Hybrid coronary revascularization *vs.* coronary artery bypass for multi-vessel disease: a meta-analysis

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Background

- Our institution has employed minimally-invasive direct coronary artery bypass (MIDCAB) for surgical revascularization of the left anterior descending (LAD) coronary artery for the past 25 years.
- We sought to analyze how minimal-access LAD grafting has evolved over the past quarter century.

Methods

- A total of 2169 patients who underwent MIDCAB between 1996 and 2020 were divided into three groups, stratified by year of surgery:
  - Group A, 1996 – 2002, n = 758 (34.9%): left internal mammary artery (LIMA) harvested almost exclusively using open techniques;
  - Group B, 2003 – 2009, n = 454 (20.9%): LIMA harvested using a combination of open and endoscopic methods;
  - Group C, 2009 – 2020, n = 957 (44.1%): LIMA mobilized utilizing robotic assistance exclusively.
- The risk profiles of each patient group were compared, as were their postoperative outcomes.
- Patient characteristics are outlined in Table 1.

Variable	All Patients 1996-2020 (n = 2169)	Group A 1996-2002 (n = 758)	Group B 2003-2009 (n = 454)	Group C 2010-2020 (n = 957)	p-value
Age (years)	66.5 ± 11.3	66.7 ± 11.5	66.4 ± 11.6	66.3 ± 10.9	0.680
BMI (kg/m^2)	27.8 ± 5.2	27.8 ± 5.6	27.4 ± 4.6	28.0 ± 5.0	0.110
Female	571 (26.3)	217 (10.0)	112 (5.2)	242 (11.2)	.197
Ethnicity					
Hispanic	271 (12.5)	45 (5.9)†,§	42 (9.3)†,¥	184 (19.2)¥,§	< .001
Black	202 (9.3)	51 (6.7)†,§	43 (9.5)†,¥	108 (11.3)¥,§	< .001
Other	266 (12.3)	11 (1.5)†	65 (14.3)†,¥	190 (19.9)¥	< .001
Priority					
Elective	1212 (55.9)	447 (59.0)	244 (53.7)	521 (54.4)	< .001
Urgent	942 (43.4)	298 (39.3)†,§	209 (46.0)†	435 (45.5)§	< .001
Emergency	15 (0.7)	13 (1.7)†,§	1 (0.2)†	1 (0.1)§	< .001
CCS Class					
Class I	259 (11.9)	120 (15.8)†,§	100 (22.0)†,¥	39 (4.1)§	< .001
Class II	421 (19.4)	117 (15.4)†	131 (28.9)†,¥	173 (81.1)	< .001
Class III	763 (35.2)	279 (36.8)†	130 (28.6)†,¥	354 (37.0)	< .001
Class IV	559 (25.8)	242 (31.9)†,§	89 (19.6)†,¥	228 (23.8)§	< .001
Reoperation	450 (20.7)	308 (40.6)†,§	96 (21.1)†,¥	46 (4.8)¥,§	< .001
Previous PCI	943 (43.5)	356 (47.0)†	176 (38.8)†	411 (42.9)	0.019
Cerebrovascular accident	299 (13.8)	137 (18.1)†,§	60 (13.2)†	102 (10.7)§	< .001
Peripheral vascular disease	310 (14.3)	134 (17.7)§	78 (17.2)¥	98 (10.2)¥,§	< .001
CHF	517 (23.8)	299 (39.4)†,§	49 (10.8)†,¥	169 (17.7)¥,§	< .001
Diabetes mellitus	863 (39.8)	235 (31.0)§	143 (31.5)¥	485 (50.7)¥,§	< .001
Dialysis-dependent renal failure	86 (4.0)	31 (4.1)	12 (2.6)	43 (4.5)	.245

Table 1. Patient demographics

Data are presented as mean ± SD or n (%).

Superscripts denote those groups that significantly differ from each other, namely:

† Group A *vs.* Group B

¥ Group B *vs.* Group C

§ Group A *vs.* Group C

BMI = Body mass index; CCS = Canadian Cardiovascular Society; CHF = Congestive Heart Failure; PCI = Percutaneous coronary intervention

Results

- Thirty-day mortality for the entire cohort was 1.2% (27 deaths), not significantly different between groups (Table 2).
- Patients in Group A had more comorbidities than those in Group C, although diabetes mellitus was more common in Group C.
- A greater proportion of cases in Group A had already undergone coronary artery surgery prior to their MIDCAB (Table 2).
- Perioperative stroke and the need for prolonged ventilation was more frequent in Group A.

Variable	All Patients 1996-2020 (n = 2169)	Group A 1996-2002 (n = 758)	Group B 2003-2009 (n = 454)	Group C 2010-2020 (n = 957)	p-value
30 Day Mortality	27 (1.2)	12 (1.6)	6 (1.3)	9 (0.9)	0.485
Stroke	11 (0.5)	9 (1.2)†,§	0 (0.0)†	2 (0.2)§	.004
Perioperative myocardial infarction	7 (0.3)	5 (0.7)§	2 (0.4)	0 (0.0)§	.051
Reoperation for bleeding	63 (2.9)	22 (2.9)	15 (3.3)	26 (2.7)	.828
Unplanned reoperation for any cause	8 (0.4)	N/A	1 (0.2)	7 (0.7)	.039
Sepsis	12 (0.6)	7 (0.3)	0 (0.0)	5 (0.2)	.109
Gastrointestinal hemorrhage	8 (0.4)	5 (0.7)	0 (0.0)	3 (0.3)	.173
Prolonged ventilation	37 (1.7)	27 (3.6)†,§	1 (0.2)†	9 (0.9)§	< .001
New-onset renal	7 (0.3)	3 (0.4)	1 (0.2)	3 (0.3)	.871
Postoperative length of stay (days)	4.91 ± 4.7	5.51 ± 7.0†,§	3.70 ± 2.3†,¥	5.03 ± 3.0¥,§	<0.001

Table 2. Postoperative outcomes

Data are presented as mean ± SD or n (%).

Superscripts denote values that significantly differ between groups:

† Group A *vs.* Group B

¥ Group B *vs.* Group C

§ Group A *vs.* Group C

Conclusions

- MIDCAB is now performed using robotic-assisted techniques exclusively,
- Contemporary MIDCAB patients have less comorbidities than previously, implying a more liberal use of this approach, rather than it being reserved for the higher-risk cases only.