Guidelines And Protocols For Blood Glucose Control In People With Diabetes Undergoing Surgical Or Investigative Procedures Or Being Admitted With Acute Illnesses Including Acute Myocardial Infarction.

Good control of diabetes is important when having specialised investigations, surgery or during acute illness. These guidelines have been drawn up by Wolverhampton Diabetes Service to help patients and those looking after them to can achieve that goal. In addition to following these guidelines, the Wolverhampton Diabetes Service offer an outreach service that can be contacted for advice and support as required. A supporting information leaflet for patients is available on our website www.wdconline.org.uk where the full guidance is also posted.
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Checklist for Medical Teams
Discuss diabetes management with the patient as a part of the discussion about the planned procedure.

Review the diabetes control to determine any obvious pre-admission problems.

Select the appropriate diabetes management protocol from the attached guidelines.

Please contact the Diabetes Outreach Team for further help and advice if the answer to any of the questions on the following check list is ‘yes’. The specialist diabetes team will offer help, support and advice whenever needed. Wherever possible, it would be best if any such input could be made electively prior to any planned admission. Please ensure any referral is timely.

Preadmission
Does the patient have any problems with recurrent hypoglycaemia?

Is the pre-admission HbA1c >8%?

Are the home blood glucose tests prior to the procedure persistently above 7mmol/L?

Has the patient had any hospital admission with unstable diabetes during the last 4 months?

Is the patient on an insulin pump?

During admission
Any of the above

Has the patient had unstable glycaemic control at any stage before during or after the procedure?

Has the patient or the team been uncertain of any aspect of diabetes management at any stage during this admission?

Are problems with diabetes control delaying or likely to delay any aspect care or discharge?

Has a problem with diabetes been observed that requires correction post-discharge?

Does the patient wish further advice on any diabetes related issues?
How to contact the diabetes team
The specialist diabetes team is happy to be contacted to support your proposed delivery of care by bleep, telephone, fax or letter. The crucial issue is that the referrals are timely.

All consultants can be contacted directly via their secretaries or switchboard and are happy to provide out of hours advice.

There is a specially configured team, called the Diabetes Outreach Team, whose specific role it is to deal with all RWHT elective, acute and other in-patient issues. They will specifically support the care of patients being admitted for surgical and other procedures including offering preadmission evaluation and stabilisation. They should be involved in the care of all patients with diabetes admitted as an emergency if there are significant diabetes related issues.

They can be contacted in the ways listed below and are happy for these details to be given to patients.

Bleep 7461 - EAU and ESS
Bleep 7639 - Vascular Unit, Cardiac Services, Renal Unit, Maternity
Bleep 1129 - All other areas and wards

By telephone on ext 8200

Faxed referrals to ext 8200

Via switchboard asking for the Diabetes Outreach Team

Team leader (Brett Healey DSN) can be contacted on 8200, by bleep 7440 or by e-mail on brett.healey@nhs.net
How to use these guidelines
From the table select the appropriate protocol for the procedure type according to the treatment modality of the patient’s diabetes.
See the document text for details of protocols 1-6.

<table>
<thead>
<tr>
<th>Treatment modality</th>
<th>Diet</th>
<th>Tablets</th>
<th>Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short day case procedures</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Angiography or angioplasty(cardiac or otherwise)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Upper GI endoscopy</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Lower GI endoscopy</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Longer day procedures or major surgery</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>DKA and HONK</td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>
Protocol 1:
Diet treated patients

Blood glucose monitoring (BGM) should be undertaken hourly by finger prick testing.

If BGM is persistently >10 follow regime 5 (GIK or split insulin regime)

If the peri-operative glycaemic control is sub-optimal or significant hypoglycaemia issues are identified, involve the hospital diabetes outreach team
Protocol 2:
Patients treated with oral agents attending for shorter procedures

Withhold diabetes tablets on the day of the surgery or procedure.

Metformin should be withheld for 24 hours prior to and after any procedure requiring use of intravenous contrast.

Blood glucose monitoring (BGM) should be undertaken hourly by finger prick testing

If BGM is persistently >10 follow regime 5 (GIK or split insulin regime)

Restart tablet treatment when normal eating is planned to resume

If peri-operative glycaemic control is sub-optimal or significant hypoglycaemia issues are identified, involve the hospital diabetes outreach team.
Protocol 3:
Investigative procedures and short day cases in insulin treated patients

This protocol should only be used for those procedures which meet the following requirements

- Diabetes patients on insulin therapy
- Fasting for ≤4 hours
- Expected duration of the procedure ≤1 hour
- Patient permitted to resume oral feeding soon after the procedure

The procedures which are frequently undertaken and often meet the above requirements are the following:

- Upper GI endoscopy
- Angiography: cardiac or vascular
- Angioplasty: cardiac or vascular
- Day surgery

All patients should have blood glucose monitoring (BGM) checked on arrival and during the procedure – as a minimum BGM should be undertaken by finger prick testing hourly.

BGM should continue to be checked hourly at the end of the procedure if the meal is delayed.

