Current Status of Coronary Surgery
CABG x OPCAB
LAF - 2011
Conventional CABG using CBP and cardioplegic arrest has been the gold standard treatment of ischaemic heart disease for several decades.

It provides the surgeon with a still bloodless operating field allowing effective myocardial revascularisation and coronary reconstruction while providing adequate myocardial protection.

Currently, around 600,000 CABG procedures are performed worldwide.

CABG is the most extensively studied surgical procedure ever undertaken with data extending to over 20 years.

Improvements in medical, anaesthetic and surgical management have ensured that its mortality has remained around 2% over the last decade despite the fact that it has been increasingly applied to an ageing and sicker patient population.
40 years of Coronary Artery Bypass Surgery

- Improves the life expectancy in certain anatomic pattern of disease
  - Left main
  - LAD
  - 3 vessel disease
  - Low ejection fraction

- Improves the angina

- Mammary artery/LAD

- Arterial graft are better
40 years of Coronary Artery Bypass Surgery

The main drawback of CABG in the long term is vein graft failure leading to recurrent angina, myocardial infarction and death.

- Antiplatelet agents and statins may improve graft longevity
- Use arterial grafts appears to improve long-term outcome
- Saphenous harvesting by no touch technique
Kaplan-Meier curve showing survival free of MACCE at 1 year from the ARTS trial, stratified by treatment and completeness of revascularization. Reprinted from van den Brand et al\textsuperscript{9} with permission from the American College of Cardiology Foundation. CVA indicates cerebrovascular accident; MI, myocardial infarction.
40 years of Coronary Artery Bypass Surgery

So with such safe therapy (CABG), why change practice (OPCAB)?

**CABG**
Is Gold Standard Treatment

- Bloodless operating field
- Effective myocardial revascularisation providing adequate myocardial protection

- 600,000 CABG procedures are performed worldwide

**OPCAB**
- World 20-25%
- Western World 15-20%
- Asian over 90%
### Meta-analyses (Significant Differences Off-pump vs On-pump)

<table>
<thead>
<tr>
<th>Cheng</th>
<th>NO</th>
<th>YES</th>
<th>INCONCLUSIVE</th>
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<tbody>
<tr>
<td>37 RT (n=3.369)</td>
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</tbody>
</table>

#### 30 day
- Mortality
- Myocardial infarction
- Stroke
- Renal dysfunction
- IABP use
- Wound infection
- Re-exploration

#### 1 year
- Costs

#### 30 day
- AFIB
- Blood transfusion
- Inotrope use
- Respiratory infection
- Ventilation time
- ICU – stay
- Hospital – stay

#### 1 year
- Costs

**Note:**
- RCT: randomised controlled trial.
- AFIB: Atrial Fibrillation
- IABP: Intra-Aortic Balloon Pump
<table>
<thead>
<tr>
<th>Wijeysundera 37 RCT (n=3449)</th>
<th>Observational Studies 22 Risk-adjusted (n=293.617)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>↓ AFIB</strong></td>
<td><strong>↓ AFIB</strong></td>
<td>RCT not find reduction in short-terms mortality and morbidity demostrated by OS, except for AFIB</td>
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<tr>
<td>Trends reduced 30 day mortality Stroke MI</td>
<td>Reduced 30 day mortality Stroke MI</td>
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<tr>
<td>1-2 years Trends reduced mortality</td>
<td>1-2 years Trends reduced mortality</td>
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<tr>
<td>Increased repeat revascularization</td>
<td>Increased repeat revascularization</td>
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</table>
Meta-analyses

- These generally reported improved or at least equivalent outcomes with off-pump compared to on-pump.

- Most of these studies is that they were performed in highly select and relatively low-risk patients group.

- In observational studies, reflecting the real life situation, the benefits of off-pump CABG appear greater.

