

# LOW SUGAR: CAUSES, COMPLICATIONS AND MANAGEMENT OF HYPOGLYCEMIA

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3/28/2018



# Objectives

- 1. Identify common preventable causes of hypoglycemia in people with diabetes
- 2. Learn how to advise patients who experience hypoglycemia
- 3. Recognize fear of hypoglycemia

# Classification of Hypoglycemia

Level	Category	Blood glucose criteria	Description
1	Alert	< 70 mg%	Requires fast acting carbohydrate and adjustment of therapy
2	Clinically significant	< 54 mg%	Serious, clinically important
3	Severe	No specified level	Associated with severe cognitive impairment, requires help to resolve

# Prevalence of Hypoglycemia

- 532,542 People with Type 2 Diabetes on Oral Therapies and Insulin: A Systematic Review and Meta-Analysis of Population Based Studies at <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126427>
- On average patients with type 2 diabetes on insulin had 23 mild or moderate and one severe episode each year
- Prevalence of hypoglycemia was 45% for mild/moderate and 6% for severe.
- Incidence of hypoglycemic episodes per person-year for mild/moderate and for severe was 19 and 0.80, respectively.

# HYPOGLYCEMIA

(Low Blood Glucose)

**Cause:** Too little food or skip a meal; too much insulin or diabetes pills; more active than usual

**Onset:** Often sudden; may pass out if untreated.

## SYMPTOMS:

		 <b>SHAKY</b>	 <b>FAST HEARTBEAT</b>
 <b>SWEATING</b>	 <b>DIZZY</b>	 <b>ANXIOUS</b>	 <b>HUNGRY</b>
 <b>BLURRY VISION</b>	 <b>WEAKNESS OR FATIGUE</b>	 <b>HEADACHE</b>	 <b>IRRITABLE</b>
<b>WHAT CAN YOU DO?</b>	 <b>CHECK</b>	<b>TREAT</b>	 <b>CHECK</b>
			

**CHECK** your blood glucose right away. If you can't check, treat anyway.

**TREAT** by eating 3 to 4 glucose tablets or 3 to 4 hard candies you can chew quickly such as peppermints or by drinking 4 ounces of fruit juice or 1/2 can of regular soda pop.

**CHECK** your blood glucose again after 15 minutes. If it is still low, treat again. If symptoms don't stop, call your health care provider.

# HYPERGLYCEMIA

(High Blood Glucose)

