



Diabetes Protocols, Standards and Case Studies

Dr Aghanya Nonso *M.B.B.S, MACE, FWACP*

Consultant Physician/Endocrinologist

7th Abuja Cardiovascular Symposium 2023



CASE LEARNING POINTS



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- DEFINITION
- CLASSIFICATION
- PATHOGENESIS
- RISK FACTORS
- CLINICAL FEATURES
- DIAGNOSIS AND INVESTIGATIONS
- COMPLICATIONS
- TREATMENT
- GESTATIONAL DIABETES

Case 1



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- A 42yr old newly employed office executive
- While undergoing routine office medical check up
- Found to have a fasting plasma glucose of 9.0mmol/l and
- A blood pressure of 110/80mmhg,
- No other presenting symptoms
- Otherwise, stable.

Case 1: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

1. Is the patient diabetic?

- a. Yes
- b. No
- c. It depends
- d. I don't know

Case 1: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

2. How will you make a diagnosis of diabetes in the patient?

- a. Repeat Fasting Blood Sugar
- b. Oral Glucose Tolerance Test
- c. Glycosylated Hemoglobin
- d. All of the above
- e. None of the above

Case 1: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

3. Is there any additional history you would want to get from the patient?
- a. Yes.
 - b. No.
 - c. I don't know

Definition



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

1. Heterogeneous endocrine/metabolic disorder
2. Affecting mainly carbohydrate, fat and protein
3. Characterized by hyperglycemia
4. Due to relative or absolute insulin deficiency
5. Associated with long-term complications

Epidemiology



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Diabetes is **found in every population in the world and in all regions**, including rural parts of low- and middle-income countries
- The number of people with diabetes is steadily rising, with WHO estimating there were **422 million adults with diabetes worldwide in 2014**
- The age-adjusted prevalence in adults **rose from 4.7% in 1980 to 8.5% in 2014**
 - **the greatest rise in low- and middle-income countries compared to high-income countries**

Epidemiology -2



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- In addition, the International Diabetes Federation (IDF) estimates that **1.1 million children and adolescents aged 14–19 years have T1DM**
- Without interventions to halt the increase in diabetes, there will be at least **629 million people living with diabetes by 2045**
- High blood glucose causes almost **4 million deaths each year,**
- The IDF estimates that the annual global health care spending on diabetes among adults was **US\$ 850 billion in 2017**

Epidemiology -3



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- In 2021, according to IDF, **Nigeria had a 3.7% prevalence of diabetes** in the adult.
- The pooled prevalences of DM in the six geopolitical zones of Nigeria were:
 - 3.0% (95% CI 1.7–4.3) in the north-west,
 - **5.9% (95% CI 2.4–9.4) in the north-east,**
 - 3.8% (95% CI 2.9–4.7) in the north-central zone,
 - 5.5% (95% CI 4.0–7.1) in the south-west,
 - 4.6% (95% CI 3.4–5.9) in the south-east, and
 - **9.8% (95% CI 7.2–12.4) in south-south zone .**

Epidemiology -4



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- The effects of diabetes extend beyond the individual to affect their families and whole societies.
- It has broad socio-economic consequences a
- It threatens national productivity and economies,
 - especially in low- and middle-income countries where diabetes is often accompanied by other diseases.

WHO Classification of Diabetes Mellitus



cardiocare
MULTISPECIALTY HOSPITAL

1. Type 1
2. Type 2
3. Hybrid forms
4. Other Specific Types
5. Unclassified
6. Hyperglycemia first detected in Pregnancy

Type 1 diabetes
Type 2 diabetes
Hybrid forms of diabetes
Slowly evolving immune-mediated diabetes of adults
Ketosis prone type 2 diabetes
Other specific types (see Tables)
Monogenic diabetes
- Monogenic defects of β -cell function
- Monogenic defects in insulin action
Diseases of the exocrine pancreas
Endocrine disorders
Drug- or chemical-induced
Infections
Uncommon specific forms of immune-mediated diabetes
Other genetic syndromes sometimes associated with diabetes
Unclassified diabetes
This category should be used temporarily when there is not a clear diagnostic category especially close to the time of diagnosis of diabetes
Hyperglycemia first detected during pregnancy
Diabetes mellitus in pregnancy
Gestational diabetes mellitus

Pathogenesis-Type 1



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- **HLA-associated, immune-mediated 1A)**
 - Concordance rate varies, up to 50%
 - multiple genetic loci contributes to diabetes risk
 - Both HLA DR3 and DR4- haplotypes contributes to diabetes risk (DQ2 and DQ8 strongest susceptibility)
 - strongest protective haplotype is DQB1*0602
- **Autoimmunity:**
 - occurs early in life e.g. anti-GAD, AIA, anti-Islet cell antibody
- **Environmental factors:**
 - congenital rubella, CMV, bovine milk etc.

