Coronary artery surgery results 2013, in Japan

The President of Japanese Association for Coronary Artery Surgery (JACAS)

Yukiyasu Sezai
The Survey Committee of Japanese Association for Coronary Artery Surgery (JACAS)

Yukihiro Orime (Nihon Univ.)

Hirokuni Arai (Tokyo Medical and Dental Univ.)

Masami Ochi (Nihon Medical Univ.)

Hiroshi Nishida (Tokyo Woman Medical Univ.)

Hankei Shin (Ichikawa Medical Center of Tokyo Dental Univ.)

Hiroshi Niinami (Saitama International Medical Center)

Official home-page of JACAS: http://www.jacas.org
Coronary artery bypass grafting (CABG), 2013

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>15,265</td>
</tr>
<tr>
<td>Isolated CABG</td>
<td>10,815 (71%) (previous year: 71%)</td>
</tr>
<tr>
<td>Concomitant CABG</td>
<td>4,450 (29%) (previous year: 29%)</td>
</tr>
</tbody>
</table>

### Isolated CABG

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial elective</td>
<td>9,187</td>
</tr>
<tr>
<td>Off-pump</td>
<td>5,965</td>
</tr>
<tr>
<td>On-pump</td>
<td>3,222</td>
</tr>
<tr>
<td>(Off-pump rate: 65%)</td>
<td></td>
</tr>
<tr>
<td>(previous year: 65%)</td>
<td></td>
</tr>
<tr>
<td>Extra initial elective</td>
<td>1,628</td>
</tr>
<tr>
<td>Off-pump</td>
<td>854</td>
</tr>
<tr>
<td>On-pump</td>
<td>774</td>
</tr>
<tr>
<td>(Off-pump rate: 52%)</td>
<td></td>
</tr>
<tr>
<td>(previous year: 53%)</td>
<td></td>
</tr>
</tbody>
</table>
Changes in OPCAB frequency rate of initial elective CABG

% of OPCAB frequency rate over years from 1996 to 2013, with a peak of 65% in 2013.
<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases of initial elective</td>
<td>9,187</td>
<td>(100%)</td>
</tr>
<tr>
<td>On-pump (cardiac arrest)</td>
<td>2,170</td>
<td>(22.6%)</td>
</tr>
<tr>
<td>On-pump (cardiac beating)</td>
<td>1,052</td>
<td>(11.5%)</td>
</tr>
<tr>
<td>Off-pump (total cases)</td>
<td>5,965</td>
<td>(64.9%)</td>
</tr>
<tr>
<td>Off-pump (complete)</td>
<td>5,830</td>
<td></td>
</tr>
<tr>
<td>On-pump (convert)</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>OPCAB complete rate</td>
<td>97.7%</td>
<td></td>
</tr>
<tr>
<td>Off to on-pump convert rate</td>
<td>2.3%</td>
<td></td>
</tr>
<tr>
<td>(previous year: 2.5%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mortality of isolated CABG: \(1.75\%\)
(\previous year:1.49\%)

Mortality of initial elective CABG: \(1.08\%\)
(\previous year:0.72\%)

On-pump (cardiac arrest) \(1.34\%\)
On-pump (cardiac beating) \(1.24\%\)
Off-pump (total cases) \(0.96\%\)
Off-pump (complete) \(0.82\%\)
(\previous year:0.45\%)

On to on-pump (convert) \(6.67\%\)
(\previous year:2.72\%)
Changes in mortality of CABG
Changes of mortality for procedures (Initial elective CABG)
Surgical results according to diseased vessels

(Initial elective cases: 9,187, mortality: 1.08%)

Mortality (%)

1VD (1.14%)

2VD (1.03%)

3VD (1.15%)

LMT (0.87%)

LMT + 1VD (1.61%)

LMT + 2VD (0.23%)

LMT + 3VD (1.30%)
Surgical results according to diseased vessels

*(Initial elective off-pump (complete): 5,830, mortality: 0.82%)*

- 1VD (1.01%)
- 2VD (0.93%)
- 3VD (0.81%)
- LMT (0.71%)
- LMT + 1VD (1.27%)
- LMT + 2VD (0%)
- LMT + 3VD (1.08%)
Surgical results according to diseased vessels

(Initial elective on-pump (arrest): 2,170, mortality: 1.34%)
Surgical results according to diseased vessels

(Initial elective off to on-pump conversion: 135, mortality: 6.67%)

Mortality (%)

