Coronary artery surgery results
In 2017

The Survey Committee of Japanese Association for Coronary Artery Surgery (JACAS)
Coronary artery bypass grafting (CABG), 2017

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>12,584</td>
</tr>
<tr>
<td>Isolated CABG</td>
<td>8,497  (68%)</td>
</tr>
<tr>
<td>Concomitant CABG</td>
<td>4,087  (32%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isolated CABG</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial elective</td>
<td>7,144</td>
</tr>
<tr>
<td>Off-pump</td>
<td>4,562</td>
</tr>
<tr>
<td>On-pump</td>
<td>2,582</td>
</tr>
<tr>
<td>(Off-pump rate : 64%)</td>
<td></td>
</tr>
<tr>
<td>(previous year : 62%)</td>
<td></td>
</tr>
<tr>
<td>Except initial elective</td>
<td>1,353</td>
</tr>
<tr>
<td>Off-pump</td>
<td>646</td>
</tr>
<tr>
<td>On-pump</td>
<td>707</td>
</tr>
<tr>
<td>(Off-pump rate : 48%)</td>
<td></td>
</tr>
<tr>
<td>(previous year : 51%)</td>
<td></td>
</tr>
</tbody>
</table>
Changes of off-pump CABG rate (Initial elective CABG)

% year


64%
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial elective CABG</td>
<td>7,144</td>
<td>(100%)</td>
</tr>
<tr>
<td>On-pump (arrest)</td>
<td>1,516</td>
<td>(21.2%)</td>
</tr>
<tr>
<td>On-pump (beating)</td>
<td>1,066</td>
<td>(14.9%)</td>
</tr>
<tr>
<td>Off-pump (total)</td>
<td>4,562</td>
<td>(63.9%)</td>
</tr>
<tr>
<td>Off-pump (complete)</td>
<td>4,431</td>
<td></td>
</tr>
<tr>
<td>On-pump (conversion)</td>
<td>131</td>
<td></td>
</tr>
<tr>
<td>Off-pump complete rate</td>
<td>97.1%</td>
<td></td>
</tr>
<tr>
<td>Off-to-on-pump conversion rate</td>
<td>2.9%</td>
<td>(previous year: 2.3%)</td>
</tr>
</tbody>
</table>
Mortality of isolated CABG: 1.52%  
(Previous year: 1.66%)

Mortality of initial elective CABG: 0.81%  
(Previous year: 1.09%)

- On-pump (arrest): 0.73%
- On-pump (beating): 1.59%
- Off-pump (total): 0.65%
  - Off-pump (complete): 0.61%  
  (Previous year: 0.86%)
- On-pump (conversion): 2.29%  
  (Previous year: 5.88%)
Changes of mortality (Isolated and initial elective CABG)

- Isolated CABG mortality:
  - 1996: 3.5%
  - 1997: 3.0%
  - 1998: 2.5%
  - 1999: 2.0%
  - 2000: 1.5%
  - 2001: 1.0%
  - 2002: 0.5%
  - 2003: 0.0%
  - 2004: 0.5%
  - 2005: 1.0%
  - 2006: 1.5%
  - 2007: 2.0%
  - 2008: 2.5%
  - 2009: 3.0%
  - 2010: 3.5%
  - 2011: 4.0%
  - 2012: 4.5%
  - 2013: 5.0%
  - 2014: 5.5%
  - 2015: 6.0%
  - 2016: 6.5%
  - 2017: 7.0%

- Initial elective CABG mortality:
  - 1996: 0.81%
  - 1997: 0.45%
  - 1998: 0.30%
  - 1999: 0.25%
  - 2000: 0.20%
  - 2001: 0.15%
  - 2002: 0.10%
  - 2003: 0.05%
  - 2004: 0.10%
  - 2005: 0.15%
  - 2006: 0.20%
  - 2007: 0.25%
  - 2008: 0.30%
  - 2009: 0.35%
  - 2010: 0.40%
  - 2011: 0.45%
  - 2012: 0.50%
  - 2013: 0.55%
  - 2014: 0.60%
  - 2015: 0.65%
  - 2016: 0.70%
  - 2017: 0.75%
Changes of mortality for procedures (Initial elective CABG)

