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# Diabetes and Other Tough Problems in Hospital Endocrinology

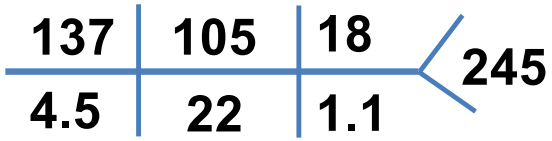
***October 18, 2019***

*Elizabeth J. Murphy, MD, DPhil*
*Deborah Cowan Endowed Professorship in Endocrinology*
*Professor of Clinical Medicine*
*University of California, San Francisco*
*Chief, Division of Endocrinology*
*San Francisco General Hospital*

# Case

**50 yo woman with diabetes is admitted to the orthopedic service with multiple fractures after being hit by a car biking to work. You are called for diabetes management.**

**Laboratory Tests:**




**X-Rays: R femur and R humerus fractures**

Meds include:

Metformin 1 gm BID

Basiglar 40 units qhs

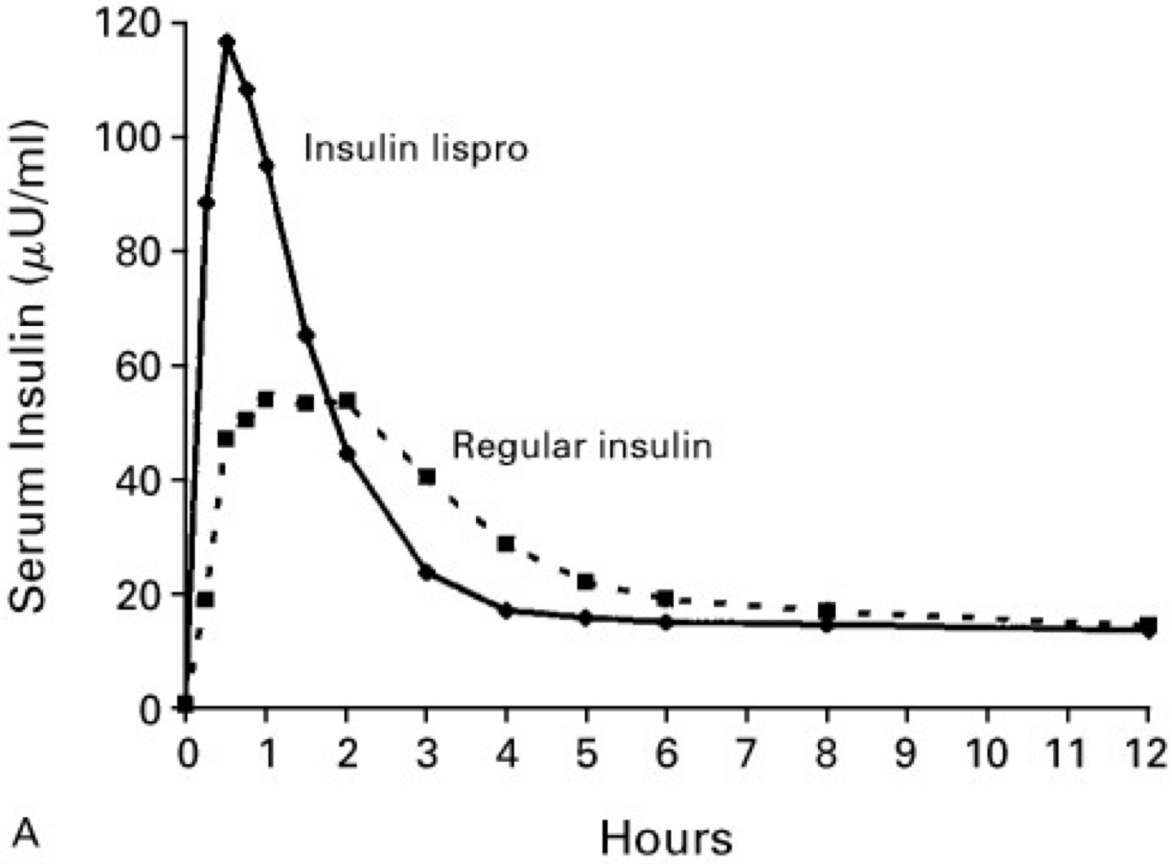
Admelog 20 units qac

| Name | Brand Name | Status | Manufacturer | Cost |
|---|---|---|---|---|
| glargine | Lantus | | Sanofi | $357 |
| glargine | Basiglar | Biosimilar | Lilly | $252 |
| glargine | Lusduna | Biosimilar | Merck | Not available |
| glargine | Toujeo | U-300 | Sanofi | $324 |
| detemir | Levemir | | Novo Nordisk | $465 |
| degludec | Tresiba | | Novo Nordisk | $612 |
| NPH (vial) | Humulin | | Lilly | $97 |
| NPH (vial) | Novolin | | Novo Nordisk | $144 |

Good Rx.com 10 2019

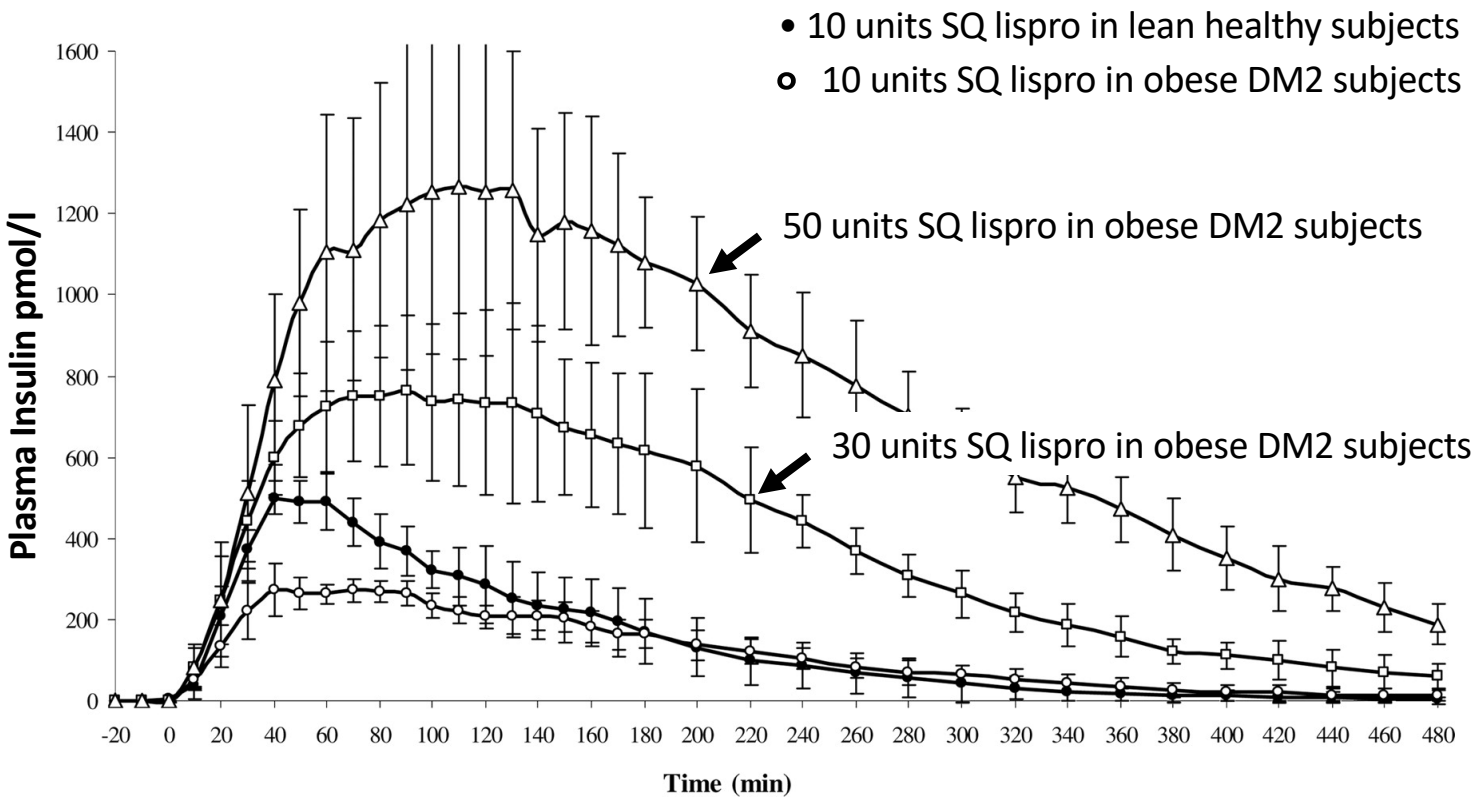
| Name | Brand Name | Status | Manu-facturer | Cost |
|---|---|---|---|---|
| aspart | Novolog | | Novo Nordisk | $294 |
| aspart | Fiasp | | NovoNordisk | $561 |
| glulisine | Apidra | | Sanofi | $551 |
| lispro | Humalog | | Lilly | $327 |
| lispro | “generic” | | Lilly | $226 |
| lispro (vial) | Admelog | Biosimilar/ Interchangeable | Sanofi | $470 |
| R (vial) | Humulin | | Lilly | $97 |
| R (pen) | Kwikipen | U-500 | Lilly | $608 |