- 1VD (0%)
- 2VD (6.25%)
- 3VD (9.86%)
- LMT (0%)
- LMT + 1VD (0%)
- LMT + 2VD (0%)
- LMT + 3VD (3.70%)
Surgical results according to diseased vessels

(Initial elective on-pump (beating): 1,052, mortality: 1.24%)

Mortality (%)

- 1VD (0%)
- 2VD (0.61%)
- 3VD (1.34%)
- LMT + 1VD (3.45%)
- LMT (0%)
- LMT + 2VD (0%)
- LMT + 3VD (2.09%)

Initial elective on-pump (beating): 1,052, mortality: 1.24%
Surgical results according to diseased vessels

(Extra initial elective cases: 1,628, mortality: 5.53%)

- 1VD (6.80%)
- 2VD (5.99%)
- 3VD (7.27%)
- LMT (5.56%)
- LMT + 1VD (1.54%)
- LMT + 2VD (5.56%)
- LMT + 3VD (3.38%)
Surgical results according to procedures
(Except initial elective cases: 1,628, mortality: 5.53%)

Mortality (%)

- Off-pump (total) 2.92%
- On-pump (beating) 10.59%
- On-pump (arrest) 5.73%
Number of grafts according to surgical procedures

<table>
<thead>
<tr>
<th>Total cases</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-pump (arrest)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 or more</td>
</tr>
<tr>
<td>On-pump (beating)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 or more</td>
</tr>
<tr>
<td>Off→on (convert)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 or more</td>
</tr>
<tr>
<td>Off-pump (complete)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4 or more</td>
</tr>
</tbody>
</table>

mean grafts (previous)

- On-pump (arrest): 2.97 (2.97)
- On-pump (beating): 3.10 (3.22)
- Off→on (convert): 3.02 (3.01)
- Off-pump (complete): 3.00 (3.17)
- Total: 2.90 (2.87)
Surgical procedures according to number of grafts

1 graft
- Off-pump
- On-pump (arrest)

2 grafts
- Off-pump
- On-pump (arrest)

3 grafts
- Off-pump
- On-pump (arrest)

4 or more grafts
- Off-pump
- On-pump (arrest)
Surgical procedures according to diseased vessels

1 vessel
- Off-pump
- Off to on-pump (conversion)

2 vessels
- Off-pump
- Off to on-pump (conversion)

3 vessels
- Off-pump
- Off to on-pump (conversion)

LMT
- Off-pump
- Off to on-pump (conversion)

LMT +1
- Off-pump
- Off to on-pump (conversion)

LMT +2
- Off-pump
- Off to on-pump (conversion)

LMT +3
- Off-pump
- Off to on-pump (conversion)

Status:
- Off-pump (beating)
- On-pump (arrest)
Surgical results of off-pump (complete) vs. on-pump (arrest) according to diseased vessels

<table>
<thead>
<tr>
<th>Disease Vessels</th>
<th>Off-pump (complete)</th>
<th>On-pump (arrest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vessel</td>
<td>1.01</td>
<td>2.27</td>
</tr>
<tr>
<td>2 vessels</td>
<td>0.93</td>
<td>1.26</td>
</tr>
<tr>
<td>3 vessels</td>
<td>0.81</td>
<td>1.30</td>
</tr>
<tr>
<td>LMT</td>
<td>0.71</td>
<td>1.56</td>
</tr>
<tr>
<td>LMT + 1</td>
<td>1.27</td>
<td>1.69</td>
</tr>
<tr>
<td>LMT + 2</td>
<td>0</td>
<td>1.12</td>
</tr>
<tr>
<td>LMT + 3</td>
<td>0.82</td>
<td>1.29</td>
</tr>
<tr>
<td>Total</td>
<td>0.82</td>
<td>1.34</td>
</tr>
</tbody>
</table>
Off to on-pump conversion rate according to diseased vessels (total: 2.3%)

- 1 vessel: Off-pump (0.7%)
- 2 vessels: Off-pump (1.6%)
- 3 vessels: Off-pump (2.6%)
- LMT: Off-pump (1.4%)
- LMT+1: Off-pump (1.8%)
- LMT+2: Off-pump (2.2%)
- LMT+3: Off-pump (2.6%)
On-pump (arrest) vs. off-pump (Initial elective CABG)

- **RCA**:
  - On-pump (arrest): 63%
  - Off-pump: 60%

- **LAD**:
  - On-pump (arrest): 84%
  - Off-pump: 90%

- **LCX**:
  - On-pump (arrest): 72%
  - Off-pump: 69%
### Off-pump vs. off to on-pump conversion (Initial elective CABG)