- Off-pump (complete)
- On-pump (beating)
- On-pump (arrest)
- Off to on-pump (conversion)
Mortality according to number of diseased vessels
(Initial elective CABG: 7,144, mortality: 0.81%)

<table>
<thead>
<tr>
<th>Vessel Count</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1VD</td>
<td>1.26%</td>
</tr>
<tr>
<td>2VD</td>
<td>0.44%</td>
</tr>
<tr>
<td>3VD</td>
<td>0.76%</td>
</tr>
<tr>
<td>LMT</td>
<td>0%</td>
</tr>
<tr>
<td>LMT + 1VD</td>
<td>0.59%</td>
</tr>
<tr>
<td>LMT + 2VD</td>
<td>1.15%</td>
</tr>
<tr>
<td>LMT + 3VD</td>
<td>1.07%</td>
</tr>
</tbody>
</table>
Mortality according to number of diseased vessels
(Except initial elective CABG: 1,353, mortality: 5.25%)

- 1VD: 6.98%
- 2VD: 4.03%
- 3VD: 5.56%
- LMT: 5.66%
- LMT + 1VD: 1.96%
- LMT + 2VD: 4.79%
- LMT + 3VD: 5.54%
Mortality according to surgical procedures
(Except initial elective CABG: 1,353, mortality: 5.25%)

Mortality (%):
- Off-pump (total): 3.09%
- On-pump (beating): 9.63%
- On-pump (arrest): 3.32%
Graft number according to procedures (Initial elective CABG)

- **Total**: 1, 2, 3, 4 or more
  - Average No. (previous year): 2.99 (3.05)

- **On-pump (arrest)**: 1, 2, 3, 4 or more
  - Average No. (previous year): 3.13 (3.17)

- **On-pump (beating)**: 1, 2, 3, 4 or more
  - Average No. (previous year): 3.03 (3.10)

- **Off to on (conversion)**: 1, 2, 3, 4 or more
  - Average No. (previous year): 2.98 (3.25)

- **Off-pump (complete)**: 1, 2, 3, 4 or more
  - Average No. (previous year): 2.94 (2.99)
Procedure according to graft number (Initial elective CABG)

1. Off-pump
   - Off to on-pump (conversion)
   - On-pump (beating)
   - On-pump (arrest)

2. Off-pump
   - Off to on-pump (conversion)
   - On-pump (arrest)

3. Off-pump
   - Off to on-pump (conversion)
   - On-pump (arrest)

4. Off-pump
   - Off to on-pump (conversion)
   - On-pump (arrest)

Procedure according to graft number

- Graft number 1: 100%
- Graft number 2: 75%
- Graft number 3: 50%
- Graft number 4: 25%

Total: 62.3%
On-pump (arrest) vs. off-pump (Initial elective CABG)

- RCA
  - On-pump (arrest): 71%
  - Off-pump: 64%

- LAD
  - On-pump (arrest): 92%
  - Off-pump: 93%

- LCX
  - On-pump (arrest): 81%
  - Off-pump: 71%
Off-pump vs. off to on-pump conversion (Initial elective CABG)

<table>
<thead>
<tr>
<th>Bypass</th>
<th>No.</th>
<th>Off-pump</th>
<th>Conversion rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCA(+)</td>
<td>2,908</td>
<td></td>
<td>2.7%</td>
</tr>
<tr>
<td>LAD(+)</td>
<td>4,241</td>
<td></td>
<td>2.4%</td>
</tr>
<tr>
<td>LCX(+)</td>
<td>3,254</td>
<td></td>
<td>2.7%</td>
</tr>
<tr>
<td>RCA(−)</td>
<td>1,654</td>
<td></td>
<td>3.1%</td>
</tr>
<tr>
<td>LAD(−)</td>
<td>321</td>
<td></td>
<td>9.3%</td>
</tr>
<tr>
<td>LCX(−)</td>
<td>1,308</td>
<td></td>
<td>3.2%</td>
</tr>
</tbody>
</table>
Age distribution according to gender (Initial elective CABG)