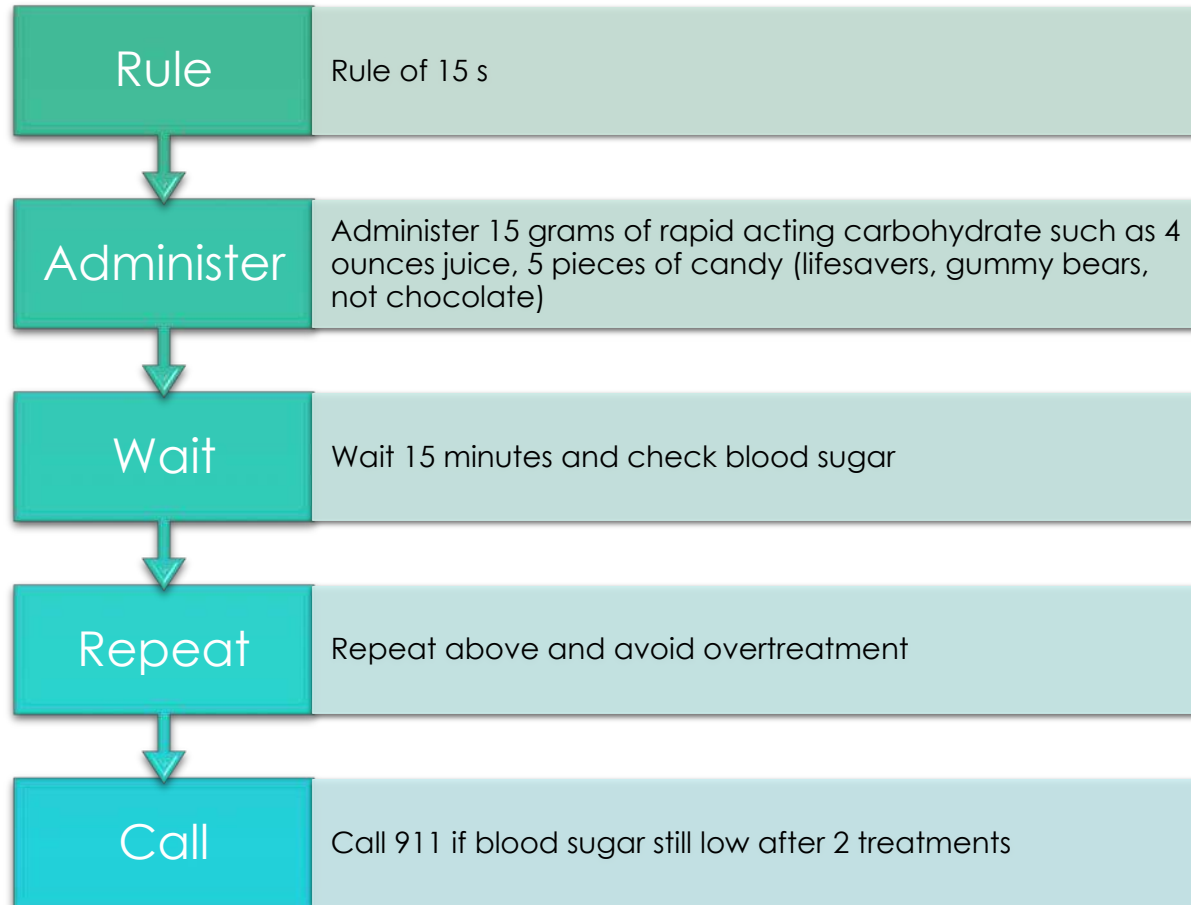
**Causes:** Too much food, too little insulin or diabetes pills, illness, or stress.

**Onset:** Often starts slowly. May lead to a medical emergency if not treated.

## SYMPTOMS:

 <p><b>NEED TO URINATE OFTEN</b></p>	 <p><b>DRY SKIN</b></p>	 <p><b>EXTREME THIRST</b></p>
 <p><b>BLURRY VISION</b></p>	 <p><b>DROWSY</b></p>	 <p><b>HUNGRY</b></p> <p><b>SLOW-HEALING WOUNDS</b></p>
 <p><b>WHAT CAN YOU DO?</b></p>	 <p><b>CHECK BLOOD GLUCOSE</b></p>	 <p><b>CALL YOUR HEALTHCARE PROVIDER</b></p>

**Call your healthcare provider** if your blood glucose levels are higher than normal for 3 days and you don't know why.



## Treatment for Hypoglycemia

# Who is at risk for hypoglycemia?

- Anyone on insulin or sulfonylurea
- People with diabetes with variable meals who take a fixed dose of mealtime insulin
- Elderly who may be losing renal function
- People on large doses of basal insulin
- Biggest risk for having hypoglycemia today is having had hypoglycemia yesterday



## Framework for Targets for Type 2

Patient Characteristics	Rationale	A1c	BP	Lipids
Healthy -Intact cognitive and functional status	Longer life expectancy	< 7.5%	< 140/90	Statins if tolerated
Complex -Multiple comorbidities -Mild/mod CI - 2 or more IADL dependencies	Treatment burden Risk of hypoglycemia Fall risk	< 8 %	< 140/90	Statins if tolerated
Very complex - LTC residents - Mod/severe CI - End stage chronic disease	Limited life expectancy Benefits unclear	< 8.5%	< 150/90	Consider risks vs. benefits

# Complications from Hypoglycemia

- Motor vehicle accident, falls, injury
- Hypoglycemia unawareness with risk of severe hypoglycemia
- Fear of hypoglycemia that can lead to poor glycemic control
- Long term study of elderly with type 2 with one or more episodes of severe hypoglycemia had a step wise increase in risk of dementia
- ACCORD study found that as cognitive function decreased, the risk of severe hypoglycemia increased

# Impaired Cognitive Function

- Per ADA standards with Level B evidence page S61
  - “Ongoing assessment of cognitive function is suggested with increased vigilance for hypoglycemia by the clinician, patient and caregivers if low cognition or declining cognition is found.”