Pathogenesis-Type 2



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- **Genetic predetermination:**
 - ~50% concordance rate
- **Environmental factors:**
 - Early: Low birth weight
 - Late: Obesity, sedentary, ageing
- **Pre-diabetes:**
 - Insulin resistance and β -cells failure

Risk Factors for Type 2



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

Risk factors for development of type 2 diabetes:

- Family history of diabetes (i.e., parent or sibling with type 2 diabetes)
- Obesity (BMI ≥ 30 kg/m²)
- Habitual physical inactivity
- Race/ethnicity (e.g., African American, Hispanic American, Native American, Asian American, Pacific Islander)
- Previously identified IFG or IGT
- History of GDM or delivery of baby ≥ 4 kg (9 lb)
- Hypertension (blood pressure $\geq 140/90$ mmHg)
- HDL cholesterol level ≤ 35 mg/dL (0.90 mmol/L) and/or a triglyceride level ≥ 250 mg/dL (2.82 mmol/L)
- Polycystic ovary syndrome or acanthosis nigricans
- History of vascular disease

Clinical Features



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Asymptomatic
- Classical symptoms:
 - polyuria, polydipsia and weight-loss
- Type 1 Lean; Type 2 Overweight
- Short Onset: in type 1; Insidious Onset type 2
- \pm features of long-term complications in type 2
- \pm other autoimmune diseases in type 1

Case 2



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- A 38yr old woman who presented in the ER
 - history of weight loss, polydipsia, polyuria,
 - generalized body weakness with blurring of vision and
 - painful sensations on both feet.
 - There is a positive family hx of diabetes in both parents of which the father died of diabetic complications.
- RBS on presentation was 26.9mmol/l
- Blood pressure 160/100mmHg

Case 2: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

■ Is the patient diabetic?

1. Yes
2. No
3. It Depends
4. I don't know

Case 2: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- What type of diabetes is she more likely to have?
 1. Type 1
 2. Type 2
 3. Hybrid forms
 4. Unclassified
 5. None of the above

Case 2: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- What other investigations are very important in the management of this patient?
 1. Full Blood Count
 2. Abdominal CT Scan focus on the pancreas
 3. Liver Function Tests
 4. All of the above
 5. Many others, but None of the above

Case 2: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

■ What is your target BP?

1. <150/90
2. <140/90
3. <130/80
4. <125/75
5. It depends

Case 2: Poll



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- What other possible complications can she have?
 1. Diabetic Nephropathy
 2. Diabetic Neuropathy
 3. Diabetic Cheiroarthropathy
 4. Diabetic Retinopathy
 5. I don't know

Diagnosis and Investigations



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

❑ Methods

1. Blood glucose: FPG, 2HPG, RBS
2. OGTT: not used routinely for diagnosis: only for borderline, IGT and Gestational DM

❑ Criteria (WHO, 1999)

1. Symptomatic:

1. Single FPG $\geq 126\text{mg/dl}$ (7mmol/L); OR

2. RBS/2HPG/OGTT $\geq 200\text{mg/dl}$ (11.1mmol/L)

2. Asymptomatic: Repeat another occasion

❑ Others: C-peptides, auto antibodies

- IGT: FPG $< 7\text{mmol/L}$, 2-hr post-glucose $7.8\text{--}11\text{ mmol/L}$
- IFG: FPG $6.1\text{--}6.9$, 2-hr post-glucose < 7.8

Descriptor	Definition
WHO-defined IFG	FPG 6.1–6.9 mmol/l
ADA-defined IFG	FPG 5.6–6.9 mmol/l
IGT	FPG <7.0 mmol/l and 2-h post-75-g OGTT glucose value \geq 7.8 mmol/l and <11.1 mmol/l
Impaired glucose regulation	IFG as defined by WHO and/or IGT
Prediabetes (defined by the ADA)	FPG 5.6–6.9 mmol/l and/or HbA _{1c} 39–47 mmol/mol (5.7–6.4%) and/or 2-h post-75-g OGTT glucose value \geq 7.8 mmol/l and <11.1 mmol/l
Non-diabetic hyperglycaemia	FPG 5.5–6.9 mmol/l and/or HbA _{1c} 42–47 mmol/mol (6.0–6.4%)

ADA, American Diabetes Association; FPG, fasting plasma glucose; IFG, Impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test.



cardiocare
MULTISPECIALTY HOSPITAL
Reversing Medical Tourism

Other Investigations



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Fasting lipid profile
- ECG
- Electrolytes, urea & creatinine
- Urinalysis
- Microalbuminuria

Monitoring



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Urine testing
- Blood glucose – lab or glucometer
- Glycated Hb
 - addition of glucose moiety to β -chain of Hb
 - test control in the last 2-3 months
- Glycosylated proteins: (fructosamine): test control for about 2-3 weeks

Diabetic Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

Can be classified broadly into two:

- I. Acute/metabolic complications
- II. Chronic complications

Acute Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Metabolic
 - a) Diabetic ketoacidosis
 - b) Hyperosmolar hyperglycaemic state
 - c) Lactic acidosis
 - d) Iatrogenic hypoglycaemia
- Infections:
 - usually bacterial e.g. UTI, acute chest infections, abscess, sepsis, malignant otitis externa, mucormycosis

Chronic Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Vascular: microvascular and macrovascular
- Neurologic
- Others: skin, eye, bones and joints, pregnancy-related

Vascular Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Microvascular:
 - i) Retinopathy
 - ii) Nephropathy
 - iii) Neuropathy
- Macrovascular:
 - i) Stroke
 - ii) Peripheral vascular disease
 - iii) Coronary artery disease
 - iv) Cardiomyopathy

Neurological Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Peripheral neuropathy
 - Distal symmetric polyneuropathy
 - Motor neuropathy (diabetic amyotrophy, foot drop, wrist drop)
- Cranial neuropathy: CN III, IV, VI and VII
- Autonomic neuropathy: postural hypotension, impotence, GI dysfunction, bladder atony, loss of sweating, resting tachycardia