Male: 79.3%

Female: 20.7%

Age distribution:
- 2214 cases (Male)
- 1881 cases (Female)
- 635 cases (Male) aged 60-69
- 796 cases (Male) aged 50-59
- 336 cases (Male) aged 49 or older
- 300 cases (Female) aged 60-69
- 665 cases (Female) aged 50-59
- 411 cases (Female) aged 49 or older
- 91 cases (Female) aged 70-79
- 62 cases (Female) aged 80 or older
Changes of elderly cases (Initial elective CABG)

- 70 y.o. ≤: 51.6%
- 80 y.o. ≤: 12.7%

Year-wise analysis from 2000 to 2017.
Changes of mortality according age (Initial elective CABG)

- 49 y.o. ≥
- 50-59 y.o.
- 60-69 y.o.
- 70-79 y.o.
- 80 y.o. ≤

Mortality (%): 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5
Graft selection

(Total graft number of isolated CABG: 22,293)

- SVG (40.9%)
- LITA (35.7%)
- RITA (15.8%)
- RA (3.7%)
- GEA (3.5%)
Stroke rate according to procedures (Isolated CABG)

Stroke cases: 97
Stroke rate: 97/8497 (isolated CABG) = 1.14%
Results of emergency CABG after PCI complications

Emergency CABG; operation after PCI complications (coronary occlusion and/or bleeding), within 24 hours

Cases: 75
Rate: 75/8497 (isolated CABG); 0.88%
Death cases: 11
Mortality: 14.67%

<table>
<thead>
<tr>
<th>Results</th>
<th>cases</th>
<th>death cases</th>
<th>mortality(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG①</td>
<td>25</td>
<td>4</td>
<td>16.00</td>
</tr>
<tr>
<td>CABG②</td>
<td>26</td>
<td>3</td>
<td>11.54</td>
</tr>
<tr>
<td>CABG③</td>
<td>11</td>
<td>1</td>
<td>9.09</td>
</tr>
<tr>
<td>CABG④</td>
<td>8</td>
<td>2</td>
<td>25.00</td>
</tr>
<tr>
<td>Other procedures</td>
<td>5</td>
<td>1</td>
<td>20.00</td>
</tr>
</tbody>
</table>
Changes in results of ventricular septal perforation

Total No.: 172, death: 40 (mortality: 23.2%)
Results of ventricular septal perforation (1)

- Total cases: 172 (mortality: 23.2%)
  - Bypass (+): 84 (mortality: 16.6%)
  - Bypass (-): 108 (mortality: 24.0%)
Results of ventricular septal perforation (2)

Anterior infarction (mortality: 21.2%)
- Patch closure: 32 alive, 10 death (42 cases, mortality: 23.8%)
- Infarction exclusion: 47 alive, 14 death (61 cases, mortality: 22.9%)
- Others: 10 cases (mortality: 0%)

Post-inferior infarction (mortality: 27.1%)
- Patch closure: 29 alive, 10 death (39 cases, mortality: 25.6%)
- Infarction exclusion: 6 alive, 6 death (12 cases, mortality: 50.0%)
- Others: 8 cases (mortality: 0%)
Changes in results of ventricular septal perforation according to infarction region

- Anterior VSP
- Post-inferior VSP


Mortality (%): 0, 10, 20, 30, 40, 50, 60, 70

2004: Anterior VSP = 20, Post-inferior VSP = 30
2005: Anterior VSP = 25, Post-inferior VSP = 25
2006: Anterior VSP = 20, Post-inferior VSP = 20
2007: Anterior VSP = 15, Post-inferior VSP = 15
2008: Anterior VSP = 10, Post-inferior VSP = 10
2009: Anterior VSP = 50, Post-inferior VSP = 50
2010: Anterior VSP = 40, Post-inferior VSP = 40
2011: Anterior VSP = 30, Post-inferior VSP = 30
2012: Anterior VSP = 20, Post-inferior VSP = 20
2013: Anterior VSP = 10, Post-inferior VSP = 10
2014: Anterior VSP = 5, Post-inferior VSP = 5
2015: Anterior VSP = 10, Post-inferior VSP = 10
2016: Anterior VSP = 20, Post-inferior VSP = 20
2017: Anterior VSP = 30, Post-inferior VSP = 30
Changes in results of papillary muscle rupture