- Trends for off-pump appear less:
  - Blood loss and need for transfusion
  - Myocardial enzyme release up 24hs
  - Early neurocognitive dysfunction
  - Renal insufficiency

- Outcome appear to be similar
  - Hospital stay
  - Mortality rate
  - Long term neurological function
Cleveland and colleagues
National Adult Cardiac Surgery Database of The STS over a 2-year period
With over 11,000 off-pump cases and over 100,000 on-pump cases

**Significant reduction in operative mortality** with off-pump (2.3% vs 2.9%) with an odds ratio for a reduction in the risk of death of 0.81 (95% CI: 0.70—0.91).

Reduction in major complications
- deep sternal infection
- bleeding
- renal failure
- prolonged ventilation with off-pump CABG

**Conclusion**: avoidance of CPB is associated with reduced mortality and morbidity.
Observational Studies

**Sergeant and colleagues**

Single-centre series of over 3000 cases over a 6-year period

Significant reduction in the risk
  - stroke in higher risk patients
  - hospital stay

Differences in mortality were not significant following risk adjustment.


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**Al-Ruzzeh and colleagues (UK)**

5000 on-pump and 2000 off-pump cases outcomes.

Significant reduction mortality with off-pump surgery compared to that predicted.

In the on-pump group the observed mortality was similar to the predicted.

In addition,

Reduction in all cause morbidity with off-pump proportional to risk stratification.

Magee and colleagues

1983 off-pump CABG and 6466 ONCABG higher risk population
  mean age was 64 years
  48% had impaired left ventricular function
  30% had diabetes
  20% had significant comorbidity
    5% with renal failure
    5% undergoing redo CABG)

Off-pump group had a higher preoperative risk. Despite this, the on-pump group had higher mortality than the off-pump group

Off-pump CABG was associated with a reduction in morbidity

Randomised Trials

van Dijk and colleagues

- Multicentre trial on a cohort of 281 patients (139 patients assigned to on-pump and 142 patients to off-pump CABG)

- No significant differences in perioperative mortality or morbidity

- Both groups had been free of cardiovascular events (93% and 94% with off-pump and on-pump)

- Off-pump group did show a reduction
  - Cardiac enzyme release
  - Duration of mechanical ventilation/hospital stay

Circulation 2001;104:1761—6
Randomised Trials

Angelini and colleagues

- Results of Beating Heart Against Cardioplegic Arrest Studies (BHACAS 1 and 2) with 400 patients randomised to on-pump or off-pump CABG

- No significant difference in mortality was observed (0% for off-pump and 1% for on-pump). At 2 years follow-up for BHACAS 1 and over 1 year for BHACAS 2, mortality was 2% and 3%, respectively

- The rate of cardiac events was 15% for off-pump compared with 18% in the on-pump group.

- Further benefits associated with off-pump surgery included reduced use of blood products, inotropic requirements, the rate of atrial fibrillation, chest infection, and reduced intensive care and hospital stay.

- 6-8 years follow-up no difference between the off-pump and on-pump groups in graft occlusion rate (10% vs 11%), hazard of death, major adverse cardiac events and health-related quality of life

Lancet 2002;359:1194-9
Puskas and colleagues randomised 200 unselected patients. They reported similar in-hospital and 30-day outcomes. Similar completeness of revascularisation (mean of 3.39 grafts for off-pump and 3.40 for on-pump), shorter length of stay, reduced transfusion requirements, and less myocardial injury with avoidance of CPB. 

J Thorac Cardiovasc Surg 2003;125:797-808
Randomised Trials

Mazzei and colleagues

- 300 patients into either undergoing revascularisation on CPB using a MECC circuit or with complete avoidance of CPB

- Equivalent:
  - in-hospital mortality
  - stroke
  - myocardial infarction
  - length of stay
  - need for transfusion between groups

- During 1-year follow-up were similar
  - Overall survival and angina-free survival between groups

- CPB circuit will always require aortic cannulation and cross-clamping to achieve global myocardial arrest whereas off-pump provides the opportunity for complete avoidance of aortic manipulation
Revisões sistemáticas

Resposta inflamatória
Lesão miocárdica
Insuficiênciarenal
Fibrilação atrial
Patência do enxérto e adequação da RM
Custos
Treinamento cirúrgico
Avoiding Cardiopulmonary Bypass in Multivessel CABG Reduces Cytokine Response and Myocardial Injury

