

APPROACH TO THE DIFFICULT DIABETIC

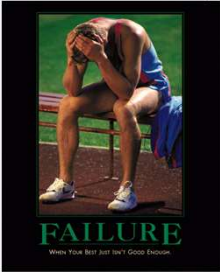
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MRCVS

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INSULIN RESISTANCE


- > **Two main reasons** for failure to respond to insulin:
- > 1. true insulin resistance
- > 2. 'pseudo-insulin resistance'



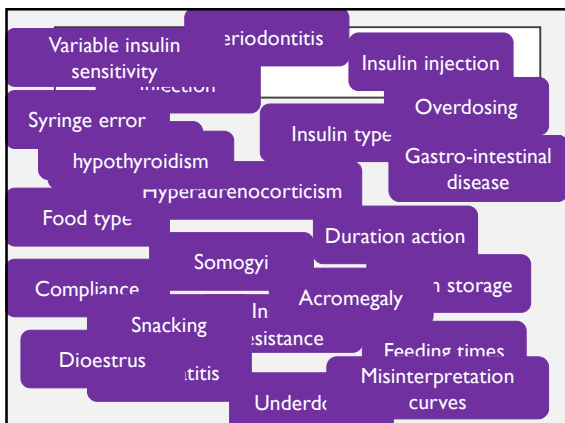
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LACK DIABETIC CONTROL

- > DM: *dynamic* disease
- > Many variables in management




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LACK DIABETIC CONTROL


- > Difficult to identify the one factor that could improve diabetic control
- > A structured stepwise approach is needed!



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QUESTION

- > Variable insulin sensitivity and insulin resistance
 - What qualifies as true insulin resistance?
 - A. >1 iu/kg/day
 - B. >1 iu/kg/injection
 - C. >1.5 iu/kg/day
 - D. >1.5 iu/kg/injection
 - E. >2.5 iu/kg/injection



Anything less:
underdosage!
(Vet-factor)

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STEPWISE SEARCH CAUSE



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CASE – HENRY – 8 YO MN DSH

- > Dx DM
- > Started Prozinc 0.5 iu/kg BID
- > 1 week later:
 - Pu/pd improved / still present
 - Weight stable – not improved
- > Dose increased by 1 iu
- > 1 week later
 - Pu/pd still present
 - Weight stable – not improved

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CASE – HENRY – 8 YO MN DSH

- > 6 weeks later:
 - Pu/pd improved / still present
 - Weight stable – not improved
- > Dose increased to 1.5 iu/kg/injection
- > Referred: history + PE + one diagnostic test

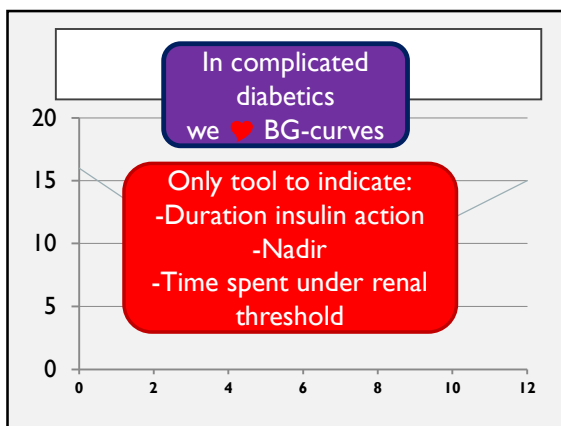
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QUESTION FOR YOU....

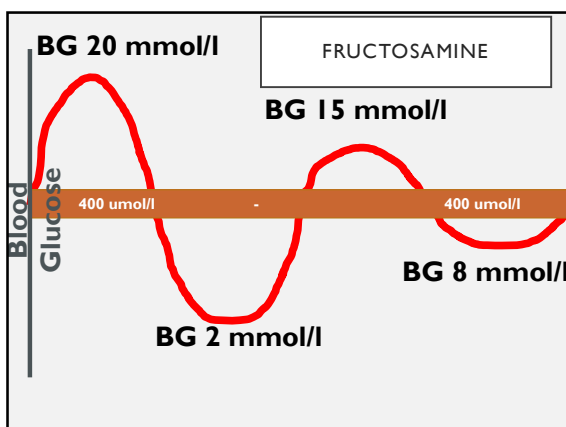
- > Which diagnostic test do you normally use first when confronted by a diabetic patient who does not respond to a seemingly appropriate insulin dose?