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# LIFESTYLE THERAPY

(Including Medically Assisted Weight Loss)

Entry HbA1c < 7.5%

Entry HbA1c ≥ 7.5%

Entry HbA1c > 9.0%

## MONOTHERAPY\*

- ✓ Metformin
- ✓ GLP-1 RA
- ✓ SGLT2i
- ✓ DPP-4i
- ⚠ TZD
- ✓ AGI
- ⚠ SUGLN

If not at goal in 3 months proceed to Dual Therapy

## DUAL THERAPY\*

- ✓ GLP-1 RA
  - ✓ SGLT2i
  - ✓ DPP-4i
  - ⚠ TZD
  - ⚠ Basal insulin
  - ✓ Colesevelam
  - ✓ Bromocriptine QR
  - ✓ AGI
  - ⚠ SUGLN
- MET**  
or other 1st-line agent
- +

If not at goal in 3 months proceed to Triple Therapy

## TRIPLE THERAPY\*

- ✓ GLP-1 RA
  - ✓ SGLT2i
  - ⚠ TZD
  - ⚠ Basal insulin
  - ✓ DPP-4i
  - ✓ Colesevelam
  - ✓ Bromocriptine QR
  - ✓ AGI
  - ⚠ SUGLN
- MET**  
or other 1st-line agent + 2nd-line agent
- +

If not at goal in 3 months proceed to or intensify insulin therapy

## SYMPTOMS

NO

YES

DUAL  
Therapy

OR

TRIPLE  
Therapy

INSULIN  
±  
Other  
Agents

**ADD OR INTENSIFY  
INSULIN**  
Refer to Insulin Algorithm

## LEGEND

- ✓ Few adverse events and/or positive benefits
- ⚠ Use with caution

\* Order of medications represents a suggested hierarchy of usage; length of line reflects strength of recommendation

