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síndrome metabólico en
pacientes del Instituto Nacional
de Cancerología de México**

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Incidencia y características del síndrome metabólico en pacientes del Instituto Nacional de Cancerología de México

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ABSTRACT

Objective: the exact prevalence of obesity in Mexico is not well known and varies between sources, but more than 30% of Mexico's population

are obese. Obesity is associated with several diseases such as metabolic syndrome; the latter, along with cancer, have become public health concerns worldwide, and their association has been widely studied in developed countries. The aim of this study was to identify the overall prevalence of metabolic syndrome and to describe its characteristics among first-time cancer patients at a referral center in Mexico.

Methods: a prospective, observational, cohort study of first-time patients of the National Cancer Institute of Mexico in the period of September 2016-2017. We identified 1,165 first-time patients, and 316 patients with known or recently diagnosed metabolic syndrome were included.

Results: median age was 55 years old and most were female (81%). The most frequent tumors were breast, gynecological, and hematological growths. Obesity (class 1-3) and abnormal glucose and/or previous DM diagnosis were mostly observed in patients with skin and soft tissue tumors; dyslipidemia, high triglycerides, and/or low HDL-cholesterol were mostly observed in patients with gastrointestinal tumors.

Conclusion: the prevalence of metabolic syndrome among first-time cancer patients was 27%. As obesity and cancer are of public concern in Mexico, the implementation of preventive strategies for MS patients, focusing on the first level of care during early stages in order to reduce the risk of cancer, is needed.

Key words: Incidence. Metabolic syndrome. Cancer. Mexico.

RESUMEN

Objetivo: la prevalencia de la obesidad en México es mayor del 30% de la población total. La obesidad se asocia con diversas enfermedades, entre ellas el síndrome metabólico; este y el cáncer se han convertido en problemas de salud pública a nivel mundial, y su asociación ha sido ampliamente estudiada en países desarrollados. El objetivo de este

estudio fue identificar la prevalencia del síndrome metabólico y describir las características entre pacientes oncológicos de primera vez en un hospital de tercer nivel en México.

Métodos: estudio prospectivo, observacional y de cohortes que incluye a pacientes oncológicos atendidos por primera vez en el Instituto Nacional de Cancerología durante el periodo de septiembre 2016 a 2017. Identificamos 1165 pacientes; 316 tenían el diagnóstico de síndrome metabólico y fueron incluidos en el presente estudio.

Resultados: la mediana de edad fue de 55 años y la mayoría de los pacientes eran del sexo femenino (81%). Las neoplasias más frecuentes fueron las de mama, ginecológicas y hematológicas. La obesidad (clase 1-3) y la glucosa anormal y/o un diagnóstico previo de diabetes mellitus se observaron mayormente en pacientes con neoplasias de piel y tejidos blandos; los pacientes con neoplasias gastrointestinales presentaron mayormente dislipidemia, triglicéridos elevados y/o HDL bajo.

Conclusiones: la prevalencia del síndrome metabólico en nuestros pacientes oncológicos fue de 27%. Al ser la obesidad y el cáncer problemas de salud pública en México, la implementación de medidas preventivas para pacientes con síndrome metabólico debe enfocarse en el primer nivel de atención, durante etapas tempranas, para poder reducir el riesgo de cáncer.

Palabras clave: Incidencia. Síndrome metabólico. Cáncer. México.

INTRODUCTION

In the last 50 years obesity rates have substantially increased in Mexico, showing a drastic increase in body mass index (BMI) among the population as a result of evolving dietary habits (1). The exact prevalence of obesity in Mexico is not well known and varies among sources, but more than 30% of Mexico's population are obese according to the most recent update of the Organization for Economic Co-operation

and Development (OECD) (2). Obesity is associated with several diseases, such as coronary heart disease, high blood pressure, and diabetes (3). The association of obesity and other previously mentioned conditions represents a widely known disorder characterized by the presence of multiple risk factors, and known as metabolic syndrome (4). This disorder is diagnosed when at least three of the following are present: central obesity, hyperglycemia, hypertriglyceridemia, low HDL-cholesterol, and hypertension (5). The last nutritional survey in Mexico (ENSANUT, from its Spanish acronym, 2012) reported that metabolic syndrome had increased to 45% (6) as compared to the report published in 2006 (7).

