



Original Article

Epidemiological trends of acute coronary syndrome in Shimla district of the hilly state of Northern India: Six-year data from the prospective Himachal Pradesh acute coronary syndrome registry



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ABSTRACT

Objectives: The epidemiological trends of incidence, treatment practices, and outcomes are reported from Shimla district of the northern state of India.

Methods: The data of clinical characteristics, treatment practices, and outcomes of patients with acute coronary syndrome (ACS) diagnosed using standard criteria were collected systematically from the defined hilly geographical region of the northern state of India from January 2013 to December 2018 as the part of Himachal Pradesh acute coronary syndrome (HP ACS) registry. The year-wise trends of incidence, demographic, clinical characteristics, treatment practices, and in-hospital mortality are reported.

Results: The incidence of ACS shows declining trends. The mean age at incident ACS is increasing without change in gender predilection. The prevalence of overweight/obesity and diabetes has increased significantly since 2013 but tobacco consumption has not changed. The reperfusion therapy has increased significantly (20.9% in 2013 to 42.1% in 2018, $p < 0.01$) primarily because of an increased use of percutaneous coronary angioplasty. There is a trend of increasing use of beta blockers. The use of other oral secondary preventive drugs remained more than 90% since 2013. The in-hospital mortality rate is declining (9.0% in 2013 to 6.0% in 2018, $p < 0.01$).

Conclusions: Epidemiological characteristics of the ACS population in Shimla district are changing. The trends of use of reperfusion therapy in ST segment elevated myocardial infarction population has although increased but is still suboptimal, and there is a need for taking initiatives both at the system and population level to improve the reperfusion therapy.

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1. Introduction

Acute coronary syndrome (ACS) is the leading cause of morbidity and mortality globally.¹ The incidence of ACS reflects prevalent health risk behavior, cardiometabolic risk factors, and effectiveness of primary preventive intervention in a given geographical region. The health literacy, availability, and accessibility of health-care services equitably may play an important role in detection, management, and control of cardiovascular (CV) risk factors. In the western world with strengthening of health system and improvement in socioeconomic state, there is a declining trend of CV risk factors since 1980s,² which is mirrored by the declining trend of incidence of ACS.^{3–5} The ongoing national programme of

control of cardiovascular diseases (CVDs), diabetes, stroke, and cancer in India aims at enhancing detection and management of CV risk factors through strengthening of primary health-care services. However, the impact of such primary preventive interventions on the trends of CV risk factors and CV outcomes is not known.

The outcome of patients with ACS is affected by the patient- and system-level barriers. There is a trend of preferential use of percutaneous coronary angioplasty (PCI) over thrombolytic therapy in high-income countries, although thrombolytic therapy continues to be the major mode of reperfusion therapy in low-income countries.^{6–11} The understanding of the secular trends of incidence, prehospital delay, treatment practices, and outcomes in ACS is important for the evaluation and monitoring of effectiveness of primary and secondary preventive interventions and to undertake evidence-based quality initiatives to bridge the management gaps for improving the outcomes.

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There is a paucity of available contemporary data about the trends of incidence, epidemiological characteristics, prehospital delay, treatment practices, and outcomes in patients with ACS from low-income countries. We report these trends in patients with ACS based on the analysis of the database of prospective population-based registry of patients with ACS from Shimla district of the hilly state of Himachal Pradesh (HP), India, from 2013 to 2018.

2. Methods

The database of Himachal Pradesh acute coronary syndrome (HP ACS) registry of Shimla district, HP, India, from January 2013 to December 2018 was analyzed to determine trends of incidence, clinical characteristics, treatment, and outcomes. The details of the study methods of HP ACS registry have been published previously.^{10,11}

