Have pump, will travel: Advice on the use of CSII when travelling

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Article points

1. Continuous subcutaneous insulin infusion (insulin pump therapy) can be used to great effect when travelling or on holiday.
2. An insulin pump can help to maintain glycaemic stability, while allowing greater flexibility with lifestyle issues.
3. Provided that the basal rate is appropriately set, varying levels of activity and time zone changes can be accommodated with relative ease.
4. The key to successful travel is pragmatic structured education, ensuring that the pump user is appropriately prepared.
5. Pump users need to be able to plan ahead and make informed decisions about their diabetes and the trip abroad, in order to prevent or minimise any potential problems while abroad.

Key words

- Continuous subcutaneous insulin infusion
- Glycaemic control
- Insulin pump therapy
- Travel

Authors' details can be found at the end of the article.

Continuous subcutaneous insulin infusion, otherwise known as insulin pump therapy, can undoubtedly be used to great effect when travelling or on holiday. If used appropriately, a pump can help to maintain glycaemic stability, while allowing greater flexibility with lifestyle issues. Given that specific evidence regarding insulin pump management is lacking for people with diabetes who undertake long distance travel for business or pleasure, this article takes a pragmatic approach to insulin pump therapy, which reflects current practice at the Royal Liverpool University Hospital insulin pump service.

During travel, daily routines, activity levels, exposure to stress and eating patterns tend to change. For people with diabetes who use continuous subcutaneous insulin infusion (CSII), apart from the meal-time flexibility offered by the pump, the bolus doses can be manipulated to cope with portion sizes that are bigger or smaller than usual and the diverse compositions of exotic culinary meals, which can also impact on glycaemic control. In addition, provided that the basal rate is appropriately set, varying levels of activity can be accommodated with relative ease, as can any time zone changes.

Education

Education is the cornerstone to effective diabetes management (Department of Health [DH] and Diabetes UK, 2005). Information regarding pump therapy and travel should form part of any structured education package for all people with diabetes initiated onto CSII. Education is an ongoing process, which must be revised and updated on a regular basis (NICE, 2003; DH and Diabetes UK, 2005).

In general, pump users should feel confident to manage their diabetes in common travel situations, such as:

- Beach and winter holidays.
- Changes in time zones.
- Actions to take in the event of pump failure.
- Coping with illness.
- Periods of increased or decreased physical activity.
- Alcohol consumption.
- Participating in the gastronomic delights of foreign lands.

As part of the education process, pump users should also be informed of alternative insulin brands that they can use if their usual type is not available. Some countries do not use U-100 insulin and may have alternative names for insulins in common use in the UK.

The pharmaceutical companies that manufacture insulin provide web-based information that can be accessed to help clarify issues for both healthcare professionals and people with diabetes.

Travel insurance

People with diabetes who are travelling abroad are advised to take out their own holiday insurance (Diabetes UK, 2012a). In keeping with the Diabetes UK recommendations, we advise pump users to buy their holiday insurance well in advance and to read the small print, which may contain complex exclusion clauses, to ensure that it provides adequate cover for all their needs when abroad.

It is essential that pump users declare all their existing medical conditions to the insurance company. Failure to do so (even a seemingly unrelated minor medical condition omitted in error) can nullify the insurance.

Although currently a controversial topic, some primary care trusts, health boards and commissioning groups require pump users to insure their pump for loss and accidental damage, even though their pump is technically owned by the NHS. Some insulin pump companies offer a loan pump for the duration of a holiday; however, they usually require confirmation that the pump will be covered by insurance for the full duration of the holiday. Diabetes UK highlights specific insurance for insulin pumps (http://insurance4insulinpumps.co.uk/), which also covers travel, on its website.

Having a pre-existing condition can significantly load premiums. Diabetes UK provides detailed information on travel insurance that is geared towards providing cover for people with diabetes at competitive rates. Details of Diabetes UK insurance services can be obtained via the internet at www.diabetes.org.uk/travel or by calling 0800 731 7431.

European health insurance card

The European health insurance card (EHIC) allows access to free or reduced cost state-funded healthcare in all European Economic Area (EEA) countries on presentation of the card (NHS Choices, 2012). The EEA consists of the European Union, Liechtenstein, Norway, Iceland and Switzerland. However, the cover provided by the EHIC is limited and does not, for example, include emergency repatriation.