On the other hand, worldwide leading causes of death according to the World Health Organization (WHO) and the Global Health Observatory include ischemic heart disease, stroke, lower respiratory infection, and chronic obstructive lung disease; however, cancer has also become a leading cause of mortality, causing 1.6 (2.9%) million deaths in 2012. Mortality rates in Mexico are no different, as cancer is the second or third leading cause of death, with approximately 78,000 cancer deaths in 2012 (8). Nonetheless, Mexico does not track morbidity data. Official sources only provide data on the number of hospital discharges from public institutions without identification of patient cases (9).

As both metabolic syndrome and cancer have become public health problems worldwide, and their association has been widely studied mostly in developed countries (10-12), the aim of this study was to identify the overall prevalence of metabolic syndrome and to describe its characteristics among first-time cancer patients at a referral center in Mexico.

PATIENTS AND METHODS

This is a prospective, observational, cohort study of first-time patients of the National Cancer Institute of Mexico (INCan, from its Spanish

acronym), from September 2016 to September 2017. The study was approved by the institutional ethics and research committees. All participants provided their written informed consent.

Patients and data

We identified 1,165 first-time patients at the INCan during a 1-year period. We enrolled 316 patients who met the eligibility criteria. Inclusion criteria included: known or recently diagnosed metabolic syndrome, ≥ 18 years of age, and good performance status. Clinical and demographic data, such as gender, age, and type of cancer were collected from the electronic medical records (INCanet). All patients underwent a complete nutritional evaluation to assess the presence of metabolic syndrome.

Definition of metabolic syndrome and measurements

For the diagnosis of metabolic syndrome, the latest harmonized definition (5) was used, which requires the presence of three or more of the following: waist circumference ≥ 80 cm in women and ≥ 94 cm in men; triglycerides ≥ 150 mg/dL; HDL-cholesterol < 50 mg/dL; fasting glucose ≥ 100 mg/dL or diabetes treatment; systolic blood pressure ≥ 130 mm Hg, and diastolic blood pressure ≥ 85 mm Hg or antihypertensive drug treatment.

Blood pressure (BP), weight (kilograms, kg), and height (centimeters, cm) were obtained, and body mass index (BMI) was calculated: weight in kilograms divided by square height in meters (kg/m^2). The waist-hip (W-H) ratio was obtained as waist measurement divided by hip measurement. Any previous history of dyslipidemia and diabetes mellitus (DM) was also recorded. Patients were sent to the laboratory for serum determinations of fasting glucose and a lipid panel.

Statistical analysis

Continuous variables were described by median and interquartile range values using the frequency analysis. Categorical variables were described by frequencies and percentiles. The SPSS v.21 (IBM, Chicago, IL) was used.

RESULTS

We identified 1,165 patients with cancer, and the incidence of metabolic syndrome according to the underlying cancer was as follows: breast (n = 131/361, 36%), gynecological (n = 75/211, 35%), gastrointestinal (n = 21/208, 10%), hematological (n = 32/126, 25%), urological (n = 29/72, 40%), soft tissue/skin (n = 14/31, 45%), head and neck (n = 9/120, 8%), and lung (n = 2/36, 6%); therefore, out of the 1,165 patients identified at the INCan, the final cohort included 313 patients (27%) with metabolic syndrome. Median age was 55 years (range, 25-91). The majority were women (n = 254, 81%; men, n = 59, 19%). Most frequent tumors included breast, gynecological, and hematological neoplasms: 42%, 24%, and 10%, respectively. Most patients were overweight (n = 130, 42%); median weight and height were 155 cm and 76 kg, respectively. Median BMI and W-H ratio were 31 and 0.92, respectively. Fifty-five percent of patients had diabetes mellitus (n = 172), and 42% had hypertension (n = 132). Before referral to our institution, 237 patients (76%) had already been diagnosed with metabolic syndrome and 76 patients (24%) were diagnosed at admission. Median laboratory parameters were as follows: glucose 121.5 mg/dL, triglycerides 185.5 mg/dL, HDL-cholesterol 41 mg/dL, total cholesterol 181 mg/dL, and LDL-cholesterol 117.6 mg/dL. Obesity (class 1-3) was mostly observed in patients with skin and soft tissue, hematological, and urological tumors: 69%, 63%, and 59%, respectively. Abnormal glucose and/or previous DM diagnosis were mostly observed in patients with skin and soft tissue, gynecological, and gastrointestinal tumors: 86%, 58%, and 57%, respectively. Dyslipidemia, high triglycerides, and/or low HDL-cholesterol

