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Malaysian National Cardiovascular Disease Database (NCVD) — Acute Coronary Syndrome (ACS) registry: How are we different?

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Abstract
Objective: The Malaysian NCVD-ACS (National Cardiovascular Disease Database-Acute Coronary Syndrome) registry attempts to determine the incidence and demographic profile of patients with ACS and to identify high risk group among them. It provides a comprehensive view to assess treatment strategies and adherence to existing guidelines for ACS patients; which can help in future development. It also aims to facilitate research using this database.
Methods: The study included patients with ST-segment elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI) and unstable angina (UA) admitted to 11 participating sites in Malaysia from 1st January 2006 to 31st December 2006. The data were analyzed in terms of characteristics, clinical presentation, treatment, in-hospital outcome and 30-day outcome.
Results: A total of 3422 patients were enrolled, with male to female ratio of 3:1, mean age of 59 ± 12 years and mean BMI of 25.8 ± 4.4 kg/m^2. Among total study population, 96% had at least one established cardiovascular risk factor. In STEMI population, 70% received fibrinolytic

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therapy and 8% proceeded for primary percutaneous coronary intervention (PCI). Mean door-to-needle time for fibrinolytic therapy was 103 ± 143 min. Medical management was conducted for 86% of NSTEMI and 91% UA patients, with intervention for 14% and 9% respectively. The overall in-hospital mortality and 30-day mortality were 7% and 8% respectively.

Conclusion: In our NCVD-ACS registry, when compared with other registries, the subjects were much younger at presentation and had higher prevalence of established cardiovascular risk factors, indicating the importance of primary prevention programme. Majority of the patients were managed medically, with low rates of cardiac interventions, the factor being driven largely by availability of resources. Mean door-to-needle time was much higher than the recommended guidelines, an issue that needs attention. The results indicate many opportunities for improvement of in-hospital and 30-day mortality.

Introduction

Coronary Artery Disease (CAD) is the leading silent killer disease world-wide [1]. It is characterized pathologically by progressive occlusive atherosclerosis, acute plaque rupture, atherothrombosis and manifested clinically as Acute Coronary Syndrome (ACS) that ranges from unstable angina (UA) to non-ST-elevation myocardial infarction (NSTEMI) to ST-elevation myocardial infarction (STEMI) [2,3].

In 2006, the estimated incidence of Coronary Artery Disease in Malaysia was 141 per 100,000 populations. In the same year, the incidence of ACS admission to CCU was only 47 per 100,000 populations, reflecting that majority of CAD patients were admitted to general medical wards [4]. The pattern of in-hospital management is largely driven by the availability of CCU beds, cardiologists and cardiac intervention facilities.

The National Cardiovascular Disease Database (NCVD) is supported by the Ministry of Health, aiming to collect information about cardiovascular diseases in Malaysia. The NCVD-ACS registry is the nation-wide registry of Acute Coronary Syndrome cases. It provides a real-life data that would represent the total population characteristics and help to find out the gap between guideline recommendation and actual clinical practice.

The current study summarizes overall design and results of first annual NCVD-ACS registry in the year 2006.

Table 1 Summary of coronary risk factors and co-morbidity.

Coronary risk factor and co-morbidity	Percentage of total population (%)
Hypertension	72.6
Dyslipidemia	55.9
Diabetes	55
Smoking	
Active smoker	33
Ex-smoker	24
History of documented coronary artery disease	22.7
Positive family history	19.7
Non cardiac co-morbidities	
Chronic lung disease	4
Renal disease	7
Cerebro-vascular dosease	4

Methods

Study population

The NCVD-ACS registry recorded patients aged 20 years or above who were admitted to 11 participating sites in the

