Insulin pumps (CSII): Using Modern technology to communicate with families of children with type 1 diabetes

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Starship children’s Health
History of Paediatric diabetes team and pumping

- First pumps started 2003 by Jean-Ann Holt who trained with Perth team

- 20-27 pump starts per year, currently 125 pumpers out of 450 children and teens 1-16 years of age

- Initially children were admitted for 2-3 days in hospital but now use continuous glucose monitoring (CGM) for 1-2 weeks and are admitted as Paediatric diabetes daystay patients only
<table>
<thead>
<tr>
<th>Benefit</th>
<th>Cochrane review $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved HbA1c</td>
<td>✓</td>
</tr>
<tr>
<td>Less variability in BSL</td>
<td>✓</td>
</tr>
<tr>
<td>Improved post prandial BSL</td>
<td>✓</td>
</tr>
<tr>
<td>Improved fasting glycaemia</td>
<td>✓</td>
</tr>
<tr>
<td>Less events of severe hypoglycaemia</td>
<td>✓</td>
</tr>
<tr>
<td>Improvement in quality of life</td>
<td>✓</td>
</tr>
<tr>
<td>Less insulin</td>
<td>✓</td>
</tr>
<tr>
<td>No weight gain</td>
<td>✓</td>
</tr>
<tr>
<td>No increase in DKA</td>
<td>✓</td>
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</tbody>
</table>

Rate of change HbA1c 0.3%/yr ($p = 0.006$)
What is an Insulin Pump

An insulin pump administers insulin through a catheter in the abdominal fat to help control a person's blood sugar levels.
Continuous Glucose Monitoring

CGMS is a way to measure glucose levels

A CGM device, gives a greater view of glucose trends
Starship Insulin Initiation Programme

Discuss suitability for insulin pump with diabetes consultant

Does your child qualify for PHARMAC pump funding?
- Must be having injections more than 2 times per day for at least 6 months

Complete ‘Registration of Interest’ form

Invitations to attend annual pump information sessions sent

Attend advanced carbohydrate training with dietician.

Now you are enrolled in pump programme

Consultant applies for Special Authority
- PHARMAC funded pumps
  - Animas Vibe
  - Medronic 522 and 722 Paradigm

Fill prescription for pump, consumables and insulin prior to training

Arrange date for insulin pump start up and training

Commence pump therapy

Pump training takes place over 2 half days followed by a 2-hour follow up 1 week later

Download pump weekly

3-4 monthly clinic follow-ups

Daily contact with diabetes team for up to 2 weeks

PHARMAC CRITERIA
- Unpredictable and significant variability in blood glucose including significant hypoglycaemia affecting the ability to reduce Hba1c.

- Four severe unexplained and recurrent hypoglycaemic episodes over a six month period either due to hypoglycaemic unawareness or to nocturnal hypoglycaemia.
Software
Animas Pump CGM

Basal (Units/Hour) vs. Bolus (Units)

mmol/L

Carbohydrates

Time
09:30 25g
09:43 38g
12:25 41g
12:48 21g
17:09 17g
18:56 39g
20:20 33g
<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/10/2014</td>
<td>If he ate at 1pm and wasn't high till 4pm unlikely to be the muffin still digesting even though low GI. Suggest no high fat foods or takeaways in first two weeks while we are still adjusting levels. High overnight so please increase basal from 0000-0500 to 0.30u/hr. Leave rest the same. If you find he is still rising after dinner tomorrow please reduce the carb ratio further to 23. Otherwise ring the doctors with any highs over 10 or lows under 4 and adjust levels over weekend. Grace</td>
</tr>
<tr>
<td>24/10/2014</td>
<td>Hi there. Had a small problem with the CGM from about 7pm to 9pm last night. Although it appeared to still be receiving readings it had lost the trending arrows. Rang the rep and recalibrated as suggested, all ok now. A few highs over the last 24 hours but no ketones. We assume that the highs yesterday afternoon were due to the chocolate muffin T had at lunch time. :)</td>
</tr>
<tr>
<td>23/10/2014</td>
<td>Congratulations on surviving your first night of pumping. I want to make a few changes based on the readings from the first night. Please 1) Reduce the carb ratio at dinner from 25 to 22. 2) Reduce the midnight basal rate from 0000 from 0.3u/hr to 0.275u/hr. 3) Increase the ISF from midnight from 6 to 7. Kind regards Rita</td>
</tr>
</tbody>
</table>
Benefits for families:

“This has revolutionized our lives” Mother of 4 y old

“Data is accessible for off-duty on-call personnel on their phone or computer. We feel like we are much more connected.” Father of 10 year old

“He is so at ease with the technology, he can txt us and the nurse and they can look at his doses and txt back.” Father of 14 year old
Benefits for Clinicians:

- Allows clinicians with parental consent to view the information on computer or mobile device.

- Clinic appointments are streamlined and put to better use allowing more time for education and planning care rather than data collection.

- Decreases amount of time by phone getting information with variable accuracy when discussing. A 60 minute phone call can now be 10 minutes.
CNS role in CSII programme:

- Co-ordination of pre-pump education
- Assessment of families understanding with dietitian
- Working with MDT for Pharmac criteria, special authority application, pre-pump insulin doses
- Day stay education x 2 days for pump initiation then outpatient follow-up at 1-2 weeks, phone/txt/email.
- Education of staff, ongoing evaluation of resources and health outcomes.
Future developments:

• Closed loop, non-invasive BG testing/CGM….

• Clinics in community settings – taking the multi-disciplinary specialist paediatric team to the family.

• Web-based education and information for staff (Moodle) and families/ schools

• Virtual clinics via skype and internet downloads

• Nurse prescribing in nurse-led clinics and pump starts