Other Complications



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Skin
 - a) non-infectious: diabetic dermopathy, necrobiosis lipoidica diabetorum
 - b) infectious e.g. candidiasis
 - c) mixed: diabetic foot syndrome
- Eye:
 - cataract, glaucoma, diabetic ophthalmoplegia
- Bones and joints:
 - Dupuytren's contracture, diabetic cheirarthropathy, Charcot's joint
- Pregnancy-related:
 - a) maternal: recurrent abortions, polyhydramnious, infertility
 - b) fetal: macrosomia, congenital malformations, hypoglycaemia

Case 3



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- A 40yr old business man, who was recently diagnosed to be diabetic with
 - RBS of 19mmol/l following osmotic symptoms of polyuria and polydipsia,
 - there is associated calf pain while walking,
 - blurring of vision and burning sensations on the feet.
- On examination, nil of note
- Investigation result showed
 - Normal EUCR and urinalysis
 - Deranged Fasting Lipid Profile

Case 3; Discussion Questions



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- What is the aim/principles of the management of this patient
- How do you manage such patient

Treatment



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

Aims

1. To alleviate symptoms
2. Blood glucose control
3. Prevent, delay or minimize complications
4. Reduce morbidity and mortality

Comprehensive Targets



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

■ Blood glucose:

- FPG: <110mg/dl (6.0 mmol/L)
- Postprandial: <140mg/dl (7.0mmol/L)
- HBA1c: <7%

■ Lipid profile:

- Triglycerides <150mg/dl
- LDL-C: <100mg/dl
- Total cholesterol: < 150mg/dl
- HDL-C: Males- >40mg/dl; Females > 50mg/dl

■ Blood Pressure:

- Systolic <130mmHg;
- Diastolic < 80mmHg

■ BMI:

- 20-25kg/m²

■ Waist circumference:

- Males <100cm; Females < 88cm

Education



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Main goal is patient empowerment:
 - Self-monitoring of blood glucose, blood pressure
 - Immediate management of hypoglycaemia
 - Foot care and foot wear
 - Cooperation with physician in meeting goals
 - Lifestyle adjustments

Lifestyle measures



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

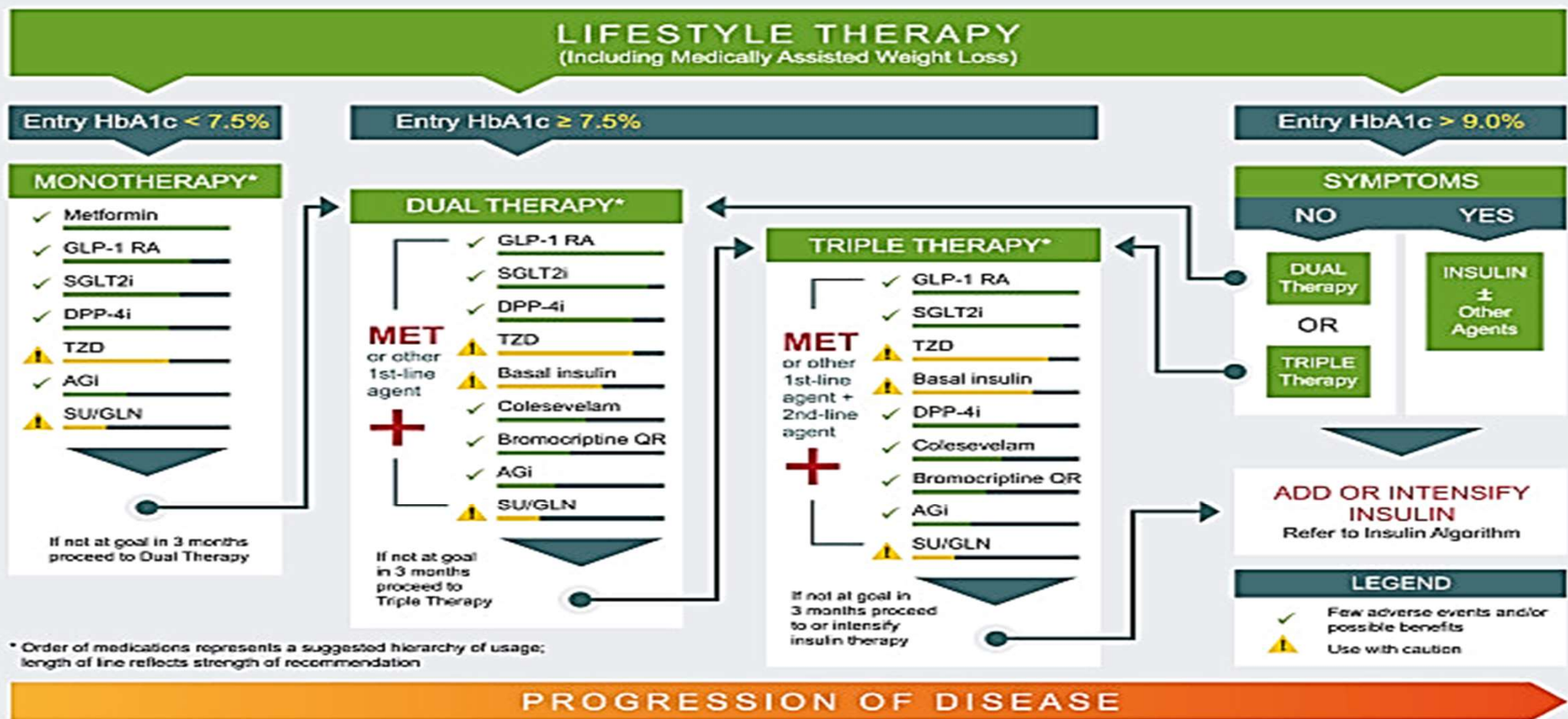
- **Exercise: program planned with the Physician:**
 - At least 30 minutes thrice weekly (if no C/I)
 - Avoid weight bearing or lifting. Examples of recommended exercises include brisk walking, jogging, bicycling, swimming.
- **Dietary measures: individualized, on-going**
 - **Refined sugars:** Drastic reduction
 - **Complex carbohydrate:** 50-60% of total calorie/day
 - **Fiber:** Increase fiber intake
 - **Protein:** 10-20% of total calorie/day
 - **Fats:** Limit intake of saturated fat and dietary cholesterol; should take <30% of total calorie/day
 - **Salt:** moderate – low intake
 - **Alcohol:** discourage in overweight/obese; generally reduce, subtract amount taken from total calorie for the day
- **Weight-loss program for overweight or obese subjects**