were mostly observed in patients with gastrointestinal, skin and soft tissue, and urological tumors: 100%, 76%, and 71%, respectively. Patients with head and neck, gynecological, and breast tumors were those most frequently seen with known or recently diagnosed hypertension: 67%, 44%, and 44%, respectively. The overall characteristics by diagnosis are shown in table I.

DISCUSSION

Several studies and meta-analyses (13-15) have demonstrated that common cancers, such as gastrointestinal, breast, pancreatic, and gynecological neoplasms, are associated with metabolic syndrome. However, to date, the mechanisms linking this disorder and cancer are not completely understood, as it is unknown whether the strength of the association between these is greater than the sum of the individual components of metabolic syndrome, which might be driving this association, or whether the metabolic syndrome is a reliable predictor of cancer risk (11). Metabolic syndrome might represent a surrogate marker for other cancer risk factors: sedentary lifestyle, high dietary fat and carbohydrate intake, and oxidative stress (5,10). On the other hand, overweight and obesity are currently very important challenges of public health worldwide, and their negative effect among chronic, non-communicable diseases such as cancer is widely known (18). Mexico has the second highest global prevalence of obesity in the adult population, which implies a major challenge for the health sector (18). Moreover, the most frequent types of cancer in Mexican adults are breast and gastrointestinal tumors in women and men, respectively. Although metabolic syndrome and its association with cancer are topics of interest, data in Mexico and other developing countries where obesity is high remain scarce. A study found a prevalence of MS in 27% of Mexican female survivors of cancer (19); furthermore, a study performed in women with breast cancer reported a prevalence of 50% among obese

women (20). Osornio-Sánchez et al. (21) reported a prevalence of 48% among patients with prostate cancer. In this study, we identified a prevalence of metabolic syndrome in 27% of first-time patients of the INCan during a 1-year period. Prior to referral to our Institution, 76% of patients were already diagnosed with metabolic syndrome, which highlights the importance of primary care. Our results showed that breast, gynecological, urological, and soft tissue/skin cancers have the highest prevalence of metabolic syndrome.

Due to the high prevalence of MS and the high incidence of cancer worldwide, it is assumed by some authors that many cases of cancer should be attributed to MS (22). Mexico is no exception, and an implementation of preventive strategies for MS patients, focusing on the first level of care during early stages in order to reduce the risk of cancer, is needed. As we acknowledge the limitations of our study—one center, small cohort due to the 1-year period—we also highlight that this is the first study performed in Mexican patients including all types of cancer and reporting the prevalence of metabolic syndrome among them. More studies in Mexican patients and other developing countries with high incidence of obesity and metabolic syndrome are encouraged for further comparisons.

REFERENCES

1. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. *Nutr Rev* 2012;70:3-21. DOI: 10.1111/j.1753-4887.2011.00456.x
2. Obesity Update. Organization for Economic Co-operation and Development website. oecd.org/els/health-systems/Obesity-Update-2014.pdf. Accessed on April 17, 2018.