2.1. Study area

Shimla district is situated south east of HP with coordinates of 31.1231° N, 77.6536° E having population of 813384 as per 2011 census with the estimated annual growth rate of 1.25%.¹² The rural urban population ratio is 75.2% vs. 24.8%. Shimla district is spread over 5131 KM² and has the literacy rate of 82.8% (male literacy of 89.5% vs. 75.9% in women).¹² The health-care services in Shimla district are primarily delivered by health centers in the government sector. There are ten civil hospitals, twelve community health centers, hundred and twenty primary health centers, and one teaching hospital. Indira Gandhi Medical College (IGMC), Shimla, is the only center with a coronary angioplasty facility in the district. The civil hospital in Rampur and IGMC hospital in Shimla are the only two hospitals capable of providing treatment to patients with ACS. The IGMC Shimla hospital has PCI services available only during day time from 9 AM to 6 PM. Patients attending other community health centers and civil hospitals in the district are not manned by physicians and are referred to the civil hospital in Rampur or to IGMC hospital, Shimla, after electrocardiogram (ECG) recording immediately or within 24 h. There are no other private hospitals in the district that treat patients with ACS. The data recorded through registries in these two hospitals in the district capture practically most of the symptomatic patients reporting to hospitals in the district. Thus, the number of patients with ACS registered in a year provides approximate estimation of annual incidence of ACS among population aged 18 years and older in the district. The annual incidence of ACS is calculated as the number of cases per 100000 person years in Shimla district. As per demographic data of the district about 78% of the district population is in the age-group above 18 years of age.¹² Taking baseline population of the district as per 2011 census¹² and adding annual growth rate of 1.25%, the population at risk was calculated for estimation of annual incidence from 2013 to 2018.

2.2. Diagnosis of ACS

Patients were diagnosed to have ACS, based on the presence of symptoms suggestive of myocardial ischemia associated with one or more of the following:

- ST segment elevation at j point of ≥ 0.2 mV in chest lead V2 and V3 and ≥ 0.1 mV in two or more contiguous leads in other chest leads and standard leads.
- ST depression in two or more contiguous leads.
- Elevated levels of myocardial injury; high sensitivity Troponin T/I to more than 99th percentile of normal reference range.

2.3. Definitions

2.3.1. ST segment elevated myocardial infarction

Patients with symptoms suggestive of myocardial ischemia with ECG evidence of ST segment elevation in two or more contiguous leads as previously defined.

2.3.2. Non-ST segment elevated myocardial infarction

Patients with symptoms suggestive of myocardial ischemia with/without ECG evidence of ST segment depression, associated with elevated markers of myocardial injury.

2.3.3. Unstable angina

The Non-ST segment elevated myocardial infarction was diagnosed in patients with symptoms suggestive of myocardial ischemia with or without ECG evidence of ST segment depression, associated with elevated markers of myocardial injury.

2.3.4. Heart failure

Heart failure was diagnosed based on history of orthopnea and or paroxysmal nocturnal dyspnea associated with clinical evidence of rales in bilateral basal lung fields.

2.3.5. Cardiogenic shock

Cardiogenic shock was diagnosed in patients with heart failure with systolic blood pressure (SBP) <90 mmHg not responding to IV fluids and associated with signs of hypoperfusion.

2.4. Ethical considerations

The study protocol of the registry was approved by the Ethical Committee of IGMC hospital.

2.5. Data collection

The details of the data collection have been reported earlier.^{10,11} In brief, all consecutive patients diagnosed with ACS based on predefined criteria admitted in the civil hospital in Rampur and IGMC hospital, Shimla, within 7 days of symptom onset reporting directly or referred by other hospitals were enrolled after obtaining informed consent. The demographics, clinical characteristics, treatment practices, use of thrombolytic therapy and/or PCI; antiplatelet agents; angiotensin converting enzyme (ACE) inhibitors; or angiotensin receptor blockers (ARBs); beta blockers; and statins during hospital stay and in-hospital outcomes were recorded as per predesigned case recording format. The reperfusion rate was calculated based on the number of patients with ACS that received either thrombolytic therapy or PCI or both. The primary outcome measure of interest was in-hospital mortality, which was defined as the death due to any cause during the hospital stay. The secondary outcome measures recorded were new onset heart failure, complete heart block, ventricular tachycardia/fibrillation, and stroke. Patients were examined and monitored on a daily basis by the attending physicians to document arrhythmias and conduction abnormalities using serial ECGs and bedside ECG monitors. New onset heart failure was considered to be present if the patient developed symptoms of orthopnea and or paroxysmal nocturnal dyspnea along with rales over bilateral lower lung fields and or S3 gallop. Stroke was defined as an acute focal neurological deficit lasting more than 24 h or resulting in death. Imaging was not required for the diagnosis of stroke and was performed as deemed appropriate by the treating physician. No classification into hemorrhagic or ischemic stroke types was made. The data were then uploaded in web-based electronic data recording format by the trained data entry operator at the time of discharge or death. The

quality of data was ensured by periodic site visit by the research assistant and cross checking the authenticity of data uploaded with the source document.