Oral hypoglycemic agents



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

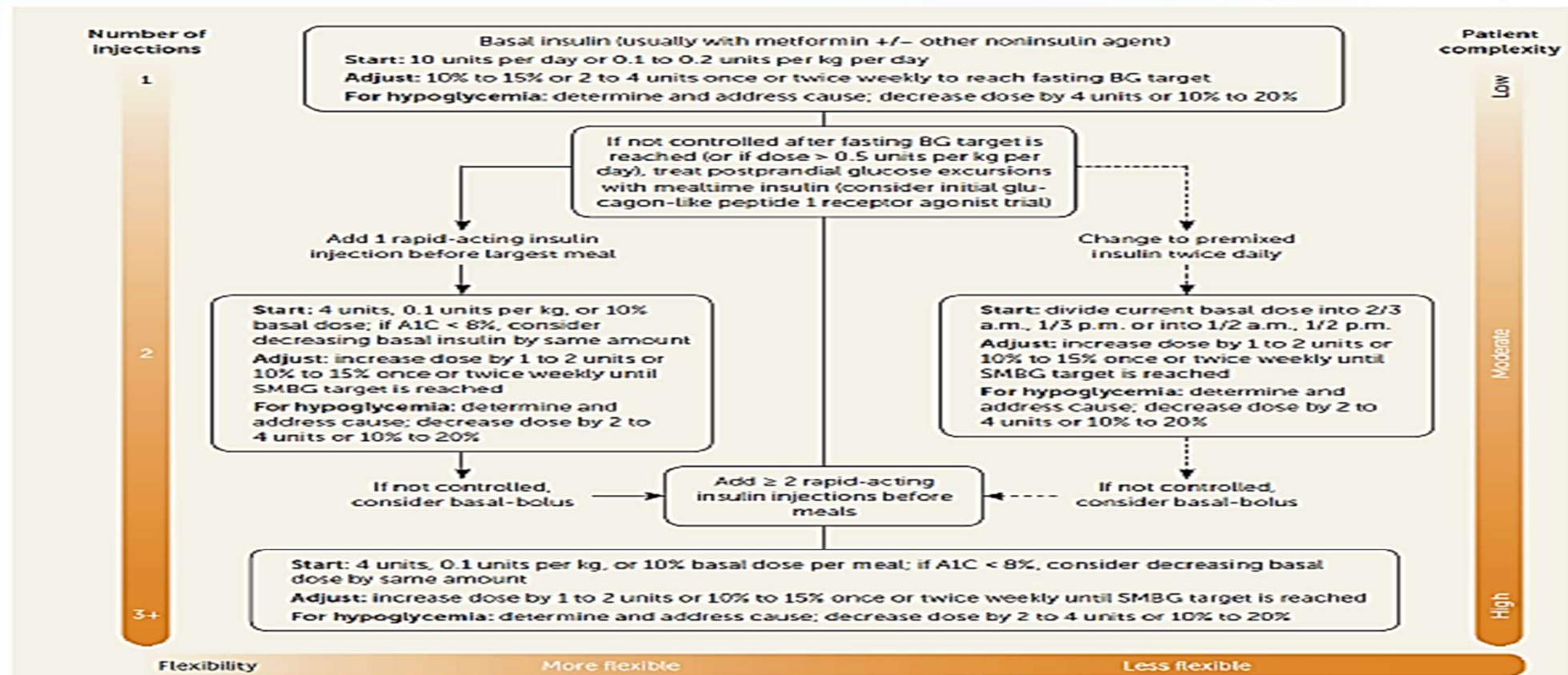


Use of Insulin in T2DM



cardiocare
MULTISPECIALTY HOSPITAL

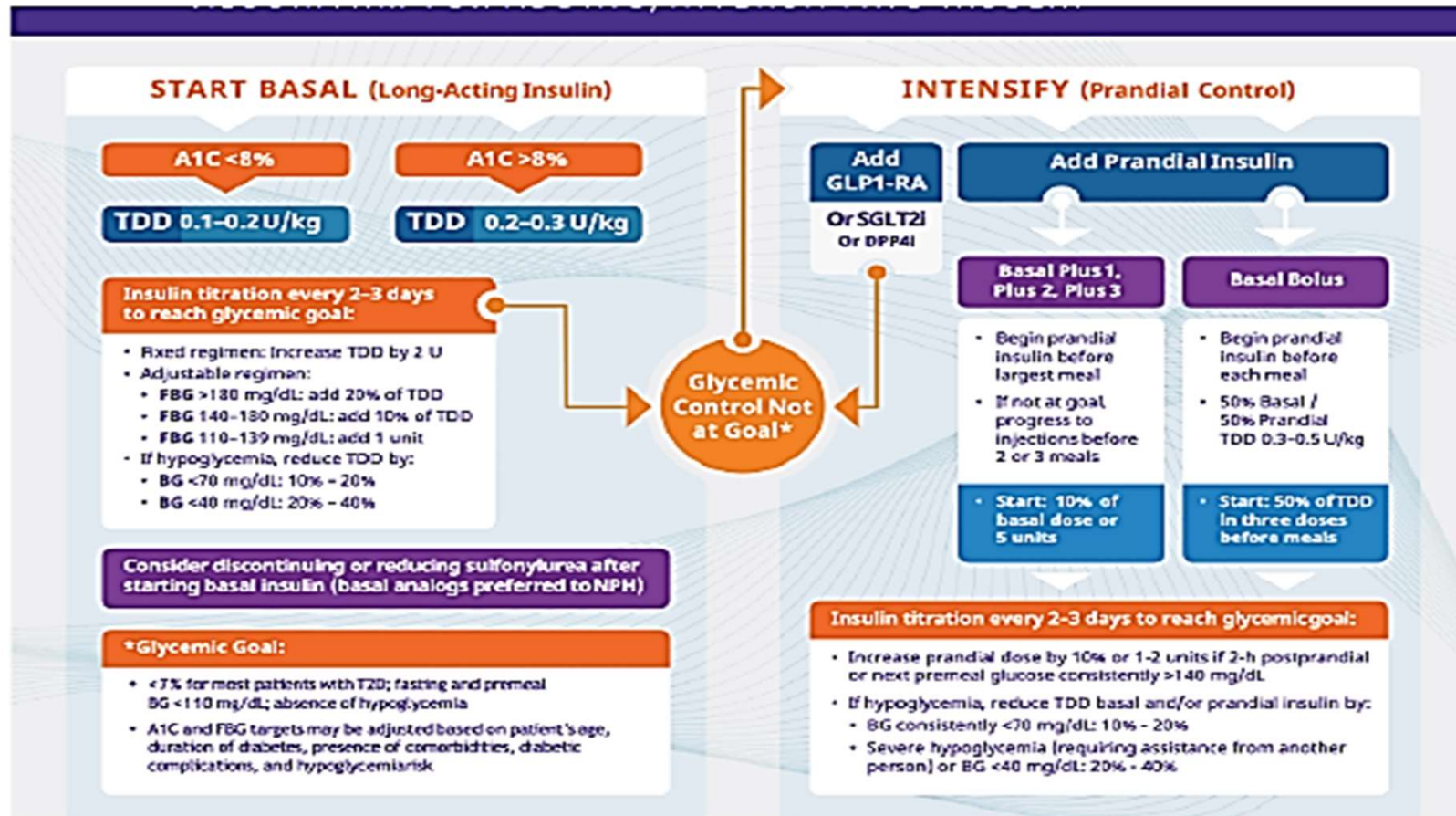
Reversing Medical Tourism



An approach to starting insulin in patients with type 2 diabetes mellitus based on American Diabetes Association guidelines.

BG = blood glucose; SMBG = self-monitoring of blood glucose.

Adapted with permission from Inzucchi SE, Bergenstal RM, Buse JB, et al. Management of hyperglycemia in type 2 diabetes, 2015: a patient-centered approach: update to a position statement of the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care. 2015;38(1):146.

