                    | 12 (4)             | 17 (6)               | 29 (5)              |
| Syncope                     | 7 (2)              | 4 (1)                | 11 (2)              |

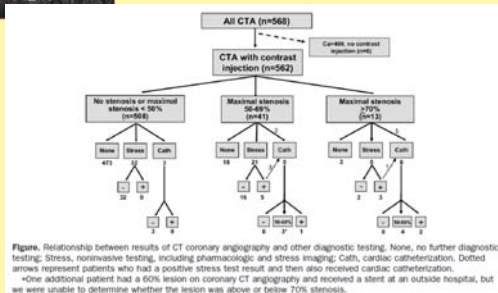
- 平均年齡 47.0 + / - 8.9 年，44% 為男性，63% 的黑人

## 結果2/4

| Characteristic                    | Delayed CTA, n=283 | Immediate CTA, n=285 | Whole Cohort, n=568 |
|-----------------------------------|--------------------|----------------------|---------------------|
| Pulse, beats/min (%)              |                    |                      |                     |
| >100                              | 37 (13)            | 21 (7)               | 58 (10)             |
| 60-100                            | 224 (79)           | 250 (88)             | 474 (84)            |
| <60                               | 22 (8)             | 13 (5)               | 35 (6)              |
| Respiratory rate, breaths/min (%) |                    |                      |                     |
| >20                               | 2 (1)              | 2 (1)                | 4 (1)               |
| 10-20                             | 281 (99)           | 282 (99)             | 563 (99)            |
| Temperature >38°C (100.4°F)       | 1 (0.4)            | 0                    | 1 (1)               |
| Presenting ECG (%)                |                    |                      |                     |
| Normal                            | 167 (59)           | 178 (62)             | 345 (61)            |
| Non-specific                      | 89 (31)            | 85 (30)              | 174 (31)            |
| Non-diagnostic                    | 18 (6)             | 16 (6)               | 34 (6)              |
| Ischemia known to be old          | 2 (1)              | 2 (1)                | 4 (1)               |
| Ischemia not known to be old      | 6 (2)              | 3 (1)                | 9 (2)               |
| Infarction                        | 1 (0.4)            | 1 (0.4)              | 2 (1)               |
| TIMI risk score (%)               |                    |                      |                     |
| 0                                 | 173 (61)           | 170 (60)             | 343 (60)            |
| 1                                 | 83 (29)            | 83 (29)              | 166 (29)            |
| 2                                 | 22 (8)             | 26 (9)               | 48 (8)              |
| 3 or 4                            | 5 (2)              | 4 (1)                | 9 (2)               |

- 大多數患者 (90%) 有TIMI危險評分 0-1

## 結果3/4



- 508例中461的患者冠狀動脈 CTA檢查 (91%) 後出院。這些患者都是30天內無死亡或無經歷非致命性心肌梗塞。
- Immediate ED 214/ 285 (75%) + Observation unit 247/ 283 (87%)

## 結果4/4

- Coronary CTA 的診斷準確性有
  - 敏感度(Sensitivity) of 100% (95% CI 59% to 100%)
  - 特異性(Specificity) of 91.5% (95% CI 88.9% to 93.7%)
  - 陽性預測值(Positive predictive value) of 13% (95% CI 5.4% to 24.9%)
  - 陰性預測值(Negative predictive value) of 100% (95% CI 99.3% to 100%)

**Table 2. Relationship between degree of coronary stenosis on coronary CT angiography and composite outcome.\***

| Maximal Coronary Stenosis, % | Composite Outcome Present | Composite Outcome Absent |
|------------------------------|---------------------------|--------------------------|
| >50                          | 7 <sup>†</sup>            | 47                       |
| <50                          | 0                         | 508                      |

\*The composite outcome was based on a composite of diagnostic testing and clinical follow-up. If a patient received an objective assessment of coronary artery disease (stress test or cardiac catheterization), it was considered the criterion standard. When a patient received both tests, the cardiac catheterization was considered the criterion standard. For this analysis, the catheterization result was considered positive if the patient had greater than a 70% stenosis. In the absence of either test, 30-day death or nonfatal myocardial infarction was considered to be the criterion standard.

<sup>†</sup>One patient who had a 60% lesion on coronary CT angiography received a stent at an outside hospital, but we were unable to determine whether the lesion was above or below 70% on cardiac catheterization. We used the most conservative approach and considered her lesion to be below 70%. In either case, our sensitivity would remain 100%. Specificity would be slightly improved.

## 限制

- 選擇性偏差 (Selection bias)
- Coronary CTA檢查每週約可做50小時
- 未追蹤沒有做Coronary CTA檢查的患者。
- 30天的研究結果只限制在心血管疾病死亡和心肌梗塞
- 未獲取相關Coronary CTA檢查不良反應事件的數據
- Coronary CTA檢查後,再進一步的相關檢查,則由主治醫生來決定。

## 討論 1/2

- 在立即使用Coronary CTA對照族群，75%的患者都可出院
- <50%血管狹窄和鈣化評分<100的最大族群裡，有86%患者可以出院，使醫院及留觀區入院率降低為14%，在平常入院率佔50%至70%。
- Coronary CTA可準確地確定或排除冠狀動脈狹窄在低，中，高風險的病人於潛在性的急性冠狀動脈症候群。
- Schuijff 發現Coronary CTA檢查提供跟 myocardial perfusion imaging 相輔相成的準確資訊。
- Hoffman and Rubinshtein 學者發現 Coronary CTA 檢查有 100%的陰性預測值(Negative predictive value)在於急性冠狀動脈症候群以及分別追蹤5個月和15個月後的主要不良心臟事件。



## 討論 2/2

- *Gallagher*學者發現 Coronary CTA 的 Sensitivity可比較於 **myocardial perfusion imaging** (86%比71%)，如 Specificity (92%比90%)
- *Goldstein*學者發現 Coronary CTA 檢查**可迅速查明患者無疾病, 並減少住院時間和降低成本**
- *Chang*學者發現 immediate Coronary CTA檢查是比 observation unit 的 Coronary CTA檢查,有較短的住院天數,且符合成本效益
- 我們觀察到**30天內**無心血管疾病死亡或心肌梗塞，在此類事件上限 CI 小於 1%,和立即性的 Coronary CTA檢查相較於傳統的管理與觀察或住院病患,更符合成本效益.
- Randomized controlled trials 仍然必要確定 Coronary CTA 的作用在於中度或高風險的病人。



## 結論

- 關於急診患者的症狀為潛在的急性冠狀動脈症候群徵象、低TIMI危險評分和非缺血性的初步心電圖結果，陰性的 Coronary CTA 結果可以安全地出院返家。