OPEN ACCESS

GAVIN PUBLISHERS

International Journal of Cardiac and Pulmonary Rehabilitation

Gunturiz ML. Int J Cardiac and Pulmonary Rehabilitation: IJCPR-103.

Review Article

DOI: 10.29011/IJCPR-103/100003

Hypertension and Diabetes: A Latent Problem in Colombia

María Luz Gunturiz Albarracín*

Department of Public Health Research Division, National Institute of Health, Bogotá, Colombia

***Corresponding author:** María Luz Gunturiz Albarracín, BsC, PhD. Public Health Research Division, National Institute of Health, Bogotá, Colombia. Tel: +5712207700 Ext: 1629; +573123600581; Email: mgunturiz@ins.gov.co

Citation: Gunturiz ML (2018) Hypertension and Diabetes: A Latent Problem in Colombia. Int J Cardiac and Pulmonary Rehabilitation: IJCPR-103. DOI: 10.29011/IJCPR-103/100003

Received Date: 09 August, 2018; **Accepted Date:** 20 August, 2018; **Published Date:** 27 August, 2018

Abstract

Chronic noncommunicable diseases are long-lasting and usually slow-moving diseases. Heart diseases and attacks, cancer, respiratory diseases and diabetes are the main causes of mortality in the world, accounting for 60% of deaths.

Hypertension and diabetes are two chronic diseases and two significant cardiovascular risk factors that also present other complications.

Hypertension is a complication of diabetes and both diseases are independent risk factors for cardiovascular, renal, cerebral disease and peripheral atherosclerotic vascular disease. It can be estimated that between 30 and 75% of the complications of diabetes can be attributed to high blood pressure.

Hypertension accelerates and worsens the harmful effects of diabetes on the arteries, so those who suffer from both diseases tend to suffer more frequently from kidney failure, myocardial infarction, thrombosis and other complications. Similarly, it increases the risk of eye conditions such as cataracts, glaucoma and retinal problems. On the other hand, diabetes increases the risk of hypertension, due to its negative action on the arteries, which predisposes the narrowing of them and leads to hypertension.

From 40 to 60 percent of diabetic patients tend to suffer hypertension, while people with hypertension have a 50% increase in the risk of type 2 diabetes. In addition, the causes of both diseases depend on both genetic and environmental factors. In young people and children tend to present a greater number of symptoms and with greater intensity than in adults and the elderly.

This article shows the situation of these pathologies in a middle-income country like Colombia, where the presence of these two diseases is growing and latent.

Keywords: Chronic Noncommunicable Diseases; Diabetes; Hypertension; Obesity

Abbreviations

DM	:	Diabetes mellitus
DM1	:	Diabetes mellitus type 1
DM2	:	Diabetes mellitus type 2
HTA	:	Hypertension
NCA	:	Chronic noncommunicable diseases
SGSSS	:	General System of Social Security in Health
LMICs	:	Low- and middle-income countries
IRSP	:	Individual Registry of Services Prestation
RAR	:	Absolute reduction rate
IDF	:	International Diabetes Federation
CGM	:	Continuous glucose monitoring

Introduction

Chronic Noncommunicable Diseases (NCD) represent a relevant burden for the system of health for its costs very high and very late intervention, when no longer a significant benefit can be obtained for the health of the patient and the family.

Direct social and economic costs and indirect that NCD cause in institutions, patients and caregivers, are part of compulsory studies to improve the policies emanating from the General System of Social Security in Health (SGSSS) in Colombia, therefore, they support the viability and necessity of implement a program to decrease the loading of the NCD that allows a solution to the integral care of the affected population [1].

Within NCDs, hypertension and Diabetes Mellitus (DM) are two diseases that are increasingly common in Low- And Middle-Income Countries (LMICs) exposing patients to an increased risk of mortality and morbidity [2]. Identifying participants in the preclinical stages through screening offers participants and providers the opportunity to modify long-term risk before serious complications occur [3,4], however, the burden of hypertension and diabetes increases in the LMICs and in many countries, there are no programs dedicated to the diagnosis, prevention and care of patients with hypertension and DM [4].