2.6. Data analysis

The data are reported as absolute counts and percentages for categorical variables, mean \pm SD for continuous variables with normal distribution, and median and inter quartile range for continuous variables with skewed distribution. The incidence of ACS was reported as the number of cases of ACS per 100000 patient years. The year-wise population at risk was calculated based on the 2011 census population as the reference population at risk. The population at risk, that is, population aged >18 years (78% of the total population), was calculated by adding 1.25% annual growth of the target population from baseline population of 2011. The differences in the trends of distribution of categorical variables from the year 2013–2018 were analyzed using the chi square test, and continuous variables with skewed distribution were analyzed using the Mann-Whitney test. The *p* value of <0.05 was taken as statistically significant. The statistical analysis was carried out using Epi info, version 3.4.3, statistical software.

3. Results

3.1. Sociodemographic characteristics and incidence trends

The sociodemographic characteristics of the ACS population in Shimla district has changed significantly since 2013. There is a trend of increasing mean age of the ACS population without significant change in gender predilection (Table 1). Overall, the incidence of ACS is declining, but the relative incidence of ST segment elevated myocardial infarction (STEMI) has increased over the years. The incidence of ACS is increasing in rural population, whereas has declined in urban population.

3.2. Trends of prevalence of CV risk factors and clinical characteristics

The prevalence of self-reported hypertension has declining trends but the current tobacco consumers remains high and has not changed over the years. The prevalence of overweight/obesity and diabetes shows increasing trends (Table 2, Supplementary Fig. 1).

The median prehospital delay has decreased significantly since 2013 and the proportion of ACS population reaching hospital

within 6 h after symptom onset has increased (Table 1). There has been a declining trend in the ignorance of symptoms among patients and an increasing trend of consulting local physicians first.

3.3. Trends in treatment practices

The use of thrombolytic therapy has not changed significantly since 2013, which remained about 35–46%; however, the proportion of patients with ACS undergoing PCI has increased significantly (2.2% in 2013 to 21.9% in 2018 $p < 0.01$) (Fig. 1, Table 4). The use of secondary preventive treatment, dual antiplatelet therapy, ACE-I/ARBs, and statins remained high since 2013. However, the use of beta blockers has increased over the years (92.2%–100%; 2013 vs. 2018) (Table 5).

3.4. Trends of in-hospital outcomes

There is a declining trend of in-hospital mortality rate (9%–6%) ($p < 0.001$), although incidence of heart failure, stroke rate, and bleeding complications did not change significantly (Table 3).

4. Discussion

The epidemiological trends of incidence, demographics, clinical characteristics, treatment practices, and outcomes of patients with ACS in Shimla district of the hilly state of HP, India, were evaluated based on the analysis of the database of Shimla district, a part of the HP ACS registry from 2013 to 2018.¹⁰

4.1. Summary of results

The epidemiological trends of ACS in Shimla district of HP state of India is characterized by increasing the mean age at index ACS event without any change in gender predilection. The incidence of ACS is declining particularly in the urban area. The overweight/obesity and diabetes revealed rising trends without significant change in current tobacco consumption status; however, the self-reported hypertension had significant declining trends. The median prehospital delay has significant declining trends with increasing awareness of symptoms of ACS. Overall, reperfusion therapy has increased significantly primarily because of increasing use of PCI. Unfortunately, no change in the thrombolytic therapy rate was observed. The use of beta blockers also showed rising trends with associated significant declining trends of in-hospital mortality.

