Diagnosis and Management of a Young Patient with Metabolic Syndrome in Wangaya Hospital Bali

I Made Suma Wirawan

Department of Internal Medicine, Wangaya General Hospital, Denpasar, Bali

Abstract: *We report young male with metabolic syndrome. Metabolic syndrome diagnosis should fulfill at least three criteria. The criteria of the metabolic syndrome are: an elevated triglycerides (more than 150 mg/dL), a low HDL cholesterol (less than 40 mg/dL), an elevated blood pressure (more than 130/85 mmHg), and an increased fasting blood glucose (more than 110 mg/dL), and an obesity (abdominal circumference in men more than 102 cm).[2]The management of the metabolic syndrome primarily aims to reduce the risk of atherosclerotic cardiovascular disease and DM type 2 in patients who has not had diabetes. The metabolic syndrome management consists of two important steps: the treatment of the causes (overweight or obesity and physical inactivity) and the treatment of lipid and non-lipid risk factors.*

Keywords: Metabolic syndrome, hypertriglycerides, blood glucose.

1. Introduction

Metabolic syndrome, also called insulin resistance syndrome or syndrome X, is a collection of risk factors responsible for an increased morbidity of cardiovascular disease in obesity and Diabetes Mellitus (DM) type 2.[1] The National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) reported the metabolic syndrome is an independent risk factor for cardiovascular disease. Therefore, it requires a rigorous lifestyle intervention.[2]

A pandemic of metabolic syndrome in Asian populations developed along with the increasing prevalence of obesity. Body mass index (BMI) of more than 25 kg/m^{2}as obese is more suitable to be applied to the Indonesian people. Moreover, the study found the prevalence of metabolic syndrome was 13.13%. Another study conducted in Depokgained the prevalence of the metabolic syndrome based on NCEP-ATP IIIcriteria with Asian modifications 25.7% in men and 25% in women.[3]

The criteria proposed by the NCEP-ATP III had been widely used. Because, it made it easier to identify a person with a metabolic syndrome.Someone is diagnosed with a metabolic syndrome if the person has at least three criteria. The criteria of the metabolic syndrome are: an elevated triglycerides (more than 150 mg/dL), a low HDL cholesterol (less than 40 mg/dL), an elevated blood pressure (more than 130/85 mmHg), and an increased fasting blood glucose (more than 110 mg/dL), and an obesity (abdominal circumference in men more than 102 cm).[2]

The management of the metabolic syndrome primarily aims to reduce the risk of atherosclerotic cardiovascular disease and DM type 2 in patients who has not had diabetes. The metabolic syndrome management consists of two important steps: the treatment of the causes (overweight or obesity and physical inactivity) and the treatment of lipid and non-lipid risk factors.[3]We reported a case of a young metabolic syndrome patient. This patient was diagnosed with metabolic syndrome with diabetes mellitus type 2, obesity, and dyslipidemia.

2. Case

A 17-year-old male student, weighted 110 kg and was 165cm tall, had a waist circumference of 110 cm. He came to a GP clinic complaining that he felt extremely weak since early in the morning, a feeling he never felt before. Patients did not have the urge to frequently drinking or urinate. But, he recalled he ate more lately. There was no weight loss noticed. The patient denied any history of DM in the family.

The physical examination reveale a blood pressure of 110/70 mmHg. The blood tests showed the random blood glucose 420 mg/dL, total cholesterol 232 mg/dL, HDL 19mg/dL, LDL 39 mg/dL, triglycerides 870 mg/dL.

The patient was then referred to our hospital. We performed additional laboratory tests. The blood test showed leukocyte 8.9x10^{3}/uL, hemoglobin 16.0 g/dL, platelet 345x10^{3}/ul, AST 49 U/L, ALT 44 U/L, BUN 30 mg/dl, serum creatinine 1.0 mg/dL, uric acid 9.2 mg/dL, random blood glucose 305 mg/dL, HbA1c 8.2%, hs-CRP 0.8 mg/L. The urinalysis showed negative for nitrite, 1+ protein, normalglucose, negative for ketones.