For procedures undertaken in the morning:

- Diabetes patient to be the first on the elective list
- No breakfast or insulin before the procedure
- Breakfast and usual morning insulin dose after procedure
- Continue with usual evening dose of insulin

For procedures undertaken during the early afternoon

- Diabetes patient to be the first on the elective list
- Give 50% (½) of the usual pre-breakfast dose of pre-mixed insulin with breakfast ensuring a minimum 10 units.
- For those on an intensive insulin regime (4 injections per day) administer the usual pre-breakfast morning dose of short acting insulin.
- After the procedure, for those on twice daily pre-mixed insulin, give 1/6th of the total morning dose as Actrapid with lunch when they are ready to eat it. Thus, for patients on 60 units of Mixtard pre-breakfast administer 10 units of Actrapid with lunch.
• For those on an intensive insulin regime (4 injections per day) administer the usual lunch-time dose of short acting insulin with food after the procedure.
• Continue with the usual evening dose of insulin

Under following circumstances move to regime 5 (GIK or split insulin regime as described on page number 12)
• All hospitalised patients who are unwell
• Pre procedure BGM >15mmol/L or ketonuria
• Procedure lasts >1 hour
• Procedure is delayed
• Vomiting
• Patient unable to resume eating after the procedure due to any reason

Diet treated patients
Blood glucose monitoring prior to the procedure and if blood glucose is consistently >15 mmol/l or the urine is strongly positive for ketones (≥2+) contact the diabetes team, and consider if the procedure needs to be can be postponed

Patients treated with oral agents
Withhold diabetes tablets on the day of the surgery or procedure. Restart tablets when normal eating is planned to resume although Metformin should be withheld for 24 hours prior to and after any procedure requiring use of intravenous contrast

Blood glucose monitoring prior to the procedure and if blood glucose is consistently >15 mmol/l or the urine is strongly positive for ketones (>1+) contact the diabetes team, and consider if the procedure needs to be can be postponed

How to contract the diabetes outreach team
Bleep 7461 - EAU and ESS
Bleep 7639 - Vascular Unit, Cardiac Services, Renal Unit, Maternity
Bleep 1129 - All other areas and wards
By telephone on ext 8200
Faxed referrals to ext 8200
Via switchboard asking for the Diabetes Outreach Team
Team leader (Brett Healey DSN) can be contacted on 8200, by bleep 7440 or by e-mail on brett.healey@nhs.net
Protocol 4: Lower GI endoscopy
Precautions and advice for endoscopy team
Please review the check list to determine how the specialist diabetes team should be engaged before, during or after the procedure.

Patients will need dietary advice on the exchange of carbohydrates in order to ensure adequate bowel preparation and this is listed below.

During this preparation period patients may experience a destabilisation of control and they should have an understanding of what to do in that event.

Please ensure they have the contact numbers of the diabetes team to seek advice if needed.

The protocols cover patients on oral agents and insulin for morning or afternoon procedures.

However, the following patients will require an intravenous insulin infusion (GIK infusion – protocol 5) to cover the procedure.

• All in-patients
• Pre procedure BM >15mmol/L or ketonuria
• Procedure lasts >1 hour
• Procedure is delayed
• Vomiting
• Patient unable to resume eating after the procedure due to any reason

Contact the diabetes team if the are any concerns.

Precautions and advice for patients
Make extra efforts to maintain good control on the days leading up the procedure.

Test your blood glucose several times on the day before the test and on the day of the test.

Your insulin doses may need adjustment in the event of blood glucose level remaining persistently above 15 and below 4.

Seek help if:

Blood glucose remains >15 or <4 despite attempts to self adjust Vomiting during the period of preparation
Patients on diet alone
Such patients are unlikely to require anything other than blood glucose monitoring as above.

Patients on oral agents
Patients should omit the afternoon and evening doses of the tablets on the day before the test and the morning and afternoon doses on the day of the test.

For insulin treated patients
• Procedure in the morning

Patients with diabetes should be first on the list.

On the day before the test, replace your “normal meal” exchanges with “fluid” exchanges throughout the day.

<table>
<thead>
<tr>
<th>Patients on twice a day premixed insulin</th>
<th>AM insulin</th>
<th>PM insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day before the test</td>
<td>Reduce dose by 50%</td>
<td>Reduce dose by 50%</td>
</tr>
<tr>
<td>Day of the test</td>
<td>Omit am dose till after the procedure. Usual dose with breakfast after the procedure</td>
<td>Usual dose</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patients on four times a day insulin</th>
<th>Long acting insulin (PM)</th>
<th>Short acting insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day before the test</td>
<td>Usual dose</td>
<td>Reduce all doses by 50%</td>
</tr>
<tr>
<td>Day of the test</td>
<td>Usual dose</td>
<td>Omit am dose till after the procedure. Usual dose with breakfast after the procedure</td>
</tr>
</tbody>
</table>

• Procedure in the afternoon

Patients with diabetes should be first on the list.

On the day before the test, after 12 midday replace your “normal meal” exchanges with “fluid” exchanges and on the day of the test before the procedure.
### Patients on twice a day premixed insulin

<table>
<thead>
<tr>
<th></th>
<th>AM insulin</th>
<th>PM insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day before the test</td>
<td>Usual dose</td>
<td>Reduce dose by 50 %</td>
</tr>
<tr>
<td>Day of the test</td>
<td>Reduce dose by 50 %</td>
<td>Usual dose</td>
</tr>
</tbody>
</table>

### Patients on four times a day insulin

<table>
<thead>
<tr>
<th></th>
<th>Long acting insulin (PM)</th>
<th>Short acting insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day before the test</td>
<td>Usual dose</td>
<td>Usual first and second doses and reduce the third dose (tea-time) by 50 %</td>
</tr>
<tr>
<td>Day of the test</td>
<td>Usual dose</td>
<td>Reduce first and second doses by 50 %</td>
</tr>
</tbody>
</table>

### Dietary instructions for insulin treated patients with diabetes

Each of the following contains 10 grammes of carbohydrate and each is equivalent to either:

1 carbohydrate exchange OR 1 large slice of bread (or equivalent) OR 1 egg sized potato

- **Lucozade** 2 fluid ounces
- **Ribena** ½ fluid ounce
- **Fresh fruit juice** ¼ pint
- **Sugar or Glucose** 2 teaspoons

**Examples of exchanges**

**Breakfast:**
- 1 plate of cereal = 1 glass fruit juice
- 2 slices of wholemeal bread = 1 cup of tea and 4 teaspoons of sugar

**Mid-morning:**
- 2 plain biscuits = 1 glass of milk

**Mid-day:**
- 2 egg sized potatoes = 4 fluid ounces Lucozade
- 1 apple = 1 cup of tea and 2 teaspoons of sugar

**Mid-afternoon:**
- 1 piece of fruit = ½ fluid ounce Ribena + water

**Teatime:**
- 2 slices of wholemeal bread = 4 fluid ounces Lucozade
- 1 piece of fruit = ¼ pint fruit juice

**Bedtime:**
- 2 plain biscuits = ½ fluid ounce Ribena + water
Protocol 5
Major Surgery and Long Day-Procedures
See Flow diagram

Please review the check list to determine how the specialist diabetes team should be engaged before, during or after any admission.

