

CASE REPORT

Steroid injection for shoulder pain causes prolonged increased glucose level in type 1 diabetics

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SUMMARY

Shoulder pain is very common in diabetic patients and often treated with steroid injections, with subsequent increases in blood glucose levels or the need for additional insulin being questioned. We report a case of significant and prolonged elevation of blood glucose levels and resultant insulin requirement in a type 1 diabetic man after a single 40 mg injection of triamcinolone for shoulder pain. Within 48 h, the shoulder pain as assessed by a visual analogue scale (0–10) was reduced to zero, but the elevated insulin requirements continued for 4 weeks after the injection. This finding suggests that steroid injections for shoulder pain in diabetics may not always be as safe as previously thought. We propose that medical practitioners advise their patients to monitor their glucose levels more carefully after such injections and that caution is exercised when considering administering these injections to those who have poorly controlled blood glucose levels preinjection to avoid ketoacidosis.

BACKGROUND

The incidence of shoulder pain is very high, being estimated to affect between 16% and 21% of the population, and its incidence is second only to that of back pain.¹ At least half of patients with shoulder pain are expected to have persistent symptoms at 18 months.² The most common form of shoulder pain is subacromial pain, representing 44% to 60% of patient symptoms of shoulder pain to a general practitioner or rheumatologist.¹

Diabetes has been shown to be a risk factor for many shoulder conditions including bursitis and can lead to subacromial pain. The incidence of diabetes in the population is high, with the incidence of type 1 diabetes as high as 57.6/100 000 and expected to rise.³ It is therefore clear that the correlation between diabetes and shoulder pain is a large and growing problem.

Patients with subacromial pain are often treated with steroid injections (often in conjunction with physiotherapy), with no notable distinctions for the treatment of diabetic patients. Via signalling through glucocorticoid receptors, corticosteroids suppress several inflammatory pathways including prostaglandin induction.⁴ This reduction in inflammation is postulated to allow a better range of movement to facilitate rehabilitation. For this reason, physiotherapy in combination with corticosteroid injections may yield a significant improvement in pain and function over 4-year follow-up over other interventions including surgery.⁵

Systemic administration of glucocorticoids is well-known to result in a rise in blood glucose levels, via inhibition of peripheral glucose transport and use and via stimulation of gluconeogenesis in the liver.⁶ However, based on the available literature, we found no previously reported evidence that injection of steroids into the subacromial bursa results in a rise in blood glucose levels, but intra-articular injections in the knee joint have been reported to raise blood glucose levels for a few days.^{7 8}

CASE PRESENTATION

This case concerns an insulin-dependent man, diabetic since the age of 18 months. He has been using the Paradigm Real-Time Insulin Pump and Continuous Glucose Monitoring System from Medtronic (Minneapolis, USA), which give blood glucose readings updated every 5 min to enable adjustments of insulin bolus injections via a pump system in order to match need. The continuous glucose monitoring system (CGMS) system is calibrated to Blood Glucose via Bayer Contour test machine at least every 12 h.

The patient presented with right-sided subacromial pain with underlying bursitis, but MR arthrogram additionally confirmed the patient had an intact rotator cuff and showed normal glenohumeral joint distension ruling out the possible diagnosis of adhesive capsulitis (or frozen shoulder). Clinical examination revealed restricted forward elevation to 120° and pain that had been present for the previous 18 months. As oral anti-inflammatory medication and physiotherapy had been unsuccessful and MR arthrogram ruled out the possibility of a rotator cuff tear or adhesive capsulitis, he was given a single 1 mL injection of 40 mg of triamcinolone into his subacromial bursa. The injection was given by a consultant shoulder surgeon from the posterior/inferior aspect under the acromion and only injected when the needle touch the under surface of the bone preventing intramuscular injection.

Within 48 h, the pain had completely disappeared and there was a substantial improvement in range of motion, improving from 120° to 160°, but the patient had noticed a substantial rise in his blood glucose levels and had to adjust his insulin basal and bolus infusions to prevent hyperglycaemia.

INVESTIGATIONS

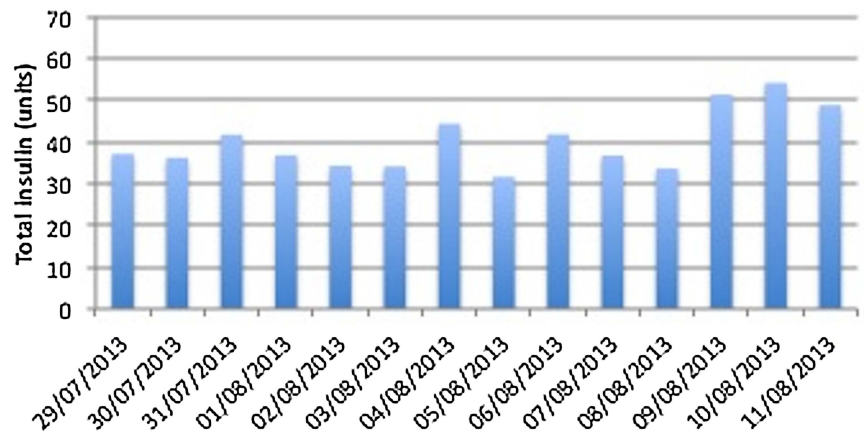
Using data collected by his continuous glucose monitoring system to compare a preinjection 2 week period with 2 weeks postinjection, it was found that his average blood glucose levels



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Figure 1 Presteroid total insulin use.



increased from a well-controlled 6.4 mmol/L pre-injection to 8.0 mmol/L postinjection. In this preinjection period, the patient was able to control his blood glucose levels well so that his daily average always fell in the 3.9–7.8 mmol/L range. However, in the postinjection 2 week period this was not achieved, with blood glucose levels above 7.8 mmol/L in 8 days out of the measured 2 week period, with a daily average as high as 10.5 mmol/L.