The patient was diagnosed with DM type II, dyslipidemia, and hyperuricemia. He was treated as an outpatient and was prescribed with oral medications: 500 mg metformintid, allopurinol 100 mgqd, and 20 mg simvastatinqd.The patient came in the following month to our outpatient clinic and had a blood test. His fasting blood glucose was 144 mg/dL, 2-hour postprandial blood glucose 187 mg/dL, total cholesterol 190 mg/dL, triglycerides 380 mg/dL. The patient was then educated for a weight-loss diet and routine physical exercise. We continued metformin 500 mgtid, 20 mg simvastatinqd.

A month afterwards, the patient fasting blood glucose was 123 mg/dL, 2-hour postprandial blood glucose 147 mg/dL, total cholesterol 200 mg/dL, triglycerides 359 mg/dL and HbA1c 6.5%. His weight was 108 kg and his abdominal circumference was 108 cm. The oral medication was continued. The patientwas diagnosed with metabolic syndrome, DM type II, dyslipidemia, and hyperuricemia.

3. Discussion

Metabolic syndrome was first documented as syndrome X and was linked with insulin resistance. Over time, there were some criteria developed to recognize the early symptoms of metabolic disorders before the suspected person falls ill. Some of the criteria for the metabolic syndrome is provided in **Table 1**.

The criteria proposed by the NCEP-ATP III has been more widely usedbecause it makes the syndrome identification more effortless.[1]Based on NCEP-ATP III, a person has a metabolic syndrome when he has least three of the following criteria:[1]

1) Anabdominal obesity (waist circumference>88 cm in women and >102 cm in men)
2) An elevated triglyceride (>150 mg/dL, or ≥1.69 mmol/L)
3) A low HDL (<40 mg/dL or <1.03 mmol/L in men and <50 mg / dL or <1.29 mmol/L in women)

4) An elevated blood pressure (systolic ≥130 mmHg, diastolic ≥85 mmHg or currently taking an antihypertensive medication)
5) Ahigh fasting blood glucose (≥110 mg/dL or ≥6.10 mmol/L or currently taking antidiabetic drugs.

In 2005, The American Heart Association and the National Heart, Lung, and Blood Institute published a modified NCEP ATP III criteriafor metabolic syndrome identification. The new criteria of the metabolic syndrome were: an increased triglycerides (>150 mg/dL), a decreased HDL (<40 mg/dL in women and <50 mg/dL in men), an elevated blood pressure (>130/85 mmHg), and an increasedglucose fasting blood (> 100 mg/dL), omitting presence of obesity if the other criteria are present. Because, there are people who are not obese but suffered an insulin resistance and had metabolic risk factors, particularly in individuals whose both parents are diabetic or their nuclear family or the second level had diabetes. [2]

Table 1: Metabolic Syndrome Diagnostic Criteria[2]

Metabolic Syndromes	NCEP AtP III	WHO	AHA	IDF
Hypertension	on anti-hypertensive medication or BP>130/85mmHg	on anti-hypertensive medication or BP>140/90 mmHg	on anti-hypertensive medication or BP>130/85 mmHg	on anti-hypertensive or BP>130/85 mmHg
Dyslipidemia	Triglyceride ≥150mg/dL	Triglyceride ≥150mg/dL, and or	Triglyceride ≥150mg/dL	Triglyceride ≥150mg/dL
	HDL	HDL	HDL	HDL
	Male <40mg/dL	Male <35mg/dL	Male <40mg/dL	Male <40mg/dL
	Female <50mg/dL	Female <40mg/dL	Female <50mg/dL	Female <50mg/dL
				or on anti-dyslipidemia
Obesity		BMI >30kg/m2		Central obesity
	Waist circumference	and or abdomen-hip ratio	Waist circumference	Waist circumference (asia)
	Male >102cm	Male >0.9	Male >102cm	Male >90cm
	Female >88cm	Female >0.85	Female >88cm	Female >80cm
Metabolic disorders				
Glucose	fasting ≥110mg/dL	DM type 2 or abnormal glucose tolerance test	fasting ≥100mg/dL	fasting ≥100mg/dL
				or diagnosed with DM type 2
Others		Microalbuminuria ≥20 u/minute (albumin:creatinine ≥30)		
Diagnosis criteria	Minimum 3 criteria present	DM type 2 or abnormal glucose tolerance test	Minimum 3 criteria present	Central obesity +2 criteria above