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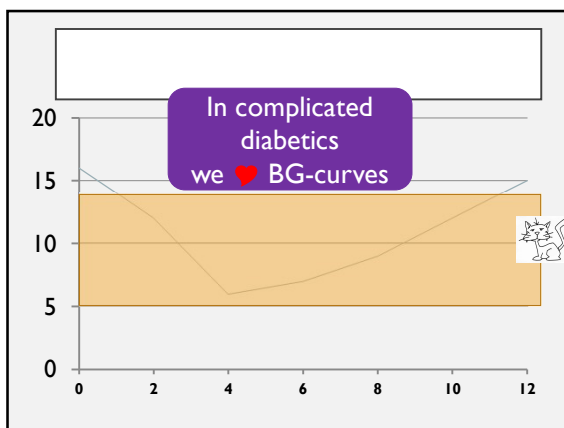
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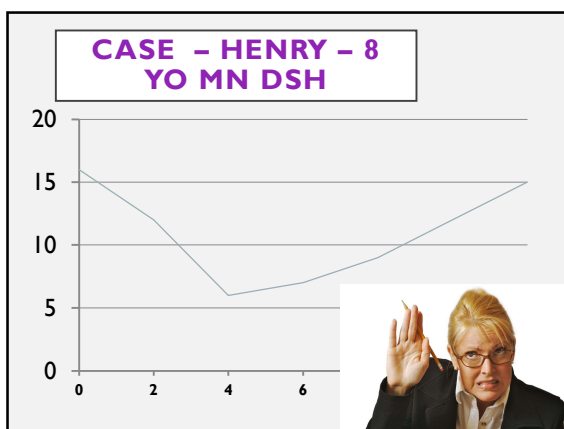
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Always combine glycaemic data
(BG-curves and fructosamine) with
clinical signs

> Discrepancy clinical picture and in-hospital curve

> **Think owner!**




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Giving extra food
without insulin
interferes greatly

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STEPWISE SEARCH CAUSE



Owner- factors

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WHAT IF...

- Same case, no history of extra feeding
- Same curve
- Fructosamine: 390 $\mu\text{mol/l}$ (good control)



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STEPWISE SEARCH CAUSE



Owner- factors

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THE COMPLICATED DIABETIC – NUMBER 1



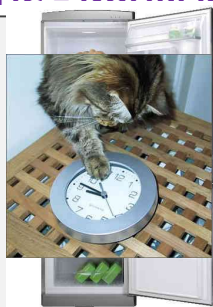
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The complicated diabetic –
number 1



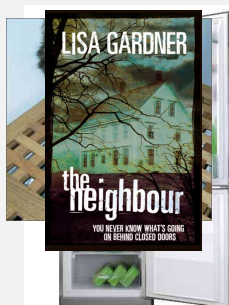
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THE COMPLICATED
DIABETIC – NUMBER 1



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THE COMPLICATED
DIABETIC – NUMBER 1



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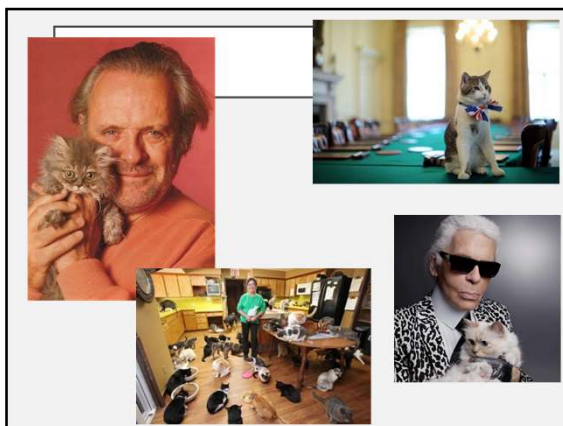
THE COMPLICATED DIABETIC – NUMBER 1

- > A **thorough** history therefore crucial
 - Prior to elaborate – expensive diagnostics
- > **Including:**
 - Demonstration injection technique + used material
 - All (!) pet caretakers need instruction
 - Also after months of Tx
- > **'Henry' Classic error:** weight loss in diabetic