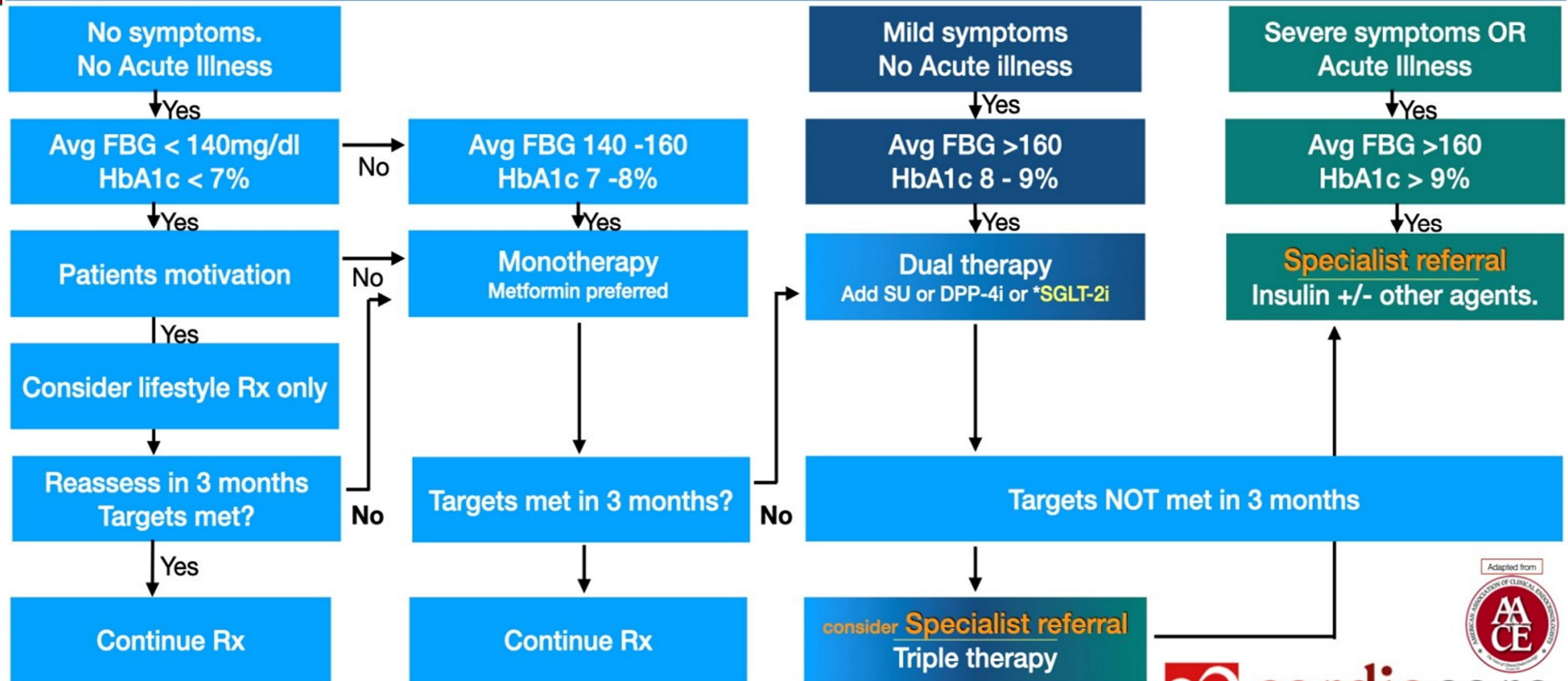


COPYRIGHT © 2020 AACE | MAY NOT BE REPRODUCED IN ANY FORM WITHOUT EXPRESS WRITTEN PERMISSION FROM AACE. WWW.AACE.COM/PUBLICATIONS/JOURNAL-REPRINTS-COPYRIGHTS-PERMISSIONS/ | DOI 10.4158/ES-2019-0472

Figure 3 : American Association of Clinical Endocrinologist Guidelines on Insulin Initiation