Good Rx.com 2019




Holleman, Hoekstra, N Engl J Med 1997; 337:176-183

Howey et al, Diabetes 43:396-402, 1994




Diabetes Care. 2010 Dec;33(12):2502-7. doi: 10.2337/dc10-1126.

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| R (pen) | Kwikipen | U-500 | Lilly | $608 |

Good Rx.com 2019

How much/what kind of insulin do you want to recommend?

a) Sliding scale for first 12-24 hours
b) Glargine 30 + Correction
c) Glargine 40 + Correction
d) Glargine 30 + R 10 QAC + Correction
e) Glargine 40+ R 20 QAC + Correction
f) I need more information

## Home Meds

Metformin 1 gm BID
Basiglar 40 units qhs
Admelog 20 units qac

How much/what kind of insulin do you want to recommend?

a) Sliding scale for first 12-24 hours
b) Glargine 30 + C
c) Glargine 40 + C
d) Glargine 30 + R 10 QAC + C
e) Glargine 40+ R 20 QAC + C
f) I need more information

## Home Meds

Metformin 1 gm BID
Basiglar 40 units qhs
Admelog 20 units qac

# How to Assess Starting Insulin Needs

- What kind of diabetes does the patient have?
- What was their control prior to admission? Get an A1C!
- What is the best estimate of insulin adherence prior to admission?
- Do they have their glucometer with them and if so what does it tell you?
- Do they have lows?
- Will they be eating more or less in the hospital?
- Will they get glucocorticoids?
- How insulin resistant will they be?

# Insulin Resistance in the Hospital

**INCREASED**

- Infection
- Stress
- Sleep deprivation
- Medications
  (e.g. prednisone)

**DECREASED**

- Negative energy balance
  - NPO
  - Poor PO intake
  - Improved diet
- Improved glycemic control

**Insulin Resistance in a Hospitalized Patient is Very Dynamic**

# Scenario 1

- Type 2 Diabetes
- A1C one month ago 9.6%
- Patient can't name the type or dose of insulin "look in the chart"
- Patient notes work has been stressful. She's missed the last couple of doses. Last time she used her insulin she felt hypoglycemic.
- Glucometer shows 5 checks in past 3 weeks, all 200s-300s
- Patient NPO for pending surgery

How much/what kind of insulin do you want to recommend?

a) Sliding scale for first 12-24 hours

**b) Glargine 30 (OR 20?) + C**

c) Glargine 40 + C

d) Glargine 30 + R 10 QAC + C

e) Glargine 40+ R 20 QAC + C

f) I need more information

## Home Meds

Metformin 1 gm BID
Basiglar 40 units qhs
Admelog 20 units qac

# Scenario 2

- Type 2 Diabtes
- A1C one month ago 8.2%
- Patient recently started going to diabetes clinic and working on better control/diet.  Knows name/dose of insulin and dose changes that were made a month ago.
- Glucometer shows 3-4 checks a day 100s-200s
- No lows
- Patient eating regular diet in the hospital.  On a low carb diet at home.

How much/what kind of insulin do you want to recommend?

a) Sliding scale for first 12-24 hours

b) Glargine 30 (OR 20?) + C

c) Glargine 40 + C

d) Glargine 30 + R 10 QAC + C

**e) Glargine 40 + R 20 QAC + C**

f) I need more information

## Home Meds

Metformin 1 gm BID
Basiglar 40 units qhs
Admelog 20 units qac

# Case

**50 yo woman with diabetes is admitted to the orthopedic service with multiple fractures.**

**Before you can round, the resident/orthopedics service starts the patient on glargine 20 units with the first dose at 11 am.**

# Other Very Important Questions

- When do you take your basal insulin?
- When did you last take your basal insulin?
- What would be the most convenient time to take your basal insulin?

# Case

**50 yo woman with diabetes is admitted to the orthopedic service with multiple fractures. Before you can round the resident/orthopedic service starts the patient on glargine 20 units first dose at 11 am.**

**Patient normally takes her glargine 40 u at bedtime.**

What are your options for getting this patient back on track?

a) Give her regular dose of 40 units glargine at bedtime.
b) Give her 20 units glargine BID and worry about the timing at discharge.
c) Give 20 u glargine HS, 10 units glargine next am, 30 u glargine next HS
d) Give 20 u glargine HS, 20 u NPH next am, 40 glargine next HS

# Case

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d) Give 20 u glargine HS, 20 u NPH next am, 40 glargine next HS

What are your options for getting this patient back on track?

a) Give her regular dose of 40 units glargine at bedtime.

**This results in 60 units of basal insulin overnight.**

b) Give her 20 units glargine BID and worry about the timing at discharge.

**Obviously no good.**

c) Give 20 u glargine HS, 10 units glargine next am, 30 U glargine next HS

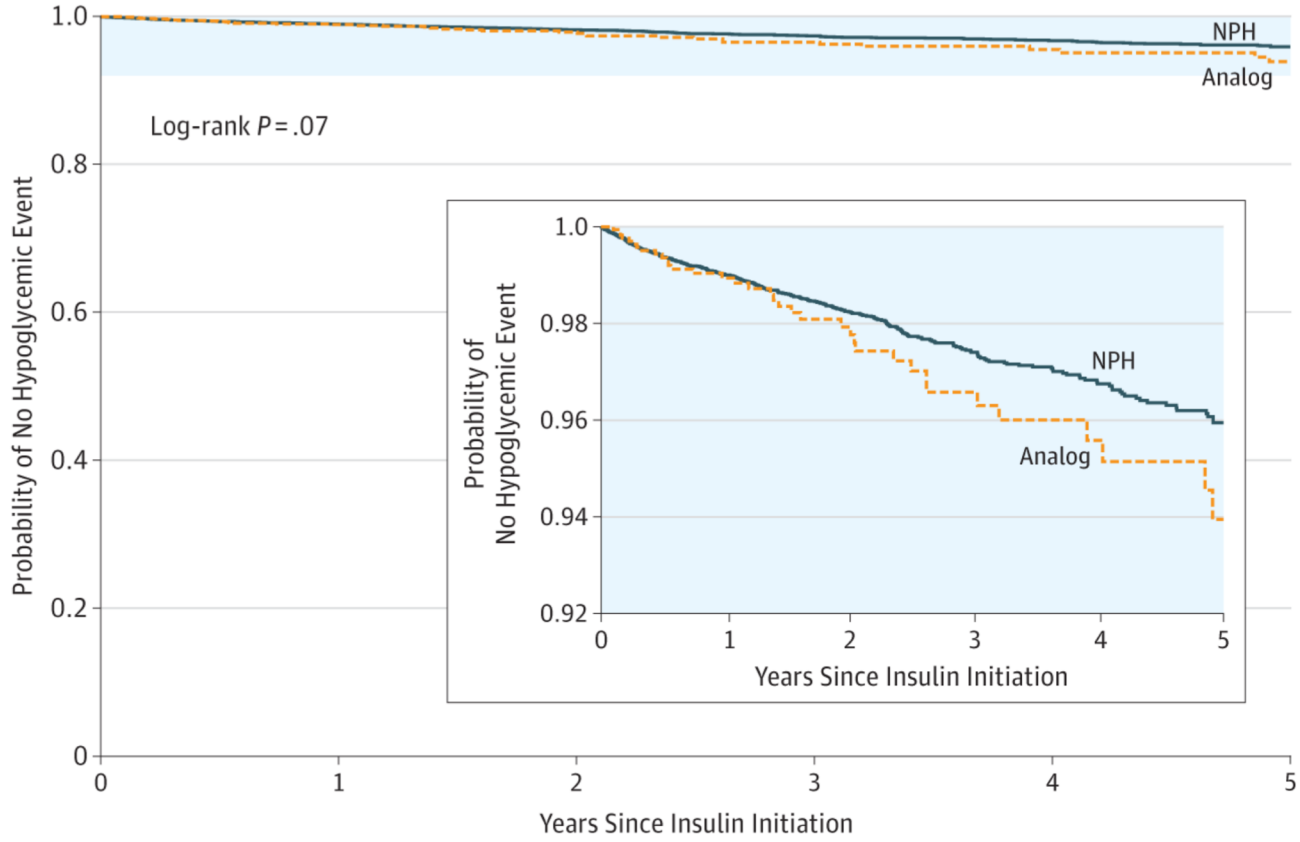
**Will take several days to get back to 40 with under or over dosing in between**