These procedures will require intravenous insulin cover in all patients on insulin therapy and in many of those who are tablet treated.

The protocols for iv insulin infusion are repeated here but are to be found on the back of all RWHT blood glucose record charts.

What ever the planned time of the procedure, it is best if people with diabetes are admitted early and commenced on the appropriate regime with sufficient time given to achieve stable control.

Schematic representation of diabetes management
(Key on the next page)
1. If blood glucose monitoring (BGM) is consistently >15mmol/l or the urine is strongly positive for ketones (>1+) contact the diabetes team, and consider if surgery be can be postponed – it is preferable to liaise with the diabetes team before a decision to cancel surgery is made since it is usually possible to proceed with surgery if appropriate adjustments are made to the treatment plan.

2. The GIK regime
500ml 10% glucose + 10mmol/L KCL + 15u Actrapid
Flush tubing with 50mls before attaching to patient
Run at 100ml/hour
If BM consistently >10 after 2 hours of commencing the infusion increase Actrapid to 20u per bag and if consistently <5 decrease Actrapid to 10u per bag

3. The GIK should be replaced by split insulin regime under following circumstances
Presence of Ketonuria
If BM is persistently <4 or >10mmol/L during GIK despite changes in the dose of Actrapid
If fluid restriction is required

4. Variable rate insulin infusion
50 units Actrapid in 50ml 0.9% sodium chloride run 10ml through tubing before attaching to patient. The concentration of insulin equals 1 unit per ml of infusate.

Run with 1 litre of 5% glucose + 20mmol KCL at 100ml/hr. Insulin infusions without i.v. glucose can be dangerous resulting in hypoglycaemia.

5. Cessation of insulin is to be strongly discouraged
Insulin should be measured using U100 Insulin Syringe. Intravenous Syringes must not be used
It may be necessary to convert 5% to 10% dextrose if fluid volume needs to be lowered or if blood glucose concentrations remain persistently low.
Acute hypoglycaemia should be treated in the conventional way.

**Sliding Scale:**
According to hourly blood glucose monitoring vary the insulin infusion as in the table.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Hourly Blood Glucose mmol/L</th>
<th>&lt;4</th>
<th>4.1-7</th>
<th>7.1-10</th>
<th>10.1-12</th>
<th>12.1-15</th>
<th>15.1-20</th>
<th>&gt;20.1</th>
<th>Doctor’s sig</th>
<th>Nurse’s sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard Insulin Regime units per hour</td>
<td>*0.5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alternative Insulin Regime if blood glucose runs constantly &lt; 4 mmol/l, (only T2 Diabetes) units per hour</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Temporarily discontinue insulin in Type 2 diabetes. For Type1 diabetes; DO NOT discontinue insulin but change to higher strength glucose (see overleaf). All regular and single (bolus) doses are administered using an insulin syringe or commercial insulin pen device. Intravenous syringes must not be used.
Protocol 6: RWHT Diabetes and Cardiac Services Joint Care-pathway for the Management of Hyperglycaemia in those with Acute Myocardial Infarction

The management of hyperglycaemia in people sustaining acute myocardial infarction has a significant impact on short term and long term outcomes. The benefit of intravenous insulin has been known for many years and the DIGAMI study clearly demonstrated improvement in cardiac outcomes following the administration of a specific structured insulin regime. Importantly the sequel study, DIGAMI 2, further showed that adequate control of blood glucose in the peri-infarction period was an independent predictor of the benefit irrespective of the insulin regime.

Currently it is recommended that the pre-meal blood glucose should be maintained between 4-7 (between 4-10 at other times) during the acute period and for 3 months thereafter. Insulin is used for most patients during the first 24 hours and then the subsequent management is tailored to meet with individual patient’s requirement.

The involvement of the Diabetes Outreach Team will be central to the appropriate diabetes management in these patients. In addition to contributing towards improvement in cardiac outcomes there are several diabetes related benefits that can accrue. There is an opportunity to make a positive change to the long term diabetes control, to screen for complications and review the existing care arrangements to provide structured long term diabetes care in what is, de facto, a high risk group.

Guidelines on Management of Diabetes in Patients with Acute Myocardial Infarction

On admission and for initial 24 hours
All patients with a myocardial infarction or suspected to have had one, should have a laboratory blood glucose estimation on admission

All of those known to have diabetes, or those suspected of such with blood glucose level >11mmol/l, should have blood glucose monitoring (BGM) 4-6 times a day throughout their stay in the hospital and their HbA1c and serum fructosamine checked during their stay in the hospital

All patients who are previously known to have diabetes with blood glucose on admission ≥11mmol/L should be commenced on intravenous insulin according to the standard protocol (see appendix 1)
All patients who are previously not known to have diabetes with blood glucose on admission ≥11mmol/L should be commenced on intravenous insulin according to the standard protocol (see appendix 1).

All patients who are previously known to have diabetes with blood glucose on admission <11mmol/L who are on diet alone or diet + a sulfonylurea should continue on their current regime and do not require intravenous insulin.

