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Implementation of a Nationwide Strategy for the Prevention, Treatment, and Rehabilitation of Cardiovascular Disease "A Todo Corazón"

Gabriela Borrayo Sanchez,[a] Martín Rosas Peralta,[b] Olga Georgina Martínez Montañez,[c] Samuel Justiniano Cordero,[d] German Fajardo Dolci,[e] Ana Carolina Sepulveda Vildosola,[f] and Jesus Arriaga Dávila[g]

[a]*Programa "A Todo Corazon", Centro Médico, Nacional, Siglo XXI, Instituto Mexicano del Seguro Social, Ciudad de México, México*
[b]*Área de Proyectos Especiales del Programa "A Todo Corazon", Centro Médico Nacional Siglo XXI, Instituto Mexicano del Seguro Social, Ciudad de México, México*
[c]*Programa "A Todo Corazon", Dirección de Prestaciones Médicas, Instituto Mexicano del Seguro Social, Ciudad de México, México*
[d]*Área de Diagnóstico y Tratamiento, Instituto Mexicano del Seguro Social, Ciudad de México, México*
[e]*Facultad de Medicina, Universidad NacionalAutónoma de México, Ciudad de México, México*
[f]*Unidad de Investigación, Educación y Politicas en Salud, Centro Médico Nacional Siglo XXI, Instituto Mexicano del Seguro Social, Ciudad de México, México*
[g]*Dirección de Prestaciones Médicas, Instituto Mexicano del Seguro Social, Ciudad de México, México*

The cardiovascular diseases (CVDs) have a growing impact over the world mortality, affecting mostly low and middle-income countries. This is due to changes in the population pyramid and the increase in unhealthy lifestyles that predispose the global population to cardiovascular risk factors such as overweight, obesity, smoking, hypertension, diabetes, dyslipidemias and metabolic syndrome. Ischemic heart disease and the cerebral vascular event remain the first causes of death reported by the World Health Organization (WHO) for more than a decade. Mexico has high prevalence in obesity, overweight, hypertension and diabetes in the population over 20 years old; Within the OECD countries (Organization for Economic Cooperation and Development) are the country with the highest mortality due to acute myocardial infarction over 45 years in the first 30 days. In order to face the growing pandemic of CVDs, the IMSS, it has developed and implemented a comprehensive care program called "A Todo Corazon", it is the first program of integral care which seeks to strengthen the actions to improving the impact of CVDs from health. This review is focused on describing the 7 axes that make up the program; each axe is described in detail. Axes one to three are dedicated to promotion and primary prevention of CVDs. Axes 4 and 5 are dedicated to infarction code, as a national strategy to confront the principal cause of death in Mexico. Finally axes 6 and 7 are dedicated to intensive care, secondary prevention and rehabilitation of CVDs. © 2018 IMSS. Published by Elsevier Inc. All rights reserved.

Key Words: Health promotion, Cardiovascular disease, Prevention, Risk calculator, Acute myocardial infarction, Rehabilitation, IMSS, Mexico.

Cardiovascular diseases (CVDs) including the strokes are the leading cause of death worldwide. World Health Organization (WHO) reported 15 million deaths in 2015 (1). In

Mexico, the INEGI (National Institute of Statistics and Geography) reported 175,078 deaths due to cardiovascular disease in 2016 (2), indeed in the last three decades has become the leading cause of death. The main underlying cause is acute myocardial infarction. Mexico has been considered one of the countries with the highest critical increased mortality in patients over 45 years old by the Organization for Economic Cooperation and Development (OECD) since 2013 (Figure 1), which persists in the latest

Address reprint requests to: Gabriela Borrayo Sanchez, Comisionada del Programa "A Todo Corazon", Centro Médico, Nacional, Siglo XXI, Instituto Mexicano del Seguro Social, Av. Cuauhtemoc 330, Col. Doctores, Del. Cuauhtemoc, 06720, Ciudad de México, México; Phone: (+52) (55) 1200-4002; E-mail: gborrayos@yahoo.com.mx or gabriela.borrayo@imss.gob
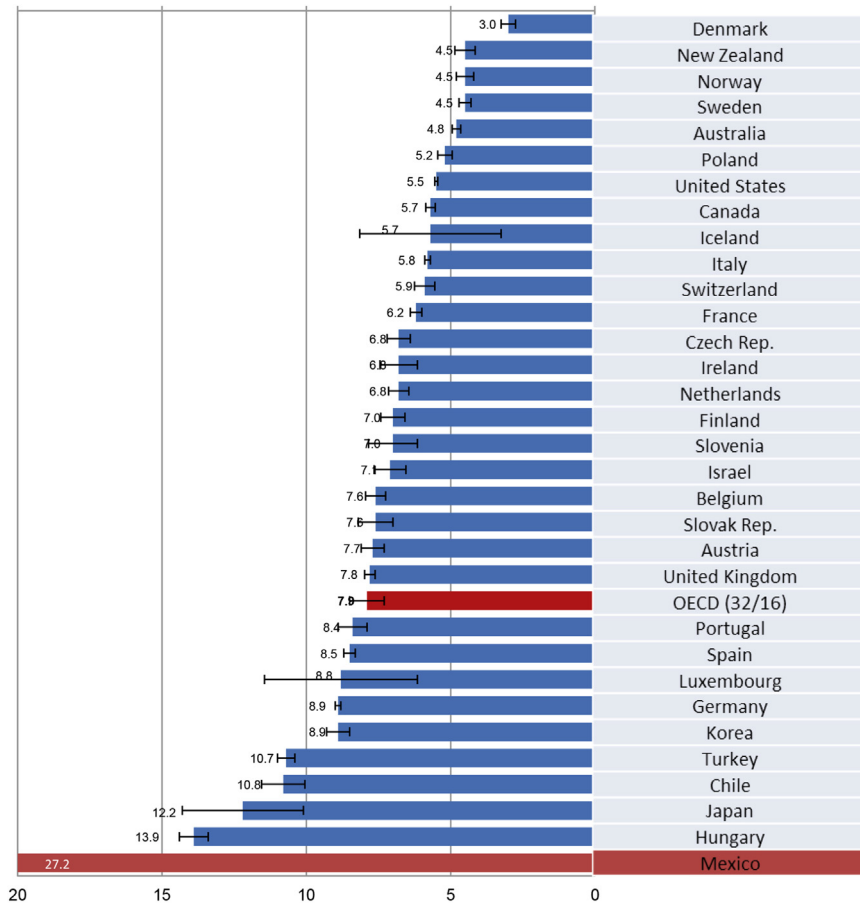
Figure 1. Mortality in adults aged 45 and over within 30 days after admission for acute myocardial infarction, as a criteria in the quality of care in systems of health (OECD) 2013. Note: The mortality in 2017 was 28 versus 7.5% of average. Health at a Glance 2017. OECD Indicators. Published on November 10, 2017 http://www.oecd.org/health/health-at-a-glance-19991312.htm.