→

owner feeds more

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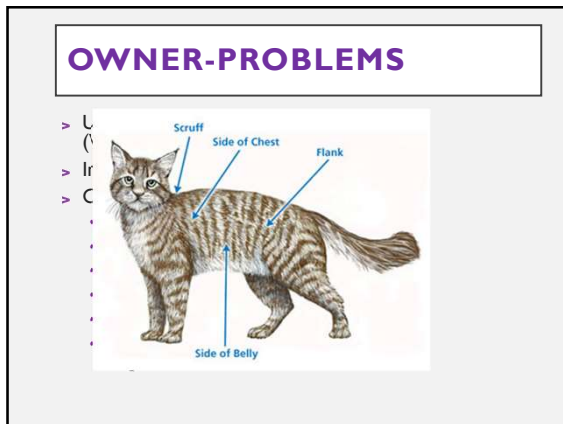


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OWNER-PROBLEMS

- > Under/over-shaking: Porcine Zinc (Caninsulin)
- > Injection site variation
- > Compatible with owner's life?
 - No: impact on long-term compliance
 - QoL-tools available
 - Review frequency
 - Review timing – 8am +6pm possible?
 - Costs problems? – HBGM – sourcing insulin
 - Creation diabetes care team: neighbours taught?

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OWNER-PROBLEM

- > Issues with snacking
- > Important for owner-pet bond




TARGET
:
Mimic
Beta-cell




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OWNER-PROBLEMS

- > **Solutions:**
 - Snacks can be allowed
 - Low carb:
 - Rice cakes
 - Vegetables
 - Cats: grazing can be a good thing
 - High carb at agreed time:
 - Addition short acting insulin: basal-bolus

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STEPWISE SEARCH CAUSE


You have now solved 50% of cases



Owner- factors

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STEPWISE SEARCH CAUSE



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**THE COMPLICATED DIABETIC
- NUMBER 2**



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CASE – BENJAMIN – 12 YO – MN DSH

Insulin dose 5 iu
caninsulin BID (5.2 kg)
Pu/Pd, ongoing weight
loss

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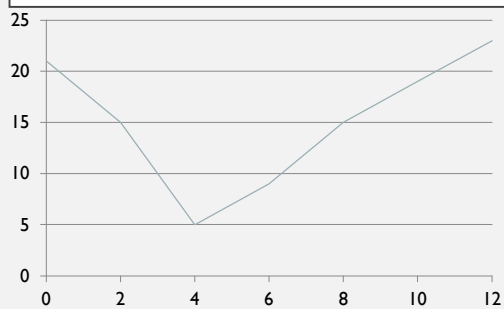
Case – Benjamin – 12 yo – MN DSH

- > Owner injects and stores correctly
- > Can we increase the insulin dose?
- > Options?

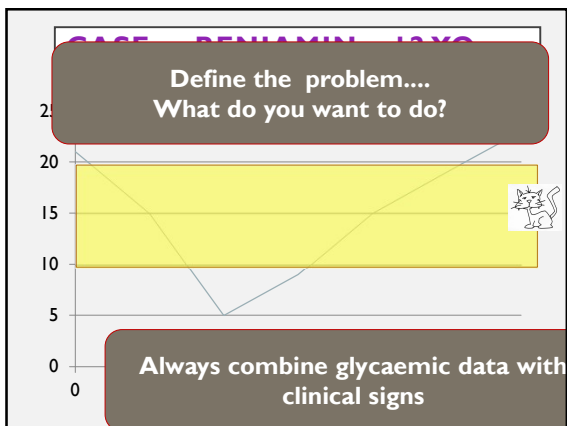
Always combine glycaemic data (BG-curves and fructosamine) with clinical signs

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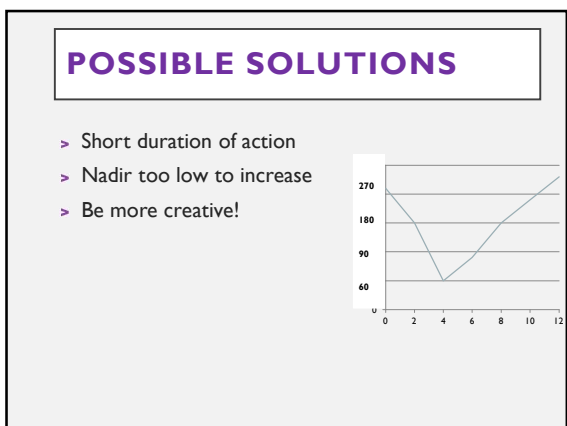
CASE – BENJAMIN – 12 YO – MN DSH