The hypertension and diabetes mellitus are considered generalized public health problems. Despite this, there are few studies that report the prevalence of these diseases or replicable screening strategies. An analysis of global data in 2005 showed that 639 million (625-654 million) patients with hypertension live in LMICs [5,6]. By 2025, the number of adults with hypertension is expected to increase by approximately 60% and almost three-quarters of the world population of hypertensive people will live in LMICs [4,7].

Hypertension (HTA)

In Colombia, according to the Ten-Year Health Plan 2012-2021, for 2008, the prevalence of HTA, in the general population, was 22% [8]. The HTA was the second diagnosis that generated more consultations in the General System of Social Security in Health (SGSSS), with 7.3% of the total population and was the seventh cause of death in the country for the year 2011, with an adjusted rate of 11.34 per 100,000 inhabitants [9].

The prevalence para Colombia of HTA in women was 26% in 2010 and 31% in 2014, with an average increase of 1.35% per year. The data of consultations by HTA from the Individual Registry of Services Prostration (IRSP), showed 10% of prevalence of HTA in 2010 and 11% in 2014, with a 0.15% annual increase. The prevalence for men, was of 23.9% in 2010 and 28.7% in 2014, with an average annual increase of 1.2% and an absolute increase of 4.8 throughout the period. The data from IRSP, recorded a prevalence of 6.4% in 2010 and 6.8% in 2014, evidencing an increase of 0.45% in the 4 years [10].

In 2010 there were 2692 deaths in women due to HTA as a basic cause of death for a mortality rate to 13.8 per 100,000 inhabitants. In 2014, there were 2821 deaths due to this cause in women, with a mortality rate of 12.7 per 100,000 inhabitants. While the absolute number increased by 129 deaths, the adjusted rate decreased by 1.1. On the other hand, in men, the number of deaths recorded in 2010 was 2,256 and 2,336 in 2014, with an average annual increase of 20 deaths and an absolute increase of 80 deaths in the entire period. The adjusted mortality rate was 14.8 in 2010 and 13.7 in 2014, with an average decrease of 0.2 per year and an absolute decrease of 1.07 between 2010 and 2014 [11].

Actions for The Management and Prevention

Hypertension can not only be prevented but can be treated appropriately and at low cost, being able to avoid deaths and disabilities secondary to the complications of this disease. It is necessary to reduce the lack of knowledge in the general population about risk factors and to effectively increase changes in habits.

Healthy habits and lifestyles help to combat arterial hypertension, not only in the prevention of its occurrence but also as a coadjutant in the success of the treatment. The healthy habits include maintaining a healthy diet, low in fat, salt and sugars; increase physical activity and maintain an adequate weight; moderate the intake of alcohol and reduce to zero the exposure and consumption of tobacco products.

Diabetes Mellitus (DM)

In Colombia, the DM reported an average mortality rate between 2009 and 2011 of 10.4 per 100,000 inhabitants, placing it within the first 10 causes of general mortality, being more than 50% preventable [11]. DM was within the first twenty causes of healthy life years lost by 2010 in population ≥45 years [12].

Incidence

At a national level annually, were 178,308 new cases of DM in women and 160,370 in men. The incidence of DM in both sexes tended to decrease. In absolute terms, this decrease was greater in the male sex, presenting an absolute Reduction Rate (RAR) in the number of new cases of 319 deaths per 100,000 inhabitants. from 2010 to 2014. The RAR in the female sex was 180 deaths per 100,000 inhabitants. for the same period. However, women registered higher incidence rates for all years of the observation period, except in 2011. The ratio of incidence rates between women and men was recorded in 2010 at 0.98 and in 2014 at 1,14 [10].

Prevalence

The prevalence of diabetes in Colombia depends on the following factors: Study period, sex, age range, diagnostic criteria,

origin and background of the population (eg, urban vs rural), and evaluation of special populations (eg, HIV/AIDS, metabolic syndrome, and high blood pressure).

The prevalence parameter was estimated taking from a systematic review and the IRSP o show a higher prevalence in women.