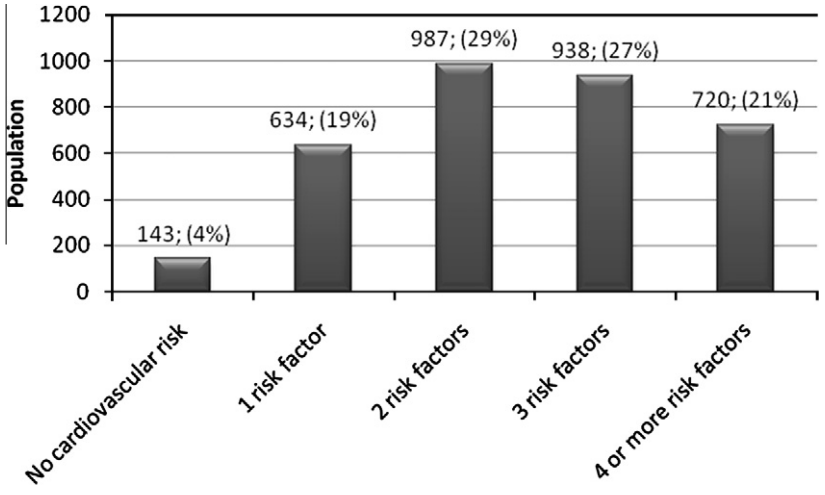

Fig. 1 Distribution of cumulative cardiovascular risk factors.

Table 2 Categorisation of patients according to Killip classification, % (number).

Killip classification code	STEMI (*N* = 1445)	NSTEMI (*N* = 1132)	UA (*N* = 845)
I	56 (802)	43 (489)	45 (377)
II	20(288)	18 (206)	12(98)
III	4 (62)	7 (76)	2 (15)
IV	5 (66)	3 (30)	0 (4)
Not stated/inadequately described	16 (227)	*29 (331)	*42 (351)

* There have been many incomplete data for NSTEMI and UA, because Killip classification was classically described for STEMI.

year 2006 and diagnosed as ACS. ST-segment elevation acute myocardial infarction is defined as persistent ST-segment elevation of $\geqslant$1 mm in two contiguous electrocardiographic leads or the presence of a new left bundle branch block in the setting of positive cardiac markers. Non-ST-segment elevation myocardial infarction is defined as occurrence of acute myocardial infarction in the setting of positive cardiac markers with or without accompanying electrocardiographic changes other than ST-segment elevation. Unstable angina is defined as symptoms felt to be consistent with acute cardiac ischemia within 24 h of hospital presentation with serial cardiac markers negative for myocardial infarction. The definitions are based on the joint Committee of the European Society of Cardiology/ American College of Cardiology [5].

Study outline

On admission of a patient with suspected ACS, a standardized case report form was added to the patient's folder and completed throughout the hospital stay. Each patient's national identification number was used to avoid double-counting. After discharge, patients were contacted by telephone or seen in the clinic for follow-up at 30 day and data-sheets were completed accordingly. After verification, data were entered into NCVD website (e-NCVD). Edit checking and data cleaning were performed periodically to identify missing or inconsistent data. After all queries being resolved, the dataset was locked and exported to the statistician for analysis. The operation of NCVD was supported by an extensive ICT infrastructure to ensure operational efficacy and effectiveness.

Statistical analysis

Continuous data were summarized as median, mean ± SD, minimum and maximum; discrete data were presented as percentage. Prognostic factors were presented as Odds ratio, 95% CI and *p*-value. For the purpose of analysis, missing data for age were imputed using the hot-deck method. All analysis was performed using STATA version 9.

Results

The NCVD-ACS Registry enrolled 3422 patients from 11 participating centers in the year 2006. Considering number of ACS admissions, economically developed states had higher admission rates (maximum of 30% in Selangor and Kuala Lumpur) when compared to less developed states (minimum of 1% in Terengganu). The mean age for all subjects was 59 ± 12 years and for STEMI, NSTEMI and UA patients, mean age was 56, 62 and 60 years respectively. Male to female ratio was 3:1. The highest incidence of ACS for men was in 50—60 year age group and for women in 70—80 years group. The proportion of Malay, Chinese, Indian and other races contributed 49%, 23%, 23% and 5% respectively.