Table 1
Epidemiological trends of ACS in Shimla district, Himachal Pradesh, India.

Characteristics	2013	2014	2015	2016	2017	2018	<i>P</i> value
Age(Overall)	311 (57.7 \pm 11.6)	272 (59.9 \pm 12.02)	141 (61.1 \pm 12.3)	259 (58.9 \pm 12.8)	232 (60.0 \pm 13.0)	147 (59.9 \pm 12.8)	0.001
Age of men with ACS	234 (57.7 \pm 11.8)	211 (59.7 \pm 12.5)	109 (60.7 \pm 12.9)	220 (57.9 \pm 12.8)	171 (59.1 \pm 13.1)	114 (58.7 \pm 12.8)	0.2
Age of women with ACS	77 (57.6 \pm 10.9)	61 (60.6 \pm 10.2)	32 (62.3 \pm 9.8)	39 (64.9 \pm 11.6)	61 (62.7 \pm 12.4)	33 (64.0 \pm 12.1)	0.001
Male	234 (75.2%)	211 (77.5%)	109 (77.3%)	220 (84.9%)	171 (73.7%)	114 (77.5%)	0.05
Female	77 (24.7%)	61 (22.4%)	32 (22.7%)	39 (15.0%)	61 (26.2%)	33 (22.4%)	
STEMI	145 (46.6%)	133 (48.9%)	78 (55.3%)	153 (59.0%)	137 (59.0%)	94 (63.9%)	0.001
NSTEMI	87 (27.9%)	74 (27.2%)	42 (29.7%)	72 (27.8%)	83 (35.7%)	41 (27.8%)	
Unstable angina	79 (25.4%)	65 (23.9%)	21 (14.8%)	34 (13.1%)	12 (5.7%)	12 (8.6%)	
Urban area	101 (32.5%)	83 (30.5%)	26 (18.4%)	80 (30.9%)	56 (24.2%)	44 (29.9%)	0.02
Incidence of ACS per 100000 population	37.4/100000	32.4/100000	16.6/100000	30.3/100000	26.8/100000	17.1/100000	0.01
Median prehospital delay (hrs, IQ range)	14.4 (4.4–41.1)	6.0 (0.9–25.1)	5.4 (2.0–15.3)	4.0 (2.0–14.0)	6.5 (2.0–25.0)	4.0 (2.0–12.0)	0.001
Percentage reporting in < 6 h from symptom onset	88 (28.3%)	132 (48.5%)	75 (53.1%)	155 (59.8%)	116 (50.0%)	83 (56.4%)	0.001
Ignorant of Symptoms	115 (36.9%)	69 (25.3%)	6 (4.2%)	39 (15.0%)	114 (49.1%)	44 (29.9%)	0.001
Consulting local Practitioner	Not reported	18 (6.6%)	59 (41.8%)	72 (27.8%)	104 (44.8%)	83 (56.4%)	0.001

ACS, acute coronary syndrome; STEMI, ST segment elevated myocardial infarction; NSTEMI, Non-ST segment elevated myocardial infarction.

Table 2
Epidemiological trends of CV risk factors.

Characteristics	2013	2014	2015	2016	2017	2018	P value
Self-reported hypertension	129 (41.4%)	88 (32.3%)	42 (29.7%)	63 (24.3%)	50 (21.5%)	34 (23.1%)	0.001
Self-reported diabetes	51 (16.4%)	56 (20.5%)	18 (12.7%)	41 (15.8%)	34 (14.6%)	23 (15.6%)	0.36
Newly detected diabetes	20 (6.4%)	12 (4.4%)	36 (25.5%)	26 (10.0%)	17 (7.3%)	13 (8.8%)	0.001
Overall diabetes	71 (22.8%)	68 (25.0%)	54 (38.3%)	67 (25.8%)	51 (21.9%)	36 (24.4%)	0.01
Overweight	92 (34.7%)	82 (33.8%)	47 (35.3%)	106 (41.7%)	102 (44.5%)	63 (45.0%)	0.04
Obesity	5 (1.8%)	7 (2.8%)	6 (4.5%)	8 (3.1%)	7 (3.0%)	10 (7.1%)	0.12
Tobacco consumer	215 (69.1%)	182 (66.9%)	103 (75.0%)	176 (67.9%)	143 (61.6%)	98 (66.6%)	0.29
Family history of premature CAD	34 (10.9%)	27 (10.0%)	4 (2.8%)	24 (9.3%)	18 (7.7%)	14 (9.5%)	0.11

CV, cardiovascular.