report of the 2017 with 28% vs. an average 7.5% of mortality (3). It is considered a crucial indicator of the quality of care in health services (4). In addition, Mexican population has high prevalence of cardiovascular risk factors, 7 out of 10 Mexicans are obese or overweight, a third of adult population has high blood pressure and one in every ten adults is diabetic; the problem is aggravated above age 50, since nearly 60% already has three or more of these risk factors (metabolic syndrome) (5).The Mexican Social Security Institute (IMSS) provides coverage for more than 72 million Mexicans (60% of the general population); in 2016 CVDs was also the leading cause of death and occupied the first reason of subsequent consultation in family practice and specialty, with more than 17.4 million. Furthermore, it is also the leading cause of Disability-Adjusted Life Year (DALY) (6). In order to face the growing pandemic of CVDs, the IMSS, it has developed and implemented a comprehensive care program called ''A Todo Corazon'', it is the first program of integral care which seeks to strengthen the actions to improving the impact of CVDs from health. This review is focused on describing the 7 axes that make up the program, each

axe is described in detail. Axes one to three are dedicated to promotion and primary prevention of CVDs. Axes 4 and 5 are dedicated to infarction code, as a national strategy to confront the principal cause of death in Mexico. Finally axes 6 and 7 are dedicated to intensive care, secondary prevention and rehabilitation of CVDs (Figure 2).

National Context

The first study of real life in the IMSS, national registry of acute coronary syndromes (RENASCA IMSS) (7) which included 2,389 patients, showed high frequency of traditional risk factors and a very high risk population by 65% with the scale of GRACE (Global Registry of Acute Coronary Syndromes) (8), the average on the scale was 168 points. Patients with acute myocardial infarction with ST-segment elevation accounted for 67%, they showed significantly greater risk of death, re-infarction, angina or recurrent ischemia, as well as increased risk of heart failure, cardiogenic shock and arrhythmias. More than 50% of patients did not receive any reperfusion strategy, only 8% received
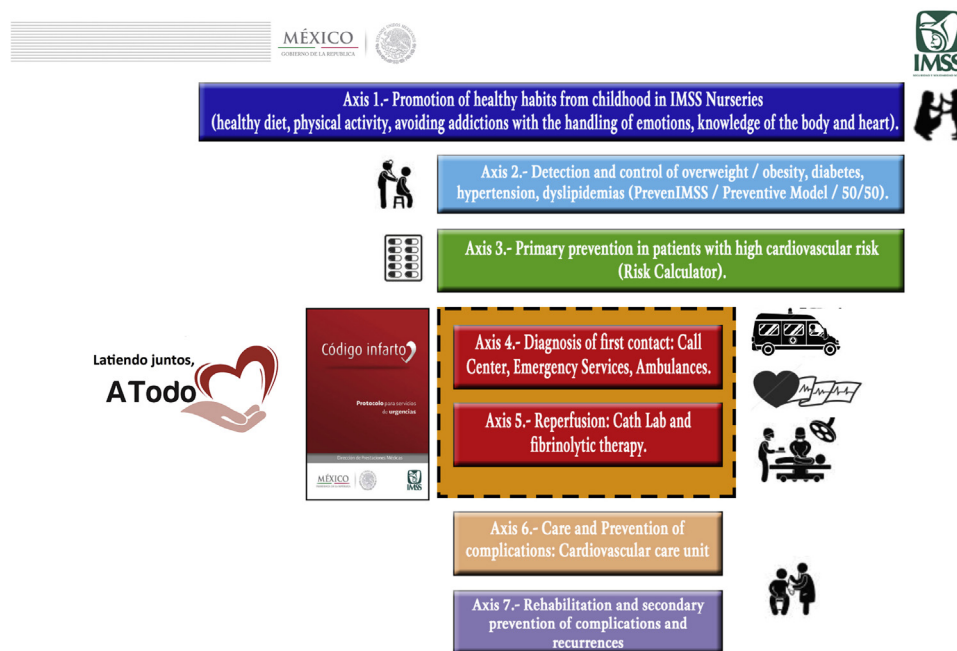
Figure 2. Axes of the ''A Todo Corazón'' Program, to strengthen actions for the prevention and treatment of cardiovascular disease.

primary angioplasty, and slightly over 40% fibrinolytic therapy. The time observed to receiving fibrinolytic therapy was over 4 h and up to 10 h for primary angioplasty.

