West Hertfordshire Teaching Hospitals NHS Trust

A guide to...

Adjusting Insulin Injection Doses

Patient information

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One of the aims of your/ your child's diabetes care is to achieve target blood glucose levels, target HbA1c level and target time in range (TIR). Evidence shows that this can reduce the risk of developing complications, such as nerve damage, eye disease, kidney disease and heart disease.

Target blood glucose levels are:

- between 4 and 7mmol/L on waking and before meals
  and
- between 5 and 9mmol/L two hours after meals

HbA1c target:

- below 48mmol/mol (or individualised lowest achievable HbA1c target agreed with you/ your child and the diabetes team)

(The HbA1c test indicates your/ your child's blood glucose levels for the previous two to three months. The HbA1c measures the amount of glucose that is being carried by the red blood cells in the body.)

Target time in range (TIR) for those wearing a continuous glucose sensor:

- glucose levels of 4-10mmol/L for 70% of the time

You/ your child is advised to wear a continuous glucose sensor or perform at least five blood glucose tests per day.

This information leaflet advises how to adjust insulin doses, with a view to having as many of your/ your child's glucose levels in the target range as often as possible. This can be challenging for different reasons. The diabetes team will support you to adjust insulin doses, until you feel confident to make adjustments to insulin doses independently.

Before you adjust doses:

- **It is a requirement to review a minimum of three days of blood glucose levels to safely adjust doses**
- **If both hypoglycaemia and hyperglycaemia episodes occur, adjust for hypoglycaemia first**
- **Focus on one part of the day**
- **Monitor impact of an insulin adjustment for three days to observe any emerging patterns**

Hypoglycaemia (low blood glucose levels, less than 4mmol/L)

If you/ your child is having three or more episodes of unexplained hypoglycaemia per week or more than 3% on sensor data reports, insulin doses may need adjustment.

Consider possible causes of hypoglycaemia

- Taking too much insulin
- Taking insulin at the wrong time
- Not eating enough carbohydrate food, for example missing carbohydrate from a meal or snack
- Physical activity and exercise
- Hot or cold temperatures
- Stress or illness
- Alcohol

When does hypoglycaemia occur?

Before breakfast	• Decrease pre-bed long-acting insulin or decrease pre-dinner rapid-acting insulin if long-acting is taken in the morning. • Measure blood glucose level during the night (at 03:00 hrs) to ensure that this change does not result in night-time hyperglycaemia. • Change one insulin at a time.
Two hours after breakfast	• Decrease pre-breakfast rapid-acting insulin.
Before lunch	• Decrease pre-breakfast long-acting insulin or decrease dose of pre-breakfast rapid-acting insulin. • Change one insulin at a time.
Two hours after lunch	• Decrease pre-lunch rapid-acting insulin.
Before evening meal	• Decrease pre-breakfast long-acting insulin or decrease dose of pre-lunch rapid-acting insulin. • Change one insulin at a time.
Two hours after evening meal	• Decrease pre-evening meal rapid-acting insulin.
03:00 hrs	• Decrease pre-bed long-acting insulin or decrease pre-dinner rapid-acting insulin if long-acting is taken in the morning. • Measure blood glucose level during the night (at 03:00 hrs) to ensure that this change does not result in night-time hyperglycaemia. • Change one insulin at a time.

How much to adjust fixed doses of Rapid-Acting Insulin or Long-Acting Insulin doses by?

Current insulin dose	**Decrease by**
Less than 5 units	**0.5 units**
Between 5 and 10 units	**1 unit**
Between 10.5 and 20 units	**2 units**
More than 20 units	**3 units**

If you are carbohydrate counting, persistent hypoglycaemia may require adjustment in ratios for carbohydrate (insulin to carbohydrate ratio). See table below for examples.

Adjust doses by approximately 10%:

How to adjust the insulin/carbohydrate ratio		
1/20g	➔	1/22g
1/18g	➔	1/20g
1/16g	➔	1/18g
1/14g	➔	1/16g
1/12g	➔	1/14g
1/10g	➔	1/12g
1/9g	➔	1/10g
1/8g	➔	1/9g
1/7g	➔	1/8g

Monitor impact of an insulin adjustment for three days to observe any emerging patterns.

Hyperglycaemia (high blood glucose levels)

Check for potential reasons for high blood glucose levels:

- Is the insulin injection device functioning correctly and are insulin pens or cartridges damaged?
- Has the insulin been stored at correct temperature? Is the insulin in date?
- Is rapid-acting insulin given at the correct time before meals? Is long-acting insulin given at the same time each day?
- Is the correct insulin dose given? Is injection supervised/ supported by parent/ carer? Are insulin doses missed?
- Is hypoglycaemia treated correctly?
- Have you any concerns with injection technique?
- Are the injection sites healthy? Lumpy injection sites (lipohypertrophy)?
- Does the child/ young person have an illness/ infection?
- Is the child/ young person less active than usual?
- Is the child/ young person experiencing stress?
- Is the child/ young person experiencing hormonal changes?
- Is the child/ young person going through a period of growth?
- Is the child/ young person taking other medications?

Remember, if you/your child has two blood glucose levels of 14mmol/L or more measure blood ketones. If ketones are 0.6mmol/L or more follow sick day rules.

When does hyperglycaemia occur?

Before breakfast	• Increase pre-bed long-acting insulin or increase pre-dinner rapid-acting insulin if pre-bed levels are greater than target or if long-acting insulin is taken in the morning. • Measure blood glucose level during the night (at 03:00 hrs) to ensure that this change does not result in night-time hypoglycaemia. • Change one insulin at a time.
Two hours after breakfast	• Increase pre-breakfast rapid-acting insulin and consider giving insulin 30 minutes before breakfast.
Before lunch	• Increase pre-breakfast long-acting insulin if post prandial glucose levels are not at target or increase dose of pre-breakfast rapid-acting insulin. • Change one insulin at a time.
Two hours after lunch	• Increase pre-lunch rapid-acting insulin.
Before evening meal	• Increase pre-breakfast long-acting insulin if post prandial glucose levels are not at target or increase dose of pre-lunch rapid-acting insulin. • Change one insulin at a time.
Two hours after evening meal	• Increase pre-evening meal rapid-acting insulin.
03:00 hrs	• Increase pre-bed long-acting insulin or increase pre-dinner rapid-acting insulin if the pre-bed glucose levels are not at target or (if long-acting is taken in the morning). • Measure blood glucose level during the night (at 03:00 hrs) to ensure that this change does not result in night-time hypoglycaemia. • Change one insulin at a time.

How much to adjust fixed doses of Rapid-Acting Insulin or Long-Acting Insulin doses by?

Current insulin dose	**Increase by**
Less than 5 units	**0.5 units**
Between 5 and 10 units	**1 unit**
Between 10.5 and 20 units	**2 units**
More than 20 units	**3 units**

If you are carbohydrate counting, persistent elevations of BG may require adjustment in ratios for carbohydrate (insulin to carb ratio). See table below for examples.

How much to adjust insulin for carbohydrates: approximate 10% adjustments:

How to adjust the insulin/carbohydrate ratio		
1/20g	➔	1/18g
1/18g	➔	1/16g
1/16g	➔	1/14g
1/14g	➔	1/12g
1/12g	➔	1/10g
1/10g	➔	1/8g
1/8g	➔	1/7g
1/7g	➔	1/6g
1/6g	➔	1/5g

Monitor impact of an insulin adjustment for three days to observe any emerging patterns.