

Diabetes

Overseas travel should not pose significant problems for air travelers with well controlled diabetes mellitus. Preplanning is important and a discussion of the itinerary with the diabetic specialist management team plays an important part in the preparation for travel.

It is important that the diabetic carries adequate equipment, e.g., blood-sugar testing sticks, blood glucose meter and insulin supplies, in case these are not available in the area of travel. Those who are being treated with insulin should carry an ample supply in their hand luggage in two different bags, ideally one being carried by a relative or friend in case of loss or theft. The supply of insulin not being used in flight should *not* be packed in checked baggage as this may be exposed to temperatures which may cause the insulin to freeze and denature. There is an additional hazard that luggage may be mislaid enroute. Insulin should be carried in hand luggage in a cool bag or precooled vacuum flask. However, it does not require refrigeration during flight. Extremes of temperature and high altitude can disable blood glucose meters and impair the accuracy of blood glucose test strips, so blood monitoring equipment should also be carried in the hand baggage where it will be immediately available for inflight use. The cabin altitude in modern jet aircraft is between 6000 and 8000 ft which should not affect the accuracy of most, if not all, blood glucose meters (1).

Journeys may cross several time zones and depending on the direction of travel, may shorten or lengthen the “regular 24 hour day” which may require an adjustment to insulin regimens. The consequences are most significant for those with Type 1 (insulin-dependent diabetes). For those patients with Type 2 diabetes treated with insulin, the endogenous insulin will provide a suitable buffer and compensate to some degree for deficiencies of an insulin regimen.

The use of short-acting soluble insulin or fast-acting insulin analogues during long flights, most conveniently given by a pen device, is recommended even if this does not form part of the usual insulin regimen (2). This gives the flexibility of allowing the short-acting insulin to be administered regularly with each meal for the duration of the flight period and can be supplemented by intermediate-acting insulin prior to the first night’s sleep on arrival at the travel destination. The other advantage of familiarity with the short-acting insulins is their value in minor illness, such as gastroenteritis or upper respiratory infection, as an adjunct to a twice-daily regimen.

It makes sound sense to ascertain in advance the anticipated flight times and the local time of arrival, so that advice can be obtained from a diabetic specialist team on how to modify the individual’s regimen. There are a number of guidelines, but the following principle and examples may be helpful. When traveling East, the travel day will be shortened and if more than 2 hours are lost, it may be necessary to take fewer units of intermediate or long acting insulin.

When traveling west, the travel day will be extended and if it is extended for more than 2 hours, it may be necessary to supplement with additional injections of soluble insulin or an increased dose of an intermediate-acting insulin.

Individuals who normally take insulin once daily before breakfast should be instructed to take their standard dose at the usual time of the day whether travel is east or west (**Tables VI and VII**). Although inflight meals will usually suffice, supplemental snacks may be necessary if meals are delayed. It is often

advisable to leave the wristwatch unadjusted during flight so that it shows the time at the point of departure, thus making it simpler to judge the spacing between meals.

TABLE VI. INSULIN ADJUSTMENT WHEN TRAVELING EAST ACROSS MULTIPLE TIME ZONES.

Usual Regimen	Day of Departure/Travel (East bound)		First Day at Destination	
Multiple injection regimen with pre-meal soluble insulin and overnight Intermediate insulin.	Usual pre-meal soluble insulin. If less than 4 hours between meals this requires a slightly reduced dose of the third soluble injection (by 1/3) and additional carbohydrate (ie, extra-large evening snack if one meal missed) and a reduction (1/3) in overnight intermediate insulin to avoid nocturnal hypoglycemia.		Return to usual insulin regimen if you have overcompensated with the reduction of the evening intermediate insulin. Additional soluble insulin (1/3 of usual morning dose) should be considered if fasting blood glucose > 14 mmol · L ⁻¹ (250 mg · dl ⁻¹).	
	Day of Departure	First Morning at Destination	10 hr After Morning Dose	Second Day at Destination
Two-dose schedule	Usual morning and evening doses	2/3 usual morning dose	Usual evening dose plus remaining 1/3 of morning dose if blood sugar over 14 mmol · L ⁻¹ (250 mg · dl ⁻¹)	Usual two doses
Single-dose schedule	Usual dose	2/3 usual dose	Remaining 1/3 of morning dose if blood sugar over 14 mmol · L ⁻¹	Usual dose

On the first morning at the destination (on an eastward flight) just before breakfast (local time), 2/3 of the usual morning dose of insulin should be taken because fewer than 24 hours will have elapsed since the previous morning's insulin injection. This adjustment should prevent hypoglycemia as a result of extra activity or disrupted meal schedules.