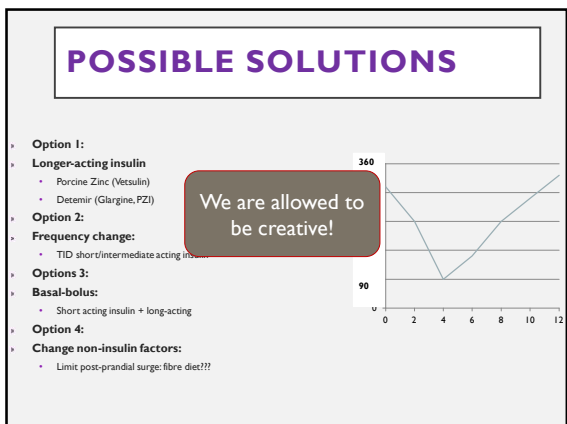
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Case – Benjamin – 12 yo – MN DSH

- > Short duration of insulin action
 - Commonly confused with insulin resistance
 - Cat>>>dog
- > Without a BG-curve: missed

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STEPWISE SEARCH CAUSE

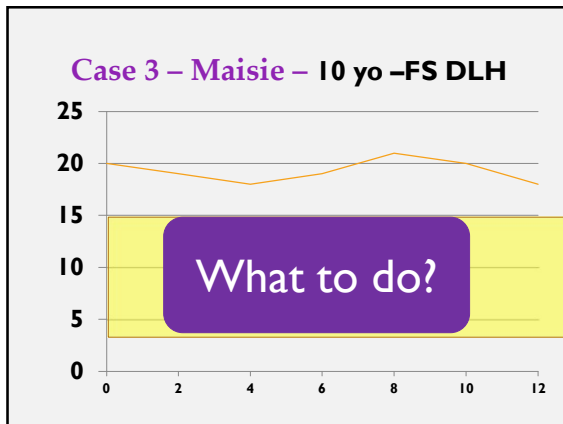


Vet-factors

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CASE – MAISIE – 10 YO –FS DLH

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Case – Maisie – 10 yo –FS DLH

> **What to do?**

- > A. Increase insulin
- > B. Run fructosamine
- > C. Leave insulin
- > D. Decrease insulin
- > E. Change insulin type
- > F. Other...

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Case – Maisie – 10 yo –FS DLH

> **Clinical image:**

- pu/pd has improved a lot since starting insulin, weight stable

> **Mismatch clinical picture and curve:**

- Curve not representative?
- Overdosis and somogyi?

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Case – Maisie – 10 yo –FS DLH

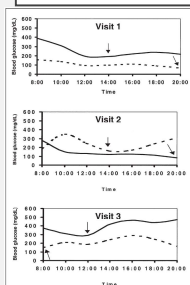
- > What to do?
- > A. Increase insulin
- > B. Run fructosamine
- > C. Leave insulin
- > D. Decrease insulin
- > E. Change insulin type
- > F. Other...

Fructosamine: 410 $\mu\text{mol/l}$

Laboratory:
 Poor control: >500
 Fair control: 450-500
 Good control: 400-450
 Excellent control: <400
 Reference interval:
 190-280 $\mu\text{mol/l}$

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CLINICAL IMAGE – CURVE MISMATCH



Evaluation of day-to-day variability of serial blood glucose concentration curves in diabetic cats

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SHOULD WE DITCH BG-CURVES THEN?

- > No!
 - Only tool for nadir and duration
- > Instead look for trends
- > Multiple curves likely to tell the truth
- > Ditch if stress hyperglycaemia in cat

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What to do?

- > A. Increase insulin
- > B. Run fructosamine
- > C. Leave insulin

Could this be Somogyi?

Fructosamine: 310 umol/l

Laboratory:

Poor control: >500

Fair control: 450-500

Good control: 400-450

Excellent control: <400

Reference interval: 190-280 umol/l

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WHAT TO DO WHEN SOMOGYI IS SUSPECTED?

- > **Three main options:**
 - 1. $\downarrow\downarrow$ insulin
 - clinical picture does not worsen
 - BG curves actually improve
 - 2. Start afresh
 - 0.25-0.5 iu/kg/injection BID
 - 3. Run longer BG-curves
 - Need appropriate frequency sampling
 - Guardian CGMS – Real Time
- > **Common clinical picture:**
 - periods of good control followed by periods of bad control


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STEPWISE SEARCH CAUSE

Vet-factors

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THE COMPLICATED DIABETIC - NUMBER 2



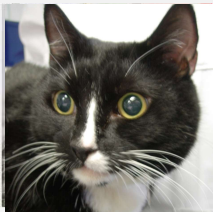
1. Insulin regimen (SID v BID)
2. Insulin type / dose / duration
3. Misinterpreting glycaemic data
4. Stress Hyperglycaemia
5. Somogyi phenomena
6. Etc. Etc.