Glycemic control algorithm

Encourage diet and lifestyle changes in all groups.



start doses small and titrate upwards

* SGLT-2i preferred in patients with established (of high-risk) ASCVD, HFrEF, Diabetic nephropathy.



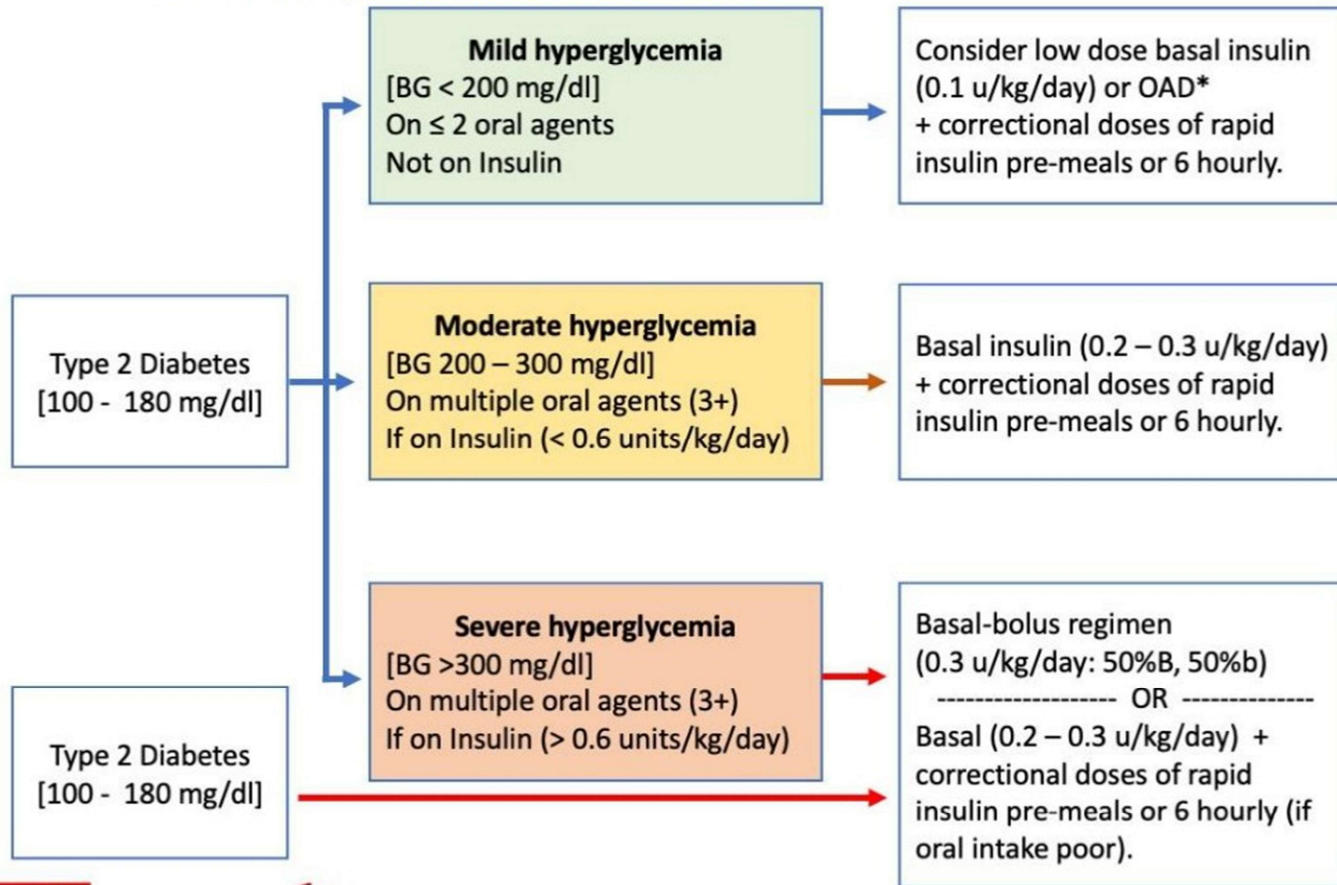
cardiocare
MULTISPECIALTY HOSPITAL
Since 1982



