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# Effects of pump-type and catheter age on insulin absorption

**Submission date**
02/04/2012

**Recruitment status**
No longer recruiting

**Registration date**
10/05/2012

**Overall study status**
Completed

**Last Edited**
12/02/2014

**Condition category**
Nutritional, Metabolic, Endocrine

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

## Plain English summary of protocol

Background and study aims:
Patients with type 1 diabetes must use insulin combined with blood glucose measurements to prevent unacceptable rises and falls in blood glucose. Insulin can be given using a syringe, an insulin pen or an insulin pump. This study focuses on insulin pumps. Until recently, all insulin pumps consisted of a needle inserted into the fat layer of your skin, a pump (containing the insulin, electronic, pump and batteries) and a catheter (a tube that can be inserted into a body cavity, duct, or vessel) connecting these two parts. Patch-pumps were recently developed, to be carried directly on the skin. It is useful to know if patch-pumps and conventional pumps cause differences in the way in which insulin is absorbed from the fat-layer of the skin into the bloodstream. Recent studies have shown that the time the insulin catheter has been used (wear-time or age of the insulin catheter) also influences the speed of insulin absorption from the fat-layer of the skin. Insulin seems to reach higher levels in the blood quicker, as the catheter gets older. We want to study the effect of two different types of insulin pumps, combined with the effect of the catheter age on absorption of insulin.

Who can participate?
Patients who have type 1 diabetes mellitus for at least 6 months, currently using an insulin pump or multiple daily insulin injections can take part in this trial. Patients should not be pregnant or use a medication which can influence glucose metabolism.

What does the study involve?
Patients will be asked to visit the clinical research unit four times. Twice while wearing the Omnipod patch-pump (PP) and twice while wearing the Paradigm catheter-based pump (CP). The visits will be in a random order, so patients will either start with the two visits wearing the Omnipod (PP) and switch to the Paradigm pump (CP) on their last two visits, or patients will start with the Paradigm pump (CP) and switch to the Omnipod (PP) during their last two visits. The two visits while wearing the same pump will be 48 hours apart. On each visit, patients will receive an identical breakfast and an insulin bolus of at least 6 units will be given through the pump. Blood will be sampled for insulin and glucose determination from 1 hour before breakfast until 4 and a half hours after breakfast.

What are the possible benefits and risks of participating?
Bruising, swelling or skin irritation at the insertion point of the intravenous catheter, the insulin catheter or the insulin pod

Where is the study run from?
1. Academic Medical Center Amsterdam, Netherlands
2. Medical University of Graz, Austria
3. University of Montpellier, France
4. Profil Institute for Metabolic Research, Germany
5. University of Padua, Italy

When is study starting and how long is it expected to run for?
From November 2011 through April 2012

Who is funding the study?
European Union under the FP7 program, ref: 247138

Who is the main contact?
Dr J Hans DeVries
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### Study website
http://www.apathome.eu

# Contact information

### Type(s)
Scientific

### Contact name
Dr J. Hans DeVries

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# Additional identifiers

### EudraCT/CTIS number

### IRAS number

### ClinicalTrials.gov number

### Secondary identifying numbers
WP1.1/CIPHER

# Study information

## Scientific Title
Comparison of Insulin absorption after administration of insulin lisPro with a patch pump versus a catHetER based pump and the effect of catheter wear-time (CIPHER)

## Acronym
CIPHER

## Study objectives
Most closed loop approaches rely on subcutaneous administration of insulin by means of conventional insulin pumps (i.e. pumps with a catheter). Until recently all insulin pumps consisted of a needle inserted into the subcutaneous tissue, a pump (containing the insulin, electronic, pump and batteries) and a catheter connecting these two parts. Recently patch-pumps were developed, to be carried directly on the skin, without the need to insert a needle manually and without a visible catheter. Internally these patch-pump still employ a catheter of about 50 mm; however, substantially less than the 600 mm of catheter tubing used with catheter based pumps. For Artificial Pancreas (AP) development it is highly relevant to know if patch-pumps and conventional pumps have different insulin absorption rates and reproducibility of insulin absorption. Recent evidence suggests that the duration of the insulin catheter usage (wear-time) also influences the speed of insulin absorption from the subcutaneous tissue, as the time to maximal insulin levels seems to move forward in time with a longer wear-time.

The objective of this trial is to measure serum insulin and glucose profiles after bolus insulin administration by a patch-pump versus a catheter based pump, reproducibility of these insulin profiles and the effect of catheter wear-time on these profiles in patients with type 1 diabetes. Testing the hypotheses that both catheter wear time and type of insulin pump influence these parameters.