International Context

In the past 20 years, CVDs mortality has declined substantially in high-income countries, mainly due to the development of comprehensive care programs. In United Kingdom, around 58% of the reduction in mortality is attributable to the reduction of risk factors and 42% due to primary and secondary prevention and treatment. In the United States, the prevention and treatment of CVDs have managed to reduce the 44% of cardiovascular mortality. A reduction of 24% is attributable to the use of statin therapy, 20% due to high blood pressure control and an additional 12% is due to tobacco cessation. However, in the management of acute myocardial infarction, timely reperfusion is the strategy that has demonstrated the most significant reduction in mortality.

"A Todo Corazon" Program

Axis 1. Promotion of Healthy Habits Since Childhood (Healthy Diet, Physical Activity, Avoiding Addictions, Knowledge of The Body and Heart)

Cardiovascular risk factors appear at an increasingly younger age making it necessary to implement preventive and health promotion activities since early childhood. There for, axis 1

was developed to implement a childhood educational program that contains four components. First, an educational program directed to improve the knowledge about the body and heart, second, a nutritional program to improve a healthy diet, third, an educational program of exercises, fourth, to help children in their emotions and healthy behavior. The impact of these 4 components will be measured using questionnaires and scales validated both for children and for parents. Numerous studies have shown that these factors can be treated through interventions aimed at promoting health at the preschool level. At the same time, the data shows that there is a persistence of the unhealthy lifestyles such as physical inactivity, tobacco use, and consumption of highly processed products or with added sugars; which begin in childhood and are maintained through adult life. Therefore, the acquisition of healthy living habits should begin as soon as possible. In Europe, the highest prevalence of overweight and obesity in children aged 7−11 years old was observed in the southern countries, reaching over 30%, Spain being the country showing the highest prevalence (9). Among the OECD countries, Mexico shows the second highest proportion of obese people of the total population (10), one in three children is overweight or obese, and is the offspring of obese parents (11). Childhood obesity in Mexico is attributed to the increase in availability of low-cost processed foods with high amounts of added fats, sugars and salt, poor physical activity and increased sedentary behavior due to high use of mobile devices and TV set in the child population. Program SI! (Salud Integral) of child education, is a program of intervention in the nurseries and the family environment designed to improve their habits, knowledge and attitudes about

four fundamental areas of health: diet, physical activity, body knowledge and management of emotions. The program has been running for over a decade in Colombia, Spain, and more recently USA and it has shown to significantly improve knowledge, attitude and habits in the intervention group (21.7 vs. 16.4%, *p* <0.001), with the greatest effect being observed in the first year after the intervention (7%) [12]. At the IMSS there are currently 1,360 nurseries catering to more than 230,000 children, 9 h per day. The program provides healthy diet, recreation, promoting health through healthy habits, immunizations, initial and preschool education in agreement to the Secretary of Public Education. In 2016, an improvement in diet was implemented through the elimination of added sugars, adding healthy fats and whole grains, as well as offering water without sugar or juices.

The IMSS in collaboration with the school of Medicine Mount Sinai will implement a collaborative study in children aged 3−4 years old, in 50 kinder gardens of Mexico City. They will be randomized to implement the Program SI! Mexico. The aim is shows that educational strategies in early ages with interventions in diet, exercise, knowledge of the body and the handling of emotions significantly improve knowledge and reduce the cardiovascular risk.

Axis 2. Detection and Control of Overweight/Obesity, Diabetes, Hypertension, Dyslipidemia and Smoking

In OECD countries, diabetes and CVDs cause 5.2% of total years lost because of disability, while in Mexico they cause 8.1%. Mexicans rank second in OECD in obesity (33% only after USA), and the highest frequency of overweight or obesity (73%) [13]. The attributable risk of CVDs mortality for major risk factors is as follows: hypertension 13%, smoking 9%, hyperglycemia 6%, and physical inactivity 6 and 5% overweight/obesity. All of these factors are potentially preventable. In the case of smoking the benefit of smoking cessation between 35 and 44 years of age, equals the rate of survival of ex-smokers with those who never smoked. According to national health survey, ENSANUT 2012 [14], the profile of the beneficiaries of the IMSS shows that 86.8% live in urban areas of more than 5,000 inhabitants and have a higher educational level than the rest of the population (39.8% have studies of high school or higher education compared with 23% in the not IMSS beneficiaries). The cumulated evidence suggests that at the first level of care, both medical advice for a change of lifestyle, drug treatment with anti-hypertensive drugs, anti-diabetics and statins reduce the likelihood of a cardiovascular event, including death [15]. According to the IMSS 13.1% of Mexicans 25 years and older have high cholesterol [16]. Similarly, 28% adult Mexicans have hypertension compared to an average 26% of the OECD countries. There for, axis 2 is dedicated to health workers. The program is designed for the detection of cardiovascular risk factors. Group workshops for mutual aid are implemented.

Specifically it will give workshops for reduction of work-related stress, specialized exercise plan, cessation of tobacco use and adequate control of blood pressure. In addition, a monthly follow-up will be done during one year and control of risk factors will be measured.

The 50/50 community health promotion program study, which included participants in Spain below 50 years of age, showed significant improvement on cardiovascular risk factors through the evaluation of the BEWAT scale (Blood pressure, Weight, Exercise, food and Tobacco, Fuster-BEWAT) (score, 0−15), with the greatest effect shown in smoking cessation [17]. Following this strategy, the IMSS has initiated a pilot study; the aim is to improving the cardiovascular health of workers between 25−50 years of age by controlling major risk factors for CVDs, in order of impact on personnel health.