According to the International Diabetes Federation [13], IDF in 2013, Colombia has a national prevalence rate of DM of 7.12% (referring to the adult population of 29,989,290 inhabitants aged 20-79 years), and the number of people with DM2 in Colombia is 2,135,380. Similarly, studies on the incidence of type 1 diabetes (DM1) in Colombia are scarce. For children aged ≤14 years by the year 1990, an adjusted incidence (for both sexes) of 3.8 per 100,000 and an estimated prevalence of 1.8 per 10,000 were found. By 2000, the incidence rate was 3.7 per 100,000, and by 2013 an incidence of 1.3 per 100,000 was seen [13-15]. Few studies have been conducted in Colombia on the frequency of gestational diabetes; the incidence is low (0.34%) depending on the population studied and the diagnostic criteria used. The estimated prevalence varies from 1.43% to 2.03%, but may increase to 10% to 14% if the calculation is aimed at pregnant women with risk factors for DM [15,16].

The rise in DM prevalence rate may be attributable to factors that are more applicable today: Longer duration of diabetes, increased life span even without a diabetes cure, increased incidence rate, forced displacement and internal migration, emigration of healthy people, immigration of susceptible individuals, and improved and better access to diagnostic screening tests

Mortality

Between 2010 y 2014, at the national level, an average of 5,650 deaths for DM were reported annually in both sexes, with the highest proportion of deaths in women (58%). There was a tendency to decrease mortality due to DM in both sexes during the study period. The decrease was similar in both sexes between 2010 and 2014. However, women reported higher incidence rates for all years of the observation period. The ratio of mortality rates between women and men was recorded at 1.15 for 2010 and at 1.13 in 2014 [10].

Between 1998 y 2011, the National Health Institute of Colombia determined the average annual raw mortality para DM and age-adjusted mortality rates at 16.3 and 21.2 deaths per 100,000 inhabitants, respectively. Of these deaths that occurred between 1998 y 2011, 3.6% were due to DM [9]. The highest diabetes-related mortality rates (>19 deaths per 100,000 inhabitants) were reported for the departments of Meta (highest at 27.24 per 100,000 inhabitants) [17].

Current status of Diabetes Care in Colombia

According to the 2007 National Health Survey (ENS 2007) [18], 96.5% of patients with diabetes had been treated by a general practitioner and 47.4% by a medical specialist. Similarly, the survey showed that 75% of patients with diabetes were advised to quit smoking and manage stress, and >80% were advised to lose weight and undergo lipid testing to regularly measure their blood or urine glucose levels. More than 90% of patients were recommended to exercise and lower sugar intake. About 80% of respondents said they did not use any method to measure their glucose levels at home [15,19].

There are few studies evaluating the use of medication by people affected with DM in Colombia. A study with adult patients (attending diabetes care programs) from 2001 to 2003 in the city of Medellin determined that 15.5% of the patients were not following a prescribed drug therapy; 44.2% received monotherapy, 36.2% dual therapy, 3.8% triple therapy, and 0.1% received a 4-drug regimen. The most common prescribed medications were sulfonylureas (58.2%), metformin (48.2%), insulin (19.6%), and thiazolidinediones (0.2%) [15,20].

An analysis of a group of 7308 people with DM cared for by the general health care system in 2007 showed that 48% were receiving monotherapy, whereas 52% were treated with a combination of ≥2 drugs (Machado-Alba J et al, 2007; Vargas H et al, 2015). The distribution of the monotherapy prescription drugs was glibenclamide 41.6%, metformin 36.6%, and insulin 21.8% [15,21]. A further analysis comprising 9 cities from 2006 to 2007 indicated that 45.8% of individuals with DM were treated with monotherapy, with metformin being the most frequently used agent (71.5%) [15,22]. Additionally, in Colombia, 40% to 60% of patients with DM2 are well controlled (hemoglobin A1c [A1C] <7.0%) [15,23]. Most of the oral and injectable medications for DM managing are available in Colombia (except for meglitinides, α-glucosidase inhibitors, and amylin mimetics). However, there are no head-to-head trials comparing different groups of medications in terms of their efficacy, safety, and long-term costs. A study published in 2012 was designed to establish the cost-effectiveness ratio of saxagliptin versus sulfonylureas in patients with DM2 who failed to realize their glycemic targets with metformin over a 20-year period. The findings indicated that the saxagliptin-treated group experienced fewer fatal and nonfatal events and fewer episodes of hypoglycemia than the sulfonylureas-treated group. Furthermore, saxagliptin therapy provided more quality-adjusted life years and life-years gained than sulfonylureas [15,24].