In this patient, there were three criteria fulfilled based on NCEP ATP III criteria. Therefore, the patient was diagnosed with metabolic syndrome.The clinical diagnosis of DM was generally considered when there was a typical complaint: polyuria, polydipsia, polyphagia, and an unexplained weight loss. Our patient had not any typical DM clinical symptoms. When the typical complaints were absent, if the first blood glucose testwas abnormal, it was not yet supporting the diagnosis of DM. Another blood test in another day should be performed. The diagnosis can be made if the second tests showed any abnormality, whether fasting blood glucose ≥126 mg/dL, random blood glucose ≥ 200 mg/dL, or oral glucose tolerance test (OGTT) ≥200 mg/dL. Our case first blood test was 402 mg/dL, and the next test 305 mg/dL, accompanied with HbA1c 8.2, all of the tests provide enough evidence of DM type II.

4. Management of Diabetes Mellitus

The first step in managing diabetes mellitus starts with a non-pharmacological approach: meal planning or medical nutritional therapy, physical activity, and weight loss when overweight or obesity is present.[4]

5. Medical Nutritional Therapy

The principle of medical nutritional therapy is to arrange the diet based on the current nutritional status and plan a dietary modification based on individual needs.

The purpose of medical nutrition therapy is to achieve and maintain:[4,5]

1) Blood glucose levels close to normal
   a) Fasting glucose 90-130 mg/dL
   b) Blood glucose 2 hours after a meal <180 mg/dL
   c) A1c <7%

2) Blood pressure <130/80 mmHg
3) Lipid profile:
   a) LDL <100 mg/dL
   b) HDL >40 mg/dL
   c) Triglycerides <150 mg/dL
4) Weight loss as normal as possible.

Our patient, a 17-year-old student, was 165 cm tall and weighted 110 kg.

Therefore, the calculation of the calorie requirement were:
a) Ideal weight
   = (height - 100) - 10% of (height - 100)
   = (165 - 100) - 10% x (165 - 100)
   = 65 - 6.5
   = 59.5 kg
b) Nutritional status
   = (actual weight/ideal body weight) x 100%
   = (110/59.5) x 100%
   = 185% (regarded as obese)
c) Total daily calorie requirement
   Basal calorie requirement
   =ideal body weight x 30
   = 59.5 x 30
   = 1785 calories
   Light activity energy reqirement
   = 10% x (Basal calorie requirement)
   = 10% x 1785
   = 179 calories

Correction due to obesity (reducing the total calorie requirement)
= 20% x (Basal calorie requirement)
= 20% x 1785 calories
357 calories

Thus, the total daily calorie requiremet was
= 1785 calories + 179 calories - 357 calories
= 1607 calories

To simplify the calculations in nutritional consultation, it was rounded into 1600 calories.