Axis 3. Primary Prevention in Patients at High Cardiovascular Risk

Comorbidities are a reality that should be recognized from the age of 50. Certainly, the health care of noncommunicable diseases is more complex than those of infectious diseases and health systems must transition the initial need for acute, short, and intensive treatments towards prevention and management of chronic conditions. Such transition requires of multidisciplinary interventions for long periods of time including interventions in three levels of care, with a continuous monitoring, adjustments to the treatment and a strong emphasis on prevention [18,19]. In patients with diabetes, adequate management may reduce the incidence of heart attack and other cardiovascular complications by 17%. According to the institutional sources of information which included 3,171,140 diabetics, 73% seeked medical care, but only 42.6% were under medical supervision. Out of 6,112,650 hypertensive, 61.1% seeked medical care with only 59% reaching blood pressure control. Primary prevention aims to achieve the reduction of the frequency of the occurrence of acute coronary ischemic events (acute myocardial infarction) as well as chronic disease (angina). Efforts should be directed to the multiple risk factors with preventive actions including exercise, smoking cessation, control of comorbidities as overweight and obesity, hypertension, diabetes mellitus and dyslipidemia [20]. Cardiovascular risk calculators can provide absolute values that provide the estimated risk of a patient to develop CVDs which will help identify patients at risk and optimize the use of various therapies. Currently there are about 25 published cardiovascular risk calculators. Although routine use of these tools is less than 50%, the regular use is about 74% within primary care physicians who are specifically interested in CVDs risk [21]. One of the most used to predict cardiovascular disease during the past 10 years is the one derived from the Framingham study [22].

The most commonly used variables include traditional cardiovascular risk factors. Although most include cut-off points to estimate cardiovascular risk, (systolic pressure, glucose levels, total cholesterol and HDL), few include smoking. Independently of the score used to measure, cardiovascular risk in the Mexican population has undoubtedly increased in the last two decades, as shown by the increase of three or more risk factors in early stages of life. The growing burden of cardiovascular risk factors, CVDs and the subsequent high demand for care, is of utmost importance to identify patients at high-risk who would benefit from primary prevention strategies (23), including changes in lifestyle and the use of statins, antihypertensives or aspirin to prevent CVDs. In IMSS, CVDs is the first cause in subsequent consultation in family medicine (16.6 million queries per year), which represents an area of opportunity in primary prevention with the use of a cardiovascular risk calculator. Data from RENASCA-IMSS study, which included hospital admissions, showed that 45.8% of patients admitted with an acute coronary syndrome showed a variety of alterations of serum lipids. It should be noted that the RENASCA-IMSS study showed that the Mexican population coronary risk factors are more frequent (and possibly prevalent) than in other populations where data have been obtained for calculations of risk and prognosis. In fact, the average GRACE score is significantly higher in Mexican patients than, for example, those reported in Canadian population. This is an area of opportunity for epidemiological research in order to optimize health services in world.

Therefore axis 3 was developed to the primary prevention in subjects with a high cardiovascular risk is directed to reduce acute or chronic coronary syndromes through adequate control of risk factors in the long term, not only with not pharmacological measures but also with programs to improve adherence to cardiovascular drugs. Thus, in this axis several strategies to improve the real control of the cardiovascular risk factors will be developed. The aim is to control at the same time all risk factors and supervising the best adherence to treatment.

Protocol for Emergency Services: Infarction Code

Include axes 4 and 5, the objective of the emergency care protocol "Infarction Code", is to ensure prompt diagnosis and treatment of patients present for acute myocardial infarction, so they receive reperfusion treatment with primary angioplasty in the first 90 min, or fibrinolytic therapy in the first 30 min (ideally 10 min), subsequent to its entry to the IMSS emergency services (Figure 3). This Protocol includes a set of coordinated actions of all involved staff, organizes continuous intake and emergency services, and assigns specific activities to the staff involved in the care of the patient. One of the initial steps in order to implement the protocol is to have dedicated staff in emergency department and cath lab 24 h a day, 7 d a week (24/7). A coordinator of infarction code directs all actions to ensure prompt diagnosis and timely treatment, directing all inputs, resources and reagents necessary for optimal acute care.
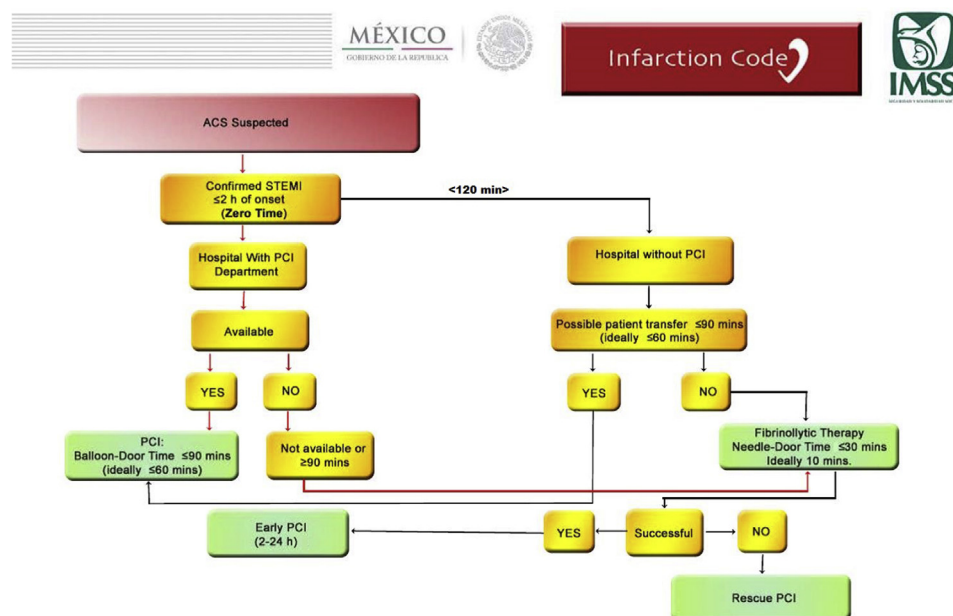

Figure 3. Algorithm of Diagnosis and Treatment of Code infarction. Note: Adaptation to the 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2018;39(2):119-177. doi:10.1093/eurheartj/ehx.393.

