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Virtual cardiac rehabilitation during the COVID-19 pandemic: a tertiary site experience

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Background: The COVID-19 pandemic resulted in the abrupt suspension of centre-based cardiac rehabilitation (CR). Multidisciplinary virtual CR (VCR) with the use of digital, telephone, and video communication was implemented for continued care access. Exercise therapy was delivered through synchronous video-supervised sessions, pre-recorded sessions, and self-directed physical activity.

Purpose: To describe patient characteristics, completion rates, and safety outcomes in a real-world VCR population.

Methods: Prospective observational study of a tertiary academic CR program. VCR was implemented at pandemic onset (March 2020). Patients who were enrolled in, and either completed or dropped out, during the study period were included. Completers were defined as completing 6 months of virtual enrolment and an exit assessment. Risk was defined by the AACPVR 2020 risk categorization. Adverse cardiovascular events were defined as a patient-initiated event requiring medical assessment and stratified as exercise or non-exercise related. Continuous variables are presented as means and SD or medians and IQR. Student's t-test was used for between group comparisons. Categorical variables are presented as n (%) and compared using the $\chi 2$ test or Fischer's exact test. A p-value <0.05 was considered significant.

Results: Between March 13th, 2020, and August 31st, 2021, 222 [mean age 61.8 years (SD, 12.6) 77% male], were enrolled and discharged from the VCR program (Table 1). There were 160 completers and 62 non-completers (completion rate 72%). Among the non-completers 26 attended the MD intake assessment only. The remaining 36 completed a median of 85 days (IQR 25-197). This cohort included 21 (9%) high-risk and 35 (16%) moderate risk patients. Those at moderate risk were more likely to be non-completers and those at low risk were more likely to be completers (Table 1). Two exercise and 17 non-exercise adverse events were observed (median clinical surveillance 217 days [IQR 205-240]) (Table 2). Exercise related adverse events included neurally mediated syncope during a synchronous video exercise session in a low risk patient. This was responded to as per centre developed virtual safety protocols. A second syncope related to heart block occurred in a moderate risk patient during independent physical activity and required permanent pacemaker insertion. Both patients completed the program. Three non-exercise adverse cardiac events resulted in cessation of participation included one death and two heart failure hospitalizations (Table 2). One stroke and 13 emergency department visits for cardiac symptoms occurred in completers.

Conclusion: Real world VCR is feasible, including in those at moderate to high risk. Modest completion rates and a low exercise related adverse event rate were observed. Synchronous video exercise sessions with video monitoring and safety protocols may improve response to adverse exercise related events.

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Table 1: Patient Characteristics

Patient Characteristics*	Total Cohort (n=222)	Completers (n = 160)	Non-completers (n = 62)
Age (years), mean (SD)	61.8 (12.6)	61.8 (13.6)	62.1 (9.47)
Male	171 (77)	121 (76)	50 (81)
Weight (kg), mean (SD)	80.8 (17.3)	80.5 (17.0)	82.71 (18.5)
BMI (kg/m^2), mean (SD)	26.9 (5.1)	26.8 (5.0)	27.4 (5.5)
Primary Indication for CR			
Stable CAD	52 (33)	36 (23)	16 (26)
Post CABG	36 (16)	27 (17)	9 (15)
Primary Prevention	20 (9)	16 (10)	4 (6)
STEMI	20 (9)	15 (9)	5 (8)
Other Cardiac Surgery	19 (8)	14 (9)	5 (8)
NSTEACS with or without PCI	17 (8)	12 (8)	5 (8)
Post PCI without ACS	14 (6)	12 (8)	2 (3)
Heart Failure	19 (8)	12 (8)	7 (11)
Pre-Transplant$^+$	3 (1)	2 (1)	1 (2)
Post-Transplant	10 (4)	8 (5)	2 (3)
Other^	12 (5)	6 (4)	6 (10)
Diabetes mellitus	62 (28)	37 (23)	25 (40)**
Hypertension	120 (54)	83 (52)	37 (60)
Coronary artery disease	157 (71)	112 (70)	45 (72)
Atrial fibrillation	50 (23)	32 (20)	18 (29)
Depression	41 (18)	29 (18)	12 (19)
LVEF			
≥50%	145 (65)	109 (68)	36 (58)
35-49%	19 (9)	13 (8)	6 (9)
<35%	16 (7)	10 (6)	6 (9)
Unknown	41 (18)	27 (17)	14 (23)
Intake EST			
Performed	156 (70)	126 (79)	30 (48)**
Average METS, mean (SD)	8.8 (3.2)	9.3 (3.2)	7.4 (2.9)
METS <5.0‡	21 (13)	14 (11)	7 (23)
AACPVR Risk Category			
High Risk	21 (9)	12 (8)	9 (15)
Moderate Risk	35 (16)	24 (15)	11 (18)**
Low Risk	160 (72)	124 (78)	36 (58)**
Incomplete Data for Stratification	6 (3)	-	6 (9)

Presented as n (%) unless noted otherwise. CR indicates cardiac rehabilitation; CAD, coronary artery disease; CABG, coronary artery bypass grafting; STEMI, ST elevation myocardial infarction; NSTEACS, non-ST elevation acute coronary syndrome; PCI, percutaneous coronary intervention; ACS, acute coronary syndrome; LVEF, left ventricular ejection fraction; EST, exercise stress test; METS, metabolic equivalents; AACPVR, American Association of Cardiovascular and Pulmonary Rehabilitation

*Partial data available as noted in the table and for the following characteristics: BMI n=155 (completers)/ n= 35 (non-completers), weight n=155 (completers)/ n=41 (non-completers).

$^+$Includes Left Ventricular Assist Device (n=1, completer)

^Other includes hypertrophic cardiomyopathy, atrial fibrillation, and other arrhythmia

‡Percentage refers to those with completed exercise stress test

**P<0.05 compared to completers group

Table 1

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Table 2: Adverse Cardiovascular Events Summary*

Exercise Related		Non-exercise Related	
Syncope	2‡	Death (post-transplant complications)	1
		Acute Heart Failure Hospitalization	2
		Hospitalization for CVA	1
		ER visit without admission for cardiac symptoms	13
Total Events	**n=2**		**n=17**

CVA indicates cerebrovascular accident; ER, emergency department.
*Median clinical surveillance 217 days (IQR 205-240)
‡One syncope occurred during synchronous video monitored exercise session. The other occurred during independent physical activity.

Table 2