d) Give 20 u glargine HS, 20 u NPH next am, 40 glargine next HS

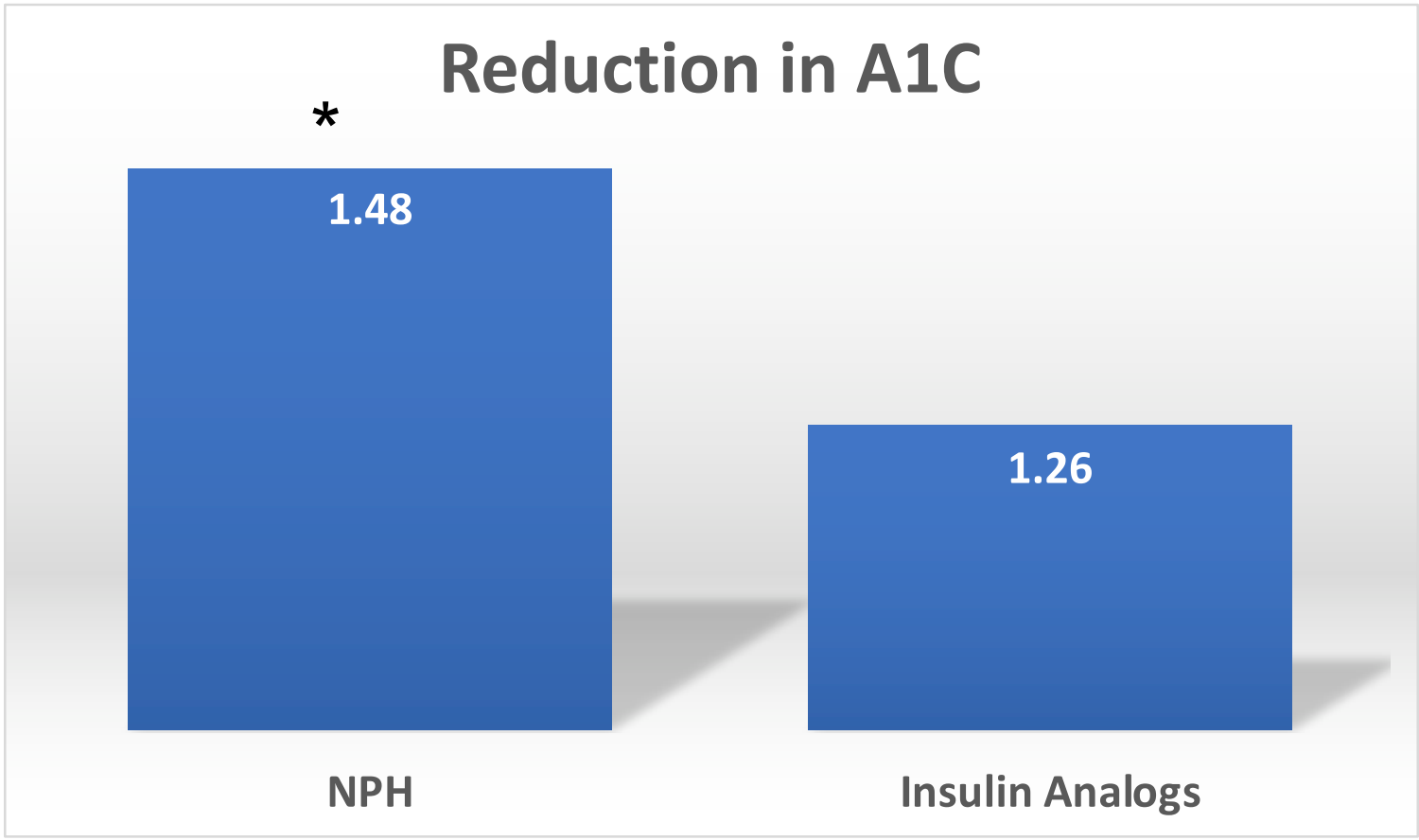
## *NPH as Basal Insulin in T2DM*

- In randomized trials NPH results in more nocturnal hypoglycemia with a strict treat to target morning glucose (< 100)
- There is no data to suggest increased severe hypoglycemia with NPH
- Basal analogues do not result in better A1C lowering or clinically significant reductions in hypoglycemia
- The cost of NPH is typically 10 times less than basal analogues

# ED visits or Hospital Admissions for Hypoglycemia with Basal Insulin Analogs vs NPH in Type 2 Diabetes




JAMA. 2018;320(1):53-62. doi:10.1001/jama.2018.7993




JAMA. 2018;320(1):53-62. doi:10.1001/jama.2018.7993

# Inpatient Advantages to NPH

- Can be used as a bridge to correct once daily basal dose timing.
- It can be adjusted twice a day allowing for more rapid titration to goal
- Allows for more basal insulin in the day for snackers
- Allows for more basal insulin during the day for steroid induced hyperglycemia which preferentially results in peripheral insulin resistance
- Allows for less basal insulin at night with renal failure/cirrhosis
- May be more affordable for patients as an outpatient

# Case

**43 yo Hispanic man with history of IDDM, HTN, hyperTG and bumex treated heart failure presents with 2 days of epigastric abdominal pain and 1 day of nausea and vomiting.**

## Laboratory Tests:

| | | | |
|---|---|---|---|
| **138** | **96** | **10** | **167** |
| **3.5** | **14** | **0.72** | |

UA 3+ glucose, + ketones

β–hydroxybuterate 10.3 mmol/L (0.4-0.5)

Lactate 0.6

ABG: 7.20/23/90

Lipase 369

Blood Lipemic

## Medications:

NPH 50 units BID
Aspart 25 units QAC
Aspart correction 3:50 > 175
Metformin 1 gm bid
Canagliflozin 300 mg daily
Atorva 80 mg daily
Fenofibrate 160 mg daily
Omega-3 FA 1 gm daily

# HYPERTRIGLYCERDEMIA

*Milk Equivalents*

- TG 8807 mg/dL
- TC  786 mg/dL
- HDL 10 mg/dL


- TG 1000  = 1% Milk
- TG 2000 =  2% Milk
- TG 3500 =  Whole Milk
- TG 10,000-18,000 = Half and Half

# Case

**43 yo Hispanic man with history of IDDM, HTN, hyperTG and bumex treated heart failure presents with 2 days of epigastric abdominal pain and 1 day of nausea and vomiting.**

**Laborator**

| | |
|---|---|
| **138** | **96** |
| **3.5** | **14** |

What type of diabetes does he have?

UA 3+ glucose, + ketones

β–hydroxybuterate 10.3 mmol/L

Lactate 0.6

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Lipase 369.

**Medications:**

175

ly

Atorva 80 mg daily

Fenofibrate 160 mg daily

Omega-3 FA 1 gm daily

A1C 8.9%

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1997!!