<table>
<thead>
<tr>
<th>Bypass</th>
<th>Number</th>
<th>Off-pump</th>
<th>Off to on-pump (conversion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCA(+)</td>
<td>3,590</td>
<td>Off-pump</td>
<td>2.4%</td>
</tr>
<tr>
<td>LAD(+)</td>
<td>5,357</td>
<td>Off-pump</td>
<td>2.1%</td>
</tr>
<tr>
<td>LCX(+)</td>
<td>4,098</td>
<td>Off-pump</td>
<td>2.4%</td>
</tr>
<tr>
<td>RCA(-)</td>
<td>2,375</td>
<td>Off-pump</td>
<td>2.0%</td>
</tr>
<tr>
<td>LAD(-)</td>
<td>608</td>
<td>Off-pump</td>
<td>3.9%</td>
</tr>
<tr>
<td>LCX(-)</td>
<td>1,867</td>
<td>Off-pump</td>
<td>2.0%</td>
</tr>
</tbody>
</table>
Age distribution (Initial elective cases)

Male: 79.0%

Female: 21.0%

(3014 case)

(Age)

≥80

70-79

60-69

50-59

49≥

(386 case)

(877 case)

(562 case)

(134 case)

(60 case)
Changes in elderly patients (Initial elective cases)

- 70 or more years: 52.8% in 2013
- 80 or more years: 12.3% in 2013
Changes in mortality according to age (Initial elective cases)

<table>
<thead>
<tr>
<th>Year</th>
<th>49 y.o. ≥ 50</th>
<th>50-59 y.o.</th>
<th>60-69 y.o.</th>
<th>70-79 y.o.</th>
<th>80 y.o. ≤ 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2.5</td>
<td>1.5</td>
<td>1.0</td>
<td>0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>2001</td>
<td>2.0</td>
<td>1.0</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>2002</td>
<td>1.5</td>
<td>0.5</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>2003</td>
<td>1.0</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>2004</td>
<td>0.5</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2005</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2006</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2007</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2008</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2009</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2010</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2011</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2012</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2013</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Graft selection
(Total number of grafts: 28,526 grafts)

- SVG (42.0%)
- LITA (36.1%)
- RITA (13.8%)
- RA (4.7%)
- GEA (3.3%)
Changes in graft selection

year

LITA

RITA

GEA

RA

SVG

%
Complication rate of postoperative stroke according to surgical procedures

Total complication rate: 111/10815 (isolated CABG) = 1.02%

- Off to on-pump (conversion): 2.36% (p=0.0097)
- Off-pump (complete): 0.75% (p=0.1186)
- On-pump (beating): 1.55% (p=0.0315)
- On-pump (arrest): 1.34% (p=0.697)

p-values indicate statistical significance of differences in complication rates among procedures.
Results of emergency CABG after complications of PCI (within 24 hours after PCI)

Total cases: 80
Frequency rate: 80/10815 (isolated CABG); 0.7%
Death cases: 11
Mortality: 13.8%

Results according to surgical procedures

<table>
<thead>
<tr>
<th></th>
<th>cases</th>
<th>death cases</th>
<th>mortality(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vessel bypass</td>
<td>22</td>
<td>2</td>
<td>9.09</td>
</tr>
<tr>
<td>2 vessels bypass</td>
<td>22</td>
<td>3</td>
<td>13.64</td>
</tr>
<tr>
<td>3 vessels bypass</td>
<td>27</td>
<td>6</td>
<td>22.22</td>
</tr>
<tr>
<td>4 vessels bypass</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Others procedures</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Changes in mortality of VSP

2013;
Total cases: 178, death cases: 43 (Mortality: 24.1%)
Results of VSP (1)

- **Total cases**: 135 alive, 43 death (mortality: 24.1%)
- **Bypass (+)**: 49 alive, 20 death (mortality: 28.9%)
- **Bypass (−)**: 86 alive, 23 death (mortality: 21.1%)
Results of VSP (2)

Anterior infarction (mortality 21.4%)

- Dagett: Alive 27, Death 7, Total 34 (mortality 20.5%)
- Komeda: Alive 65, Death 19, Total 84 (mortality 22.6%)
- Others: Alive 7, Death 1, Total 8 (mortality 0.14%)

Post-inferior infarction (mortality 30.7%)

- Dagett: Alive 17, Death 5, Total 22 (mortality 22.7%)
- Komeda: Alive 15, Death 11, Total 26 (mortality 42.3%)
- Others: Alive 4, Death 0, Total 4 (mortality 0%)
Changes in mortality of papillary muscle rupture of LV