It is worth noting that many countries are unable to give the same level of treatment as the NHS; also, travellers may find it difficult to access publicly funded healthcare in some countries. For these reasons, private insurance is still recommended (Diabetes UK, 2012a).

An EHIC card can be obtained online at www.ehic.org.uk or by calling 0845 605 0707; alternatively, an information pack can be obtained from Post Office branches.

Supplies

Extra supplies should always be taken when travelling out of the country (Bolderman, 2002; Diabetes UK, 2012b). Generally the advice is to take approximately 50% more supplies than are actually needed, in case larger quantities than normal are used or some supplies are damaged (Bolderman, 2002).

All medication including insulin, pump consumables, hypo remedies, equipment for self-monitoring of blood glucose (SMBG) and holiday paperwork, such as insurance documents, should be carried in hand luggage (Diabetes UK, 2012b). This strategy will avoid difficulties if baggage becomes lost or the plane is delayed. Furthermore, as highlighted by the Civil Aviation Authority (2012) and Diabetes UK (2012b), if insulin is left in checked-in luggage, it may be exposed to extreme, often freezing temperatures, which will cause it to lose potency (American Diabetes Association, 2011).

Any supplies the pump user has not brought with them will need to be purchased abroad. The costs of these are not usually covered by holiday insurance. Also, depending on the country visited, there may be extra costs that have to be considered, such as a doctor's consultation to obtain a prescription for the insulin before it can be dispensed and purchased.

Suggested extra supplies that insulin pump users should consider taking with them when travelling abroad are outlined in *Box 1*.

Box 2 lists essential holiday paperwork that pump users should take with them when travelling abroad.

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1. Insulin pump users must declare all their existing medical conditions to the insurance company, as failure to do so (even a seemingly unrelated minor medical condition) can invalidate the insurance.
2. Diabetes UK highlights specific insurance for insulin pumps (http://insurance4insulinpumps.co.uk/), which also covers travel, on its website.
3. All medication, pump consumables, hypo remedies, equipment for self-monitoring of blood glucose and holiday paperwork should be carried in hand luggage to avoid difficulties if baggage becomes lost or the plane is delayed.
4. Extra supplies should always be taken when travelling out of the country. Generally the advice is to take approximately 50% more supplies than are needed, in case larger quantities than normal are used or some supplies are damaged.

Box 1. Extra supplies that insulin pump users should consider taking when travelling abroad.

- Extra insulin and supplies of other medication.
- Adequate supplies for the pump, e.g. cannulas and lines.
- Long-acting insulin to use in the event of insulin pump failure.
- Insulin pens/needles or syringes.
- Spare pump if available.
- Battery key or coin to open and close the battery compartment.
- Blood glucose meter, test strips, lancets and lancing device.
- Batteries for both the blood glucose meter and pump.
- Test strips to check for ketones.
- Hypo management supplies – dextrose tablets weigh less and are smaller in size than most liquids; also, they will not cause a problem in airport security.
- A method of safe sharps disposal.

Box 2. Holiday paperwork that pump users should take with them when travelling abroad.

- Details of holiday insurance.
- EHIC if travelling to a country in the European Economic Area.
- Letter on hospital-headed notepaper confirming diabetes, insulin pump use and the need to carry sharps.
- Emergency contact numbers for the insulin pump company and the hospital insulin pump team.

Airport security

In the authors' experience, some pump users have had negative experiences when negotiating airport security. Problems encountered have included requests to remove pumps for closer inspection or an insistence that the pump is X-rayed. Unfortunately, the key issue seems to be that not all airport security staff are familiar with CSII, a situation that is compounded by language barriers in some foreign airports.

Pump users need to consider the security 100 mL fluid restriction when choosing the type of fast-acting carbohydrate to carry for the management of a hypoglycaemic event in an airport or on a flight. Dextrose tablets are an acceptable option as they are non-liquid, light in weight and small in size.