All other patients who either have blood glucose <11mmol/l or who are on subcutaneous insulin or who are on multiple oral agents should have these therapies discontinued and they should be commenced on intravenous insulin according to the standard protocol (see appendix 1). In particular it is not appropriate to continue either Metformin or any of the Glitazones during an acute cardiac event.

**After 24 hours**
At this stage, the diabetes outreach team should have been involved with the care of all patients with diabetes who have sustained a myocardial infarction (during weekdays).

Patients who are on intravenous insulin during the first 24 hours should be switched over to subcutaneous twice a day pre-mixed insulin regime. Basal bolus regime should only be used in those patients who were previously on this form of insulin therapy. Recommendations for commencement of subcutaneous insulin in patients who are newly diagnosed to have diabetes are in appendix 2 (during weekends insulin treatment may need to be commenced by the cardiology team).

Patients who are on dietary therapy or on sulphonylureas during the first 24 hours should be continued on this therapy unless their control is poor and they merit conversion to insulin.

Patients should have a regular review of their glycaemic control and the dose of insulin or sulphonylureas should be adjusted if BG test is persistently above target (target 4-7 before meals). Some of the patients who are not previously known to have diabetes, may require very small dose of insulin to maintain normoglycaemia and these patients may be changed over to dietary measures or a sulphonylurea.

Patients should have a systematic review of their diabetes and they should be provided with appropriate diabetes education (appendix 2) whilst on the ward.
**Discharge planning**

Patients should be advised to continue the therapy they are on at the time of discharge i.e. dietary therapy, sulphonylurea or subcutaneous insulin, for the following 3 months.

Patients on subcutaneous insulin should be provided with necessary equipment and education required to continue insulin at home and patients should be sufficiently confident with their diabetes self care to allow safe discharge. If they are deemed to be unable to self-administer insulin appropriate district nurse arrangements should be made and a letter of authorisation to administer insulin should have been provided.

A letter with details of the diabetes management and further management plan should be formally recorded in the notes and sent to the General Practitioner of all patients. In particular there must be a clear decision as to whether it is intended to continue insulin therapy amongst those newly on insulin and what the therapeutic management plan will be in the event of insulin cessation.

The discharge letter must include the correct insulin type and dose and ensure the correct cartridges for the pen device, pens (injection devices), needles and needle disposal equipment. The letter should include a list of equipment to be provided on prescription.

It is the role of the diabetes outreach team to ensure that ongoing follow up is arranged to allow completion of diabetes education programmes and safe stabilisation of any new insulin therapy. An appointment should be made and given, prior to discharge, for a diabetes consultant outpatient clinic at 3 months.

Some of the out-of-area patients would not be able to attend for follow up at Wolverhampton and for these patients information regarding their diabetes management during hospital stay and the proposed management plan should be sent to the GP.

All remaining patients should be reviewed in the outreach clinic at 1 week, 1 month and 2 months after discharge and in the diabetes/ medical follow up clinic at the end of 3 months. The intention is to achieve good glycaemic control and pursue the intended therapeutic management plan (as above and see below) efficiently.

Some of the patients would require follow up appointments with the chiropody team, retinal screening service, renal clinic and community diabetes service.
All follow up arrangements should be made by the diabetes outreach team at the time of discharge.

**Outreach clinic follow up**
Check serum fructosamine at every visit and HbA1c at the end of 3 months

Optimise glycaemic control (Target: 4-7 before meals and 4-10 after meals, HbA1c ≤7 and serum fructosamine <300)

Ensure full patient education regarding diabetes self care.

Long term management plan needs to be constructed for an individual patient with appropriate preparation made

All patients with type 1 diabetes should continue insulin after 3 months

All patients with type 2 diabetes on insulin on admission should be continued on insulin after 3 months

All patients with type 2 diabetes on maximum or near-maximum oral therapy on admission may need to continue insulin after 3 months depending on such factors as: pre admission glycaemic control, glycaemic control target in that particular patient, patient choice, ability to self care, consideration of safety of use of Metformin or the Glitazones, likelihood of achieving good glycaemic control on return to oral agent therapy.

All patients with type 2 diabetes, on sub-maximum oral therapy with pre-MI Hba1c <7.5, should be changed back to oral agents after careful consideration of safety of use of Metformin or the Glitazones. Patients with higher HbA1c may need escalation of oral regime or continuation of insulin therapy after 3 months

Patients with type 2 diabetes who were on dietary therapy or the sulphonylurea class of oral agents prior to MI and during their hospital stay and have maintained satisfactory control during the follow up period should be advised to continue to this therapy after 3 months

In patients with a new and definite diagnosis of diabetes at the time of presentation, insulin may well need to be continued after the 3 month period, if following discharge their home blood glucose tests are persistently >7mmol/l and / or a substantial dose of insulin (>1u/kg) was required in a non-obese patient and / or if HbA1c on admission was >8.
Insulin should be discontinued after 3 months, in all the remaining patients with a newly diagnosed of diabetes / acute hyperglycaemia and appropriate tests should be planned to confirm the diagnosis of diabetes if this is not secure.