Mean BMI was 25.8 ± 4.4 kg/m^2 with 75% of recorded BMI greater than 23 kg/m^2. Hypertension was the most prevalent cardiovascular risk factor, present in 72.6% subjects, followed by dyslipidaemia in 55.9% and DM in 55%. Considering smoking habit, 33% of entire cohort and 50% of STEMI population were active smokers and 24% of entire cohort was ex-smokers. Coronary artery disease was previously diagnosed in 22.7% of subjects and 19.7% had a

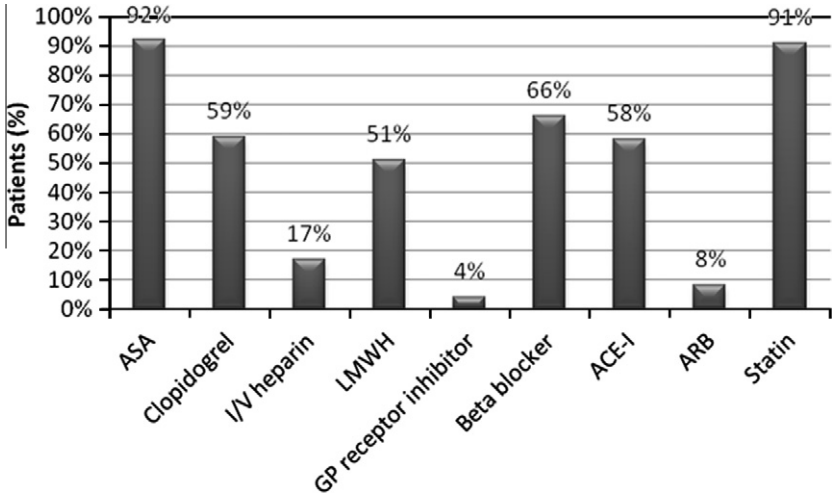

Fig. 2 Medical therapy for patients in NCVD-ACS registry. ASA Acetylsalicylic acid; LMWH Low-molecular weight heparin; GP Glycoprotein; ACE-I Angiotensin converting enzyme inhibitor; ARB Angiotensin receptor blocker.

'positive' family history (Table 1). Of total population, 21% had more than three risk factors, 27% had three risk factors, 29% had two risk factors and 19% had 1 risk factor (Fig. 1).

Of total population, 42% (1445) were diagnosed as STEMI, 33% (1132) as NSTEMI and 25% (845) as UA. According to Killip classification [6], 76% of STEMI patients were in class I and II, 9% were in class III and IV (Table 2).

Among STEMI patients, 70% (1018) received fibrinolytic therapy. Reasons for not receiving fibrinolytic therapy included primary percutaneous coronary intervention (PCI) in 8% (117), presentation after more than 12 h in 13% (193), contraindications to streptokinase in 5% (70), remaining 3% (47) included missing data and refusal to treatment.

Streptokinase was solely used as fibrinolytic agent and mean door-to-needle time was 103 ± 143 min.

Coronary angiogram was performed in 35% (1205) of all patients during the hospital admission and out of those who had angiogram, 46% (550) had PCI. Among those who had PCI, 56% (308) belonged to STEMI, 30% belonged to NSTEMI and 14% belonged to UA group. Coronary Artery

Table 3 Prognostic factors for in-hospital death among STEMI patients.

Factors	*N*	Odd ratio	95% Confidence	*p*-Value
Age group (years)				
20—<40	113	1.00	—	—
40—60	801	1.02	(0.29, 3.67)	0.97
>60	527	1.93	(0.53, 0.700	0.32
Killip classification code				
I	891	1.00	—	—
II	288	2.02	(1.17, 3.50)	0.01
III	62	3.37	(1.54, 7.37)	0.002
IV	66	8.50	(4.18, 17.27)	<0.001
TIMI risk score				
0—2	641	1.00	—	—
3—4	375	1.09	(0.55, 2.18)	0.80
5—7	337	2.03	(1.09, 3.78)	0.03
>7	88	6.78	(3.22, 14.28)	<0.001
Smoking				
Never	951	1.00	—	—
Former (quit > 30 days)	533	3.30	(1.52, 7.16)	0.002
Current (any tobacco use within last 30 days)	414	2.46	1.03, 5.89)	0.04
Diabetes				
Yes	525	6.16	(2.82,13.45)	<0.001
No	538	1.00	—	—
Hypertension				
Yes	680	5.15	(2.24, 11.84)	<0.001
No	433	1.00	—	—
Coronary artery disease[*]				
Yes	779	1.06	(0.48, 2.36)	0.88
No	356	1.00	—	—
Dyslipidemia				
Yes	278	2.56	(1.06, 6.15)	0.04
No	458	1.00	—	—
Family history of premature cardiovascular disease				
Yes	168	3.28	(1.23, 8.76)	0.02
No	742	1.00	—	—
Fibrinolytic therapy				
Yes	1014	0.67	(0.43, 1.05)	0.08
Not	427	1.00	—	—
Percutaneous coronary intervention				
Yes	308	0.94	(0.39, 2.26)	0.88
No	1133	1.00	—	—

[*] CAD defined as ''yes'' on any of the followings: (1) History of MI, (2) documented coronary artery disease >50% stenosis, (3) chronic angina, (4) new onset angina.