Although airport security metal detectors will not harm the pump, their sensitivity to alarm can vary on a day-to-day basis due to the level of security required by the country concerned (Bolderman, 2002; Diabetes UK, 2012b). Since there is a risk that the pump will trigger the alarm, pump users should have their hospital travel letter to hand and inform the security staff that they are wearing an insulin pump before entering the metal detector (Bolderman, 2002). They should explain that they are wearing an insulin pump for medical purposes and that they should not disconnect from it. Pre-travel education should prepare individuals to anticipate that they will almost certainly be body searched and their pump may be "swabbed" for explosives.

All insulin pump manufacturers specify that functioning pumps should never be X-rayed or body scanned as these procedures have the potential to cause the pump to malfunction. Equipment such as blood glucose meters or insulin pumps that are inactive, with the battery removed, can be X-rayed without causing harm (Diabetes UK, 2012b).

The flight

As insulin pumps and continuous blood glucose monitoring (CGM) systems are considered to be medical devices, the airline should be informed about them before travel so that precise advice on their use on board the aircraft can be obtained (Civil Aviation Authority, 2012; Diabetes UK, 2012b). Once on board the plane, pump users should make the cabin crew aware that they are using a pump in case its operation is mistaken for electrical equipment, which should normally be switched off during the flight, especially at take-off and landing.

During flight, handsets that communicate with pumps or CGM equipment by radio waves or Bluetooth technology must be switched off for the duration of the journey because of the risk that signals from the handset might interfere with the aircraft's communication and navigation systems (Civil Aviation Authority, 2012; Diabetes UK, 2012b).

Impact of altitude

King et al (2011) have suggested that changes in atmospheric pressure during flight can adversely affect insulin delivery from a pump and cause the formation of air bubbles, which could have a detrimental impact on glycaemic control. They recommend that an insulin pump should be disconnected before take-off and landing and that the pump user should check that there is no air in the insulin before reconnecting it. However, the study did not suggest how glycaemic control during the flight should be managed, or how to compensate for any missed basal insulin. Nor did they discuss the impact of altitude on patch pumps, and, if this was an issue, how it could be managed.

Further analysis of the study by King et al (2011) reveals that the cohort size was not large enough to provide adequate statistical power for the between-pump comparisons. Also, given that part of the study was conducted in a hyperbaric chamber and all of the tested pumps were delivering into air as opposed to infusing into subcutaneous tissue, the methods of testing did not replicate clinical practice, hence the findings must be viewed with caution.

Indeed, as highlighted by Hirsch (2011), there are so many confounding factors that can impact on glycaemic control, such as changes in food choices and reduced physical activity during travel, that a small dose variation in insulin via a pump is insignificant. In keeping with our own experience, Hirsch (2011) reported that in prolonged clinical experience he has not seen alterations in insulin delivery during flight. However, robust studies are required to further investigate the impact of altitude on insulin pump delivery. In the meantime, it seems pragmatic to ask pump users to check for air bubbles in their infusion set when flying.

Time zones

For people who require insulin to manage their diabetes, entering different time zones will affect their insulin requirements. When flying internationally, the time on the flight, and consequently the routine on it, will always follow the country of origin, only changing to the country of destination on landing.

For pump users travelling across international time zones, insulin management becomes a much simpler affair. In keeping with others, the authors find that even if the pump user has a variable basal rate, target glycaemic control is maintained if the clock on the pump is just re-set to reflect the new time schedule on landing (Bolderman, 2002; Dudley and Dudley, 2004). This strategy adequately compensates for any changes in the duration of basal profiles arising from the gain or loss of hours (Dudley and Dudley, 2004). Attempting to make gradual changes to the basal rate to accommodate the diurnal clock is not supported by evidence; indeed, in practice this strategy is not practical and has great potential for user error.

Glycaemic control

While on holiday, pump users commonly experience some variation in glycaemic control for a variety of reasons, such as changes in insulin absorption, stress, variations in physical activity levels, and eating unfamiliar carbohydrate and food compositions. The best way for pump users to combat this is to perform more frequent SMBG and correct an elevated blood glucose value as necessary until adapted to their new routine.

Hot climates

Insulin is chemically transformed in solution to insulin transformation products (ITPs). The major forms of ITPs are deamidated insulins, covalent dimers and higher oligomers. Exposure to heat and daylight accelerates ITP production and denatures insulin (Brange, 1987; Gregory et al, 1991; DeFelippis et al, 2006; Pryce, 2009).