PROGRESSION OF DISEASE

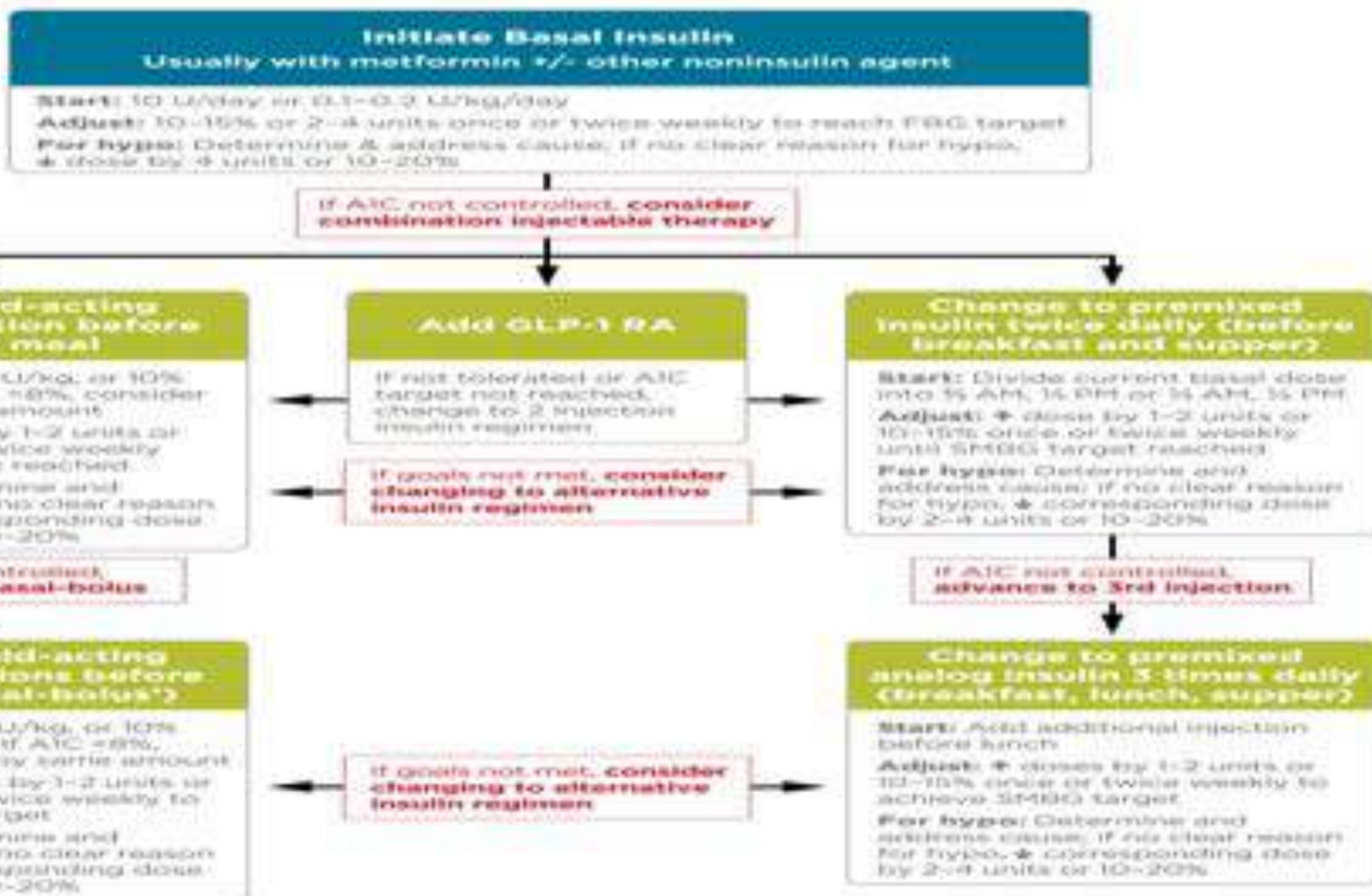
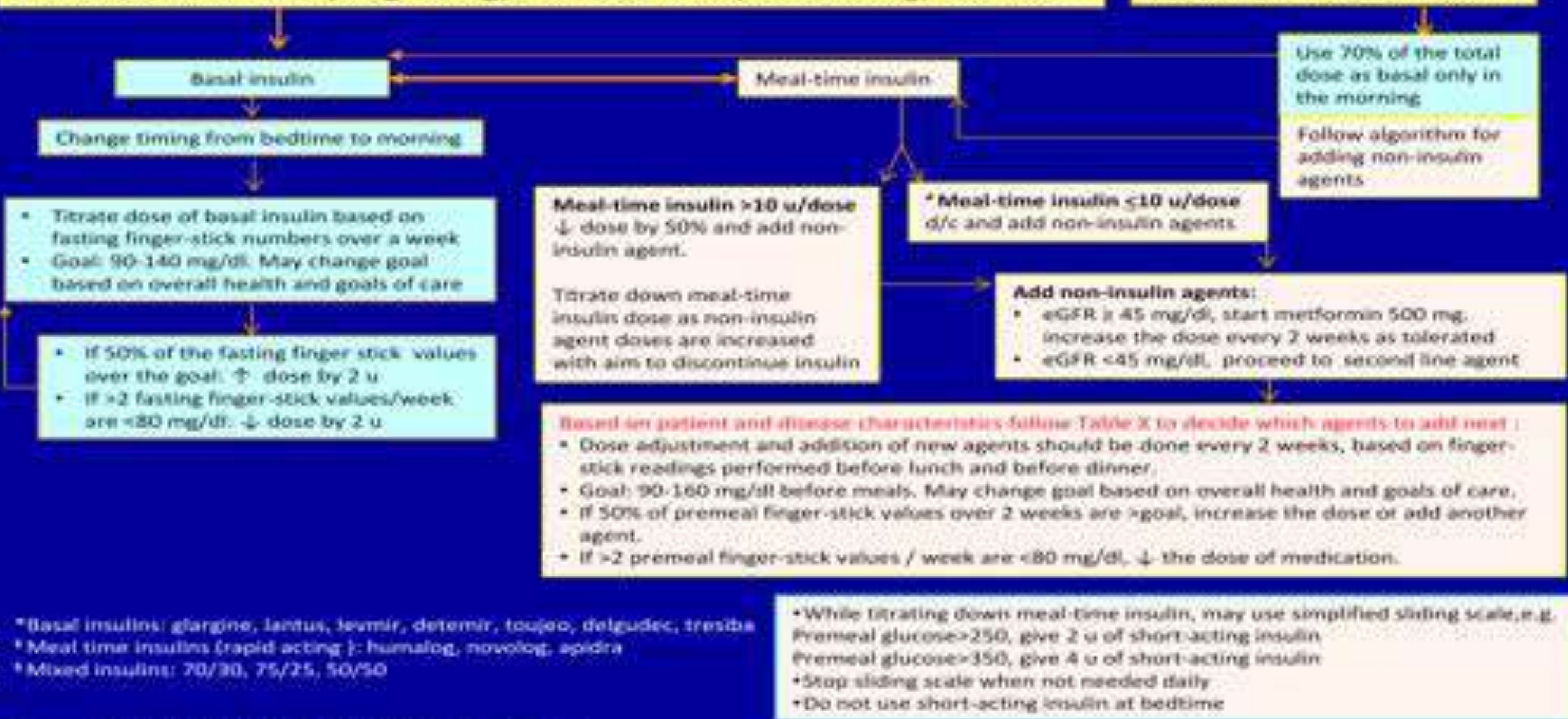