The recommended composition of the food for the patient was:[4]
a) 60% Carbohydrate (1 gram of carbohydrate = 4 calories)
   = 60% x 1600
   = 960 calories from carbohydrates, equivalent to 240 grams of carbohydrates
b) 20% Protein (1 gram of protein = 4 calories)
   = 20% x 1,600
   = 320 calories of protein, equivalent to 80 grams of protein
c) 20% Fat 20% (1 gram of fat = 9 calories)
   = 20% x 1,600
   =320 calories from fat, equivalent to 35.5 grams of fat

The clinical management emphasizes on the relationship between obesity and the metabolic syndrome, and the role of the brain in the regulation of energy. Weight management is the basis for treating obesity and metabolic syndrome. A weight loss of 5-10% had been showed to improve the metabolic profile.[6,7,8]An integrated management of body weight should include a diet of calorie restriction, physical activity, behavioral change. Our patient had not shown a decrease in weight.

In type 2 DM, physical exercise mayimprove overall glucose controlwhich showed a decrease in HbA1c concentration. It is a guideline to predict the risk of diabetic complications and death. In addition, a routine physical exercise will improve thebody fat reduction, arterial blood pressure, baroreflexsensitivity, endothelium-dependent vasodilatation, skin blood flow, the heart rate and blood pressure (either at rest or when active), hypertriglyceridemia, and fibrinolysis. The morbidity and mortality in physically active diabetes were50% lower than those who lived a sedentary life. A regular physical exercise will prevent the macro- and microvascular complications, and increase the life expectancy.[9,10,11]

The principle of physical exercise are: [4]
a) Frequency: regularly 3-5 times per week
b) Intensity: mild and moderate (60-70% of maximum heart rate)
c) Duration: 30-60 minutes
d) Type: endurance (aerobic) to improve cardiorespiratory such as walking, jogging, swimming, and cycling.

Patients with type 2 DM with HbA1c of 7.5% to less than 9% should be educated for having a healthier lifestyle and accompanied with an oral monotherapy. In selecting the oral medication, a physician should consider these factors: safety (hypoglycemia, the effect on the heart), effectiveness, availability, patient tolerance, and price. It is expected that within 3 months, the t HbA1c will be <7%. HbA1c can be used to to assess the effect of the previous 8-12 weeks of therapy. In patients who have reached the therapeutic target, the HbA1c has to be checked at least twice a year.[4,13]