Inpatient glycaemic management guidance

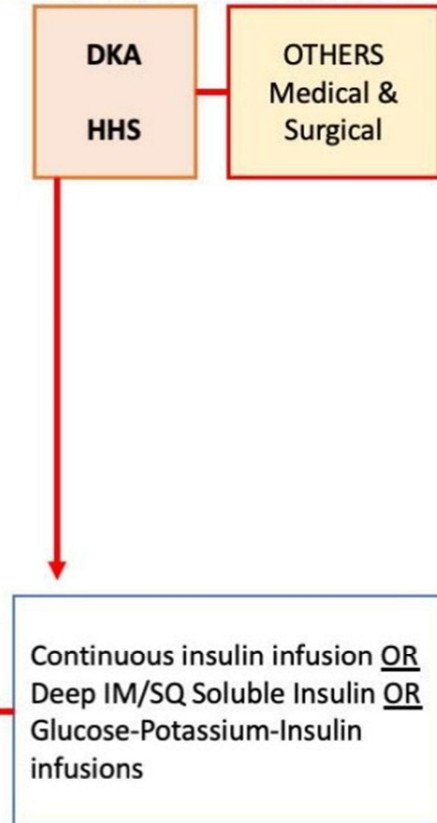
2
AL
sm

Non-critically ill patients with diabetes



Titrate as needed

Critically ill patients with diabetes



Transition

*Not a substitute for clinical evaluation and judgement.
Orange and Red line treatments require adequate specialist oversight.
Adapted from; Francisco JP et al; Lancet Diabetes and Endocrinology; 2021*

Case 4



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- A 37yr old teacher, presented to the gynaecology emergency at 14weeks of gestation with a RBS of 13mmol/l.
- She has had two previous pregnancies carried to term.
 1. Which other history will you be interested in making a diagnosis.
 2. What is your diagnosis

Case 5



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- A 42yr old business woman presented to the clinic at a gestational age of 27weeks with a FBS of 5.6mmol/l,
- There is a previous history of macrosomic babies in the past two pregnancies.
 1. What is the diagnosis?
 2. What is the reason for the diagnosis

Diagnosis of GDM



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

Criteria	Diagnosis
IADPSG (75 gram OGTT) [6]	At least one value meeting the threshold: Fasting plasma glucose ≥ 5.11 mmol/l 1-h plasma glucose ≥ 10 mmol/l 2-h plasma glucose ≥ 8.5 mmol/l
Old ADA (100g OGTT) [11]	At least two values meeting the thresholds: Fasting plasma glucose ≥ 5.28 mmol/l 1-h plasma glucose ≥ 10 mmol/l 2-h plasma glucose ≥ 8.61 mmol/l 3-h plasma glucose ≥ 7.78 mmol/l
WHO (75 g OGTT) [12]	At least one value meeting the threshold: Fasting plasma glucose ≥ 7 mmol/l 2-h plasma glucose ≥ 7.78 mmol/l

IADPSG, International Association of Diabetes and Pregnancy Study Groups; ADA, American Diabetes Association; WHO, World Health Organisation.