Insulin must never be discontinued in those suspected of having type-1 diabetes

**Diabetes/medical clinic follow-up**
The management plan constructed during their follow up with the outreach team should be reviewed and implemented. This may require modification in some patients after a review of serial fructosamine and HbA1c at 3 months

Plans for long term follow up needs to be made. For patients who are from outside the area, care should be handed over to their local diabetes team with a letter to sent to the diabetes service

**How to contact the diabetes outreach team**

Bleep 7461 - EAU and ESS
Bleep 7639 - Vascular Unit, Cardiac Services, Renal Unit, Maternity
Bleep 1129 - All other areas and wards

By telephone on ext 8200

Faxed referrals to ext 8200

Via switchboard asking for the Diabetes Outreach Team

Team leader (Brett Healey DSN) can be contacted on 8200, by bleep 7440 or by e-mail on brett.healey@nhs.net
All patients with acute MI

**On admission and for 24 hrs**

- **Blood Glucose (BG)**
  - **DM**
  - **BG ≥ 11, on any DM treatment**
  - **BG < 11, on insulin or Met or TZD or vomiting**
  - **BG < 11, Diet or on SU only**

- **Standard IV insulin sliding scale for 24 h**

**During in-patient stay**

- Convert to SC insulin after 24 hours
- Monitor BM and adjust dose (aim 4-7) and regime
- HbA1c, Fructosamine
- Systematic diabetes review and education

**Discharge process**

- For out of area patients who can not attend, send information to GP regarding diabetes management during hospital stay and the proposed long term management plan
- If on insulin continue for 3/12
- Education, equipment and communication to GP
- Set forward plan for long term diabetes management: (D/OHA/Insulin) or review of diagnosis

**Follow up**

- Most out of area patients would now be discharged
- Outreach review 1 week, 1 and 2 months
  - Glycaemic control
  - Education
  - Systematic review + HbA1c, Fructosamine for 3/12 OPA
  - Consolidate long term management plan (D/OHA/Insulin)
- OPA 3/12 (Dr)
  - Review diagnosis of DM in “new patients”
  - Management plan (D/OHA/Insulin) if DM
  - Systematic review if DM

**Key:** * appendix 1 **appendix 2  D: Diet  MET: Metformin  TZD: Thiazolidinedione  SU: Sulphonylurea

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Appendix 1

The split insulin glucose regime

50 units Actrapid in 50ml 0.9% sodium chloride run 10ml through tubing before attaching to patient. The concentration of insulin equals 1 unit per ml of infusate.

Run with 1 litre of 5% glucose + 20mmol KCL at 100ml/hr. Insulin infusions without i.v. glucose can be dangerous resulting in hypoglycaemia.

Cessation of insulin is to be strongly discouraged

It may be necessary to convert 5% to 10% dextrose if fluid volume needs to be lowered or if blood glucose concentrations remain persistently low.

Acute hypoglycaemia should be treated in the conventional way.

**Sliding Scale:**
According to hourly blood glucose monitoring vary the insulin

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Hourly Blood Glucose mmol/L</th>
<th>&lt;4</th>
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<th>10.1-12</th>
<th>12.1-15</th>
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<td>6</td>
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<td>Alternative Insulin Regime if blood glucose runs constantly &lt; 4 mmol/L (only T2 Diabetes) units per hour</td>
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*Temporarily discontinue insulin in Type 2 diabetes. For Type 1 diabetes, DO NOT discontinue insulin but change to higher strength glucose (see overleaf).

All regular and single (bolus) doses are administered using an insulin syringe or commercial insulin pen device. Intravenous syringes must not be used.
Appendix 2

Insulin start up recommendations
These recommendations are for patients who have not been on insulin prior to hospital admission and need to be commenced on subcutaneous insulin after the initial 24 hours.

Patients who are likely to be able to self inject insulin after some education:

Start Humalog mix 25 via Kwikpen following clinical practice GNCP 23. Patient should self inject from the outset.

Large adults with BMI above 30 kg/m² - 20 units at breakfast 10 units at evening meal

Medium adults with BMI 22-30 kg/m² - 16 units at breakfast 8 units at evening meal

Slim adults with BMI below 22 kg/m² - 12 units at breakfast 6 units at evening meal

There should be a 30 minute 'overlap' from starting S/C insulin to stopping I/V insulin.

Pen needles should be ordered on TTO

For patients who are likely to be dependant on district nurses

Humalog mix 25 should be dispensed in a 10ml vial. A supply of insulin syringes should be sent with the patient for the district nurse.

For Humulin M3 there should be a 1 hour overlap.
Protocol 7
Management of Diabetic Ketoacidosis and HONK

The Royal Wolverhampton Hospitals NHS Trust

Inform the Diabetes team as soon as possible

Date: ........................................................................................................................................
Time of admission: ...........................................................................................................

The Management of Adult Diabetic Ketoacidosis (DKA) and Hyperosmolar Non-Ketotic Coma (HNKC)

**DKA:** is a life threatening condition requiring prompt diagnosis and treatment, and should be excluded in all people who are hyperglycaemic, dehydrated, drowsy or vomiting or presenting with abdominal pain, myocardial infarction or stroke. All patients should be seen as early as possible by the diabetes team.

**DIAGNOSIS:** Blood glucose > 15mmol/l, pH < 7.25, Bicarbonate < 17mmol/l, urine ketones +++. Blood gas analysis mandatory. Rarely DKA presents in acidic ketostix -ve patients or patient may have Lactic Acidosis. In non-acidotic patients consider HNKC (osmolality 2xNa + 2xK + Glucose + Urea > 320). Patients who do not meet these criteria but are unwell and in pre-DKA may need to follow the protocol but only with specialist advice from the diabetes team.

**BASELINE INVESTIGATIONS**

<table>
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<tr>
<th>Procedure</th>
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<tbody>
<tr>
<td>Lab blood glucose</td>
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<td>U &amp; E</td>
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<td>Blood gases</td>
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<td>Urine / ketones</td>
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<td>Blood cultures</td>
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</table>

Repeat blood gases, U&E, lab blood glucose at 2 hours and then every 4 hours until pH normal. U&Es with Bicarbonate if previous blood gases show improving acidosis. U&Es every 2 hours if K+ not in normal range. Repeat ECG at 24 hours.