On the day of departure, when traveling west across five or more time zones, the diabetic traveler should take the usual doses of insulin before breakfast (Table VII).

TABLE VII. INSULIN ADJUSTMENT WHEN TRAVELING WEST ACROSS MULTIPLE TIME ZONES.

Usual Regimen	Day of Departure/Travel (West bound)		First Day at Destination
Multiple injection regimen with pre-meal soluble insulin and overnight Intermediate insulin.	Usual pre-meal soluble insulin. Additional soluble insulin injection with additional meal/snack. Modest reduction (1/3) in overnight Intermediate insulin to avoid nocturnal hypoglycemia.		Return to usual insulin regimen. Additional soluble insulin (1/3 of usual morning dose) should be considered if fasting blood glucose > 14 mmol · L ⁻¹ (250 mg · dl ⁻¹).
	Day of Departure	18 hr After Morning Dose	First Morning at Destination
Two-dose schedule	Usual morning and evening doses	1/3 usual dose followed by meal or snack if blood glucose > 14 mmol · L ⁻¹	Usual two doses
Single-dose schedule	Usual dose	1/3 usual dose followed by meal or snack if blood glucose > 14 mmol · L ⁻¹	Usual dose

During the flight, meals can be eaten according to the airline schedule. Consultation with the cabin crew on the timing of meals may be helpful. It is vital that patients check their blood sugar before meals at 4- to 6-hourly intervals, during the flight. About 18 hours after the morning injection of insulin, regardless of whether the patient is still in flight or at the destination, blood glucose should be tested again. If the blood glucose is $14 \text{ mmol} \cdot \text{L}^{-1}$ ($250 \text{ mg} \cdot \text{dl}^{-1}$) or less, the individual may safely wait until the first morning at the destination and take the normal insulin dose at the usual time (local time), even though more than 24 hours have elapsed. However, if the blood glucose is greater than $14 \text{ mmol} \cdot \text{L}^{-1}$, an additional dose of insulin equal to one-third of the usual morning dose should be taken, followed by a meal or a snack. The next morning (local time) the usual dose of insulin should be taken. Individuals who normally take insulin twice daily should be advised to leave their wristwatches set to local time of the departure point during air travel. The normal second dose of insulin should be administered about 10-12 hours after the morning dose followed by a meal or a snack (Table VII). From that point on they should follow the same plan as travelers who take one injection daily. Thus approximately 18 hours after the first dose of insulin and 6 hours after the second, the blood should be tested. If the blood glucose level is above $14 \text{ mmol} \cdot \text{L}^{-1}$, an extra dose of insulin equal to one-third of the morning dose should be taken (3).

Some insulin-treated diabetics prefer a seat near a toilet for privacy during insulin injection although with pen devices this may be unnecessary. However, this is a matter of personal preference. Most airlines will try to accommodate such a request if notified well in advance. Many airlines provide “diabetic meals,” but these are often designed for those people with Type 2 diabetes and may contain an insufficient amount of carbohydrate for Type 1 diabetics risking incipient hypoglycemia. The “vegetarian meal” choice is often suitable for people with Type 1 diabetes, containing pasta based dishes or rice. Type 1 diabetics should carry additional carbohydrate to cover contingencies such as delayed flights or, indeed, delayed meals (4). They should also consider alerting cabin crew to the fact that they are insulin-using diabetics, and should have readily accessible identification (e.g., medic-alert bracelet) stating this.

Individuals with Type 2 diabetes treated by oral agents should not have the potential problems of those taking insulin. Additional doses of tablets are usually not required to cover an extended day, although the use of a drug such as repaglinide may be valuable to cover an additional meal. A dose of the normal hypoglycemic agent may have to be omitted on a truncated day in the case of a long west-to-east air journey.

Diabetic travelers under reasonable control can fly anywhere safely if they plan adequately in advance and discuss the proposed journey with their diabetic specialist adviser. The wider use of short acting insulin and ease of administration with pen devices has greatly simplified the management of diabetes during intercontinental travel.

Useful web-sites for patient information:

American Diabetes Association: www.diabetes.org

Canadian Diabetes Association: www.diabetes.ca

Diabetes UK website: www.diabetes.org.uk

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