# Report of the Expert Committee on the Diagnosis[illegible]ication of Diabetes M[illegible]

THE EXPERT COMMITTEE ON THE DIAGNOSIS AND CLASSIFICATION [illegible] DIABETES MELLITUS*

IDDM

It is now considered to be particularly important to move away from a system that appears to base the classification of the disease, in large part, on the type of pharmacological treatment used in its management toward a system based on disease etiology where possible.

These range from autoimmune destruction of the β-cells of the pancreas with conse-

[illegible] current Expert Committee has [illegible]ly considered the data and rationale [illegible] what was accepted in 1979, along with research findings of the last 18 years, and we are now proposing changes to the NDDG/WHO classification scheme (Table 1). The main features of these changes are as follows:

1. The terms insulin-dependent diabetes mellitus and non-insulin-dependent diabetes mellitus and their acronyms, IDDM and NIDDM, are eliminated. These terms have been confusing and have frequently resulted in classifying the patient based on treatment rather than etiology.

# Diabetes Subtypes

## DM1

- Lean
- Younger
- DKA
- Can have a positive family history
- Autoimmune
- Requires insulin

## DM2

- Overweight/obese
- Older
- HONK/HHS (no DKA)
- Almost always have a positive family history
- Insulin resistance/metabolic syndrome
- Can treat with oral agents

# LADA:
# Latent Autoimmune Diabetes in Adults

- Technical definition:
  - age >30 at diagnosis
  - insulin independence for at least 6 months after initial diagnosis
  - Presence of autoantibodies
- Slow progression, often low insulin requirements
- Is this just Type 1 DM in an older person?
- Estimates are that up to 10% of folks diagnosed with DM2 might have LADA

# Antibodies Associated with DM1 and LADA

- Glutamic Acid Decarboxylase (GAD65)
  - Most sensitive, the higher the titer the greater the risk
- Islet Cell Antibodies (ICA)
- IA-2, IA-2β
- ZnT8
  - More commonly positive in Asian patients
- The more antibodies positive the higher the risk
- Initial screen with GAD65 is the most cost efficient strategy

# Ketosis Prone DM2

- Originally described in Africa in 1960s
- Also called Flatbush diabetes, type 1.5, Type 1B, atypical diabetes
- Accounts for 25-50% of new diagnosis of DKA in African-American and Hispanic patients
- Negative antibodies
- Often occurs at initial presentation

# Ketosis Prone DM2

## *Clinical Course*

- More than half of patients go into remission for a year or more
- Beta-cell function recovers post DKA and should be checked as an outpatient (e.g. c-peptide)
- More than 75% of patients will be off insulin at one year
- At 10 years up to 40% of patients remain off insulin

# Case

**43 yo Hispanic man with history of IDDM, HTN, hyperTG and bumex treated heart failure presents with 2 days of epigastric abdominal pain and 1 day of nausea and vomiting.**

FH: Father with T2 Diabetes
BMI: 29
c-peptide – 1.0 ng/ml (0.8-3.5)
GAD65 Antibody – 5.0 IU/ml (0.0-5.0)

## Laboratory Tests:

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β–hydroxybuterate 10.3 mmol/L

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Lipase 369.

Blood Lipemic

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Aspart correction 3:50 > 175
Metformin 1 gm bid
Canagliflozin 300 mg daily
Atorva 80 mg daily
Fenofibrate 160 mg daily
Omega-3 FA 1 gm daily

What type of diabetes does he have?

a) IDDM

b) Type 1 Diabetes/LADA

c) Ketosis prone Type 2 Diabetes

d) I don't know but I think something funny is going on here.

# Case

**43 yo Hispanic man with history of IDDM, HTN, hyperTG and bumex treated heart failure presents with 2 days of epigastric abdominal pain and 1 day of nausea and vomiting.**

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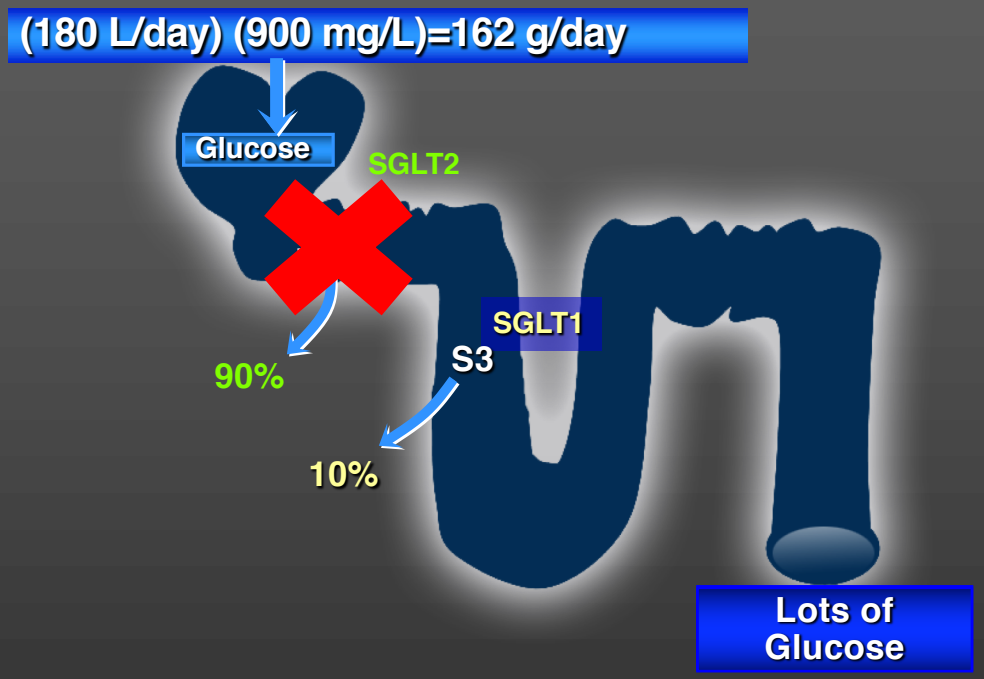
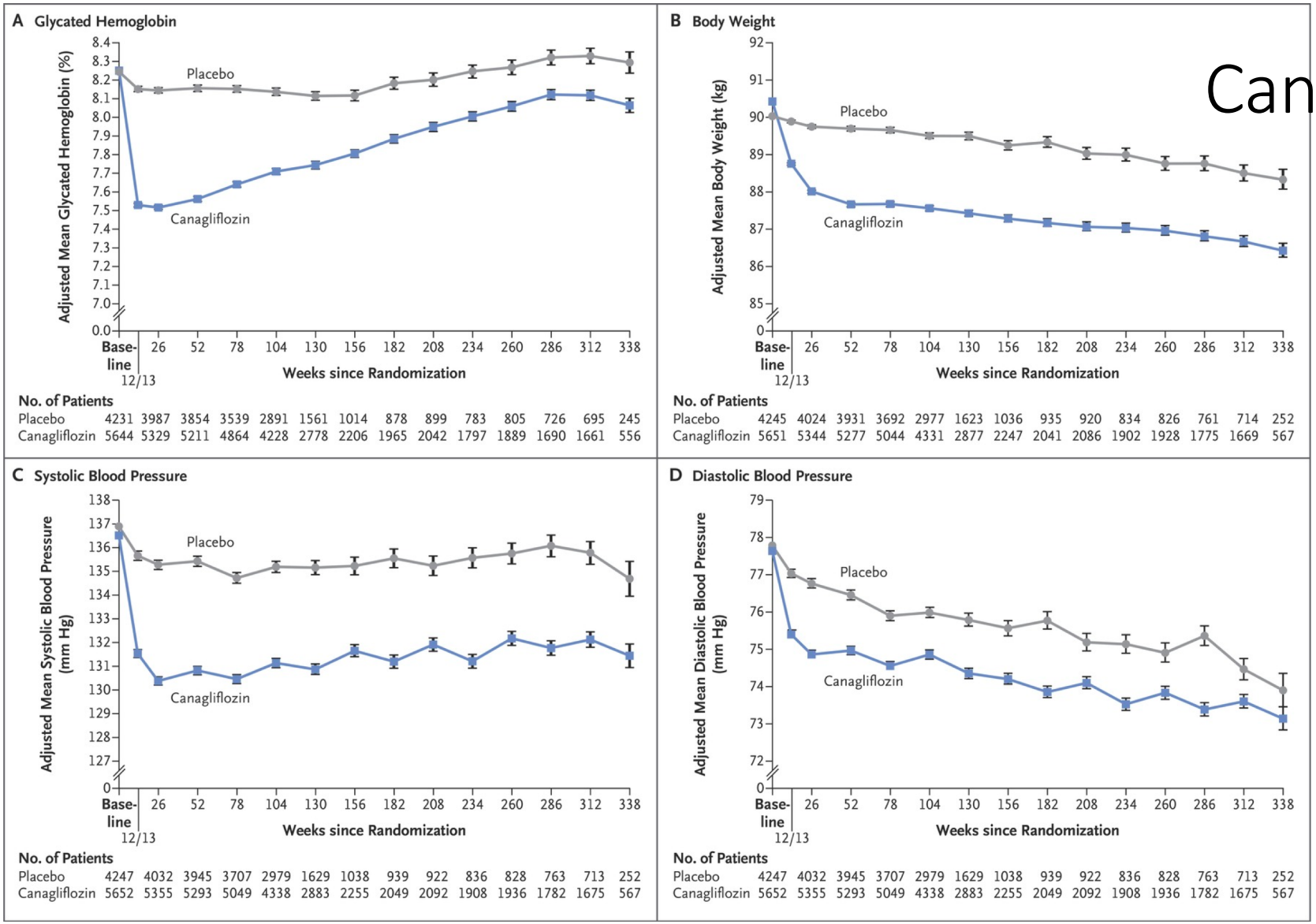
# Renal Handling of Glucose