Song Wan, MD, PhD, Mohammad Bashar Izzat, FRCS (CTh), Tak Wai Lee, FRCS, Innes Y. P. Wan, FRCS, Nelson L. S. Tang, FRCPA, and Anthony P. C. Yim, MD

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Insuficiência renal

- Complicação grave e freqüente (1 - 5%)
- Geralmente é transiente
- IR leve pré-operatória é preditor independente para morbi-mortalidade e sobrevivência a médio e longo prazo
- Reston e cols demonstram em Meta-análise uma significante redução de IRA em pacientes operados sem CEC

Fibrilação atrial

- A mais freqüente com incidência de 20-40%
- CRMsCEC reduz significativamente a FA (8% x 39%)
- Redução acentuada nos nos idosos
Permeabilidade do enxerto e adequação da RM

- Continua sendo um ponto muito criticado no que se refere a qualidade da anastomose e a RM completa
- Existe um conflito de evidências científicas e parte pode ser explicado:
  - Cuidadosa seleção dos pacientes
  - Habilidade cirúrgica
  - Experiência cirúrgica
  - Eliminação anti-plaquetária da CEC
Economic Costs in a NHS Environment
Operative costs were significantly lower in the off-pump group.

Economic Costs in a USA Environment
Cardiopulmonary bypass was found, in multiple regression models, to be an independent predictor of both increased postoperative length of stay (p<0.0001) and increased hospital stay (P=0.0048).

Economic Costs in a Canadian Environment
A savings of 14% of the hospital cost was obtained in the off-pump approach.

- Custos em sistema de saúde é importante
- A CRM's CEC apresenta redução de custos (+/- 25%) em diversos Trials Randomizados e Controlados
Treinamento cirúrgico

CRMsCEC pode ser realizada por cirurgiões em treinamento

Resultados imediatos /médio prazo são tão bons quanto os operados por cirurgião treinado

Programas de treinamento na CRMsCEC devem ser estimulados
### Observed/expected ratios (95% CI) for mortality and morbidity based on preoperative risk scores

<table>
<thead>
<tr>
<th>YEARS: 1998;1999</th>
<th>ONCABG</th>
<th>OPCABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO</td>
<td>106,423 (90%)</td>
<td>11,717 (10%)</td>
</tr>
<tr>
<td>Mortality</td>
<td>1.02 (0.99-1.05)</td>
<td><strong>0.81</strong> (0.70-0.91)</td>
</tr>
<tr>
<td>Any Major Complication</td>
<td>1.03 (1.01-1.04)</td>
<td><strong>0.77</strong> (0.72-0.82)</td>
</tr>
<tr>
<td>Neurological (stroke/CVA)</td>
<td>1.05 (1.00-1.09)</td>
<td><strong>0.62</strong> (0.49-0.74)</td>
</tr>
<tr>
<td>Renal (failure)</td>
<td>1.02 (0.99-1.04)</td>
<td><strong>0.86</strong> (0.77-0.94)</td>
</tr>
<tr>
<td>Respiratory (vent depend)</td>
<td>1.03 (1.01-1.05)</td>
<td><strong>0.68</strong> (0.61-0.74)</td>
</tr>
<tr>
<td>Bleeding (reop)</td>
<td>1.03 (0.99-1.07)</td>
<td><strong>0.73</strong> (0.63-0.84)</td>
</tr>
</tbody>
</table>

**OPCABG 1. STS Database. Cleveland et al ATS 2001;72:1282-9**

- **OPCABG:** Deep sternal infection

- **OPCABG:** ↓ mortality and ↓ morbidity

David Tagget
A “corrida” para definir o melhor procedimento cirúrgico
(RMcCEC x RMsWithCEC é cruel !!! Por que?

- O cirurgião deve usar o procedimento que tiver melhores resultados
- Cirurgia com e sem CEC sempre serão técnicas complementares
- O foco é demonstrar a superioridade da Cirurgia x ATC
Obrigado !
RM Com e Sem CEC
21 anos follow-up

First Patient Operated by Dr. Enio Buffolo 1981