Our patient initial HbA1c was 8.2%. The patients received oral metformin monotherapyof 500 mg bid for 3 months. The next test showed the HbA1c was 6.5%. The patient reached the desired target. The treatment with metformin was continued.
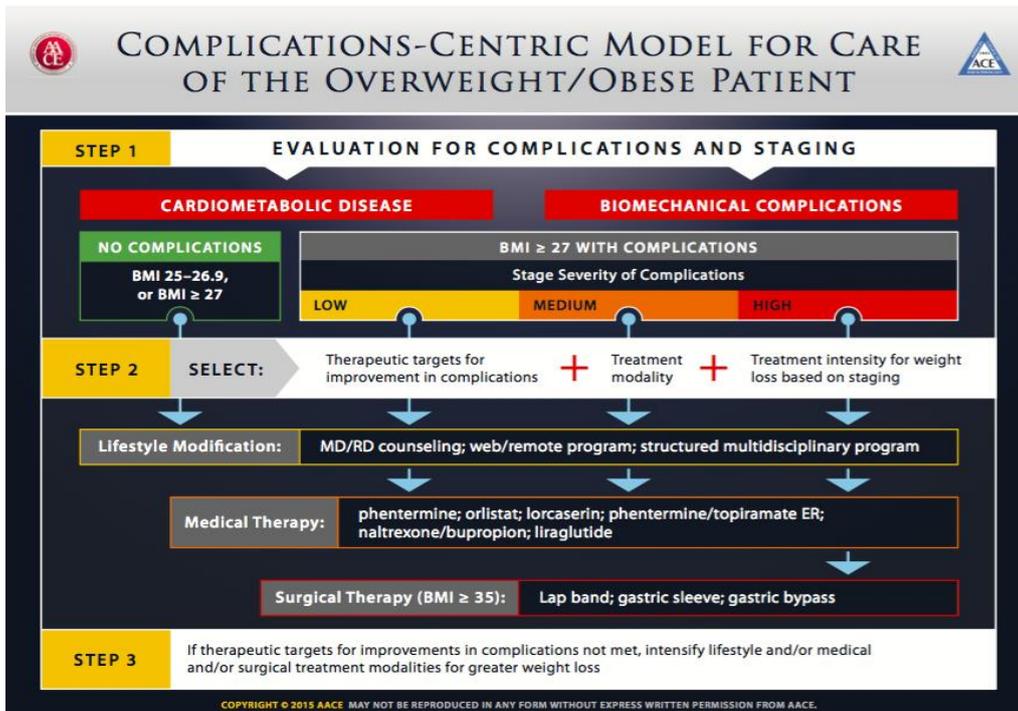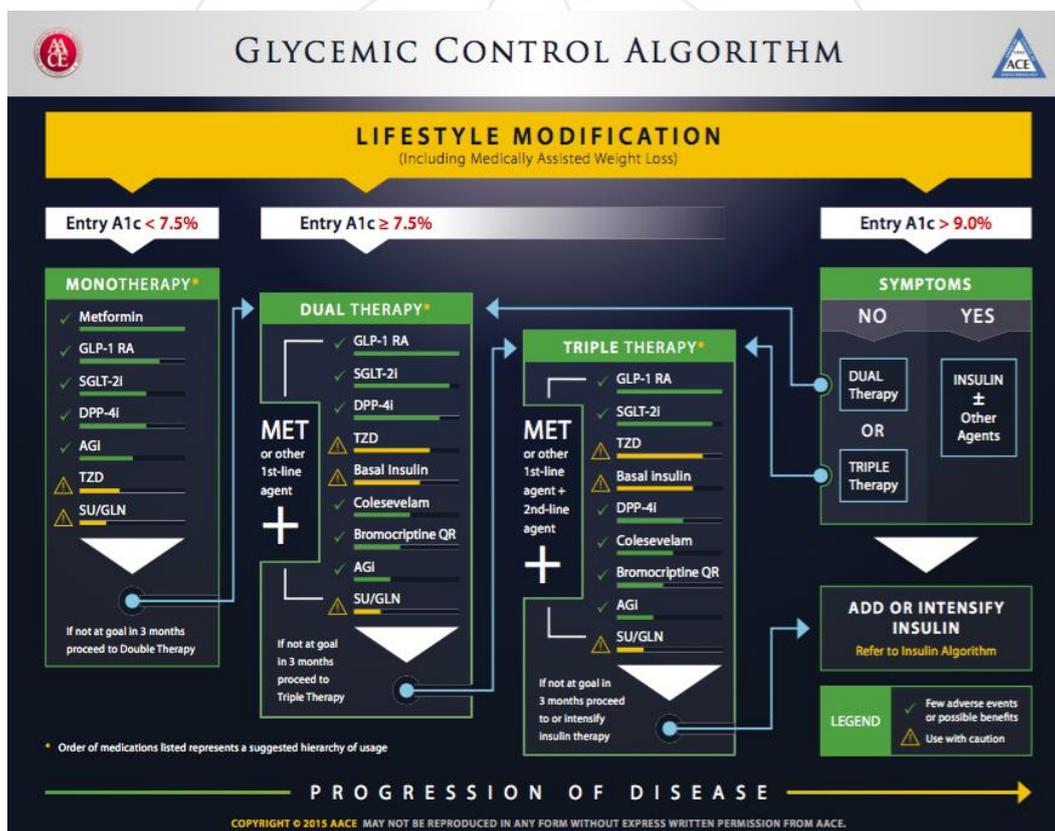
Chart 1: Overweight patient management[14]