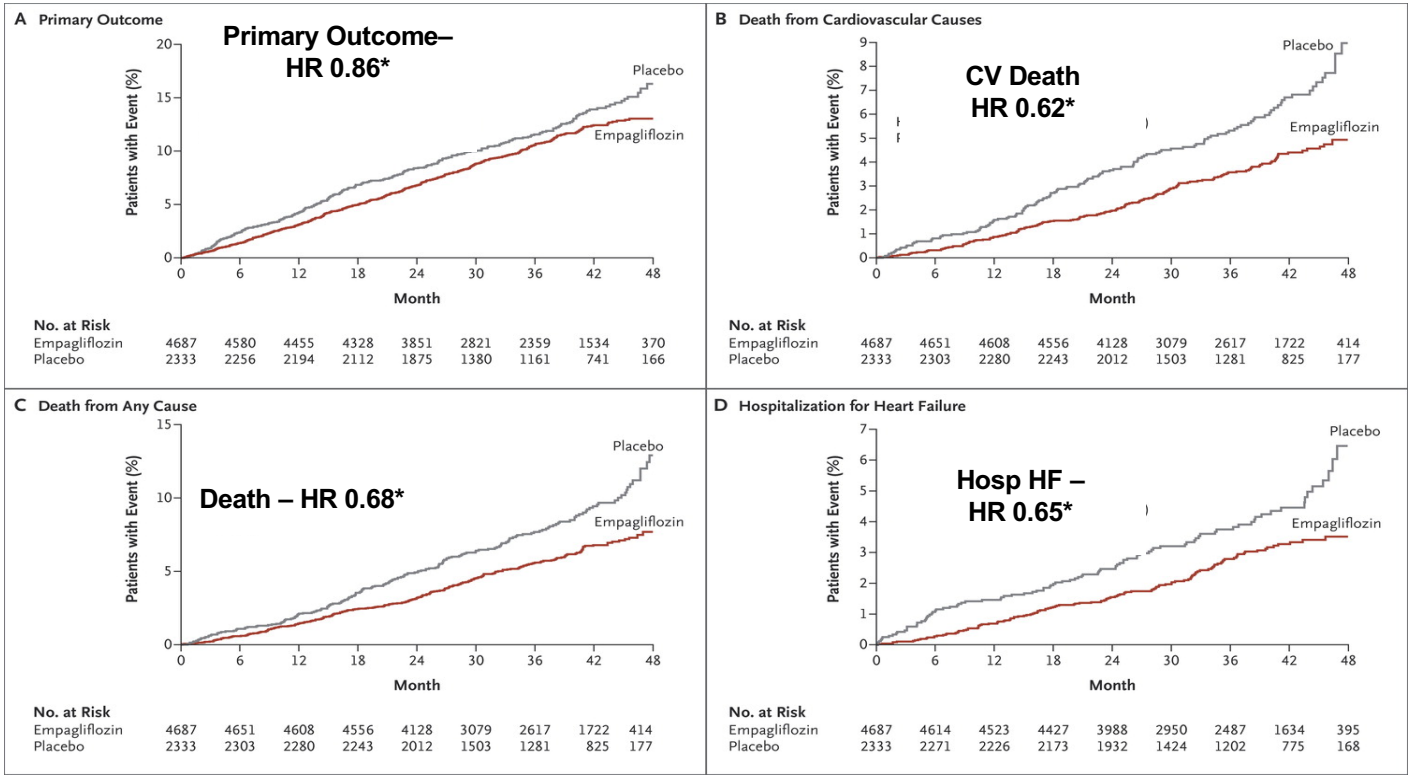
# Canvas Trial




Neal et al, N Engl J Med 2017; 377:644-657 DOI: 10.1056/NEJMoa1611925.

The NEW ENGLAND JOURNAL of MEDICINE

# Empagliflozin (SGLT2): CV and Mortality Benefit



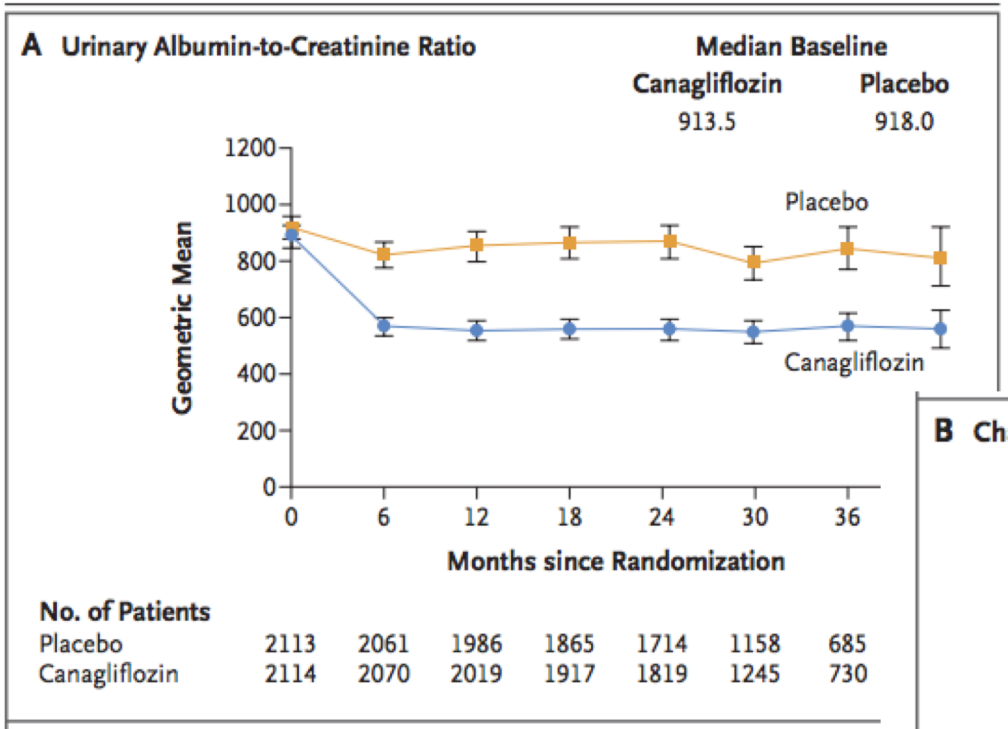

Zinman B et al. N Engl J Med 2015;373:2117-2128.