His average daily bolus infusion increased from 22.2 units preinjection to 26.7 units for 1 week postinjection, reflecting a 20.3% increase. This change is not a reflection of lower basal insulin levels in the postinjection period, which also increased from an average of 18 units to 20.5 units. Preinjection this was delivered through an average of seven boluses per day and post-injection it was delivered through an average of eight boluses per day, showing that the patient maintained a stringent monitoring and insulin delivery process. Taking results of the insulin bolus and basal levels together, a two-tailed unpaired student t test indicated a significant difference between total insulin levels before (figure 1) and for 2 weeks after the steroid injection (figure 2) with a significance level 0.00612. This elevation in total insulin needed lasted up to 34 days post-steroid (figure 3), with a further two-tailed unpaired student t test showing a significant difference (0.03811) between presteroid insulin levels and days 1–34 post-steroid.

DIFFERENTIAL DIAGNOSIS

Elevated blood glucose level could have been due to an increased carbohydrate intake but was unlikely in this case as in

the postinjection period the patient’s average daily carbohydrate intake actually decreased from 263 g preinjection to 235 g in days 1–13 postinjection, and an average of 224 g between days 1–34. The elevation could have been due to infection but this was unlikely, as there was no fever. Excessive stress is also a possibility but was denied by the patient.

OUTCOME AND FOLLOW-UP

Using VAS (0–10), the shoulder pain was reduced to zero with forward and lateral range of motion restored to 180°; the insulin levels returned to normal after 5 weeks.

DISCUSSION

This case report has demonstrated that injections of triamcinolone into the subacromial bursa can cause a significant rise in the average daily insulin bolus needed to control blood glucose levels. Despite this increase, the patient was still unable to maintain his blood glucose levels within the normal 3.9–7.8 mmol/L range. This indicates that triamcinolone injections into the subacromial bursa may not be as safe as once thought, given the lack of literature describing the same result. As we believed this particular patient to be especially stringent in his blood glucose monitoring and insulin administration through the use of his continuous glucose monitoring and insulin pump system, we believe that there exists a significant risk of causing blood glucose elevation leading to ketoacidosis in diabetic patients receiving this injection, especially if it is noted that they have poorly controlled blood glucose levels preinjection and do not regularly monitor their blood glucose levels.

Figure 2 1–13 Day post-steroid total insulin.

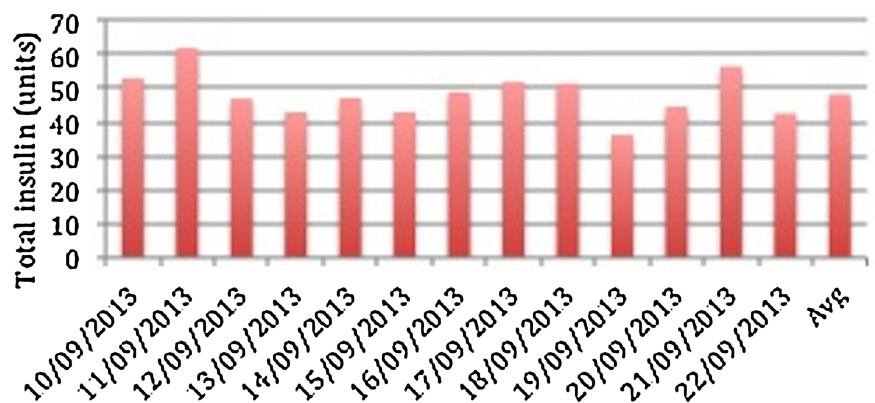
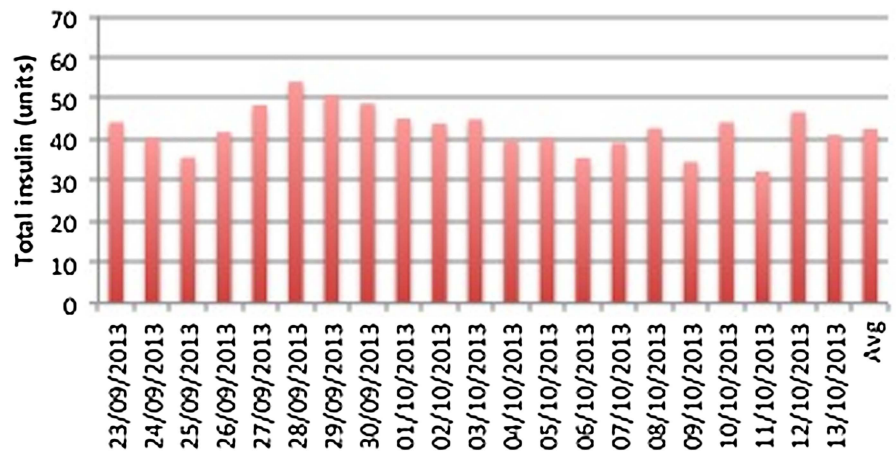


Figure 3 14–34 Day post-steroid total insulin.



Patient's perspective

The patient was pleased with the outcome regarding the shoulder pain but was surprised at how long it affected his insulin requirement. He wondered if he would have adjusted his insulin sufficiently if he had not been in the fortunate situation of having the continuous glucose monitoring system in place prior to the steroid injection.

Learning points

- ▶ A single triamcinolone steroid injection for shoulder pain in diabetic type 1 patients can give rise to significant elevation of blood glucose levels for many weeks.
- ▶ Practitioners should warn diabetic type 1 patients about this possible side effect.
- ▶ Diabetic type 1 patients should consider monitoring their blood glucose levels more frequently after steroid injection for shoulder pain to prevent hyperglycaemia.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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