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The Impact of Aortic Manipulation on Neurological Outcomes After Coronary Artery Bypass Surgery: A Risk-Adjusted Study

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PURPOSE: The incidence of cerebrovascular accidents (CVA) after conventional Coronary Artery Bypass Grafting (CABG) still remains high (2.5–4.6%). Cerebral embolization by atherosclerotic plaque debris during aortic manipulation, is cited as a major underlying mechanism of post-operative stroke. Reducing stroke rates by eliminating aortic manipulation is a driving concept in Off-Pump CABG (OPCAB) development. We investigated the effect of aortic manipulation on post-operative neurological outcomes after CABG surgery utilizing a risk-adjusted approach.

METHODS: From January 1998 to June 2002, 7,272 patients underwent isolated CABG surgery via 3 levels of aortic manipulation; full aortic clamp application (On-Pump surgery), (n=4,269), partial/side aortic clamp application (OPCAB surgery), (n=2,527) or a "no-touch" technique (OPCAB surgery), (n=476). A risk-adjusted logistic regression analysis was performed to establish the likelihood of post-operative stroke with each technique. Pre-operative risk factors for stroke from the literature and those found significant in a univariate model were used.

RESULTS: Patients with a fully applied aortic clamp were 1.6 times more likely to have a stroke versus those without any aortic manipulation [95%CI=1.09-2.44, (p=0.02)]. Similarly patients receiving full aortic clamping were 1.8 times more likely to develop post-operative CVA than those with a partial/side aortic clamp applied [95%CI=1.19-2.84, (p=0.01)]. In contrast patients who underwent partial/side aortic clamp surgery and those operated on with the "no touch" approach showed no significant differences [OR=0.9, (95%CI:0.59-1.34), (p=0.57)].

CONCLUSION: Recent studies have demonstrated lower post-operative CVA rates with OPCAB surgery. While complete aortic occlusion during On-Pump CABG is a contributing mechanism of post-operative stroke, partial/side clamp application during OPCAB surgery appears not to be.

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Improved Survival After Coronary Revascularization Without Cardiopulmonary Bypass Versus the Conventional Approach in High-Risk Patients

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Background: The premise of coronary revascularization without cardiopulmonary bypass (off-pump CABG) proposes that patient morbidity and, potentially, mortality can be reduced without compromising the excellent results of the conventional approach (on-pump CABG), especially in high-risk patients. The aim of this study was to compare operative and 1 year mortality after off-pump vs. on-pump CABG in a subset of high-risk patients.

Methods: Between January 1, 2000, and December 31, 2000, 513 high-risk patients with a Parsonnet's risk scores of 19.5 or higher underwent CABG; 38.6% (n=198) underwent On-pump CABG and 61.4% (n=315) had off-pump CABG. To adjust for potential confounders, a multivariate Cox regression model was constructed to assess the association between off-pump CABG and the risk of mortality. Any preoperative risk factor that was significantly related to on vs. off-pump CABG selection and/or risk factor that was related to mortality in the univariate analysis (p<0.1) was included in the multivariate model.

Results: Off-pump CABG was associated with a lower operative mortality than on-pump CABG (5% Vs. 12%, p=0.02). The median follow-up for the on-pump CABG patients was 12.2 (0-28.6) months and for the off pump 12.6 (0-26.4) months. In the multivariate analysis, off-pump CABG emerged as an independent predictor of LOWER late mortality (Table). Advanced age, acute renal failure, acute myocardial infarction, and preoperative intraaortic balloon counterpulsation may also increase the mortality risk.

Conclusions: Compared to on-pump CABG, off-pump CABG can be performed with lower mortality in high-risk patients. Off-pump CABG may be a better revascularization option in this subset of patients.

Risk Factors for late mortality

| | Hazard Ratio | 95% Confidence Intervals | P |
|--------------------------------------|--------------|--------------------------|-------|
| Off-pump CABG | 0.60 | 0.37 to 0.96 | 0.03 |
| Age> 75 years | 1.72 | 1.07 to 2.74 | 0.02 |
| Chronic Renal Failure | 1.90 | 0.1.02 to 3.53 | 0.04 |
| Hemodialysis | 4.17 | 2.13 to 8.15 | <0.01 |
| Acute myocardial Infarction | 1.91 | 1.17 to 3.12 | 0.01 |
| Intraaortic balloon Counterpulsation | 3.58 | 1.76 to 7.27 | <0.01 |

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Preoperative Risk Factors for Post-Coronary Artery Bypass Graft Atrial Fibrillation