Bypass Graft Surgery (CABG) was performed only in 0.02% (67). For NSTEMI and UA, majority were treated medically while PCI was done in 14% and 9% respectively.

Considering the pattern of in-hospital medication, Aspirin and Statins were prescribed in more than 90%, beta blocker in 66%, Clopidogrel in 59%, ACE-I in 58% and LMWH in 51% and GP receptor inhibitor in 4% of all patients (Fig. 2). Prescription rate for LMWH in NSTEMI and UA patients were 68% and 64% respectively.

The overall in-hospital mortality for the entire cohort was7% (229) which was highest among STEMI (9%) followed by NSTEMI (7%) and UA (3%). At 30 days, overall mortality rate was 8% (288) and among ACS stratum these were 11%, 8% and 4% respectively.

In patients with STEMI, the predictors of high in-hospital mortality in descending order of odd ratio were higher Killip class, higher TIMI risk score, diabetes mellitus, hypertension, cigarette smoking, family history of premature cardiovascular disease and dyslipidemia. Prognostic factors for 30-days mortality in STEMI patients were almost similar with in-hospital death with the exception of dyslipidemia.

In NSTEMI/ UA, the predictors of high in-hospital mortality were higher Killip class, smoking, diabetes mellitus and heart failure. For 30-days mortality, poor prognostic factors were higher Killip class, diabetes mellitus and smoking (Table 3—6). In our study, we did not find TIMI risk score as predictor of mortality in NSTEMI/ UA group.

Table 4 Prognostic factors for in-hospital death among NSTEMI/ UA patients.

Factors	*N*	Odd ratio	95% Confidence	*p*-Value
Age group (years)				
20—<40	53	1.00	—	—
40—60	871	1.37	(0.16, 11.95)	0.78
>60	1050	3.8	(0.45, 32.15)	0.22
Killip classification code				
I	1247	1.00	—	—
II	304	2.27	(1.27, 4.04)	0.01
III	91	4.56	(2.16, 9.60)	<0.001
IV	34	11.74	(4.81, 28.63)	<0.001
TIMI risk score				
0—2	1137	1.00	—	—
3—4	689	0.72	(0.43, 1.19)	0.20
5—7	148	1.94	(0.88, 4.270)	0.10
Smoking				
Never	951	1.00	—	—
Former (quit > 30 days)	533	3.30	(1.52, 7.16)	0.002
Current (any tobacco use within last 30 days)	414	2.46	1.03, 5.89)	0.04
Diabetes				
Yes	971	3.03	(1.40, 6.55)	0.01
No	686	1.00	—	—
Hypertension				
Yes	1401	1.57	(0.70, 3.53)	0.28
No	352	1.00	—	—
*Coronary artery disease (CAD)**				
Yes	1419	1.72	(0.82, 3.61)	0.15
No	331	1.00	—	—
Dyslipidemia				
Yes	852	1.22	(0.53, 2.79)	0.64
No	443	1.00	—	—
Heart Failure				
Yes	236	2.15	(1.18, 3.91)	0.01
No	1278	1.00	—	—
Family history of premature cardiovascular disease				
Yes	236	1.11	(0.37, 3.33)	0.86
No	939	1.00	—	—
Percutaneous coronary intervention				
Yes	242	0.64	(0.26, 1.63)	0.36
No	1732	1.00	—	—

In STEMI population, use of fibrinolytics showed a trend towards better outcome (Fig. 3).

In NSTEMI and UA population, patients who underwent PCI had a trend towards better outcome (Fig. 4).

Discussion

The NCVD-ACS registry started with 11 pilot centers which represented most of the states of Malaysia.