Simply keeping the pump and tubing covered by clothes will provide an adequate shield from sunlight and heat for short periods. Anecdotally, in very hot climates pump users should consider changing their line and cartridge more frequently (e.g. every 2–3 days) to help maintain the efficacy of the insulin. All

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2. Exposure to heat and daylight denatures insulin; keeping the pump and tubing covered by clothes will provide an adequate shield from sunlight and heat for short periods.
3. Anecdotally, in very hot climates pump users should consider changing their line and cartridge more frequently (e.g. every 2–3 days) to help maintain efficacy of the insulin.

spare insulin should be kept in cool conditions such as those provided by a refrigerator or a FRÍO® insulin travel wallet (FRÍO UK Ltd, Haverfordwest).

People using insulin pumps can sunbathe, but they must ensure that the pump and tubing are kept out of direct sunlight, either by lying on them or by shielding them with clothes or a towel. Pump users should also consider where they are going to insert their cannulas, so that they can avoid a "patchwork" effect on their tan caused by the cannula plaster blocking out the sun.

Pump users should be educated to avoid sunburn. Apart from the obvious effects, it has the potential to limit the choice of cannula sites.

Tape adhesion problems

In a hot climate, one of the most common problems with the cannula site is poor adhesion between the cannula plaster and the skin, owing to excessive perspiration. Applying a thin layer of antiperspirant and allowing it to dry before inserting a cannula, or using a product such as Skin Tac™ adhesive barrier wipes (Torbot, Cranston, USA) around the insertion site, can help to overcome the problem (Dudley and Dudley, 2004).

Skin should be free of sunscreens and oils, as these agents may also have a detrimental impact on cannula tape adhesion.

The beach

Pump users should be advised never to change their insulin cartridge or battery on the beach. Following this advice will reduce the risk of sand entering the pump chambers and damaging the pump.

As sand has the potential to scratch the pump casing, it is advisable for the pump user to protect it by keeping it in a case while on the beach. If a pump user places the pump directly on the beach while sunbathing, heat from the hot sand has the potential to denature the insulin in the pump, which will have a damaging effect on its therapeutic action.

Swimming

Provided that the insulin pump is waterproof, pump users can spend long periods of time in the water attached to their pump. After swimming, they should rinse the pump in cool clean tap water to remove any residues, such as chlorine.

Salt can be corrosive, so even if a pump is indicated for use in water, it may be appropriate to avoid using it in salt water or to use a waterproof cover to protect it. Protective covers for pumps that are not guaranteed waterproof can be purchased from the relevant pump companies.

Depending on the degree of physical activity undertaken by the pump user when swimming, the pump can be removed for a maximum of 1–2 hours per day without ill effect. For activities lasting longer than this, either the pump must be worn or strategies that allow prolonged periods of exercise off the pump must be implemented.

"Untethered" exercise

A successful strategy that the authors use to increase the time that both children and adults can be "untethered" from their pump is to replace some of the basal rate insulin dose with a daily injection of a long-acting analogue. Obviously, individuals have different requirements, but we usually start by reducing each basal time segment by 50% and replacing it with a long-acting analogue.

The "untethered" approach should be initiated a few weeks before the holiday starts to ensure that the long-acting insulin analogue has reached its peak effect and appropriate glycaemic targets are achieved while maintaining the flexibility offered by the pump.

Winter sport holidays

It is perfectly safe for individuals using insulin pumps to participate in skiing and other winter sports. If it is the first time an individual has used a pump for winter sports activities, he or she will require information on how to manipulate the temporary basal rate and insulin-to carbohydrate ratios to accommodate increases in physical activity.

Extreme cold may cause the insulin to freeze, particularly in the tubing. This could then lead to hyperglycaemia, which, if left unchecked, could easily progress to diabetic ketoacidosis. Also, as noted earlier, if insulin is frozen it will not work effectively. To avoid these situations, pump users should be advised to use their body and clothes to insulate their pump and tubing as a means of preventing the insulin from freezing.

Conclusion

CSII, with its increased flexibility, can help individuals negotiate international travel with ease while maintaining glycaemic stability. The key to successful travel is pragmatic structured education, ensuring that the pump user is appropriately prepared.

Pump users need to be able to plan ahead and make informed decisions about their diabetes and the trip abroad, in order to prevent or minimise any potential problems while travelling. ■

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