Insulin pumps and real-time continuous glucose monitoring (CGM) devices have been available in Colombia for several years. A study published in 2013 evaluated the use of integrated pump/

CGM technology associated with A1C levels <7.0% and showed that an A1C <7.0% before sensor-augmented insulin pump therapy, when combined with the consistent use of CGM sensors and bolus estimation algorithms, led to further reductions in A1C compared with pump therapy alone. A recent study described the experience of a high-complexity center with patients with DM1 undergoing simultaneous kidney-pancreas transplantation. Twenty-seven simultaneous kidney-pancreas transplants were performed between 2001 and 2012, with a patient survival rate at 1 and 2 years of 92% and 87%, respectively. The survival rate of the pancreatic graft at 1 year was 88% [15,25,26].

Cost of Diabetes Care in Colombia

The direct costs of diabetes care include expenses for medications, hospitalizations, consultations, and the management of complications and indirect costs include human capital-based criteria, including the loss of income estimated as a result of premature death and diabetes-related disabilities. The total annual cost associated with diabetes in Colombia was approximately US $ 2.6 billion, with a direct cost of approximately US $ 415 million and an indirect cost of approximately US $ 2.2 billion.65 The per-capita direct cost was US $ 442, and the per-capita health expenditure was US $ 209 [15,27].

The estimated mean overall (eg, direct and indirect) cost to DM2 was 5.7 billion Colombian pesos (US $ 2.7 million), with direct costs of 1.95 billion Colombian pesos (US $ 921 million) and indirect costs of 3.77 billion Colombian pesos (US $ 1.77 million) [15,28]. The cost of DM2 was determined by taking into consideration the perspectives of society and of the Ministry of Health as financers. The estimated lifetime cost per patient, including both direct and indirect costs (societal perspective), was 57,565,000 Colombian pesos (US $ 27,140). This amount represents an average annual cost per patient of 1,784,000 Colombian pesos (US $ 845). From the perspective of the Ministry of Health as financial, the average cost of DM2 projected for a patient was 19,576,000 Colombian pesos (US $ 9230), value that amounts to an annual cost per patient of 611,750 Colombian pesos (US $ 288). The average indirect cost was 37,767,000 Colombian pesos (US $ 17,806), value that amounts to an annual cost per patient of 1,187,000 Colombian pesos (US $ 559) [15,28].

In a study of partial economic evaluation carry out in Cartagena was determine the economic cost of DM2 from the viewpoint of the third payer (health care system or insurance company) during the period from 2007 to 2011. The data were collected from 123 medical records from health care provider databases. Using a market exchange rate of US $ 1 = 1925 Colombian pesos (May 15, 2014), the average cost per patient during the study period was US $ 616 (1,185,800 Colombian pesos). Finally, the total estimated cost of DM for Cartagena was US $ 2,684,528 (~5,168,000,000 Colombian pesos) based on the average cost per patient, diagnosed for the year 2011 (4358 patients with diabetes) [15,29].

Physiopathology

The physiopathology of hypertension in diabetes is varied. In the case of patients with established nephropathy, the volume of extracellular fluid is expanded as a consequence of an increase in total body sodium and the activity of the renin-angiotensin-aldosterone system is diminished, so that hypertension is volume dependent, similar to other nephropathies. In the absence of diabetic nephropathy, increased total body sodium with normal or low activity of the renin-angiotensin-aldosterone system has been reported. In type 2 diabetes mellitus, where hypertension is more frequent, a state of insulin resistance develops secondary, in many cases, to a state of alpha-adrenergic hyperactivity and peripheral vasoconstriction. This state of poor peripheral metabolism of glucose leads to secondary hyperinsulinism and a decrease in insulin clearance. Hyperinsulinemia can increase blood pressure by one or more of the following mechanisms. First, it produces renal sodium retention through an increase in its reabsorption at the tubular level (at least acutely) and increases the activity of the sympathetic nervous system. Another mechanism is hypertrophy of vascular smooth muscle secondary to the mitogenic action of insulin, which produces vascular remodeling. Insulin modifies the transport of ions through the cell membrane, thus increasing the cytosolic calcium levels of the vascular tissues, which causes a state of vascular hyperreactivity to the vasoconstrictive agents [30-34]. Finally, it is known that the ability of insulin to induce vasodilation, an effect demonstrated in endothelial cell cultures through the increase in nitric oxide synthesis, is reduced in situations of insulin resistance and diabetes, probably by inactivation of nitric oxide or by a reduction in ability of the vascular endothelium to synthesize it [31,34,35].