Risk factors for GDM



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

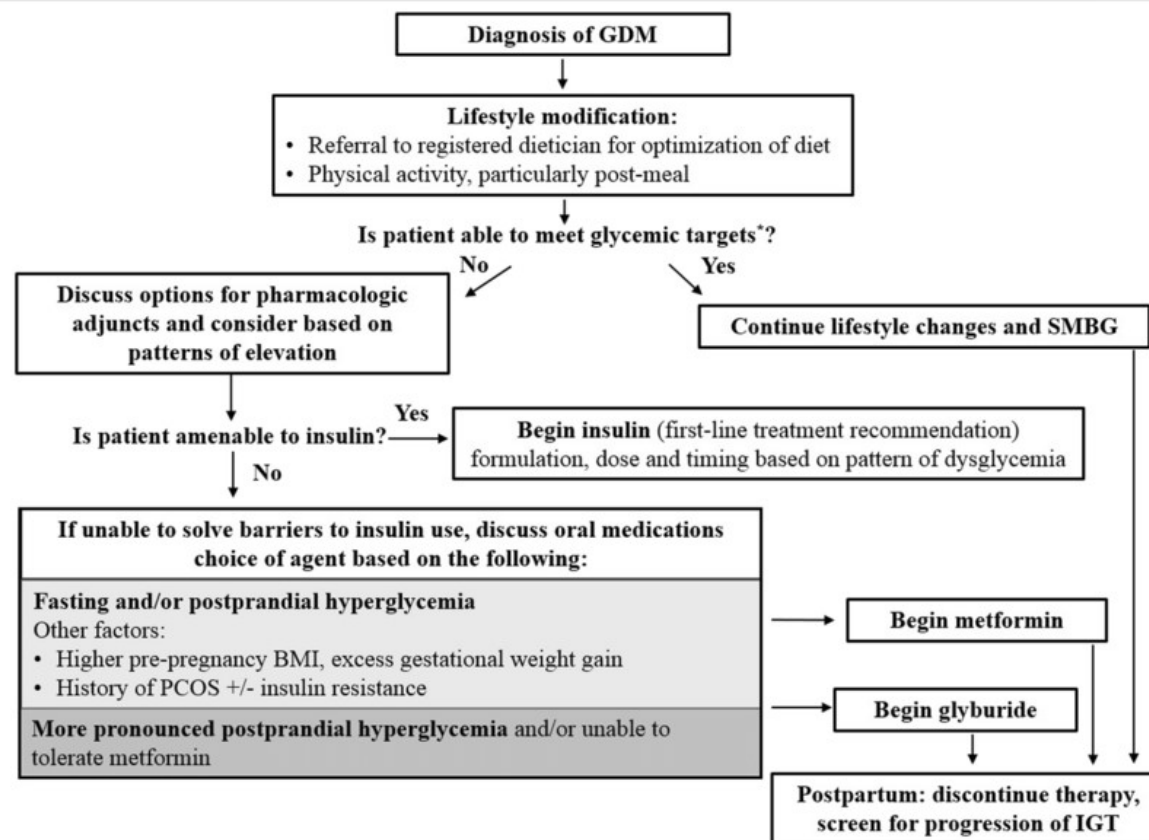
- Previous gestational diabetes.
- A large baby in their last pregnancy, e.g. >4.5kg.
- A previous unexplained stillbirth/perinatal death.
- Maternal obesity (BMI above 30kg/m²).
- Family history of diabetes (first-degree relatives).
- Family origin with a high prevalence of type 2 diabetes:
 - South Asian.
 - Black Caribbean.
 - Middle Eastern.
- Polyhydramnios

Management of GDM



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism



*Glycemic targets (mg/dL): fasting <95; 1 hour postprandial <140; 2 hour postprandial <120 [3,4]

Management of GDM



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

Box 13.16 Checklist for gestational diabetes during clinic visit

- Monitoring BG, aim:
 - Fasting BG $<5.9\text{mmol/L}$.
 - 1h postprandial BG $<7.8\text{mmol/L}$ (some advocate lower BG targets for obese women, e.g. <5.1 fasting and <7.0 after meals).
- Monitor maternal weight, BP, and urinalysis.
- Monitor fetal size (abdominal circumference)—increase treatment if abdominal circumference $\geq 70\text{th}$ percentile.
- Treatment:
 - Diet and lifestyle advice.
 - Oral hypoglycaemic agents if diet and exercise inadequate or incipient macrosomia: metformin/glibenclamide; insulin therapy—NPH and/or rapid-acting insulin analogues (aspart and lispro).
- Reinforce dietary advice throughout pregnancy.
- Advice on physical activity (at least 30min daily).
- At 36 weeks' clinic visit, discuss and document:
 - Mode and timing of delivery.
 - BG management and insulin infusion rate for delivery.
 - Increased risk of type 2 diabetes and evidence for delaying and prevention (diet and lifestyle or metformin).
 - Benefits of breastfeeding (mother and baby).
 - Options for safe, effective post-partum contraception.
 - Post-partum follow-up—fasting glucose or OGTT 6 weeks post-delivery.



**THANK YOU SO MUCH
FOR YOUR ATTENTION**

7th Abuja Cardiovascular Symposium 2023



REFERENCES



cardiocare
MULTISPECIALTY HOSPITAL

Reversing Medical Tourism

- Gardner DG, Shoback D. *Greenspan Basic and Clinical Endocrinology*. 9th Ed. New York. McGraw Hill. 2011. p657-674
- Longo DL, Kasper DL, Jameson JL, Fauci AS, Hauser S, Loscalzo J (eds). *Harrison's Principles of Internal Medicine*. 19th Ed. United States of America. McGraw Hill. 2015. p2009-10, 2399-2401
- John W, Katherine O. *Oxford Handbook of Endocrinology and Diabetes*. 3rd Ed. Oxford Medical Publication. 2014. p752-759
- Classification of Diabetes Mellitus 2019. WHO
- Uloko A.E et al, Prevalence and Risk factors for Diabetes mellitus in Nigeria: A systemic review and meta analysis. Pub med 2014.