**MANAGEMENT:** Initial management of DKA / HNKC is identical. Management must be started in the admitting area without delay and the medical registrar contacted promptly. Always arrange admission to Diabetes speciality ward (D18) or if the patient is in a coma - the patient should be managed in the Critical care Unit.

**DO NOT USE SINGLE BAG COMBINED GLUCOSE / INSULIN / K+ INFUSIONS IN DKA**

**KEEP NIL BY MOUTH UNTIL TRANSFER TO S/C INSULIN**
INSULIN:

a) Stat 10 Units IM Actrapid followed promptly by
b) Insulin infusion 6 ml/hr (50 Units Actrapid in 50ml 0.9% Sodium Chloride - discard 10ml through tubing before attaching to patient because insulin binds to plastic).

If no fall in blood glucose at 4 hours, increase to 10 ml/hr.

Only when blood glucose < 10mmol/l should IV insulin rate be reduced to 3 ml/hr (see recovery phase management). Ward nurses should check pump / connections every hour and document remaining volume.

FLUIDS:

KEEP PATIENT NIL BY MOUTH

1 litre in ½ hour
1 litre in 1 hour
1 litre in 2 hours x 2
1 litre in 4 hours x 2
1 litre in 6 hours repeat

Start with IV 0.9% Sodium Chloride. When blood glucose ≤ 10mmol/l change to 5% glucose at same rates. Do not change back to 0.9% Sodium Chloride if BMs rise. Use 10% glucose if BM falls below 5 mmol/l. Consider modifying insulin infusion rate if no improvement.

In hypovolaemic patients who remain hypotensive (systolic < 100) after 2 litres of fluid consider plasma expansion with 1 or 2 additional units 4.5% human albumin (PPF) or gelofusine. Great caution in the elderly and in patients with cardiac / renal disease. Reduce rate (4 litres in 24 hours) and consider CVP monitoring.

Potassium (K+)

No K+ in the first litre. Subsequently add as follows:– according to repeat U + E’s.

<table>
<thead>
<tr>
<th>Serum K+</th>
<th>KCL (mmol/l)</th>
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<tbody>
<tr>
<td>&lt;3.5</td>
<td>40</td>
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<td>3.5 - 5.5</td>
<td>20</td>
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<tr>
<td>&gt;5.5</td>
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</table>

per litre bag of fluid

MONITORING: ECG monitor, hourly obs, close fluid balance, urinary catheter if no urine passed in 4 hours. CVP in elderly / cardiac patients. Repeat as above.

ADDITIONAL MANAGEMENT: Avoid bicarbonate unless severe life-threatening acidosis is not responding by 2 hours of above management (pH < 7.0, 200ml 1.26% NaHCO3 + 20mmol/KCL over 30 mins) but should be discussed with Consultant Physician first. Avoid NG tube unless patient comatose and vomiting, then insert with the patient in left lateral position and head down. Aspirate hourly. In HNKC avoid 0.45% sodium chloride unless sodium remains > 160mmol/l 2 hours after onset of therapy. No more than 2 litres. Antibiotics if obvious infection - patients often hypothermic, pyrexia masked, WBC is usually high.

RECOVERY PHASE: When blood glucose ≤ 10mmol/l, reduce insulin infusion and change to 5% glucose (see above). Follow hourly variable insulin infusion as below, do not stop insulin and do not reduce rate below 3 ml/hr. If blood glucose drops <5mmol/l use 10% glucose to maintain blood glucose 5-10. Do not stop glucose infusion if glucose rises >10mmol/l, but increase insulin as below. Do not vary this insulin regime without diabetes specialist advice.

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<thead>
<tr>
<th>Hourly BG Monitoring</th>
<th>Insulin infusion ml/hr</th>
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<td>0 - 5</td>
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<td>5 - 10</td>
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<td>10.1 - 20</td>
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<td>15.1 - 20</td>
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<td>20 +</td>
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10% Glucose

Continue 5% Glucose

Aim to convert to s/c insulin at breakfast or lunch, never late in the day or night time.

ORAL INTAKE AND SC INSULIN: Commence oral fluids when pH normal and patient alert and not vomiting. Transfer to diet and s/c insulin after 24 - 36 hours. In patients previously on insulin increase their usual daily dose by a third. Patients new to insulin will need 0.5 - 1u/kg daily in divided doses. Remember to continue the IV insulin / glucose infusion for 1 hour after the first s/c dose.

REFER: It is Mandatory to inform Diabetes team ASAP - seek out of hours advice from a Diabetes Consultant as required. Management plan should be made with the diabetes team. Follow up must be arranged with the Diabetes Team.

REFERENCES:
# Hourly Observation

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<th>Clock Time</th>
<th>Hours from start</th>
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**Date:**     /     /  
**Name:** ........................................................ 
**Unit No.:** ................................................. 

**Target Zone:** 

**Baseline Values:** 

| Blood glucose (0 - 40 mmol) | 
| Urine volume | 
| Urine - ketones | 
| Urine - glucose | 
| Blood - pH | 
| Serum - KOH | 
| Remaining volume | 
| INNUL IN U/H |

**Date:**     /     /  
**Name:** ........................................................ 
**Unit No.:** ................................................. 

**Target Zone:** 

**Baseline Values:** 

| Blood glucose (0 - 40 mmol) | 
| Urine volume | 
| Urine - ketones | 
| Urine - glucose | 
| Blood - pH | 
| Serum - KOH | 
| Remaining volume | 
| INNUL IN U/H |
| Hours from start: | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
|------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Clock Time:      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| BLOOD GLUCOSE   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| (0 - 40 mmol)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| ABG, U & E glucose due |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| SERUM K+        |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| BLOOD - pH      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| SERUM - HCO3    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| URINE - GLUCOSE |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| URINE KETONES   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| URINE VOLUME    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| PULSE           |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| B.P             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| I.V. Fluids     |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

*Department of Medical Illustration Royal Wolverhampton Hospitals NHS Trust

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2ND PART - USE INSIDE FIRST  Date: / / Name: ...........................................  Unit No: ...........................................