Long-Term Actions

In Colombia, the Ministry of Health and Social Protection included in its Decennial Plan, Cardiovascular Health, prevention and control of Diabetes 2014-2024 [8].

At the same time, the strategies "RECCETA A for a million hearts" and "Know your risk and healthy weight" were presented, which seek to identify the risk of the Colombian population due to diabetes, to suffer a heart attack or a stroke (thrombosis) and guarantee access to interventions that effectively reduce the number of heart attacks and thromboses, in addition to helping maintain control of hypertensive patients [8].

Meanwhile, the Ten-Year Public Health Plan 2012-2021, in the dimension of healthy living and non-communicable conditions, includes three goals directly related to chronic kidney disease and its causes, such as hypertension and diabetes:

• By 2021 maintain 85% of people without chronic kidney disease or stage 1 and 2 despite having precursory diseases (high blood pressure and diabetes).

• By 2021, reduce arterial hypertension by 25% in people over 25 years of age.

• By 2021, reduce premature mortality due to diabetes in 25% of the population between 30 and 70 years of age.

In addition, the Plan includes goals to prevent and control the risk factors related to hypertension and diabetes such as unhealthy eating, cigarette smoking, harmful alcohol consumption, physical inactivity and overweight and obesity [8].

In developing countries like Colombia, the care of patients with chronic disease is associated with catastrophic health expenditures for patients and their families. Hence the importance of working on issues related to the prevention and control of diabetes and hypertension, in addition to the early detection of the disease itself [8].

Finally, it is important to mention that hypertension and diabetes are closely related to obesity and metabolic syndrome.

Obesity, metabolic syndrome and type-2 Diabetes Mellitus (DM2) are three interrelated conditions that share a number of pathophysiological mechanisms and that are frequently observed to lead, in succession, to cardiovascular complications. The fact that their prevalence is increasing alarmingly should prompt all healthcare professionals urgently to implement measures to prevent these complications. The most effective, though also the least adopted, are those related to lifestyle modification. Drug treatment targeted at controlling risk factors (e.g., hypertension, dyslipidemia, and thrombophilia), metabolic abnormalities, and excess weight is also necessary [36-39].

Obesity is recognized as a risk factor for cardiovascular disease, which produces independent adverse effects in the cardiovascular system. This relationship is complex due to several associations with risk factors/cardiovascular disease markers such as hypertension, dyslipidemia, insulin resistance/dysglycemia or DM2. Obesity induces a variety of structural adaptations of the cardiovascular system, from subclinical myocardial dysfunction to severe left ventricular systolic heart failure. Abnormalities in cardiac metabolism and later cardiac energy have been proposed as the main contributors to cardiovascular disease related to obesity. Ectopic fat deposits play an important role in several of the hypotheses postulated to explain the association between obesity, cardiac metabolism and cardiac dysfunction [40].

Conclusions

Hypertension and diabetes are diseases whose prevalence, management and prevention depend on various genetic and environmental factors and become a deadly couple without proper care.

In general, diabetic-hypertensive patients should follow dietary and hygienic rules that often could be sufficient to avoid an increase in blood sugar and high blood pressure. On the other hand, with these two conditions, should avoid obesity and overweight and have a balanced and healthy diet, which includes the reduction of intake of sugars, salt, alcohol, among others.