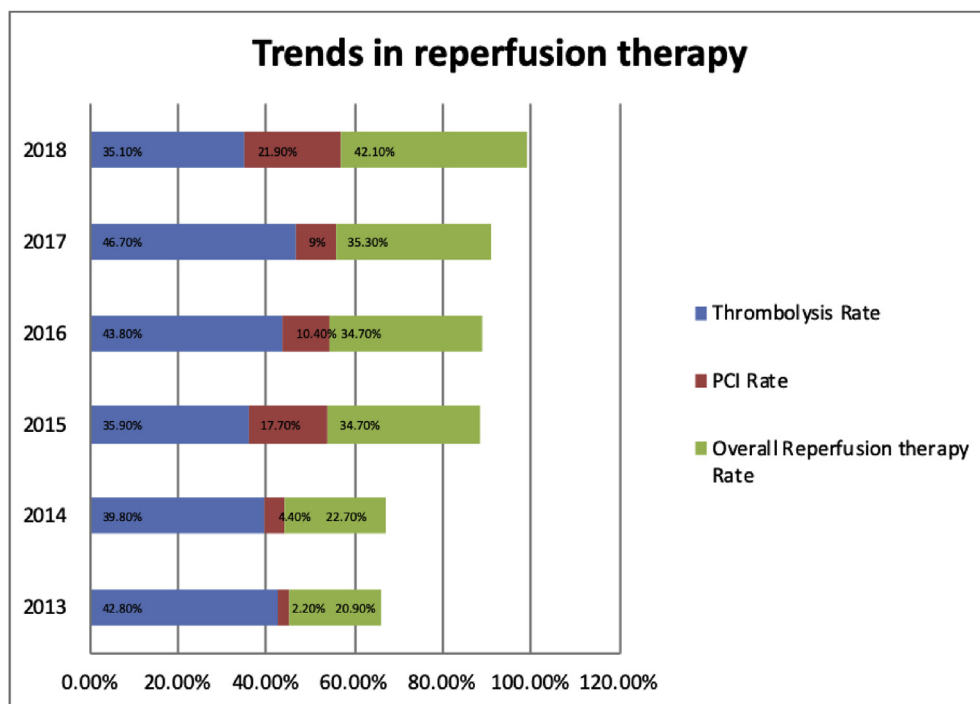


Fig. 1. Year-wise trends in reperfusion therapy.

Table 3
Epidemiological trends of Hemodynamic and electrical instability and in-hospital outcomes.

Characteristics	2013	2014	2015	2016	2017	2018	P value
Killip class (111/IV)	26 (8.3%)	19 (7.0%)	9 (6.3%)	8 (3.0%)	12 (5.1%)	10 (6.8%)	0.17
Heart failure	14 (4.5%)	13 (4.7%)	8 (5.6%)	10 (3.8%)	2 (0.8%)	3 (2.0%)	0.09
CHB	32 (10.2%)	6 (2.2%)	8 (5.6%)	6 (2.3%)	9 (3.8%)	3 (2.0%)	0.001
A Fib	0	1 (0.3%)	0	5 (1.9%)	8 (3.4%)	5 (3.4%)	0.001
VT/VF	2 (0.6%)	3 (1.1%)	5 (3.5%)	1 (0.3%)	0	0	0.001
Bleeding	0	1 (0.3%)	0	0	0	2 (1.3%)	0.05
Stroke	0	0	1 (0.7%)	0	0	0	0.12
Death	28 (9.0%)	12 (4.4%)	12 (8.5%)	17 (6.5%)	4 (1.7%)	9 (6.1%)	0.001

CHB, complete heart block; A Fib, atrial fibrillation.

Table 4
Trends in change of rates of reperfusion therapy.