Axis 4. Diagnosis of First Contact, Emergency Services and Ambulance (Infarction Code)

The Following Data Must be Included:

Clinical data. The typical symptom includes chest pain, radiating to the left arm, with greater than 20 min duration, which may be accompanied of nausea and diaphoresis. In young people, diabetics, women and older adults, the presentation may be atypical.

Electrocardiogram. A 12 or 16-lead electrocardiogram (ECG) within the first 10 min of arrival to the emergency room is important to confirm the diagnosis or zero time (time ''0'') (24). If there are changes in the inferior leads, a 16 derivations ECG (dorsal and right derivation) allows for identification of right ventricular infarction. Acute myocardial infarction findings are defined as an elevation of the ST segment greater than or equal to 0.1 mv in at least two contiguous leads (e.g. in DI and AVL or DII, DIII or AVF) either greater than 0.15 mV in precordial leads (V1−V4 or V1−V6) (25), another is the presence of ''novo'' blocking of left or right bundle branch or a new appearance of Q waves two contiguous leads.

Biomarkers. Biomarkers include troponins, especially high sensitivity troponins, and total creatine phosphokinase and MB fraction. Biomarker levels reflect infarct size and the time evolution. Biomarkers are especially useful when there are atypical symptoms and absence of electrocardiographic data compatible with acute myocardial infarction. In cases where symptomatology and electrocardiogram data are typical of acute myocardial infarction, determination of biomarkers should not delay initiation of reperfusion strategy and should be repeated every 8−12 h up to 24−48 h after initial presentation.

Axis 5. Reperfusion: Cath Lab and Fibrinolytic Therapy (Infarction Code)

Treatment of Acute Myocardial Infarction. The treatments of reperfusion are the ''cornerstone'' for preserving cardiac function and reduce mortality. Although the global trend is to increase primary angioplasty and data has consistently shown greater benefits in multiple randomized clinical trials, there is point of equivalence between both treatments in the first 2 h of after clinical presentation, so that in places with limited access to a cath lab, fibrinolytic therapy provides benefits to patients without absolute contraindications that increase the risks of bleeding. To continue with a pharmacoinvasive strategy between the 2−24 h (26) (Figure 4). Adjunct therapy is essential to the success of the strategies of reperfusion, which includes the use of antiplatelet agents (aspirin, clopidogrel, heparin and some new antiplatelet) (27,28), associated with the
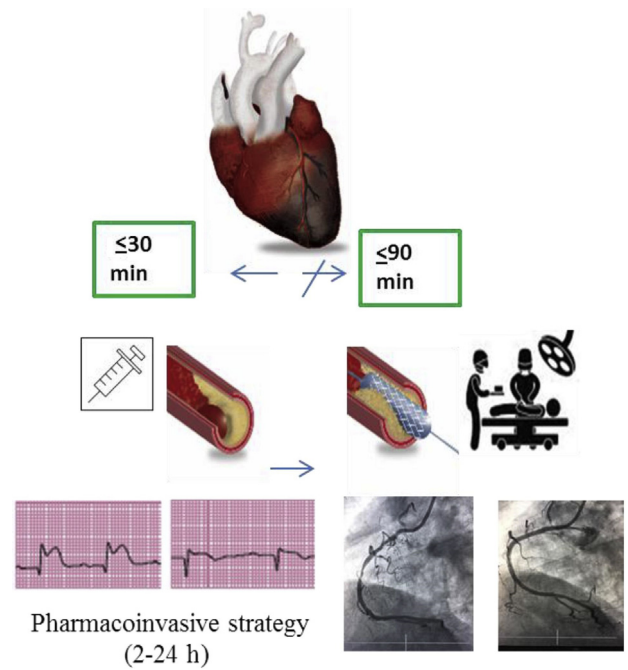

Figure 4. The electrocardiographic data reperfusion in the emergency care protocol infarction code and pharmacoinvasive strategy.

suitable use of beta blockers (29), statins (30) and calcium antagonists (in the absence of contraindications). In addition it is important to implement routine measures that include supplemental oxygen, bed rest, pain relief and use of anxiolytics. The implementation of the Protocol of care requires organization of the emergency services, equipment, reagents and skilled personnel, leadership, excellence and an integrated teamwork, identification of barriers and alternative solutions as well as having permanent 24/7 staff in hemodynamics and emergency services. The firs network of reperfusion was implemented including Cardiology Hospital XXI Century, nine hospitals and two medical units of family medicine with more than 20 beds (Figure 5). Effective internal and external communication through mobile devices and the Infarction Code Regulator Center simplified procedures and cut times, aiding in the prompt arrival of the patient to a primary angioplasty facility.