3. Apovian CM. Obesity: definition, comorbidities, causes, and burden. *Am J Manag Care* 2016;22(7 Suppl):s176-85.
4. O'Neill S, O'Driscoll L. Metabolic syndrome: a closer look at the growing epidemic and its associated pathologies. *Obes Rev* 2015;16(1):1-12. DOI: 10.1111/obr.12229
5. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. *Circulation* 2009;120:1640-5. DOI: 10.1161/CIRCULATIONAHA.109.192644
6. Barquera S, Campos-Nonato I, Hernández-Barrera L, Pedroza-Tobías A, Rivera-Dommarco JA. Prevalencia de obesidad en adultos mexicanos, ENSANUT 2012. *Salud Pública de México* 2013;55(Supl 1):S151-S160. DOI: 10.21149/spm.v55s2.5111
7. Rojas R, Aguilar-Salinas CA, Jiménez-Corona A, Shamah-Levy T, Rauda J, et al. Metabolic syndrome in Mexican adults. Results from the National Health and Nutrition Survey 2006. *Salud Pública Mex* 2010;52(Supl 1):S11-S18. DOI: 10.1590/S0036-36342010000700004
8. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, et al. GLOBOCAN 2012 v1.0, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 11 [Internet]. Lyon, France: International Agency for Research on Cancer; 2013. Available from: <http://globocan.iarc.fr>. Accessed on April 17, 2018.
9. Mohar-Betancourt A, Reynoso-Noverón N, Armas-Texta D, Gutiérrez-Delgado C, Torres-Domínguez JA. Cancer Trends in Mexico: Essential Data for the Creation and Follow-Up of Public

- Policies. *Journal of Global Oncology* 2017;3(6):740-8. DOI: 10.1200/JGO.2016.007476
10. Esposito K, Chiodini P, Colao A, Lenzi A, Giugliano D. Metabolic syndrome and risk of cancer: a systematic review and meta-analysis. *Diabetes Care* 2012;35:2402-11. DOI: 10.2337/dc12-0336
 11. Harding J, Sooriyakumaran M, Anstey KJ, Adams R, Balkau B, Briffa T, et al. The metabolic syndrome and cancer: Is the metabolic syndrome useful for predicting cancer risk above and beyond its individual components? *Diabetes Metab* 2015;41(6):463-9. DOI: 10.1016/j.diabet.2015.04.006
 12. Esposito K, Capuano A, Giugliano D. Metabolic syndrome and cancer: holistic or reductionist? *Endocrine* 2014;45:362-4. DOI: 10.1007/s12020-013-0056-2
 13. Esposito K, Chiodini P, Capuano A, Bellastella G, Maiorino MI, Giugliano D. Metabolic syndrome and endometrial cancer: a meta-analysis. *Endocrine* 2014;45(1):28-36. DOI: 10.1007/s12020-013-9973-3
 14. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet* 2008;371:569-78. DOI: 10.1016/S0140-6736(08)60269-X
 15. Matthews CE, Sui X, LaMonte MJ, Adams SA, Hébert JR, Blair SN. Metabolic syndrome and risk of death from cancers of the digestive system. *Metabolism* 2010;59:1231-9. DOI: 10.1016/j.metabol.2009.11.019
 16. Osaki Y, Taniguchi S, Tahara A, Okamoto M, Kishimoto T. Metabolic syndrome and incidence of liver and breast cancers in Japan. *Cancer Epidemiol* 2012;36:141-7. DOI: 10.1016/j.canep.2011.03.007

17. Aleksandrova K, Boeing H, Jenab M, Bas Bueno-de-Mesquita H, Jansen E, van Duijnhoven FJ, et al. Metabolic syndrome and risks of colon and rectal cancer: The European prospective investigation into cancer and nutrition study. *Cancer Prev Res (Phila)* 2011;4:1873-83. DOI: 10.1158/1940-6207.CAPR-11-0218
18. Barrera-Cruz A, Rodríguez-González A, Molina-Ayala MA. Escenario actual de la obesidad en México. *Rev Med Inst Mex Seguro Soc* 2013;51(3):292-9.
19. Ortiz-Mendoza CM, de la Fuente-Vera TA. Obesity and components of metabolic syndrome in Mexican women survivors of cancer. *Rev Med Inst Mex Seguro Soc* 2014;52(5):588-93.
20. Ortiz-Mendoza CM, de-la-Fuente-Vera TA, Pérez-Chávez E. Metabolic Syndrome in Mexican Women Survivors of Breast Cancer: A Pilot Study at a General Hospital. *Med Arh* 2014;68(1):19-21. DOI: 10.5455/medarh.2014.68.19-21
21. Osornio-Sánchez V, Camacho-Castro AJ, García-Salcido F, Muñoz-Ibarra E, Garza-Sainz G, Mayorga-Gómez E, et al. Síndrome metabólico en pacientes con cáncer de próstata en tratamiento con bloqueo androgénico. *Rev Mex Urol* 2014;74(2):79-83. DOI: 10.1016/S2007-4085(15)30016-1
22. Mendonça FM, de Sousa FR, Barbosa AL, Martins SC, Araújo RL, Soares R, et al. Metabolic syndrome and risk of cancer: Which link? *Metabolism* 2015;64(2):182-9. DOI: 10.1016/j.metabol.2014.10.008