Characteristics	2013	2014	2015	2016	2017	2018	P value
Percentage of STEMI received thrombolytic therapy	62 (42.8%)	53 (39.8%)	28 (35.9%)	67 (43.8%)	64 (46.7%)	33 (35.1%)	0.11
Rescue PCI in post thrombolysis patients with STEMI	4/62 (6.5%)	3/53 (5.7%)	4/28 (14.3%)	4/67 (5.9%)	3/64 (4.7%)	3/33 (9.0%)	0.09
Percentage of ACS received PCI (primary invasive strategy + rescue PCI)	7 (2.2%)	12 (4.4%)	25 (17.7%)	27 (10.4%)	21 (9.0%)	32 (21.9%)	0.001
Percentage of patients with ACS who received reperfusion therapy (either PCI or thrombolysis)	65 (20.9%)	62 (22.7%)	49 (34.7%)	90 (34.7%)	82 (35.3%)	62 (42.1%)	0.001

STEMI, ST segment elevated myocardial infarction; ACS, acute coronary syndrome; PCI, percutaneous coronary angioplasty.

Table 5
Trends of change in use of oral secondary preventive drugs.

Characteristics	2013	2014	2015	2016	2017	2018	P value
Aspirin	311 (100%)	272 (100%)	141 (100%)	259 (100%)	232 (100%)	147 (100%)	
Clopidogrel	311 (100%)	272 (100%)	141 (100%)	259 (100%)	232 (100%)	147 (100%)	
RAAS inhibitors	311 (100%)	272 (100%)	141 (100%)	259 (100%)	232 (100%)	147 (100%)	
Statins	308 (99.0%)	269 (98.9%)	141 (100%)	259 (100%)	232 (100%)	147 (100%)	0.15
B Blockers	289 (92.9%)	263 (96.6%)	139 (98.5%)	259 (100%)	232 (100%)	147 (100%)	0.001

RAAS, renin angiotensin aldosterone system.

4.2. Demographic trends

The mean age of the ACS population reported in the various registry studies from northern America, western and northern Europe is higher than that reported in low-income countries.^{9,10,12–15} The age of onset of symptomatic coronary artery disease (CAD) depends upon age of exposure to risk factors and their effective modifications that in turn are influenced by level of community health literacy, access to quality health care. The high-income countries have reached the phase of epidemiological transition where there is a receding incidence of degenerative diseases as a result of leading healthy lifestyle, early detection, and effective risk modification. The autopsy studies conducted on the general population and on army personnel who died during combat or because of unintentional injuries the during 1950s–1980s and between the 1990s–2011 demonstrated significant decline in anatomical CAD in the age-group of 20–59 years without decline in elderly population.^{16,17}

The epidemiological studies monitoring the trends of CV risk factors in high-income countries reported declining population mean levels of total cholesterol, systolic blood pressure, and prevalence of smoking.² However, there are no such data available in the Shimla district based on the periodic survey studies to understand the reasons for the trends of delayed onset of ACS.

4.3. Trends of incidence of ACS

The World Health Organization Monitoring Trends and Determinants in Cardiovascular Diseases project examined the incidence of ACS in 21 countries. The incidence of ACS is falling rapidly in northern and western Europe, whereas is not falling as fast in southern, central, and eastern Europe and is in fact rising in some populations.^{18–22}

The data of HP ACS registry suggest declining trend of ACS in Shimla district. The possible reasons for declining incidence of ACS in the present study area could be improving population health behavior, effective risk factor modification, or may be under reporting of cases of ACS. The national program for control of CVD, stroke, diabetes, and cancer launched since 2011, where the focus is on detection and management of high-risk population in the community. This may have lead to increased awareness and treatment of diabetes, hypertension, and dyslipidemia, although the tobacco consumption rate is still prevalent among ACS population and has not declined since 2013. However, there are no two point survey data available about CV risk factor control rates from the study area to substantiate this assumption. The other reasons could be, patients are being admitted in other hospitals in the district and are thus not captured in the registry centers. Although there are some newer hospitals that have come up in Shimla city, they are without onsite cardiologists and therefore patients with ACS are generally referred to IGMC hospital after diagnosis and are not admitted in these hospitals. In the rural area, there are no hospitals in the private sector providing care for patients with ACS in the district. The window period of 7 days for enrollment was intended to capture all the

patients that might have reported to nonregistry hospitals in the district initially and were in turn referred to the registry hospitals in the district. This ensured that the patients who were initially admitted for short time in some of the community hospitals in the district and were later referred to registry centers were also enrolled and thus chances of underreporting is less likely to be the reason for declining incidence since 2013.