Pilot Study. The impact of the implementation of the strategy infarction code was assessed the in a pilot study which included a comparison of the cohorts before and after the implementation of the strategy. The pilot included 1,227 patients, 919 men (75%) and 308 women (25%), the average age was 64 ± 11 years: the results showed significant changes in favor of reperfusion, with an increase in percutaneous coronary intervention (16.6−42.6%), lower (39.3−25%) fibrinolytic therapy and lower percentage of not reperfused (44−32%). Time electrocardiogram door was significantly reduced from 19−9 min ($p < 0.0001$),
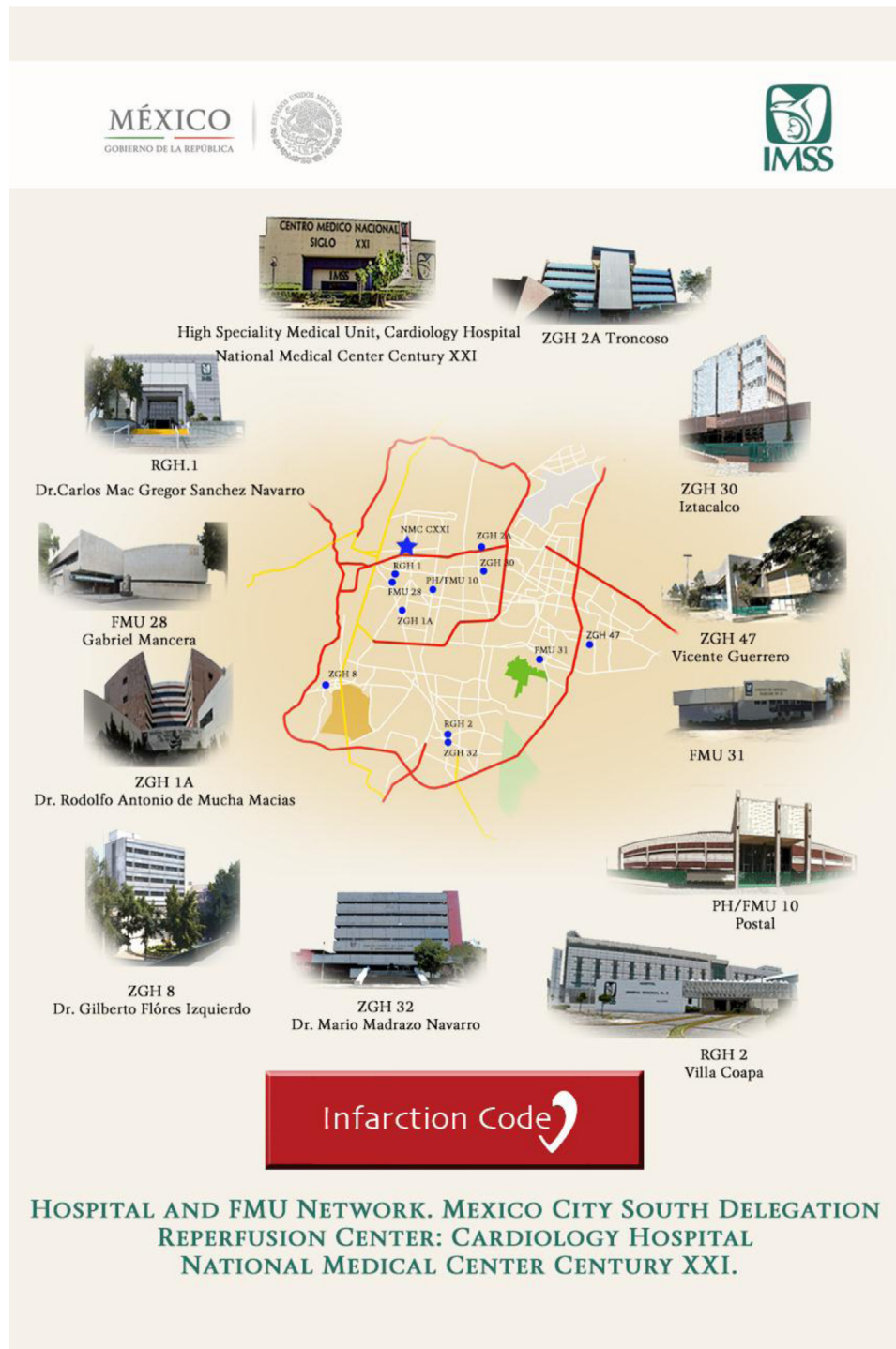
Figure 5. Network of reperfusion of the Cardiology Hospital and emergency room of the Hospitals South D.F. Delegation services for the implementation of the Infarction Code.

door needle from 92−72 min ($p = 0.004$), door balloon of 141−93 min ($p < 0.0001$), ischemia time 316−291 min ($p = 0.045$) and transfer times 105−61 min ($p = 0.002$). In terms of hard clinical outcomes, there was a significant decrease in heart failure (17.3 vs. 11.3%, $p = 0.004$, OR 0.61 CI 95% 0.43−0.85), re-infarction (3.9 vs. 1.9%, $p = 0.03$, OR 0.47; 95% CI 0.23−0.95), death (21 vs. 12.2%, $p = 0.004$, OR 0.52 CI 95% 0.38−0.71) and major

cardiovascular events (35.3 vs. 29.3%, $p = 0.034$, OR 0.76 CI 95% 0.59−0.97) (31).

Axis 6. Care and Prevention of Complications: Cardiovascular Care Unit

The implementation of the Cardiovascular Intensive Care Unit over fifty years ago resulted in 30% reductions mortality of patients with acute myocardial infarction (32), serious arrhythmias, and the implementation of an organized system is attributed to the close monitoring of the measures of cardiopulmonary resuscitation (CPR) with defibrillation or cardioversion. The implementation of Infarction Code, including hemodynamic invasive and non-invasive monitoring, availability of transitional pacemaker, devices of ventricular support, hemodialysis, mechanical ventilation, the use of Extracorporeal Membrane Oxygenation (ECMO) and ball of intra-aortic balloon pump counter pulsation patients harm or severe as a bridge to the transplant (33), hypothermia, blood thinners and beta blockers (34) have managed to reduce mortality to less than 5% (35). However the co-morbidity of patients in stroke is more complex and requires greater specialization and equipment (36). The presence of electrical and mechanical complications, early identification and prompt treatment reduces the impact on morbidity and mortality.

