Influence of contractility and heart rate on pressure drop coefficient and fractional flow reserve for epicardial stenosis

Kranthi K. Kolli[a], *Tarek Helmy*[a], *Mohamed Effat*[a], *Arif Imran*[a],
Massoud Leesar[a], *Eric W. Schneeberger*[a], *Dwight Hand*[a],
William Gottliebson[b], *Paul Succop*[a], *Srikara V. Peelukhana*[a], *Rupak K. Banerjee*[a]
[a]*University of Cincinnati, Cincinnati, OH*
[b]*Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Introduction: Fluctuations in heart rate (HR), area stenosis (AS), and contractility (CY) are likely to occur during coronary catheterization procedures. For improved functional diagnostics, evaluation of coronary circulation should rely on methods independent of these hemodynamic changes. This study evaluates the influence of CY and HR on both fractional flow reserve (FFR) and an alternative diagnostic index, pressure drop coefficient (CDP_e).

Hypothesis: We hypothesize that the CDP_e, assessed in vivo, is independent of CY and HR.

Methods: Simultaneous measurements of distal hyperemic coronary-arterial pressure drop (dp) and average peak flow velocity (APV) were performed on seven pigs (42±3 kg), using a dual sensor-tipped guide wire (Volcano Therapeutics). Left ventricular pressure (LVP) was measured with a 5F Mikro-Tip Catheter (Millar Instruments) connected to a Sonometric system. Angioplasty balloons were used to create desired blockage. CDP_e was calculated as $(dp)/(0.5*1.05*APV^2)$. CY was calculated by differentiating LVP signals, obtaining left ventricular $(dp/dt)_{max}$, an index of CY. To investigate the effect of HR and CY on FFR and CDP_e, these indices were computed for "<50%AS" and ">50%AS," during atrial pacing at HR <110 and HR >110 bpm. A total of 90 measurements were obtained. A two-way repeated measures ANOVA was performed.

Results: The mean values of FFR and CDP_e were not significantly ($P>.05$) different for variable HR conditions. But mean values of FFR and CDP_e were statistically different ($P<.05$) under variable CY conditions.

Conclusion: HR has insignificant and CY has significant influence on FFR and CDP_e for epicardial stenosis under normal microvascular conditions.
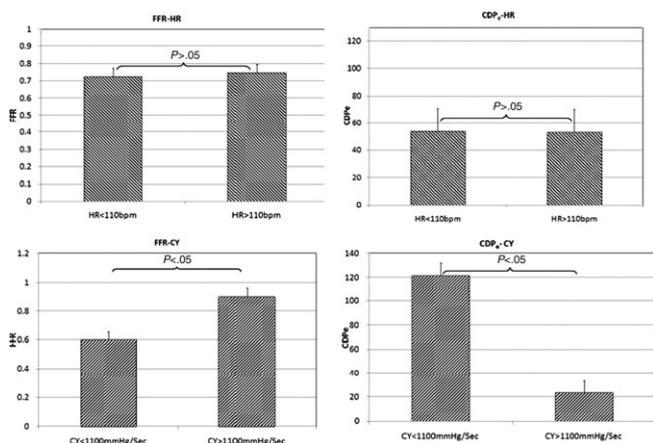
Comparison of same-sitting robotic hybrid coronary revascularization with standard, off-pump coronary artery bypass grafting in patients with multivessel coronary artery disease

William Bachinsky, Gouthami Boga, Lukasz Kiljanek, Anita Todd,
Susan Reilly, Tammy Whitaker, Christine McCarty
Pinnacle Health @ Harrisburg Hospital, Enola, PA, USA

Objective: Comparative study of same-sitting, robotic hybrid coronary revascularization (HCR) vs. standard sternotomy, off-pump coronary artery bypass grafting (OPCAB) in patients with multivessel coronary artery disease (MVCAD). HCR is a relatively novel procedure introduced as an alternative to traditional CABG incorporating surgical and percutaneous coronary intervention (PCI) in patients with MVCAD. Although there is some data on staged HCR, the data on same-sitting robotic HCR is meager.

Methods: We conducted a single-center, prospective analysis comparing same-sitting HCR patients ($n=10$) to a group of consecutive, OPCAB patients ($n=23$) by a single surgeon during a similar time period. HCR patients underwent robotic-assisted, left internal mammary artery (LIMA) to left anterior descending artery (LAD) (±diagonal) off-pump bypass via mini-anterior thoracotomy. After confirmation of LIMA patency by angiogram, HCR patients underwent immediate PCI utilizing either bare metal or drug-eluting stents. Aspirin was administered preoperatively and clopidogrel was administered immediately following PCI in all HCR patients.

Results: The groups were well matched except for lower syntax score (28.10±8.7 vs. 38.78±14.49, $P<.05$), lower prevalence of diabetes mellitus (10% vs. 48%, $P<.05$), and hypertension (60% vs. 95%, $P<.05$) in the HCR vs. OPCAB groups. Analysis of hospital outcomes revealed significant differences of HCR vs. OPCAB groups regarding percent extubated in the operating room (100% vs. 26%, $P<.001$) and need for blood transfusions (0.30±0.95 vs. 1.43±2.13 U/patient, $P<.05$). The HCR group was noted to have shorter ICU length of stay (29.20±12.70 vs. 58.40±91.80 h, $P=.148$) and total length of hospitalization (4.90±2.81 vs. 7.65±5.76 days, $P=.075$). At 30 days, there were no statistically significant differences in death, MI, or revascularization rates.

Conclusions: Our study demonstrates that same-sitting, robotic-assisted HCR is feasible and may offer superior hospital outcomes (including lower bleeding rates) in patients with MVCAD compared to the standard OPCAB. With more experience, we believe that HCR can be expanded to the higher syntax group of patients and may offer great potential as an effective alternative to standard CABG in patients with MVCAD.

Outcomes of patients with human immunodeficiency virus undergoing cardiac surgery

Shalin P. Desai, Sharon Hunt, Niv Ad
Inova Heart and Vascular Institute, Falls Church, VA, USA

Introduction: Highly active antiretroviral therapy (HAART) has significantly reduced mortality due to HIV infection; however, there is concern that this therapy can cause dyslipidemia and increase the risk for coronary disease. Additionally, given their immunocompromised condition, these patients may be at increased risk for postoperative infections and complications. We evaluated HIV (+) patients undergoing cardiac surgery at a single center to determine the rate of complications, infections, and need for revascularization.

Methods: A retrospective review of 10,747 consecutive cardiac surgery patients at Inova Heart and Vascular Institute revealed 12 patients who were found to be HIV (+). Data was reviewed from the STS database and supplemented with chart review of these 12 patients for CD4 count, viral load, opportunistic infections, antiretroviral use, and repeat revascularization. Comparisons were made with the HIV (+) group and a subgroup of patients with age less than 55 ($n=2775$), in areas of length of stay, infection, stroke, operative death, prolonged ventilator use, readmission within 30 days, and renal failure.

Results: Mean age of the HIV (+) group was 49.6 (±8.7) years, with seven males and five females. Length of time of HIV diagnosis ranged from 1 to 13 years, with average CD4 count of 382. Operations performed were eight CABGs, three valve repairs (MVR, MVR/AVR) for endocarditis, and one ASD repair. Mean follow-up time was 52.4 (±24.6) months in the HIV (+) group, with no deaths reported. The HIV (+) patients were found to have significantly more superficial sternum infections (16.7% vs. 0.25%, $P<.05$),