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Background: Controversy exists as to which preoperative clinical and/or ECG characteristics distinguish pts. who develop postoperative atrial fibrillation (AF). We examined the usefulness of preoperative clinical and ECG variables previously shown to predict post-CABG AF risk, in a large cohort of pts. **Methods:** Using a prospective database of 1553 consecutive pts. at one institution who were in sinus rhythm before surgery, had no previous cardiac surgery, and underwent standard CABG without concurrent valvular surgery, we retrospectively analyzed clinical data and the preoperative standard 12-lead ECG. Data are mean ±SD. **Results:** In-hospital sustained (> 5 min) postoperative AF occurred in 508/1553 (33%) pts. and increased with age: 13% [≤ 55 yr], 29% [56-65 yr.], 45% [≥66 yr.], P<0.0001. On univariate analysis age, prior AF, P-duration (lead II) and PR-interval were significantly associated with AF occurrence (Table). Multivariate analysis showed that age (P<0.0001, OR=1.3, per 5 yr increment, 95% CI, 1.2-1.4), prior AF (P<0.0001, OR=3.7, 95%CI, 2.3-6.0) and P-duration > 110 ms (P=0.02, OR=1.3, 95% CI, 1.0-1.7) were independently associated with AF risk. **Conclusions:** To our knowledge, this is the largest study using preoperative ECG and clinical variables to predict post-CABG AF. Our results show that greater age, prior history of AF and prolonged intraatrial conduction are independently associated with postoperative AF risk. This information can be used to guide prevention strategies for AF.

Univariate Risk Factors for AF

| | AF (n=508) | No AF (n=1045) | P value |
|----------------------|------------|----------------|---------|
| Age, yr | 68±9 | 62±11 | <0.0001 |
| Male, n (%) | 336 (66) | 704 (67) | 0.63 |
| Prior AF, n (%) | 57 (11) | 27 (3) | <0.0001 |
| Prior MI, n (%) | 265 (52) | 525 (50) | 0.48 |
| COPD, n (%) | 46 (9) | 72 (7) | 0.13 |
| Beta-blockers, n (%) | 239 (47) | 547 (52) | 0.05 |
| Heart rate, bpm | 72±14 | 72±15 | 0.55 |
| PR-interval, ms | 170±29 | 164±26 | <0.0001 |
| PR > 180 ms | 135 (27) | 242 (23) | 0.14 |
| P-duration, ms | 117±17 | 115±18 | 0.02 |
| P-duration > 110 ms | 318 (63) | 550 (53) | 0.0002 |

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Intramyocardial Injection of Autologous Bone Marrow Cells Improves Myocardial Perfusion in Severe Ischemic Heart Disease: A 30-Day Assessment

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Background: Adult bone marrow cells (BMC) have the potential to contribute to angiogenesis, myogenesis and matrix remodeling which might be explored therapeutically in ischemic tissues. We tested the hypothesis that intramyocardial injection of autologous BMC is safe and well-tolerated, and may help increase perfusion and the number of viable cells in patients (pt) undergoing incomplete CABG for severe coronary artery disease (CAD).

Methods: 10 pt (8 men), 59±1 years, with limiting angina and 3-vessel CAD, not optimal candidates for complete CABG due to the extension of the disease were enrolled. Before and 30-days after surgery, pt underwent laboratory tests, 24-hour ECG monitoring and echocardiogram; myocardial perfusion (at rest/after pharmacological vasodilation) was assessed in 17 cardiac segments with 201TI scintigraphy (SPECT) and magnetic resonance (MRI). BMC were obtained immediately prior to surgery, and the lymphomonocytic fraction separated by density gradient centrifugation. During surgery, 4mL containing approximately 13±3x10⁷ BMC (CD34+=1.30±0.40%) were delivered by multiple injections in non-grafted areas of ischemic myocardium.

Results: Injected segments included the inferior (n=7), anterior (n=5) and lateral (n=1) walls. No major complications or deaths occurred and the ejection fraction increased from 0.45±0.03 to 0.51±0.02 (P=.003). As expected, 30-days vs. baseline MRI showed reduction in total ischemic score (0.65±0.14 vs. 0.21±0.07; P=.01) but more interestingly, the ischemic score of injected areas also reduced significantly (1.21±0.13 vs. 0.43±0.21; P=.002). Similarly, cardiac scintigraphy showed improvement in perfusional defects in 10 out of the 13 injected segments. All patients remained free of angina.

Conclusions: In the short-term, intramyocardial injection of autologous BMC is safe and well-tolerated, and may have contributed to increase myocardial perfusion in non-grafted areas. This strategy could be used for myocardial angiogenesis in pt suffering from a more advanced (diffuse) CAD not suitable for complete surgical revascularization provided these findings are confirmed in a larger randomized series of pt with longer follow-up.