Figure 8.2—Combination injectable therapy for type 2 diabetes. FPG, fasting blood glucose; hypoglycemia, hypoglycemia. Adapted with permission from Inzucchi et al. (31).

## Algorithm for Simplification of Insulin Regimen From multiple injections to once-a-day long-acting (basal)+ non-insulin agents

**Patient on both basal(long-acting) and meal-time(short-acting) insulins<sup>†</sup> \***

**Patient on Mixed insulin<sup>‡</sup>**



- \* Basal insulins: glargine, lantus, levmir, detemir, toujeo, delgudec, tresiba
- † Meal time insulins (rapid acting): humalog, novolog, apidra
- ‡ Mixed insulins: 70/30, 75/25, 50/50

- While titrating down meal-time insulin, may use simplified sliding scale, e.g.  
Premeal glucose >250, give 2 u of short-acting insulin  
Premeal glucose >350, give 4 u of short-acting insulin  
• Stop sliding scale when not needed daily  
• Do not use short-acting insulin at bedtime

# Pharmacotherapeutics for Type 1

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Most should be treated with multiple dose injections of a basal and mealtime insulin or a continuous infusion pump (Level A evidence)

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Most should use rapid acting analogs at mealtime to avoid hypoglycemia (Level A evidence)

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Consider patient education on matching mealtime insulin dose to carbohydrate intake at meal (nutritional dose), pre-meal blood glucose level (correction dose) and level of physical activity (Level E/ expert opinion)

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Patients successful on an insulin pump should continue this therapy after age 65 (Level E/expert opinion)

# Fear of Hypoglycemia

Should be treated  
per ADA  
recommendations

Can be a barrier  
to achieving A1c  
target

HFS II screening  
tool for assessment



# Sample of Items on HFS II

- Ate large snack
- Kept BG >150 mmol/L
- Reduced insulin when BG low
- Measured BG six or more times per day
- Take someone with me when out
- Limited out-of-town travel
- Limited driving
- Avoided visiting friends
- Stayed home more than liked
- Limited physical activity
- Made sure others were around
- Avoided sex
- Kept BG high during important tasks
- Had others check on me
- Not recognizing low BG
- Not having food available
- Passing out in public
- Embarrassing myself in social situation
- Having hypoglycemic episode alone
- Appearing drunk or stupid

# Hypoglycemia Unawareness

- Per ADA standards with Level A evidence page S34
  - People with hypoglycemia unawareness should be treated using blood glucose awareness training (or other evidence-based intervention) to help reestablish awareness of hypoglycemia and reduce fear of hypoglycemia