The Following Circumstances Require Special Attention:

Arrhythmias. The pathophysiology of electrical complications in the acute myocardial infarction is multifactorial, includes an increased cellular excitability caused by the process of ischemia, hemodynamic alterations and the autonomic system, as well as precipitants factors such as alterations imbalance and pharmacological.

Serious arrhythmias such as ventricular tachycardia without a pulse and ventricular fibrillation are more frequent in the first 48 h of an acute event in up to 90 percent of the cases, and are the major cause of sudden cardiac death. Their presence have been associated with very extensive infarcts, heart failure, persistent hypotension and tachycardia (37). Both types of arrhythmias may be the initial manifestation of heart failure, ischemia, by both the magnitude of heart damage generated and the acute myocardial infarction. Nevertheless atrial fibrillation is the most common arrhythmia (present in 8−22% of patients with acute myocardial infarction), and its presence is usually associated with large infarcts, increased sympathetic stimulation and increased atrial pressure secondary to failure of the left ventricle. Sinus bradycardia or changes in atrioventricular conduction can be of varying degrees. When the atrioventricular advanced blockages of 2nd or 3rd grade placement of a temporary pacemaker, in order to avoid the decrease in cardiac output and the evolution to asystole is indicated. Furthermore, the coexistence of extensive alterations in intraventricular conduction are considered an indication for the placement of transitional pacemaker and its presence is associated with poor prognosis in the short and long term, since they are the largest translation the ischemic myocardial damage.

Mechanical Complications ("Heart Failure"). The presence of mechanical complications is related to the extent of the damage to cardiac infarction and ischemic residual area, therefore a timely and successful reperfusion has significantly reduced its frequency. Its presentation has a bimodal pattern; up to one-third of patients present mechanical complications within the first 24 h of initial presentation and the remainder within the first week. A noninvasive imaging method, such as echocardiogram, allows the evaluation of the extent of the damage and the detection of other associated complications, and also allows initiating treatment. Heart failure, undoubtedly, is the most common mechanical complication following a non-reperfused myocardial infarction. Clinical manifestations may vary, depending on the degree of the extension, from simple tachycardia, acute pulmonary edema to overt cardiogenic shock. Diagnosis is made by clinical evaluation and X-ray of the chest, using a scale that allows risk stratification. Treatment should be directed to reduce the oxygen consumption, with the use of intravenous vasodilators (only when patient does not present hypotension), diuretics, and in selected cases, mechanical support ventilation may be required. The presence of acute heart failure in is considered an indication for revascularization in this group of patients. Cardiogenic shock is the most severe manifestation of mechanical complications (38); it is present in 9.7% of the patients with infarction in Mexico. It may be due to severe heart damage and in 3.2% of the cases it is associated with the presence of other mechanical complications including: rupture of the free wall of the heart, rupture of the septum, dysfunction or rupture of the muscles that hold the mitral valve, (2.8%) (39).

Initial treatment should be focused on improving low perfusion including inotropic drugs, use of diuretics and improvement of the amount of oxygen in the blood. It is advisable to perform hemodynamic monitoring for the more efficient management of the drugs as well as the presence of any complications. Some patients may benefit from intra-aortic balloon pump counter pulsation support (40) or other ventricular support devices. Multivessels revascularization is indicated in patients with cardiogenic shock, which has proven to reduce mortality in the short and medium term, even in elderly patients. However, in presence of rupture, wall free of the ventricle or the interventricular septum, and the presence of rupture or dysfunction of the papillary muscle, or the left main coronary artery disease, urgent surgical treatment is indicated (41).

Right ventricular infarction is a complication involving up to 30% of the patients with infarction of inferior location. The presence of right ventricular infarction includes

a classic hemodynamic triad: increased jugular vein, hypotension and clean lung fields; but in severe cases it can present with cardiogenic shock with left and right ventricular failure.

Axis 7. Rehabilitation and Secondary Prevention of Complications and Recurrences

Secondary Prevention. Secondary prevention includes detection and treatment in the early stages of a cardiovascular event. In this sense early stratification of patients with acute myocardial infarction takes on great importance. The results of the ETIAM-ST (42) (risk stratification early in patients with acute myocardial infarction with ST-Elevation) study, showed that elderly age (over 65) and the presence of traditional risk factors (diabetes, hypertension, dyslipidemia and smoking) were significantly associated with early death during coronary care unit admission. Mortality was explained by the reperfusion strategy as well as a history of previous ischemic heart disease and complications such as cardiogenic shock. Diabetes mellitus, high blood pressure, non-cardiac vascular disease, and history of previous ischemic heart disease are also markers of high risk of death compared with patients without these features, probably due to a greater risk of existing coronary artery disease.

Other determinants of mortality include hypotension, tachycardia and heart failure. In these patients the left ventricular ejection fraction lowers than 40% is another determinant of mortality. In terms of location and size of infarction, anterior infarction, has been shown to correlate with higher mortality compared to inferior location unless when right ventricular infarction is also present. Patients with previous anterior infarction and acute inferior infarction have higher mortality and constitute a higher risk group. Other complications are related to the presence of electrical disorders, including arrhythmias and AV block, in which mortality is two times higher in patients who develop conduction disturbances.