The relative incidence of STEMI has increased significantly since 2013. The incidence of STEMI reported from low-income countries is higher than that from the high-income countries. The reasons for rising trends of incidence of STEMI are not clear. The rising incidence of ACS in rural population needs further studies to gain insights. STEMI is more frequent among smokers and younger population. Tobacco consumption and exposure to indoor biomass smoke is higher in rural population.

4.4. Trends in change in treatment practices

The treatment practices over the years in Shimla district show changing trends. The reperfusion therapy rate has increased from about 21% to 42% primarily because of increase in PCI rate from 2.2% to 21.9% as the thrombolytic therapy rate remained only about 35%–46%. The use of beta blockers has also increased significantly since 2013. The use of dual antiplatelet therapy, ACE-I/ARBs, and statins remained high during this period. The trend of improvement in the use of beta blockers and reperfusion therapy in the district is reflected by significant decline in the in-hospital mortality rates from 9.0% to 6.1% ($p < 0.01$). The use of evidence-based secondary preventive drugs is significantly higher than that reported from the high-income countries. This is primarily because of the fact that IGMC Shimla hospital is a teaching hospital in the district and health-care providers are well informed about the guideline based treatment of ACS. However, the reperfusion rate is significantly low compared with the rates reported from some other parts of India.⁷

The low thrombolysis rate is a cause of concern and is the result of late reporting to hospitals. The ignorance about the symptoms of ACS, long traveling time from remote villages, and consulting local practitioners were the some of the reasons for prehospital delay. The inability of health-care providers at peripheral health-care centers to diagnose and institute thrombolytic therapy was also a major reason behind low thrombolysis rate in the district. Thus, this registry study provides valuable information and underscores the necessity of undertaking public health initiatives and capacity building of high volume hospitals in the district, located at block levels to improve the thrombolysis rate in eligible patients with STEMI. There is a need for establishing coordinated regional networking of health-care centers in the district and linking with IGMC Shimla hospital for enhancing timely diagnosis and thrombolysis of eligible patients with STEMI in the peripheral hospitals using tele-ECG–based decision support system. The studies addressing the impact of community education and establishing networking of regional hospitals supported by technology-based diagnostic decision support system on thrombolysis rate and outcomes are required.

4.5. Limitations

The authenticity of capturing all patients with ACS in the district cannot be ascertained. This may have resulted in under estimation of incidence of ACS. However, considering the fact that there has been no change in the hospitals having capacity to treat patients with ACS since 2013 and the practice of referrals to these two hospitals continues to remain similar over the years in general, we believe this has not lead to any bias in the estimation of changing trends of incidence, demographic and clinical characteristics, treatment practices, and outcomes. The other potential bias could be in estimation of annual incidence of ACS due to inaccurate estimation of reference population size. Although care has been taken to calculate the yearly size of the target population by annual growth rate of 1.25% based on estimation of growth rate between 2001 and 2011 census populations;¹² however, growth rate of different age groups may not be uniform, and thus there is always a possibility of error in estimation of target population size.

5. Conclusion

The epidemiological characteristics of ACS show declining trend of incidence of ACS in Shimla district, HP. The mean age of index ACS population is increasing without any change in gender predilection. Although prehospital delay is declining, this has not translated into any substantial increase in reperfusion rates. The use of evidence-based secondary preventive drugs is significantly higher than that reported from high-income countries. Overall the in-hospital mortality is declining; however, more needs to be done to increase the reperfusion rate to decrease the mortality further.

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Conflicts of interest

All authors have none to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ihj.2020.01.003>.

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