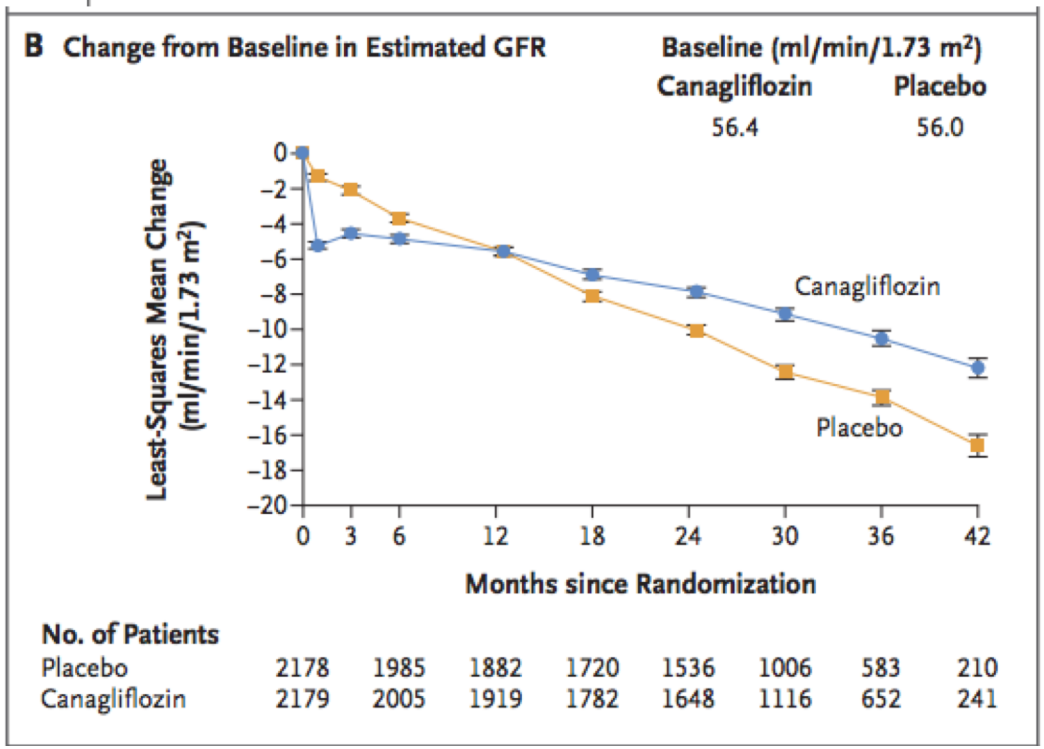
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 13, 2019 VOL. 380 NO. 24

# Canagliflozin and Renal Outcomes in Type 2 Diabetes and Nephropathy

V. Perkovic, M.J. Jardine, B. Neal, S. Bompoint, H.J.L. Heerspink, D.M. Charytan, R. Edwards, R. Agarwal, G. Bakris, S. Bull, C.P. Cannon, G. Capuano, P.-L. Chu, D. de Zeeuw, T. Greene, A. Levin, C. Pollock, D.C. Wheeler, Y. Yavin, H. Zhang, B. Zinman, G. Meininger, B.M. Brenner, and K.W. Mahaffey, for the CREDENCE Trial Investigators*

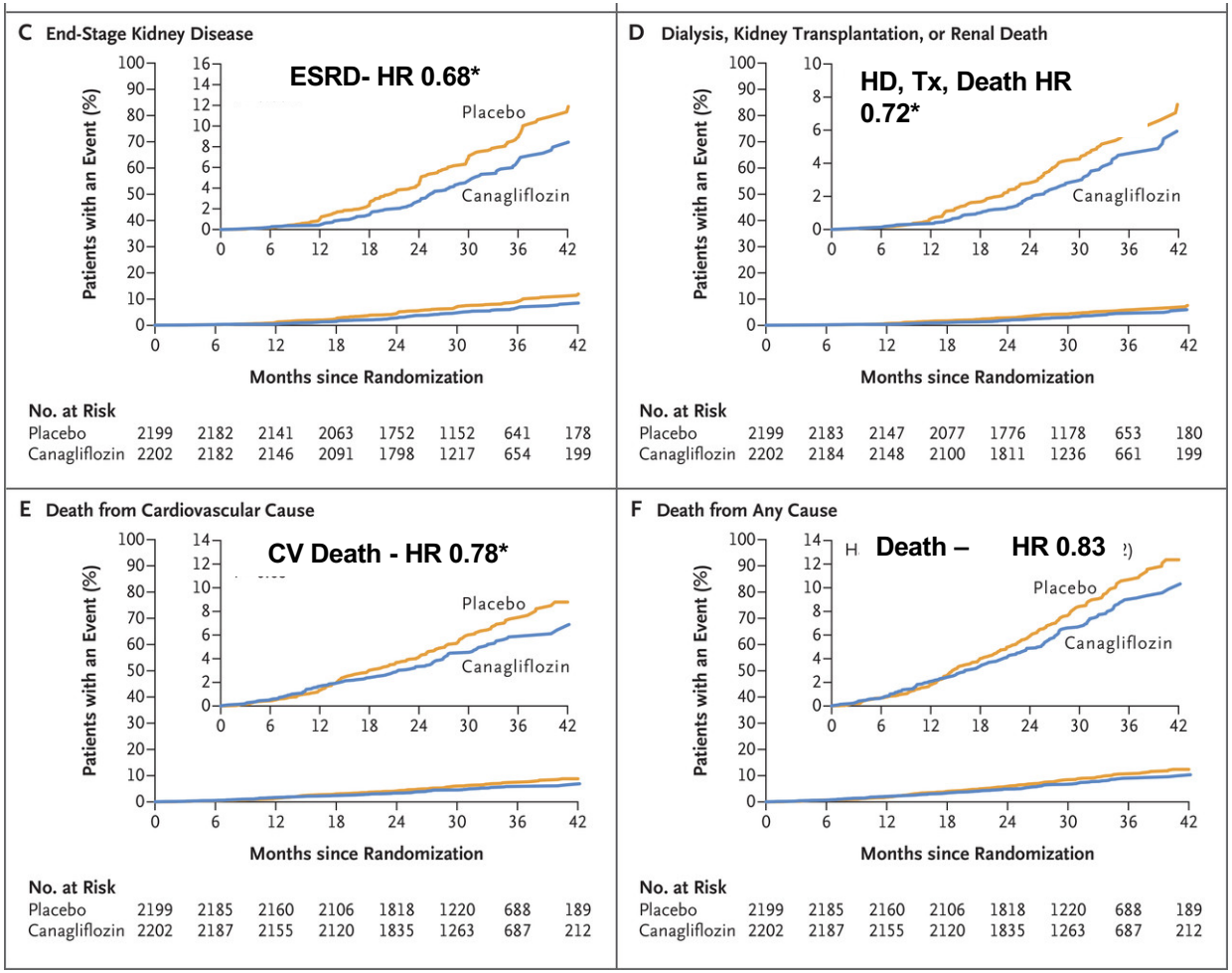



V Perkovic et al. N Engl J Med 2019;380:2295-2306.

The NEW ENGLAND JOURNAL of MEDICINE

# Canagliflozin and Renal and Cardiovascular Outcomes




V Perkovic et al. N Engl J Med 2019;380:2295-2306.