Secondary prevention programs are intended to reduce hospitalizations, recurrent myocardial infarction and reduce mortality in patients with established cardiovascular disease as well as improve quality of life. Changes in lifestyle, control of risk factors reaching established targets in the clinical practice guidelines and prescription medical therapy including aspirin, statins, beta blockers, the angiotensin converting enzyme inhibitors, as well as antiplatelet therapy can improve the course of ischemic heart disease (43), through the reduction of all-cause mortality up 75%. A strategy based on the use of a fixed-dose combination (FDC) or cardiovascular polypill, including key medications to reduce CV risk as a once daily dose pill, has been shown to improve adherence to medical therapy. The FOCUS study showed improved adherence in secondary prevention population of patients receiving the Fuster-

polypill compared with the group receiving separate medications after 9 months of follow-up (50.8 vs. 41%, $p < 0.019$) (44). All patients benefit from cardiac rehabilitation (CR). In the IMSS the CR programs were implemented started in the 1970s, however the use of these programs in eligible patients according to the 2016 national registry on CR in Mexico (RENAPREC II) programs, is very low (4.4%).

Hence, we propose general instructions for appropriate use of early cardiac rehabilitation in patients with acute myocardial infarction in three phases:

Early Cardiac Rehabilitation

Phase I: Hospital

a) Intensive Care Unit (24−48 h). Carry out exercises from low metabolic consumption 1−2 Mets (metabolic equivalent 3.5 consumer unit ml/KG/min of O2), passive, isotonic, evidently to monitor heart rate, blood pressure and oxygen saturation symptoms (can be used the Borg scale).

In addition, implement breathing exercises and stretching and progressive mobilization, followed by physical therapy and activities of daily living (eating, toilet, sitting and standing position).

b) Hospitalization. Deambulation should begin in this phase, which includes standing, walking and general physical activity not greater than 3.5 Mets. In this phase the emphasis on adherence to medication and clinical symptoms of decompensating critical. Discharge indications should include exercise recommendations to achieve phase II as well as education for the control of risk factors and reintegration to work and family life.

Phase II: Ambulatory. This phase includes evaluation and stratification of risk, exercise prescription, modification of risk factors, psychological control, education and return to work. It should begin ideally 2−3 weeks after discharge, and requires risk stratification with different scales AACVPR (American Association of Cardiovascular and pulmonary prevention) (39).

To assess the cardiovascular conditions patients must undergo a low-level stress test (following a Bruce or Naughton protocol) or cardiopulmonary testing equipment (PCP) if available as it allows more precise evaluation.

The therapeutic exercise and physical activity recommendations should include intensity and frequency of the training. The program includes 20 sessions per month, divided into 3−5 sessions per week of 30−45 min of duration each. or at least. The sessions are divided into warming out, exercise, training and cooling or relaxation, the time for each phase varies according to diagnosis, age and the general conditions of the patient.

The Borg scale used to evaluate constantly the Rating of Perceive Exertion (RPE), patients are taught to take the pulse during the sessions and electrocardiogram and blood pressure monitoring are required.

Emphasis should be directed toward appropriate nutritional control, smoking cessation with dedicated smoking clinics as well as appropriate control of lipids, diabetes and systemic arterial hypertension: Furthermore, sedentary lifestyle, anxiety, depression (psychology), should also be monitored. Also as one of the primary objectives it deals with occupational therapy and vocational rehabilitation.

Phase III: Self Help. Physical activity outside the medical institution should be carried out by the patient individually or as part of a group, as it will help easily identification of clinical signs and symptoms.

There is no time limit for this phase, also called phase IV when the patient is totally independent and carries out his physical activity because there are no regular contact with the cardiac rehabilitation team. This stage can include activities such as dance, Tai Chi, yoga among others. The aerobic component should always be predominant.

From February 2015—October 2017, infarction code strategy has helped with a program of early cardiac rehabilitation, with the participation of more than 15 medical units with service of physical medicine and rehabilitation. In a preliminary analysis of the impact with early cardiac rehabilitation (ECR) 1,141 patients, 921 cases and 220 controls were included. The average age was $62.6 \pm 10\ 5$ years. The most frequent diagnosis was inferior infarction was 48% of the total of patients. The main cardiovascular risk factors were sedentary 77.8% ($p < 0.0001$); hypertension 62% (PNS), smoking 59.2% ($p < 0.0001$).). The reference to phase II was 89%. The beginning of ECR was 1.86 ± 1.689 d, $p < 0.0001$. In the ECR group there was a significant decrease in ICU days (2.4 ± 2.2 vs 4.86 ± 4.1, $p < 0.0001$); total days of hospitalization (8.67 ± 5.2 vs 12.31 ± 7.7, $p < 0.0001$); days of incapacity (58.61 against 67.77, $p < 0.0001$) and better quality of life (45).

Conclusion

We have developed in Mexico the first program of integral care at an institutional level, *"A Todo Corazón",* which seeks to strengthen the actions for health promotion in childhood, prevention and attention of cardiovascular diseases in adults. This program will give us the basis for improving the impact of cardiovascular diseases in the social security institutions in low income countries. The greatest progress has been achieved in axes 4 and 5 of the infarction code; as standardized care protocol that has improved the quality of care with more timely reperfusion treatment and significant reduction in mortality, as well as in axis 7, by implementing an early cardiac rehabilitation

program that has improved the quality of life and significantly decreased the days of intensive therapy and disability. The rest of the axes focused on preventive strategies have their own long term challenges, however they are in development and implementation.

Conflict of Interest

The authors declare no conflict of interest.

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