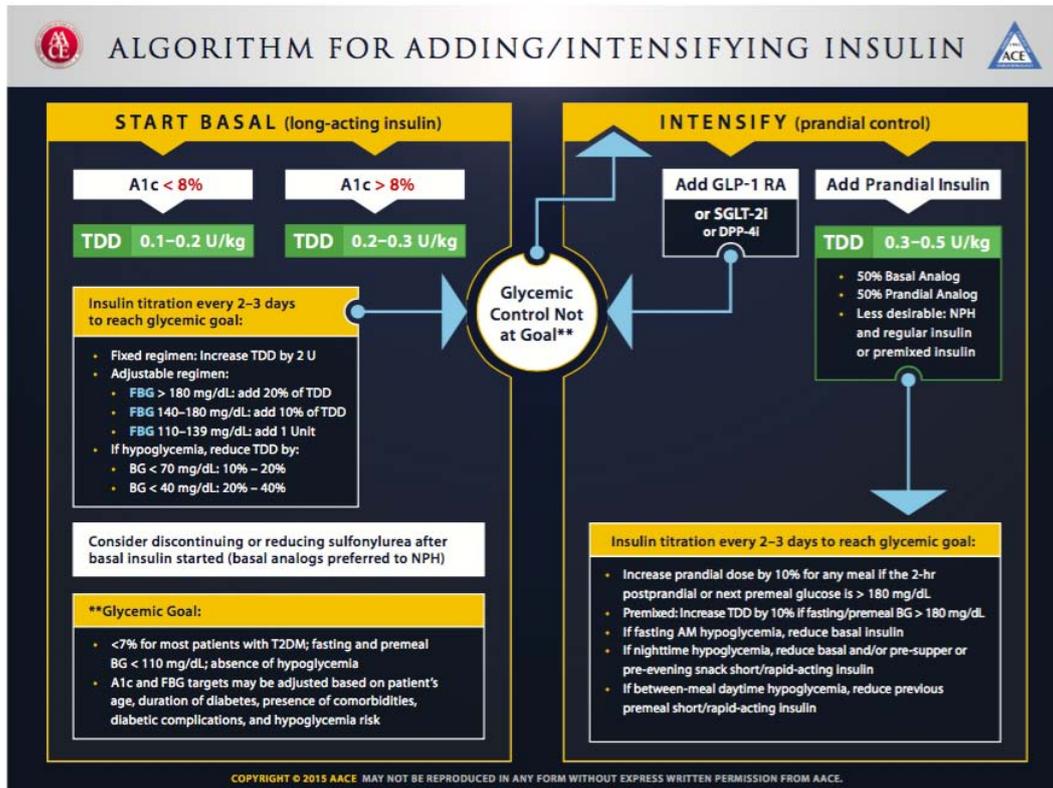**Chart 2:** Type II DM Therapy[14]

Chart 3: Insulin initiation[14]

Dyslipidemia in a patient with DM further increases the risk of cardiovascular disease. Lipid profile examination should be done at the time of diagnosis of diabetes is made. In an adult, the lipid profile should be examined at least once a year. Dyslipidemia is common in diabetic people, presenting an elevated triglyceride, reduced HDL, and normal or slightly elevated LDL. The therapy main target is to reduce LDL. Behavioral change to reduce the cholesterol and saturated fat intake and to increase physical activity is shown to improve lipid profile.[14,15]

Our patient had a very high triglyceride and a slightly increased LDL. He had been given 20 mg simvastatin qd. In 3 months, the patient had not met the targets.Some studies could not show a clear evidence that starting a medical therapy on triglyceride of 500-1000 mg/dL actually lowered the risk of pancreatitis.[16,17] Therefore, it was recommended to modified the dietary intake and to evaluate and to look for the secondary causes which increased the triglycerides. NICE 2014 does not recommend a medical therapy to lower triglyceride in preventing cardiovascular risk.[15]It is in contrast with the modified ATP III recommendation which allowsa triglyceride-lowering medication on triglyceride >500 mg/dL. Moreover, ESC/EAS 2011 allows the administration when triglyceride reaches >200 mg/dL.[16]

6. Conclusion

We reported a young male with metabolic syndrome. His initial HbA1c was 8.2% and had received an oral metformin 500mg bid for 3 months. The next HbA1c was 6.5%.The initial lipid profile was high in triglycerides and a slightly elevated LDL. He took 20mg simvastatinqd. The next test had not yet met the target of therapy.The patient had been given the information about his dietary requirement and restriction, and the recommended physical exercise.