Evento

CLOCK TIME:

TARGET ZONE

INSULIN u/hr

Remaining volume

ABG, U & E glucose due

SERUM K+

BLOOD - pH

SERUM - HCO3

URINE - GLUCOSE

URINE KETONES

URINE VOLUME

PULSE

B.P

I.V. Fluids

Remaining volume

0          5         10         15         20          30         40

Target Zone

Clock Time

0  5  10  15  20  30

HOURLY OBSERVATION

BLOOD GLUCOSE (0 - 40 mmol)
Management of diabetes during acute medical illness

Patients with diabetes are at a higher risk of hospital admission for acute medical illnesses and common examples include infective conditions, acute myocardial infection and acute stroke. Effective management of diabetes during the period of acute illness contributes to a successful clinical outcome and may lead to an early discharge from the hospital with reduction in rate of readmission.

Management of diabetes in patients with acute illness provides several challenges:

Hyperglycaemia: Blood glucose level can rise significantly in presence of infections or when steroids are used. Appropriate changes need to be made in the doses of anti-diabetes medications and quite often oral agents need to be changed to insulin therapy. Patients who are eating appropriately, are not vomiting and do not have ketonuria do not need intravenous insulin.

Hyperglycaemia with ketonuria: During a period of severe stress of an acute illness or surgery, patients with poor diabetes control can develop a rapid increase in blood glucose level and ketonuria. This requires intensive management including intravenous insulin (see intravenous sliding scale insulin on page 15), intravenous fluids and frequent blood glucose testing.

Vomiting: Intravenous insulin therapy is required in those patients who are vomiting due to any reason, and are unable to follow their normal eating pattern. Usual dose of insulin is only started after regular eating is resumed.

Hypoglycaemia: Patients with acute medical illness often develop hypoglycaemia due to poor oral intake and under these circumstances blood glucose should be carefully monitored. After using standard hypoglycaemia management, the dose of anti-diabetic medications may need to be decreased, and often such treatment requires discontinuation. Patients require close observation, as following resumption of normal eating the dose need to be appropriately readjusted to maintain satisfactory blood glucose control.

Changes in self-management: As a result of an acute medical illness there may be a change in various aspects of self management of diabetes. As a result, arrangements may be required for District Nurse support at the time of discharge. Early contact with the Diabetes Outreach Team is helpful in making appropriate arrangements to prevent delay in discharge.
Changes in follow-up arrangements: Patients being discharged from acute medical wards may need a review of their diabetes follow-up arrangements. These changes can be made with the help of the Diabetes Outreach team.

Frequency of BG testing: During the stay in the hospital most patients need blood glucose testing at least four times a day and those on intravenous insulin may require hourly testing.

Involvement of Outreach: The Diabetes Outreach Team works in all areas of the hospital assisting in diabetes management for patients who have been admitted to the hospital for any indication. Their assistance should be sought in patients who have any of the above-mentioned needs and in patients with serious hyper- or hypoglycaemia and/or ketonuria, an urgent review should be requested.

They can be contacted on the following numbers:

Bleep 7461 - EAU and ESS
Bleep 7639 - Vascular Unit, Cardiac Services, Renal Unit, Maternity
Bleep 1129 - All other areas and wards

By telephone on ext 8200

Faxed referrals to ext 8200

Via switchboard asking for the Diabetes Outreach Team

Team leader (Brett Healey DSN) can be contacted on 8200, by bleep 7440 or by e-mail on brett.healey@nhs.net
Patient Information

Diabetes control at the time of surgery or other acute medical illness
Good control of blood glucose before, during and after surgical procedures or events such as heart attack, stroke and other acute medical illnesses is important and helps in the recovery from these events. It is important for people with diabetes to be aware of the management plan for diabetes before, during and after any planned procedure. They are encouraged to seek information and advice on any aspects that are unclear to them regarding the care planned for their diabetes. Whenever possible, this should be done well before a planned procedure.

How do I prepare for the admission for a planned procedure?
Your diabetes management should be discussed with you as part of the discussion and consent process for any operation or procedure. If there are particular problems with your diabetes, your surgical/medical team can make arrangements with the Diabetes Outreach Team to offer further advice. You can also directly contact the Diabetes Outreach Team a few weeks before the operation, if your blood glucose control is not satisfactory or if you have other concerns about diabetes care. This would allow you sufficient time to adjust to your medication and achieve better control before the event.

Who would support my diabetes care whilst I am in the hospital?
You may be admitted to the hospital for reasons related or unrelated to your diabetes. The ward and the department where you are admitted would depend upon the reason for hospital admission.

The Diabetes Outreach Team would be available to support you and the ward staff irrespective of which ward you are admitted to. The Diabetes Outreach Team is a team of doctors, nurses, dieticians and chiropodists who support diabetes care for patients who are admitted to the hospital. They may routinely visit you during your hospital stay and make assessment of diabetes care or they may be requested to visit the ward under following circumstances:
Urgent assessment of any patient who has or is heading towards any serious unstable diabetes state (progressively rising blood glucose and heavy ketonuria)

Any patient who is not in the above category but has a poor control of their diabetes, the outreach team would be contacted by the ward staff. Early contact with the Diabetes Outreach Team would help avoid postponement of surgery and prevent any delay in discharge following surgery.

When diabetes care requires further attention following discharge and this may not be dealt with safely by the patient alone or by their general practitioner.

In addition, you can request the ward staff to contact the outreach team if you have any questions or concerns about the diabetes care that you are receiving.