Total No.: 68, death: 13 (mortality: 19.1%)
Results of papillary muscle rupture

Total cases:
- Alive: 55
- Death: 13
- Total: 68 (mortality: 19.1%)

Bypass (+):
- Alive: 41
- Death: 3
- Total: 44 (mortality: 6.8%)

Bypass (-):
- Alive: 14
- Death: 10
- Total: 24 (mortality: 41.6%)
Changes in results of LV free wall rupture

Total No.: 131, death: 46 (mortality: 35.1%)
Results of LV free wall rupture

Total cases
- Alive: 85
- Death: 46
- Total: 131 (mortality: 35.1%)

Blowout type
- Bypass (+)
  - Alive: 14
  - Death: 28
  - Total: 42 (mortality: 66.6%)
- Bypass (-)
  - Alive: 12
  - Death: 24
  - Total: 36 (mortality: 66.6%)

Oozing type
- Bypass (+)
  - Alive: 18
  - Death: 19
  - Total: 37 (mortality: 5.2%)
- Bypass (-)
  - Alive: 53
  - Death: 17
  - Total: 70 (mortality: 24.3%)
Changes in results of LV free wall rupture according to rupture type
Changes in results of left ventricular aneurysm (LVA)

Total No.: 170, death: 9 (mortality: 5.29%)
Results of left ventriculoplasty and/or aneurysmectomy

Total cases
- 161 alive
- 9 death
- 170 (mortality: 5.29%)

Bypass (+)
- 115 alive
- 5 death
- 120 (mortality: 4.16%)

Bypass (-)
- 46 alive
- 4 death
- 50 (mortality: 8.00%)
Results of MVR or MVP for ischemic MR

- **Total cases**: 340 (mortality: 4.49%)
  - Mitral valve plasty
    - Total: 251 (mortality: 4.19%)
      - Bypass (+): 233 (mortality: 4.51%)
      - Bypass (-): 18 (mortality: 0%)
  - Mitral valve replacement
    - Total: 89 (mortality: 5.31%)
      - Bypass (+): 63 (mortality: 7.35%)
      - Bypass (-): 26 (mortality: 0%)
Results of ischemic MR+LVA or ischemic cardiomyopathy

- **Total cases**: 53 (mortality: 7.54%)
  - Left ventriculoplasty + Mitral valve plasty
    - Total: 49 (alive) + 4 (death)
    - Bypass (+): 26 (alive) + 3 (death)
    - Mortality: 7.69%
  - Bypass (-): 10 (alive) + 3 (death)
    - Mortality: 10.34%
  - 10 (mortality: 0%)

- Left ventriculoplasty + Mitral valve replacement
  - Total: 13 (alive) + 1 (death)
    - Bypass (+): 8 (alive) + 1 (death)
      - Mortality: 7.14%
    - Bypass (-): 5 (alive) + 1 (death)
      - Mortality: 0%
Conclusions (1)

1. The mortality of isolated CABG was 1.52%, that of initial elective CABG was 0.81%, indicating better excellent results than those of previous year.
2. Of initial elective CABGs, 64% cases underwent off-pump procedure, showing still high rate. The mortality of off-pump was 0.61%, which was much lower than that of previous year, indicating excellent results.
3. Off to on-pump conversion rate was 2.9%, and the mortality of those cases was 2.29%, which was remarkable better results than that of previous year.
4. Of all 4 and/more bypass procedures, 62.3% cases were done by off-pump CABG.
5. CABG cases is getting older year by year, more than 70 years old patients rate was 51.6%, more than 80 was 12.7%, showing high rate.
6. Arterial grafts were used in 58.8% of all grafts, while vein grafts were used in 40.9%. The frequency of vein graft usage increased in recent years.

7. The complication rate of central nerve system stroke of all isolated CABG was 1.14%. This rate of off-pump CABG showed significantly lower than those of on-pump (beating), which means that OPCAG can avoid this complication.

8. After PCI complications, emergency operation underwent in 0.88% of all isolated CABG within 24 hours. The mortality of those cases was 14.67%, showing still high rate.

9. The results of complications for acute and old myocardial infarction got worse than those of previous year. Especially, the mortality of post-inferior VSP and blowout type free wall rupture, were high rate, indicating poor prognosis.