2013:
Total cases: 39, death cases: 9 (mortality: 23.1%)
Results of papillary muscle rupture

- Total cases: 30 (9 deaths, mortality: 23.1%)
- Bypass (+): 16 (6 deaths, mortality: 37.5%)
- Bypass (-): 23 (3 deaths, mortality: 13.0%)
Changes in mortality of cardiac rupture

2013;
Total cases: 135, death cases: 42 (mortality: 31.1%)
Results of cardiac rupture

Total cases:
- Alive: 93
- Death: 42
- Total: 135 (mortality 31.1%)

Blowout type:
- Bypass (+): 15 Alive, 30 Death (mortality 66.6%)
- Bypass (-): 12 Alive, 25 Death (mortality 67.6%)
- Total: 45 (mortality 66.6%)

Oozing type:
- Bypass (+): 12 Alive, 2 Death (mortality 14.3%)
- Bypass (-): 66 Alive, 10 Death (mortality 13.2%)
- Total: 78 (mortality 13.3%)
Changes in mortality of left ventricle aneurysm

2013;
Total cases: 282, death cases 12 (mortality: 4.26%)
Results of left ventricular-plasty (including left ventriculectomy) against LV aneurysm and/or ischemic cardiomyopathy

- Total cases: 164
- Total deaths: 4
- Total cases: 168 (mortality 2.38%)

- Bypass (+): 125
- Bypass deaths: 2
- Bypass cases: 127 (mortality 1.57%)

- Bypass (-): 39
- Bypass deaths: 2
- Bypass cases: 41 (mortality 4.88%)
Results of mitral valvuloplasty and replacement against ischemic mitral regurgitation

Mitral valvuloplasty

- Total cases: 444
- alive: 421 (95.07%)
- death: 23 (5.03%)
- Mortality: 4.92%

Mitral valve replacement

- Total cases: 367
- alive: 350 (95.76%)
- death: 17 (4.24%)
- Mortality: 4.63%

- Bypass (+): 301
  - alive: 286 (95.04%)
  - death: 15 (4.96%)
  - Mortality: 4.75%

- Bypass (-): 51
  - alive: 49 (96.13%)
  - death: 2 (3.87%)
  - Mortality: 3.92%

- Total cases: 100
  - alive: 94 (94.00%)
  - death: 6 (6.00%)
  - Mortality: 6.00%

- Bypass (+): 74
  - alive: 70 (94.59%)
  - death: 4 (5.41%)
  - Mortality: 6.33%

- Bypass (-): 26
  - alive: 21 (80.77%)
  - death: 5 (19.23%)
  - Mortality: 5.00%
Results of LV aneurysm and or ischemic cardiomyopathy concomitant with mitral valve regurgitation

Total cases

LV-plasty + MV-plasty

- Total cases
  - LV-plasty + MV-plasty: 106 (mortality 7.02%)
  - LV-plasty + MV-plasty (+) bypass: 96 (mortality 5.88%)
  - LV-plasty + MV-plasty (+) bypass (-): 77 (mortality 6.10%)
  - LV-plasty + MV-plasty (-) bypass: 19 (mortality 5.0%)

LV-plasty + MV replacement

- Total cases
  - LV-plasty + MV replacement: 10 (mortality 16.7%)
  - LV-plasty + MV replacement (+) bypass: 7 (mortality 22.2%)
  - LV-plasty + MV replacement (-) bypass: 3 (mortality 0%)
Conclusions (1)

1. The mortality of isolated CABG and initial elective CABG were 1.75%, and 1.08% respectively, indicating excellent results.

2. Of all initial elective CABG, 65% cases underwent off-pump CABG (OPCAB), showing high frequency rate. The mortality of OPCAB was 0.82%, which was very low.

3. Of 4 or more bypass surgery, 59% cases underwent OPCAB.

4. CABG cases have been getting older; the rate of 70 or more years old was 52.8%, 80 or more years old was 12.3%.

5. The frequency use rate of arterial grafts was 58%, on the other hand, that of vein graft (42%) gradually increased in recent years.
Conclusions (2)

6. Postoperative stroke rate of CABG was 1.02% and that of OPCAB was 0.75%, which was significantly lower than those of on-pump (arrest) and on-pump (beating).

7. Emergency CABG after complications of PCI were performed 0.7% of isolated CABG cases, demonstrating high mortality (13.8%).

8. As for the results of complications after myocardial infarction, post-inferior wall VSP, rupture of papillary muscle of LV, and blowout type of cardiac rupture were still bad, indicating high mortality.