# Medical management of hypoglycemia unawareness

- Per ADA standards with level A evidence page S61
- Patients treated with insulin or with an episode of clinically significant hypoglycemia [ $<54$  mg%] should be advised to raise their glycemic targets to strictly avoid hypoglycemia for at least several weeks in order to partially reverse hypoglycemia unawareness and reduce the risk of future episodes

# Population Management Ideas

Identifying elderly patients with A1c < 7% on insulin or sulfonyl urea

Ensure all patients on insulin or sulfonylurea are taught about recognition and treatment of hypoglycemia

Consider insulin pump, continuous glucose monitor and glucagon for injection at home for patients with frequent severe hypoglycemia

# Situations for mental health referral (1)

- Impaired self-care with diabetes distress after education
- Positive screen for depression
- Disordered eating, eating disorder, disrupted patterns of eating
- Intentional omission of meds/insulin to lose weight
- Positive screen for anxiety or fear of hypoglycemia

# Situations for mental health referral (2)

- Serious mental illness suspected
- Youth and families with behavioral self-care difficulties, repeated DKA admissions
- Positive screening for cognitive impairment
- Declining or impaired ability to perform diabetes self-care behaviors
- Before bariatric or metabolic surgery, and after surgery if adjustment support needed

# Case studies

# Elderly woman with failing kidneys

- Subjective
  - 74 year old Filipino woman with Stage 5 CKD recently consulted to nephrologist to consider dialysis
  - On basal/bolus insulin with good control and increasing frequency of hypoglycemia. Basal insulin slowly decreased from 40 units to 18 units, bolus from 10 units to 5 units lunch and dinner only
  - On multiple meds for HTN, HLD, gout, epoetin injections for anemia q2weeks
- Objective
  - BMI = 32, abdominal obesity
  - BP 116/78 P = 70
  - A1c = 6.1% Hemoglobin = 8
  - Creatinine = 7.8 mg%, GFR < 10
  - SMBG for past 2 weeks
  - AC Breakfast range 87 to 99 median 94
  - AC Lunch 126 to 140 median 132
  - AC Dinner range 140 to 189 median 152



# Young adult on 3 oral agents

- 35 yo Asian man diagnosed 1 year ago
- Diabetes diagnosed with routine screening, A1c = 9%. No HTN, no HLD
- Started on metformin, then a DPP-4 was added, and 1 month ago glipizide 5 mg at breakfast was added. He started feeling hungry and shaky after breakfast requiring daily mid-morning snack. Checked BG once = 62
- Walks briskly 30 to 60 minutes every day
- Gained 5 pounds since starting glipizide
- Objective
- BMI = 24, waist = 32
- BP 124/78 P = 70
- A1c = 7.2%
- Lipids, chemistry panel normal
- SMBG for past 2 weeks
- AC Breakfast range 108 to 128 median 118
- AC Lunch (post snack) 126 to 155 median 130
- AC Dinner range 140 to 178 median 152

# References

- AACE/ACE COMPREHENSIVE TYPE 2 DIABETES MANAGEMENT ALGORITHM 2018, *Endocr Pract*.2018,doi:10.4158/CS-2017-0153 on line at <https://www.aace.com/publications/algorithm>
- Inzucchi SE et al. Management of Hyperglycemia in Type 2 diabetes, 2015. *Diabetes Care* 2015; 38:140-149
- Khunti K et al. Clinical inertia with regard to intensifying therapy in people with type 2 diabetes treated with basal insulin. *Diabetes Obes Metab* 2016; 18:401-409 on line at <http://onlinelibrary.wiley.com/doi/10.1111/dom.12626/full>
- Munshi MN et al. Simplification of insulin regimen in older adults and risk of hypoglycemia [published online June 6, 2016]. *JAMA Intern Med*. doi:[10.1001/jamainternmed.2016.2288](https://doi.org/10.1001/jamainternmed.2016.2288).
- Standards of Medical Care in Diabetes. *Diabetes Care* 2018; 41 (Suppl. 1): S1-S159