The NEW ENGLAND JOURNAL of MEDICINE

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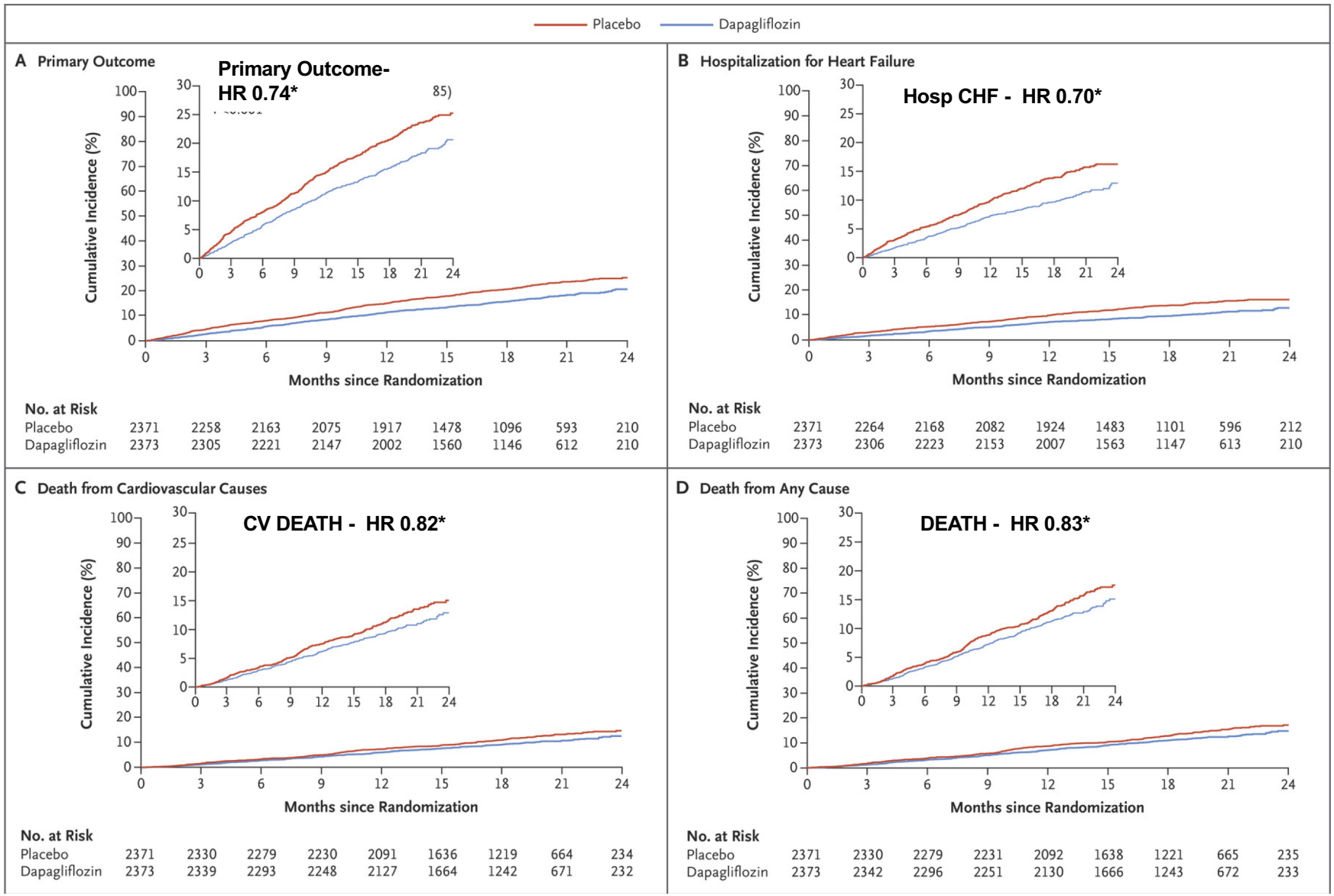
ORIGINAL ARTICLE

# Dapagliflozin in Patients with Heart Failure and Reduced Ejection Fraction

J.J.V. McMurray, S.D. Solomon, S.E. Inzucchi, L. Køber, M.N. Kosiborod, F.A. Martinez, P. Ponikowski, M.S. Sabatine, I.S. Anand, J. Bělohlávek, M. Böhm, C.-E. Chiang, V.K. Chopra, R.A. de Boer, A.S. Desai, M. Diez, J. Drozdz, A. Dukát, J. Ge, J.G. Howlett, T. Katova, M. Kitakaze, C.E.A. Ljungman, B. Merkely, J.C. Nicolau, E. O'Meara, M.C. Petrie, P.N. Vinh, M. Schou, S. Tereshchenko, S. Verma, C. Held, D.L. DeMets, K.F. Docherty, P.S. Jhund, O. Bengtsson, M. Sjöstrand, and A.-M. Langkilde, for the DAPA-HF Trial Committees and Investigators*

September 19, 2019. DOI: 10.1056/NEJMoa1911303


Placebo
Dapagliflozin
A Primary Outcome
Primary Outcome-
HR 0.74*
Cumulative Incidence (%)
Months since Randomization
No. at Risk
Placebo 2371 2258 2163 2075 1917 1478 1096 593 210
Dapagliflozin 2373 2305 2221 2147 2002 1560 1146 612 210
B Hospitalization for Heart Failure
Hosp CHF - HR 0.70*
Cumulative Incidence (%)
Months since Randomization
No. at Risk
Placebo 2371 2264 2168 2082 1924 1483 1101 596 212
Dapagliflozin 2373 2306 2223 2153 2007 1563 1147 613 210
C Death from Cardiovascular Causes
CV DEATH - HR 0.82*
Cumulative Incidence (%)
Months since Randomization
No. at Risk
Placebo 2371 2330 2279 2230 2091 1636 1219 664 234
Dapagliflozin 2373 2339 2293 2248 2127 1664 1242 671 232
D Death from Any Cause
DEATH - HR 0.83*
Cumulative Incidence (%)
Months since Randomization
No. at Risk
Placebo 2371 2330 2279 2231 2092 1638 1221 665 235
Dapagliflozin 2373 2342 2296 2251 2130 1666 1243 672 233

# SGLT2 Inhibitors

*Indications in Adults with DM2*

| SGL2 Inhibitors | Trade Name | FDA Approved Indications | Cost/mth (Good rx.com 10/2019) |
|---|---|---|---|
| canagliflozin | Invokana | 1. Glucose control<br>2. Reduce risk of major cardiovascular adverse events in patients with established cardiovascular disease<br>3. Reduce risk of ESRD, doubling of creatinine, CV death, hospitalization for HF - in patients with diabetic nephropathy with albuminuria | $498 |
| dapagliflozin | Farxiga*+ | 1. Glucose control | $485 |
| empagliflozin | Jardiance+ | 1. Glucose control<br>2. Reduce the risk of cardiovascular death in patients with established cardiovascular disease | $476 |
| ertuglifozin | Steglatro | 1. Glucose control | $287 |

*Forxiga is approved in Europe for DM1

+On fast track path for approval for CVD and hospitalization in CHF patients with or without diabetes

# SGLT-2 Inhibitors

++

- Lower glucose
- Lower blood pressure
- Lead to weight loss

+++++

- Reduce hospitalization for CHF
- Reduce renal failure
- Reduce death

---

- Increase in UTI and genital infections
- Increase in fractures
- Maybe increased amputations
- Maybe increased Fournier's gangrene
- Increased rates of euglycemic DKA

# Euglycemic Ketoacidosis

*What we think we know*

- Patients at increased risk for DKA are at increased risk of ketoacidosis (DM1/LADA, ketosis prone DM2)
- Reported precipitants are things that result in relative insulin deficiency OR promote ketones
  - Reduction or stopping insulin
  - Severe acute illness/stress (e.g. surgery)
  - Dehydration
  - Extensive exercise
  - Low carbohydrate diets/poor PO intake/fasting
  - Excessive alcohol intake

# Euglycemic Ketoacidosis

*What we think we know*

- Ketoacidosis can still occur several days after the SGLT2i is stopped
- Normal urine ketones might be misleading so check plasma ketones if concerned.
- Symptoms are similar to DKA with n/v, lethargy, abdominal pain but the glucose is relatively normal
- Treat with insulin and carbohydrates to correct relative insulin deficiency and dampen glucagon response
- For now would avoid use in hospital

# Case

33 yo man came to the ED with SOB, palpitations, nausea, vomiting and diarrhea.

PMH Graves disease 4 years earlier and admitted 4 months prior for a.fib and had not made it to any outpatient follow up but reports taking meds.