References

[1] National Cholesterol Education Program-ATP III. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on detection, evaluation, and treatment of high blood cholesterol in adults (adults treatment panel III). JAMA. 2002;285:2846-97

[2] Dekker JM, Girman C, Rhodes T, Nijpels G, Stehouwer CD, Bouter LM, et al. Metaboliksindrome and 10 years cardiovascular disease risk in the Hoorn study. Circulation. 2005;112(5):2099-100

[3] American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 2005;28(supl 1):S37-42

[4] PB PERKENI. KonsensusPengelolaan Diabetes Mellitus Tipe 2 di Indonesia. Malang. 2015

[5] American Diabetes Association. Nutrition principles and recommendations in diabetes clinical practice recommendation. Diabetes care. 2004; 27(suppl. 1):S36-46.

[6] Ripsin CM, Kang H, Urban RJ. Management of blood glucose in type 2 diabetes mellitus. American Academy Of Family Physician. 2009;79(1):29-36.

[7] Kunar S. New dietary guidelines for diabetes from the American Diabetes Association. British nutrition bulletin. 2002;27:93-96.

[8] Balkau B. The metaboliksindrome – a risk factor for diabetes and cardiovascular diseases. Eur Diabetes Nursin g. 2006;3(3):126-130.

[9] Voulgart C, Moyssakis I, Papazafiropoulou A, Perrea D, Kyriaki D, Katsilambros N, et al. The impact of

metaboliksindrome on left ventricular myocardial performance. Diabetes Metabolism Research and Reviews. 2010;26:121-127.

[10] Cassella-Filho A, Chagas ACP, Maranhao RC, Trombetta IC, Cesena FHY, Silva VM, et al. Effect of exercise training on plasma levels and functional properties of high density lipoprotein cholesterol in the metaboliksindrome. Am J Cardiol. 2011;107:1168-117

[11] Manucci E, Dicembrini I, Lauria A, Pozzilli P. Is glucose control important for prevention of cardiovascular disease in diabetes? Diabetes care. 2013;36(suppl 2):S259-S263

[12] American Diabetes Association. Classification and Diagnosis of Diabetes. Diabetes Care. 2015;38(Suppl.1): S8-16

[13] Handelsman Y, Bloomgarden ZT, Grunberger G, Umpierrez G, Zimmerman RS, Bailey TS, et al. American association of clinical endocrinologists and American college of endocrinology – Clinical practice guidelines for developing diabetes mellitus comprehensive care plan – 2015. ENDOCRINE PRACTICE. April 2015;21(1):1-87.

[14] Garber AJ, Abrahamson JI, Blonde L, Bloomgarden ZT, Bush MA, Dagogo-Jack S, et al. AACE/ACE comprehensive diabetes management algorithm 2015. EndocrPract. 2015;21(4):e1-10.

[15] NICE. *Lipid Modification: Cardiovascular Risk Assesment and The Modification of Blood Lipids for The Primary and Secondary Prevention of Cardiovascular Disease*. NICE clinical *guideline*. 2014:1-37

[16] Catapano AL, Reiner Z, De Backer D, Graham I, Taskinen MR, Wiklund O, et al. *ESC EAS Guidelines for The Management of Dyslipidemias*. European Heart Journal. 2011;32:1769-1818.

[17] Stone NJ, Robinson J, Lichtenstein AH. *A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines.* Circulation. 2013;00:000-000