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DOUBLE-CHECK THE DIAGNOSIS...

> type 2 DM in the cat?

- Or acromegaly induced?




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STEPWISE SEARCH CAUSE

You have now solved 75% of cases


Money spent: BG-curve +/- fructosamine



Vet-factors

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STEPWISE SEARCH CAUSE




1
2
3

Pet-factors

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**THE COMPLICATED DIABETIC
- NUMBER 3**

Pet-factors



-Truly variable insulin sensitivity or insulin resistance


-Diseases that make 'mimicking lost beta-cell' difficult

-interfere with insulin action

-interfere with post-prandial hyperglycemia

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**THE COMPLICATED DIABETIC
- NUMBER 3**



1. Infection (UTI, dental)
2. Inflammation (pancreatitis-IBD-gingivo-stomatitis)
3. Medication (steroids, megestrol acetate)
4. Hormonal disturbances (HAC, HT4, HS)
5. Other diseases (Cardiac and renal, neoplasia, obesity)

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THE COMPLICATED DIABETIC – NUMBER 3

- > Essential: good history & PE
- > Hx: inappetance / anorexia
 - DM does NOT cause this
 - Unless: DKA



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IMPORTANCE OF OTHER DISEASES

- > Once **Owner** and **Vet** Factors deemed unlikely....
- > Think **Pet** factors,
 - think concurrent disease
 - CBC
 - biochemistry profile
 - Urinalysis
 - Urine culture (12%-20% UTIs)
 - T₄
 - fPLI
 - B12: GI disease
 - (thoracic radiographs)
 - (abdo US – rads – BP – others according to Hx + PE)

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WHAT IF OUR DIABETIC NEEDS DIABETOGENIC DRUGS?



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THE COMPLICATED DIABETIC - NUMBER 3

1. Infection (UTI, dental)
2. Inflammation (pancreatitis-IBD-gingivo-stomatitis)
3. Medication
(steroids, megestrol acetate)
4. Hormonal disturbances
(HAC, HT4, HS)
5. Other diseases (Cardiac and renal, neoplasia, obesity)

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WHAT IF OUR DIABETIC NEEDS DIABETOGENIC DRUGS?



1. Reassess need: diagnosis correct –disease resolved?
2. Replace with non-diabetogenic
3. Replace with less diabetogenic

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WHAT IF OUR DIABETIC NEEDS DIABETOGENIC DRUGS?

> **Reassess need**

- IBD or Atopy diagnosis correct: food intolerance - hypersensitivity?
- IBD – IMHA - : in remission?
- Asthma - bronchitis: environmental changes – obesity

> **Replace non-diabetogenic**

- IBD or Atopy: cyclosporin
- IBD: budesonide
- Asthma – bronchitis: use of inhalers

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**WHAT IF OUR DIABETIC NEEDS
DIABETOGENIC DRUGS?**

> **Replace less-diabetogenic**

- Pred versus Dex
- Hydrocortisone versus Pred
- Topical versus systemic (eye, ear, skin)
- Use **2nd immunosuppressive** to lower dose pred
 - Azathioprine
 - Mycophenolate Mofetil
 - Cyclosporin
- **Align with BID insulin** – bid pred
- Sometimes pred-treated IBD case more stable!

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STEPWISE SEARCH CAUSE




Pet-factors

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STEPWISE SEARCH CAUSE

You have now solved 95% of cases
 Money spent: case-dependent



Pet-factors

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THE DIFFICULT DIABETIC UNRAVELLED CONCLUSIONS

- > **Stepwise approach:**
 - **Owner:** thorough history
 - **Vet:** combine glycemic data with clinical picture
 - **Pet:** hx and PE - think about common co-morbidities
- > **BG-curve** is our favourite tool in the difficult diabetic
- > **Concurrent disease** common
- > Recognition non type 2 essential

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THE DIFFICULT DIABETIC UNRAVELLED CONCLUSIONS

- > **5% cases still unexplained:**
 - 'brittle diabetic'
 - unknown reasons variable insulin sensitivity
 - **Approach:**
 - daily HBGM dictating dosing schedule
 - if HBGM not possible: steady safe dose

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THANK YOU!



1

Owner-factors

2

Vet-factors

3

Pet-factors

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