ECG: Atrial fibrillation with RVR at 140

Labs

**TSH < 0.01** (0.37-4.42) uU/mL

**Free T4 2.24** (0.8-1.76)

Labs 4 months prior

**TSH < 0.01**

**Free T4 5.79**

MEDS:

Methimazole 5 mg BID

Propranolol 20 mg BID

**EXAM:**

BMI 31.2 BP 157/81  HR 140  RR 20  95% RA

HEENT: Bilateral mild proptosis with no lid lag

Neck: Moderate thyromegaly with a smooth gland, no nodules or bruit

CV: irregularly irregular, normal  S1/S2

Pulm: Normal respiratory effort, clear to auscultation

Skin: No diaphoresis, no skin nodules

Ext: No edema, no tremor

Psych: Normal affect and mentation

# ED COURSE

ENDO CONSULT:

Recommended to
- increase methimazole
- treat rapid rate
- sort out GI symptoms

IN ED
- IV metoprolol for rate control
- D/C home with close endocrine f/u

2 HOURS LATER:

Represents to ED still c/o DOE, diarrhea and endocrine called for question of thyroid storm.

Should this be treated as thyroid storm?

# UPTODATE SUMMARY

The diagnosis of thyroid storm is based upon the presence of severe and life-threatening symptoms (hyperpyrexia, cardiovascular dysfunction, altered mentation) in a patient with biochemical evidence of hyperthyroidism (elevation of free T4 and/or T3 and suppression of TSH). There are no universally accepted criteria or validated clinical tools for diagnosing thyroid storm. In one scoring system (table 1), a score of 45 or more is highly suggestive of thyroid storm, whereas a score below 25 makes thyroid storm unlikely. (See 'Diagnosis' above.)

Diagnostic criteria for thyroid storm*

| Thermoregulatory dysfunction | |
|---|---|
| Temperature (°F \| °C) | |
| 99 to 99.9 \| 37.2 to 37.7 | 5 |
| 100 to 100.9 \| 37.8 to 38.2 | 10 |
| 101 to 101.9 \| 38.3 to 38.8 | 15 |
| 102 to 102.9 \| 38.9 to 39.4 | 20 |
| 103 to 103.9 \| 39.4 to 39.9 | 25 |
| ≥104.0 \| >40.0 | 30 |

| Central nervous system effects | |
|---|---|
| Mild | 10 |
| Agitation | |
| Moderate | 20 |
| Delirium | |
| Psychosis | |
| Extreme lethargy | |
| Severe | 30 |
| Seizure | |
| Coma | |

| Gastrointestinal-hepatic dysfunction | |
|---|---|
| Moderate | 10 |
| Diarrhea | |
| Nausea/vomiting | |
| Abdominal pain | |
| Severe | 20 |
| Unexplained jaundice | |

| Cardiovascular dysfunction | |
|---|---|
| Tachycardia | |
| 99 to 109 | 5 |
| 110 to 119 | 10 |
| 120 to 129 | 15 |
| 130 to 139 | 20 |
| ≥140 | 25 |
| Atrial fibrillation | 10 |

| Heart failure | |
|---|---|
| Mild | 5 |
| Pedal edema | |
| Moderate | 10 |
| Bibasilar rales | |
| Severe | 15 |
| Pulmonary edema | |

| Precipitant history | |
|---|---|
| Negative | 0 |
| Positive | 10 |

**Score = 45**
**highly suggestive**
**of thyroid storm**

* A score of 45 or more is highly suggestive of thyroid storm, a score of 25 to 44 supports the diagnosis, and a score below 25 makes thyroid storm unlikely.

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The diagnosis of thyroid storm is based upon the presence of severe and life-threatening symptoms (hyperpyrexia, cardiovascular dysfunction, altered mentation) in a patient with biochemical evidence of hyperthyroidism (elevation of free T4 and/or T3 and suppression of TSH). There are no universally accepted criteria or validated clinical tools for diagnosing thyroid storm. In one scoring system (table 1), a score of 45 or more is highly suggestive of thyroid storm, whereas a score below 25 makes thyroid storm unlikely. (See 'Diagnosis' above.)

# DIAGNOSIS

*Adapted from: Burch HB, Wartofsky L. Life-threatening thyrotoxicosis. Thyroid storm. Endocrinol Metab Clin North Am 1993; 22:263.*

There are no universally accepted criteria or validated clinical tools for diagnosing thyroid storm. In 1993, Burch and Wartofsky introduced a scoring system using precise clinical criteria for the identification of thyroid storm (table 1) [12]. A score of 45 or more is highly suggestive of thyroid storm, whereas a score below 25 makes thyroid storm unlikely. A score of 25 to 44 is suggestive of impending storm. While this scoring system is likely sensitive, it is not very specific. Another diagnostic system based upon similar clinical findings (central nervous system manifestations, fever, tachycardia, congestive heart failure, gastrointestinal manifestations) has been proposed [2], but this latter system may have reduced sensitivity for making the diagnosis [6].

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| Coma | |
| **Gastrointestinal-hepatic dysfunction** | |
| Moderate | 10 |
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| Cardiovascular dysfunction | |
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| Tachycardia | |
| 99 to 109 | 5 |
| 110 to 119 | 10 |
| 120 to 129 | 15 |
| 130 to 139 | 20 |
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| Atrial fibrillation | 10 |
| **Heart failure** | |
| Mild | 5 |
| Pedal edema | |
| Moderate | 10 |
| Bibasilar rales | |
| Severe | 15 |
| Pulmonary edema | |
| **Precipitant history** | |
| Negative | 0 |
| Positive | 10 |

**Score = 45**
**highly suggestive**
**of thyroid storm**

* A score of 45 or more is highly suggestive of thyroid storm, a score of 25 to 44 supports the diagnosis, and a score below 25 makes thyroid storm unlikely.

# THYROID STORM

- 32 yom came into the ED with testicular swelling.
- HR 140+, a.fib with RVR, CHF with bad edema (including testicular).
- Tox screen  positive for meth.
- Found to have a suppressed TSH.
- Cardiology treated the a.fib. with iv amiodarone load.
- Approximately one hour later patient was acutely altered, febrile and transferred to the ICU.

Diagnostic criteria for thyroid storm*

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| Mild | 5 |
| Pedal edema | |
| Moderate | 10 |
| Bibasilar rales | |
| Severe | 15 |
| Pulmonary edema | |
| **Precipitant history** | |
| Negative | 0 |
| Positive | 10 |

**Score = 100**
**This really is highly suggestive of thyroid storm**

* A score of 45 or more is highly suggestive of thyroid storm, a score of 25 to 44 supports the diagnosis, and a score below 25 makes thyroid storm unlikely.

# UPTODATE. - Clinical Features

Hyperpyrexia to 104 to 106°F is common. Agitation, anxiety, delirium, psychosis, stupor, or coma are also common and are considered by many to be essential to the diagnosis. In one series, altered mentation was the only clinical finding that distinguished "storm" from "compensated" hyperthyroidism [6], and in another series, it was statistically associated with mortality [5]. In a retrospective study from Japan, older age >60 years, central nervous system dysfunction, requirement of mechanical ventilation, and nonuse of antithyroid drugs or beta blockers were associated with higher mortality [7]. Other symptoms may include severe nausea, vomiting, diarrhea, abdominal pain, or hepatic failure with jaundice.

# Case

33 yo man came to the ED with SOB, palpitations, nausea, vomiting and diarrhea. He was diagnosed with Graves disease 4 years earlier and admitted 4 months prior for a.fib and had not made it to any outpatient follow up but reports taking meds.

ECG: Atrial fibrillation with RVR at 140

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Labs 4 months prior

**TSH < 0.01**

**Free T4 5.79**

MEDS:

Methimazole 5 mg BID

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# HYPERTHYROIDISM IN THE HOSPITAL

- True thyroid storm is exceedingly rare.
- Treating a patient for thyroid storm (e.g. high dose steroids, SSKI etc) has a good chance of making them worse if they aren't in storm.
- When considering thyroid storm think about:
  - Is the patient clinically hyperthyroid?
  - Do they have alerted mental status?
  - Are they febrile with no other cause?

# SUMMARY

- Keep talking with the patients.  That's a lot of the fun and detective work of being a doctor.
- Always think about what type of diabetes the patient has and assess for yourself.
- SGLT2 inhibitors are amazing drugs for renal failure/CHF and they lower glucose too.
  - Be aware/on the look out for euglycemic ketoacidosis
- Thyroid storm is rare.