Table I. Patient demographics and clinical characteristics by type of cancer

Variable n (%)	Cancer diagnosis							
	Breast	Gynecological	Urological	Gastrointestinal	Skin/Soft tissue	Lung	Head/Neck	Hematological
Median age (range)	55 (35-91)	58 (32-84)	55 (25-75)	64 (45-75)	57 (44-75)	60 (60-61)	54 (40-72)	50 (25-82)
Gender								
Female	131	75 (100)	6 (21)	12 (57)	7 (50)	2	5 (55)	16 (50)
Male	(100)	-	23 (79)	9 (43)	7 (50)	(100)	4 (45)	16 (50)
Known metabolic syndrome	99 (76)	54 (72)	23 (79)	19 (90)	11 (79)	2 (100)	6 (67)	23 (72)
Weight (median, kg)	73.7 (51-117)	76.8 (52-119)	81.1 (67-122)	68.8 (56-109)	78.8 (55-103)	70.5 (50-91)	73.7 (69-126)	82.8 (63-130)
Height (median, cm)	153 (140-168)	152 (135-168)	167 (148-189)	160 (140-189)	160 (144-176)	153 (139-167)	161 (142-171)	163 (139-182)
BMI								
Classification	60 (46)	23 (31)	12 (41)	11 (52)	6 (43)	1 (50)	4 (44)	12 (38)
Overweight	36 (27)	25 (33)	14 (48)	8 (38)	6 (43)	1 (50)	0	13 (41)
Obesity class 1	24 (18)	20 (27)	2 (0.7)	2 (10)	2 (14)	0	2 (22)	7 (21)
Obesity class 2	11 (9)	7 (9)	1 (0.3)	0	0	0	3 (34)	0
Obesity class 3								
W-H ratio								
Female								
< 0.86	23 (18)	10 (13)	2 (33)	2 (16)	0	0	0	0
≥ 0.86	108 (82)	65 (87)	4 (66)	10 (81)	7 (100)	2 (100)	5 (100)	16 (100)
Male								
< 0.86	0	0	1 (4)	1 (11)	1 (14)	0	0	0
≥ 0.86	0	0	22 (95)	8 (88)	6 (85)	0	4 (100)	16 (100)
Diabetes mellitus	67 (51)	44 (59)	15 (52)	10 (48)	11 (79)	1 (50)	5 (55)	19 (59)
Hypertension	57 (44)	33 (44)	11 (38)	9 (43)	4 (29)	2 (100)	6 (67)	10 (31)

Glucose (median, mg/dL)	117 (60-339)	128 (81-346)	123 (88-500)	127 (103-215)	155.5 (80-390)	126 (113-139)	122 (86-214)	121 (74-574)
Triglycerides (median, mg/dL)	169 (36-587)	210.5 (68-670)	287.5 (61-581)	171.5 (68-599)	173 (116-344)	-	180 (163-228)	151.5 (46-422)
HDL								
Female (median, mg/dL)	42.4 (24-94)	41 (25-60)	-	38.6 (37-57)	39.8 (24-61)	-	41 (32-44)	40 (27-59)
Male	-	-	33.9 (24-54)	40.6 (37-57)	35.2 (24-61)	-	38 (32-44)	45 (27-59)

Nutrición
Hospitalaria