**What if there is an emergency admission?**
For patients who have to undergo an emergency surgical procedure or are hospitalised for any acute medical condition, the diabetes team has prepared standard protocols for acute management of diabetes and these are available on all the wards. Short guidelines are printed on the back of every hospital blood glucose record sheet. Guidelines can also be found on our website [http://www.wdconline.org.uk](http://www.wdconline.org.uk).

The Diabetes Outreach Team would be involved in the care as described above

**What will happen to the diabetes treatment after I am admitted?**
Diabetes treatment may or may not need to be altered and this will depend on the diabetes background and the complexity of medical issues involved

People on diet treatment alone will be little affected.

Otherwise what will happen depends very much on what is planned. There are guidelines for most circumstances.

The regular dose of tablets or insulin may be modified or withheld on the day of the surgery and in some cases for a period of time before and/or after the surgery.
In many situations, good diabetes control will need insulin treatment via a drip into a vein and this is carefully controlled using a pump. Such intravenous insulin drips are usually given along with glucose to be sure that low blood sugars are avoided and an adequate amount of fluid is given. The blood glucose is monitored frequently by finger prick testing and maintained in a target range of between 4 and 10mmol/l.

After resumption of regular food intake, the usual treatment (tablet or insulin) will be restarted as before. However, on occasion, changes may need to be made in the light of circumstances. The treatment dose may be altered and in certain instances diabetes treatment may be changed if that is needed, for example from tablet treatment to insulin.

What would happen to the other aspects of diabetes care?
Standard 8 of the National Service Framework for diabetes states that “all children, young people and adults with diabetes admitted to hospital for whatever reason will receive effective care of their diabetes and wherever possible they will continue to be involved in decisions concerning their diabetes care”. Where ever possible patients should feel in control of their diabetes and should be happy with the timing of their meals, snacks, blood testing and insulin injections. Keeping this in mind the following plan would usually be followed:

**Blood Glucose Testing:** Most patients with diabetes in the hospital need to check blood glucose four times a day. The nursing staff would routinely do the test although you can undertake the test yourselves. The staff may need to check your technique and they may need to do additional tests.

**Injections:** Inform the ward team of your usual insulin treatment and bring your own supplies with you. If they are removed for safe keeping, make sure that they are returned to you at the end of your stay. The nursing staff on the ward would administer insulin. However if you have been on insulin and/or you have been successfully trained in insulin administration during your current hospital stay, you can administer insulin yourself. Under these circumstances the nurses may check your injection technique. Adjustment of the insulin dose whilst on the ward should only be undertaken in conjunction with the nursing and medical staff.

**Meals:** Whilst in the hospital you would receive the diet prepared for people with diabetes. If you have any other medical condition with specific diet requirements you should inform the ward staff.
You should continue to receive breakfast, lunch and evening meal at a fixed time, with snacks in between meals and at bedtime. Expect to be able to use your own emergency supplies of biscuits, sugary drinks and fruit or glucose tablets to treat hypoglycaemia if you are on insulin or sulphonylurea tablets — you can bring these supplies with you. If you do experience a hypo, inform your nurse or doctor. If you are unsure about the diet you can request to speak to a dietician

**Communication:** If your first language is not English, hospital staff would bring in an interpreter and involve family members and friends where appropriate.

**What would happen to diabetes care after discharge from the hospital?**
At the time of discharge, you should be clear about the plan for diabetes. You would need to know what to watch out for including high or low blood sugar readings, the doses of any treatments especially if they have been changed and the use of any newly provided equipment such as insulin pens and blood testing machines and strips. You would be provided with a discharge summary that gives a full list of medications and the follow up arrangements. On returning home, the diabetes treatment may require further modification. You should monitor blood glucose levels more frequently and adjust medication as needed, seeking advice and assistance whenever required. You should be clear about whom to contact if there are any concerns about diabetes – this will usually be your general practice team or the Diabetes Outreach Team

**Seeking advice and summary of what care to expect**
The medical team who are planning your surgery or procedure should be your first port of call. They need to know about your concerns and they can give you a plan as to what will happen with your diabetes care and treatment. Your general practice team can also help. If you remain concerned or if you believe your diabetes is not safely controlled you are welcome to contact the Diabetes Outreach Team who will try and help. It may be that you will be referred to them any way as part of the preparation for your operation, procedure or test. You can also look at the web site which carries all of the protocols and guidelines form the care of diabetes at this time. [http://www.wdconline.org.uk](http://www.wdconline.org.uk)
You should expect that your diabetes will be considered where an operation or a test is being planned; that you will get specific advice about what to do about your diabetes treatment in the run up to the admission; that if there are specific problems you will be seen by the Diabetes Outreach Team and given further advice and support; that there will be a clear protocol of care for your diabetes during the procedure; that throughout your stay your diabetes will be monitored for safe control; that your meals, treatment and blood testing will be given at the appropriate time and that you will feel in control of your diabetes and would be involved with any decision making and that any change in treatment would be fully explained to you.

Contact details
If you feel uncertain or lack confidence about your diabetes control as you approach any admission for an operation, procedure or test please feel free to contact the Diabetes Outreach Team on the numbers below. When you contact us we will need to know the expected date of admission what it is that you are having done, your diabetes treatment, your current blood testing results and if contacting after discharge some information about your hospital admission. Please explain to us clearly what exactly it is that you have concerns about and be sure that you get satisfactory answers, help, advice and support.

Diabetes Outreach Team
Bleep 7461 - EAU and ESS
Bleep 7639 - Vascular Unit, Cardiac Services, Renal Unit, Maternity
Bleep 1129 - All other areas and wards

By telephone on ext 8200

Faxed referrals to ext 8200

Via switchboard asking for the Diabetes Outreach Team

Team leader (Brett Healey DSN) can be contacted on 8200, by bleep 7440 or by e-mail on brett.healey@nhs.net