The mean age of subjects was 59 ± 12 years, which was significantly younger than that of Global Registry of Acute Coronary Events (GRACE) and other ACS registries. [7,8]. Moreover, STEMI patients were much younger at presentation. 75% of subjects were male. Considering gender distribution in the country, female patients seems to be under-represented [9]. Two-third of the patients had BMI above 23, the cut-off point for public health action as recommended by WHO [10].

Ninty six percent of total cohort had at least one cardiovascular risk factor. Of total, 72.6% had hypertension. 55.9% had dyslipidemia and 55.0% had DM. In GRACE, the figures were 57.8%, 43.6% and 23.3% respectively. The high prevalence of cardiovascular risk factors among the subjects probably also explains presentation of ACS at much younger

Table 5 Prognostic factors for death in 30-days among STEMI patients.

Factors	*N*	Odd ratio	95% Confidence	*p*-Value
Age group (years)				
20—<40	88	1.00	—	—
40—60	581	1.18	(0.39, 3.59)	0.78
>60	428	1.88	(0.61, 5.84)	0.28
Killip classification code				
I	707	1.00	—	—
II	223	1.40	(0.84, 2.34)	0.20
III	49	2.64	(1.20, 5.79)	0.02
IV	53	6.64	(3.15, 14.00)	<0.001
TIMI risk score				
0—2	492	1.00	—	—
3—4	270	1.61	(0.90, 2.89)	0.11
5—7	263	2.26	(1.26, 4.04)	0.01
>7	72	7.70	(3.62, 16.40)	<0.001
Smoking				
Never	314	1.00	—	—
Former (quit > 30 days)	200	5.19	(2.33, 11.56)	<0.001
Current (any tobacco use within last 30 days)	560	3.18	(1.45, 6.79)	0.01
Diabetes				
Yes	390	5.62	(2.70, 11.71)	<0.001
No	399	1.00	—	—
Hypertension				
Yes	534	4.92	(2.24, 10.79)	<0.001
No	308	1.00	—	—
Coronary artery disease				
Yes	599	0.86	(0.40, 1.87)	0.71
No	258	1.00	—	—
Dyslipidemia				
Yes	225	1.87	(0.81, 4.29)	0.14
No	331	1.00	—	—
Family history of premature cardiovascular disease				
Yes	127	4.23	(1.76, 10.20)	0.02
No	583	1.00	—	—
Fibrinolytic therapy				
Yes	776	0.54	(0.35, 0.84)	0.01
Not	321	1.00	—	—
Percutaneous coronary intervention				
Yes	276	0.66	(0.31, 1.42)	0.29
No	821	1.00	—	—

Table 6 Prognostic factors for death in 30-days among NSTEMI/ UA patients.

Factors	*N*	Odd ratio	95% Confidence	*p*-Value
Age group (years)				
20—<40	35	1.00	—	—
40—60	639	0.65	(0.13, 3.20)	0.60
>60	819	1.97	(0.41, 9.52)	0.40
Killip classification code				
I	967	1.00	—	—
II	266	1.88	(1.13, 3.11)	0.02
III	82	3.20	(1.60, 6.40)	0.001
IV	28	6.96	(2.82, 17.21)	<0.001
TIMI risk score				
0—2	806	1.00	—	—
3—4	554	0.76	(0.48, 1.18)	0.22
5—7	133	1.53	(0.76, 3.05)	0.23
>7				
Smoking				
Never	714	1.00	—	—
Former (quit > 30 days)	428	2.43	(1.25, 4.72)	0.01
Current (any tobacco use within last 30 days)	298	1.84	(0.85, 3.93)	0.12
Diabetes				
Yes	763	3.12	(1.58, 6.16)	0.01
No	496	1.00	—	—
Hypertension				
Yes	1062	1.38	(0.67, 2.86)	0.38
No	265	1.00	—	—
Coronary artery disease				
Yes	1089	1.78	(0.92, 3.46)	0.09
No	247	1.00	—	—
Dyslipidemia				
Yes	688	0.95	(0.47, 1.93)	0.90
No	297	1.00	—	—
Family history of premature cardiovascular disease				
Yes	176	1.29	(0.51, 3.31)	0.59
No	699	1.00	—	—
Percutaneous coronary intervention				
Yes	219	0.64	(0.29, 1.43)	0.28
No	1274	1.00	—	—

age. Primary prevention would play an important role to control the risk factors.