## Ethics approval required
Old ethics approval format

## Ethics approval(s)
1. Medical Ethics Review Academic Medical Center Amsterdam [Medisch Ethische Toetsingscommissie Academisch Medisch Centrum Amsterdam], 21 April 2011, ref: 2011_017#C2011113
2. Committee to Protect People southern Mediterranean IV [Comité de Protection desPersonnes Sud Méditerranée IV], June 2011
3. Hospital and University of Padua Ethics Committee for Experimentation [Azienda Ospedaliera e Università degli Studi di Padova Comitato Etico per la Sperimentazione], July 2011
4. Ethics Committee of the Medical Association of North [Ethikkommission der Ärztekammer Nordrhein] September 2011

## Study design
Multi-centre open-label randomized crossover intervention trial

## Primary study design
Interventional

## Secondary study design

Randomised controlled trial

## Study setting(s)
Hospital

## Study type(s)
Treatment

## Participant information sheet
Not available in web format, please use the contact details below to request a patient information sheet

## Health condition(s) or problem(s) studied
Diabetes Mellitus Type 1

## Interventions
The study will consist of the measurement of glucose and serum insulin levels at baseline and following a meal. Patients with Type 1 diabetes will come in for two blocks of visits: one block of two visits (48 hours apart) while wearing the Omnipod Insulin Pump (PP) and one block of two visits while wearing a Medtronic Paradigm Pump (CP). The visit blocks will be in random order, using a crossover design. For study visits, patients will report to the CRC in a fasting state in the early morning hours and blood sampling for insulin levels will start to record baseline values. If baseline glucose >7.8 mmol/L, blood glucose levels will be stabilized to euglycaemic levels (65-140 mg/dL / 3.6  7.8 mmol/L) by intravenous administration of insulin. Patients will then be served an individually standardized breakfast and mealtime insulin bolus (>6 U). Blood will be sampled for insulin and glucose determination until 4.5 hours postprandially. Both pumps will be filled with insulin lispro. The two visits in a given block will be 48 hours apart. Patients will change the insulin
catheter / insulin pod the afternoon before the first study visit in both blocks, patients will then continue to wear this insulin catheter / insulin pod until the end of the second visit in both blocks. We will use the second visits in each block to perform a separate analysis investigating the effect of catheter wear-time.

## Intervention Type
Other

## Phase
Not Applicable

## Primary outcome measure
1. Time to peak serum insulin levels following administration of the mealtime insulin bolus with CP and PP
2. Coefficient of variation (CV) of basal and postprandial insulin levels after CP and PP.

## Secondary outcome measures
1. Postprandial glucose excursions
2. Early insulin t50% and area under the curve for insulin levels
3. Maximum concentration of insulin levels
4. Delta baseline to peak in insulin levels and coefficient of variation of basal insulin levels
5. Glucose levels and the outcomes listed above for insulin will also be calculated for glucose values after administration of mealtime bolus.

### Overall study start date
01/11/2011

### Completion date
30/04/2012

## Eligibility

### Key inclusion criteria
1. Aged 18 years or above
2. Diagnosed with Type 1 diabetes mellitus (DM) at least 6 months according to the WHO definition
3. Treated with CSII or MDII for at least 3 months
4. Body Mass Index (BMI) <35 kg/m²
5. Willing and able to wear the study pump devices for the duration of the study and undergo all study procedures
6. Willing to use insulin lispro for the duration of the trial
7. HbA1c measured during the last three months between 6 and 10%
8. Signed informed consent form prior to study entry
9. Using <66 insulin units per day on average

### Participant type(s)
Patient

### Age group
Adult

### Lower age limit
18 Years

### Sex
Both

### Target number of participants
20

### Key exclusion criteria
1. Patient is pregnant, or breast feeding during the period of the study
2. Patient is using a medication that significantly impacts glucose metabolism (oral steroids) except if stable for at least the last three months and expected to remain stable for the study duration
3. Has severe medical or psychological condition(s) or chronic conditions/infections that in the opinion of the Investigator would compromise the patients safety or successful participation in the study
4. Patient is actively enrolled in another clinical trial or took part in a study within the past 30 days
5. Known adrenal gland problem, pancreatic tumour, or insulinoma
6. Inability of the patient to comply with all study procedures
7. Inability of the patient to understand the patient information
8. Patient donated blood in the last 3 months

**Date of first enrolment**
01/11/2011

**Date of final enrolment**
30/04/2012

# Locations

**Countries of recruitment**
France

Germany

Italy

Netherlands

**Study participating centre**
**Academic Medical Centre**
Amsterdam
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1100DD

# Sponsor information

**Organisation**
Academic Medical Centre (Netherlands)

**Sponsor details**
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**Sponsor type**
Hospital/treatment centre

**Website**
http://www.narcis.nl/

**ROR**
https://ror.org/03t4gr691

# Funder(s)

**Funder type**
Government

**Funder Name**
The European Commission (EU) - FP7 Program ref: 247138

# Results and Publications

**Publication and dissemination plan**
Not provided at time of registration

**Intention to publish date**

**Individual participant data (IPD) sharing plan**

**IPD sharing plan summary**
Not provided at time of registration

**Study outputs**

| Output type | Details | Date created | Date added | Peer reviewed? | Patient-facing? |
|---|---|---|---|---|---|
| Results article | results | 01/07/2013 | | Yes | No |