Similarly, smoking should be stopped, as smoking increases, aggravates and accelerates the effects on blood vessels of hypertension and diabetes. The trend shows that for every cigarette a diabetic smoke equals six of a healthy person.

In Colombia, where the incidence and prevalence of these diseases is quite important, several programs have been initiated and some strategies have been established, which in the future could improve the quality of life of patients who suffer from them and prevent their occurrence in more people.

Acknowledgments

The author thanks the National Institute of Health for their support in the publication of this article.

Conflicts of Interest

The author declares no conflict of interest.

References

1. Gallardo-Solarte K, Benavides-Acosta FP, Rosales-Jiménez R (2016) Costos de la enfermedad crónica no transmisible: la realidad colombiana. Rev Cienc Salud 14: 103-114.

2. Steyn K, Sliwa K, Hawken S, Commerford P, Onen C, et al. (2005) INTERHEART Investigators in Africa. Risk factors associated with myocardial infarction in Africa: the INTERHEART Africa study. Circulation 112: 3554-3561.

3. Van den Donk M, Sandbaek A, Borch-Johnsen K, Lauritzen T, Simmons RK, et al. (2011) Screening for type 2 diabetes. Lessons from the ADDITION-Europe study. Diabet Med 28: 1416-1424.

4. Pastakia SD, Ali SM, Kamano JH, Akwanalo CO, Ndege SK, et al. Screening for diabetes and hypertension in a rural low income setting in western Kenya utilizing home-based and community-based strategies. Global Health 9: 21.

5. World Health Organization. Cardiovascular Diseases in the African Region: Current Situation and Perspectives. Geneva: Report of the Regional Director; 2005.

6. Bloomfield GS, Kimaiyo S, Carter EJ, Binanay C, Corey GR, et al. (2011) Chronic noncommunicable cardiovascular and pulmonary disease in sub-Saharan Africa: An academic model for countering the epidemic. Am Heart J 161: 842-847.

7. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK. (2005) The Global burden of hypertension: analysis of worldwide data. Lancet 365: 217-223.
8. Ministerio de Salud y Protección Social. Plan Decenal de Salud Pública 2012-2021.
9. Observatorio Nacional de Salud. Primer Informe ONS, Aspectos relacionados con la frecuencia de uso de los servicios de salud, mortalidad y discapacidad en Colombia, 2011. [Internet]. Bogotá-Colombia: Imprenta Nacional de Colombia; 2013.
10. Observatorio Nacional de Salud. Quinto Informe ONS. Carga de enfermedad por enfermedades crónicas no transmisibles y discapacidad en Colombia. 2015.
11. Observatorio Nacional de Salud. Mortalidad Evitable en Colombia para 1998-2011. 2014.
12. Peñaloza RE, Salamanca N, Rodríguez Hernández J (2014) Estimación de la carga de enfermedad para Colombia 2010. Bogotá: Pontificia Universidad Javeriana Centro de Proyectos para el Desarrollo (CENDEX) 94.
13. International Diabetes Mellitus Federation IDF Diabetes Atlas (6th ed.), International Diabetes Mellitus Federation, Brussels, Belgium (2013).
14. Aschner P, Aguilar-Salinas C, Aguirre L, Franco L, Gagliardino JJ, et al. (2014) IDF DM Atlas DM in South and Central America: an update DM. Res Clin Pract 103: 238-243.
15. Vargas-Uricochea H, Casas-Figueroa LA (2015) An Epidemiologic Analysis of Diabetes in Colombia. Annals of Global Health 81: 742-53.
16. World health statistics 2015. Part II Global health indicators.
17. Statistics DANE 2015.
18. Ministerio de la Protección Social. Encuesta Nacional de Salud. 2007.
19. Colombia: Economy and demography.2017.
20. Villegas Perrasse A, Abad S, Faciolince S, Hernández N, Maya C, et al. (2006) El control de la diabetes mellitus y sus complicaciones en Medellín, Colombia, 2001-2003. Rev Panam Salud Pública 20: 393-402.
21. Machado-Alba J, Moncada Escobar J, Mesa Escobar G (2007) Patrones de prescripción de antidiabéticos en un grupo de pacientes colombianos. Rev Panam Salud Pública 22: 124-131.
22. Machado-Alba J, Moncada-Escobar J, Gaviria H (2009) Quality and effectiveness of diabetes care for a group of patients in Colombia. Rev Panam Salud Pública 26:529-35.
23. Tamayo DC (2013) Diabetes en Colombia: construyendo el panorama desde la perspectiva del Observatorio de Diabetes de Colombia. Libro Blanco del Observatorio de Diabetes de Colombia.
24. Elgart JF, Gonzalez L, Caporale JE, Valencia JE, Gagliardino JJ (2012) Evaluación económica del tratamiento de diabetes tipo 2 con saxagliptina en Colombia. Medwave 12: e5306.
25. Gómez AM, Grizales AM, Veloza A, Marín A, Muñoz OM, et al. (2013) Factores asociados con el control glucémico óptimo en pacientes tratados con bomba de insulina y monitorización continua de glucosa en tiempo real. Av Diabetol 29: 74-80.
26. Serrano OJ, Villegas JI, Echeverri GJ (2014) Trasplante simultáneo de riñón y páncreas en pacientes con diabetes mellitus de tipo 1, Clínica Fundación Valle del Lili, Cali, 2001-2013. Rev Colomb Cir.; 29: 32-41.
27. Barceló A, Aedo C, Rajpathak S, Posada JG, Mesa L, et al. (2003) The cost of diabetes in Latin America and the Caribbean. Bull World Health Organ 81: 19-27.
28. González JC, Walker JH, Einarson TR (2009) Cost-of-illness study of type 2 diabetes mellitus in Colombia. Pan Am J Public Health 26: 55-63.
29. Álvarez-Arias G, Carranza-Conde V (2014) Costos económicos de la Diabetes Mellitus en Cartagena de Indias. Universidad de Cartagena; Facultad de Ciencias Económicas. Programa de Economía, Remisión de Proyectos. Tesis de Grado, Cartagena de Indias D.T Y C.
30. Coca A, Aranda P, Marín R, Calvo C (2000) Hipertensión arterial y diabetes no insulinodependiente. En Casos Clínicos en Hipertensión Arterial. 2º ed. Barcelona, España. Masson 101-106.
31. Esmatjes E, Vidal J (1998) Repercusión cardiaca de la diabetes mellitus. Rev Esp Cardiol 51: 661-670.
32. Arauz-Pacheco C, Parrot MA, Raskin P (2002) The Treatment of Hypertension in Adult Patients with Diabetes (Technical Review). Diabetes Care 25: 134-147.
33. Fauci AS, Braunwald E, Isselbacher KJ (1998) Vasculopatía hipertensiva. En Harrison: Principios de Medicina Interna. 14º ed. España. McGraw-Hill Interamericana 246:1574-1589.
34. Araya-Orozco M (2004) Hipertensión arterial y diabetes mellitus. Revista Costarricense de Ciencias Médicas 25: 65-71.
35. Henry P, Thomas F, Benetos A, Guize L (2002) Impaired fasting glucose, blood pressure and cardiovascular disease mortality. Hypertension 40: 458-463.
36. Alegría Ezquerra E, Vázquez JMC, Barrero AA (2008) Obesidad, síndrome metabólico y diabetes: implicaciones cardiovasculares y actuación terapéutica. Revista Española de Cardiología 61: 752-764.
37. Gunturiz ML and Chaparro PE (2017) Diabetic Cardiomyopathy: Cause or Consequence of Diabetes Mellitus? Cardiology and Cardiovascular Medicine 1: 155-168.
38. Kim NH, Seo JA, Cho H, Seo JH, Yu JH, et al. (2016) Risk of the Development of Diabetes and Cardiovascular Disease in Metabolically Healthy Obese People: The Korean Genome and Epidemiology Study. Medicine (Baltimore) 95: e3384.
39. Gunturiz Albarracín ML (2017) Metabolic Syndrome and Cardiovascular Implications in Younger People. Therapeutic Advances in Cardiology 1: 188-198.
40. Piché ME, Poirier P. Obesity, ectopic fat and cardiac metabolism. Expert Rev Endocrinol Metab 13: 213-221.