Only 8% of STEMI, 14% of NSTEMI and 9% of UA underwent PCI, the opportunity for intervention was largely driven by the availability of cardiologists and cardiac intervention facilities in different centers.

The mean door-to-needle time (DNT) was 103 ± 143 min, much higher than recommended DNT of less than 30 min [11,12].

Prescription of in-hospital medications was good for Aspirin (92%) and Statins (91%). Clopidogrel was still under-prescribed (59%) and GP receptor inhibitor had very low prescription rate (4%), due to high cost and less availability of these drugs.

Overall in-hospital and 30 day mortality were highest in STEMI, followed by NTEMI and lowest in UA, similar to other registries in the late 90s.

Considering mortality in STEMI group, Odd ratio is statistically significant for higher Killip class, higher TIMI risk score, diabetes mellitus, hypertension, cigarette smoking, family history of premature cardiovascular disease and dyslipidemia. In NSTEMI/ UA, odd ratio is statistically significant for higher Killip class, smoking, diabetes mellitus and heart failure. When comparing with ACS registry of other Asian countries [13,14], Malaysian ACS registry had remarkable similarities in terms of younger age at presentation and high prevalence of risk factors among subjects.

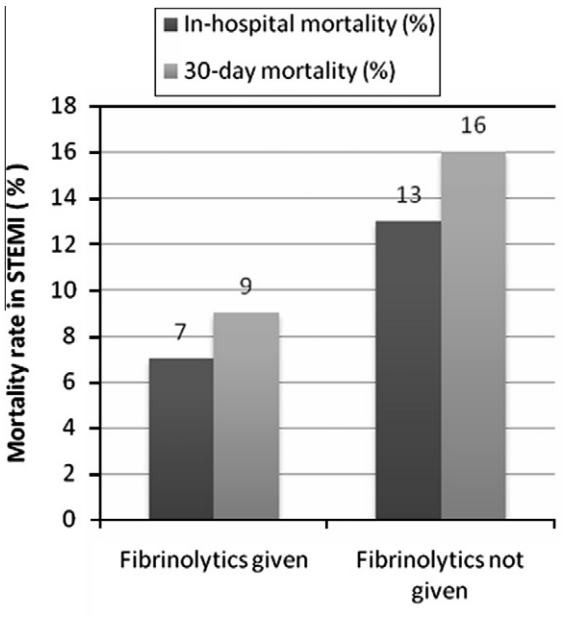

Fig. 3 In-hospital and 30-day mortality rate in STEMI patients according to fibrinolysis status.

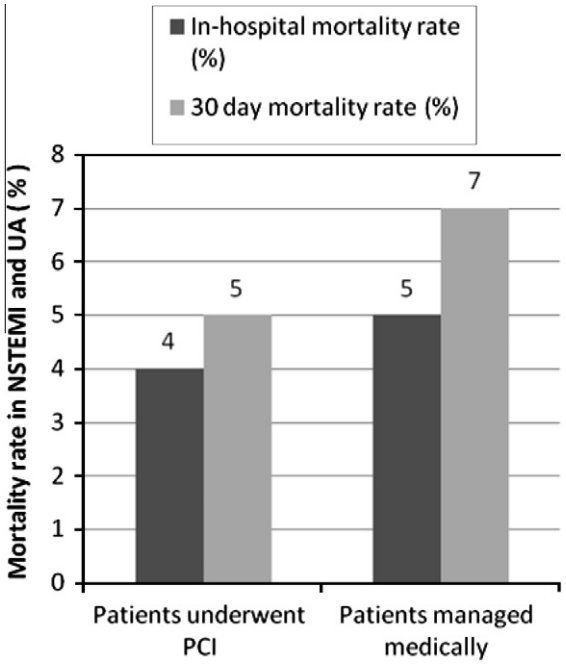

Fig. 4 In-hospital and 30-day mortality rate in NSTEMI and UA patients according to PCI status.

Conclusion

The analysis of 1st annual NCVD-ACS report revealed some remarkable features in terms of early age of subjects with high prevalence of cardiovascular risk factors, high mean door-to-needle time for fibrinolysis and low rates of cardiac interventions. NCVD-ACS registry aims to improve the overall cardiac services in Malaysia through its ongoing journey.

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