



# Diabetic Ketoacidosis Due to Intra-articular Steroids: A Case Report

**Urgent Message:** Corticosteroid use is common, and patients receiving corticosteroids of any type are at risk for hyperglycemia and ketoacidosis.

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## Abstract

A 63-year-old male presents to urgent care with a self-diagnosis of urinary tract infection (UTI). The patient had been experiencing urinary frequency leading both he and his wife to believe he may have a UTI. After a simple dipstick urinalysis, it was determined the patient did not have a urinary tract infection but in fact had hyperglycemia and ketosis. Further questioning determined the patient had no history of diabetes but had recent intra-articular steroid injections. Patients receiving corticosteroids of any type are at risk for hyperglycemia.

## Introduction

A 63-year-old male presents to urgent care while on vacation with concerns that he may have a urinary tract infection (UTI). The patient states that he has been voiding frequently for the last 2 days. His wife nods her head in agreement. The wife also states he has been acting “off,” has been repeating things, and is occasionally confused. She says his personality seems different. He has no complaints of dysuria, urinary urgency, abdominal or flank pain, nausea, vomiting, diarrhea, fever, or chills.

Past medical history includes hypertension, osteoarthritis, and gout. Medications include losartan, hydrochlorothiazide, atorvastatin, and allopurinol.

## Physical Exam

His vital signs were normal. He was minimally agitated,

but awake, alert, and oriented. He appeared well hydrated. Head, ears, eyes, nose, and throat, as well as cardiopulmonary, abdominal, neurologic, and extremity exams were all normal.

## Testing

Urinalysis was performed which showed a very dilute urine, large glucose and large ketones but no blood or leukocyte esterase.

Upon further questioning, the patient admits to excessive thirst over the past few days. He also disclosed that he has severe osteoarthritis of both knees and needs knee replacements. Four days prior to travel, his orthopedist had performed intra-articular steroid injections (IASIs) in both knees to reduce his discomfort while on vacation. It is unknown the specific medication or what dose was administered.

A review of the patient’s medical records showed lab work done 1 month prior to admission with a normal complete blood count, comprehensive metabolic profile, a normal fasting glucose, and a HbA1c of 6.4%. The patient had not been informed he was prediabetic. A fingerstick glucose test completed in the urgent care center delivered a result too high for the glucometer to register (>500 mg/dl).

He was sent to the emergency department where lab work showed:

- Blood glucose of 860 mg/dl
- Serum bicarbonate of 14
- pH 7.21
- Anion gap of 13
- Serum ketones were positive consistent with a diag-

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nosis of diabetic ketoacidosis (DKA)

He was given intravenous fluids, placed on an insulin drip, and admitted to an intensive care unit (ICU). Patient was lost to follow-up, and therefore some details of the case were changed to protect patient anonymity and confidentiality.

## Discussion

A literature search of PubMed and Google Scholar using the key words “intra-articular,” “joint injection,” “steroid,” “corticosteroid,” “hyperglycemia,” “diabetes,” “prediabetic,” “ketoacidosis,” and “non-diabetic” in various combinations returned multiple articles of elevated blood glucose in patients with diabetes and patients without diabetes who received IASIs. No case reports were found in which diabetic ketoacidosis occurred in any patient following IASIs.

Use of corticosteroids in both the urgent care and orthopedic setting has become commonplace for their anti-inflammatory and pain-relieving effects. It is commonly perceived among clinicians that IASIs are safer than systemic steroids, and that the benefits of IASIs, such as reduced pain and increased mobility, significantly outweigh the risks of complications of these injections.<sup>1</sup>

The most well-known complication of IASIs is infection. Rarer local complications include skin necrosis, post injection flare of arthritis, and tendinopathy, including patellar tendon rupture. Systemic complications include transient hyperglycemia and adrenal suppression.<sup>1</sup>

Although thought to be safer than systemic corticosteroids, IASIs may be as likely as oral steroids to cause hyperglycemia in diabetic patients. Those with poor glycemic control and those prone to DKA are especially susceptible.<sup>2</sup>

A literature review by Waterbrook, et al, found several studies identifying hyperglycemia in diabetic patients after orthopedic corticosteroid injections, however none had significant complications from the hyperglycemia. In most cases, blood sugar returned to baseline in 24 hours.<sup>3</sup>

Uboldi, et al, found that patients without diabetes will have a 43% increase in blood glucose 2 hours after intra-articular steroid injection, while patients with diabetes may have up to a 70% increase in glucose from baseline 2 hours after intra-articular steroid injection. However, blood glucose returned to baseline in all patients without complication within 24 hours, prompting the authors to recommend that IASI are safe in diabetic patients.<sup>4</sup>

Both Barker and Choudhry found that hyperglycemia may occur up to 1 week after IASI in patients with diabetes.<sup>2,5</sup> Clinicians are encouraged to ensure patients who have poor control or those who are prone to DKA

have access to follow-up for close monitoring.

More than 9 million Americans have undiagnosed diabetes and more than 79 million Americans may have pre-diabetes.<sup>6</sup> Those without adequate primary care, poor follow-up, or poor insight regarding their health may have an increased risk for hyperglycemia following IASIs. In a study by Nguyen, et al, a screening questionnaire for risk factors for hyperglycemia and diabetes was administered to patients prior to IASIs in the knee. More than 60% had a high risk of having inadequately treated diabetes or previously undiagnosed diabetes.<sup>7</sup>

## Recommendations

Following IASI, diabetic patients should be warned of the possibility of hyperglycemia and should be advised to regularly monitor their blood glucose for at least a week following injection.<sup>2,5</sup> Clinicians are encouraged to counsel all patients on the symptoms of hyperglycemia (such as polydipsia, polyuria, polyphagia) following the administration of steroids.<sup>2</sup> Early recognition allows early assessment and intervention if needed.

## Conclusion

This patient was treated in the ICU for DKA. After a 3-day hospitalization, he became asymptomatic, his lab results returned to normal, and he was discharged on no diabetic medications. He had no permanent sequela. Providers believed the 2 injections simultaneously doubled the dose of corticosteroids received, and accidental soft-tissue injection—rather than intra-articular injection—may have contributed to the extreme hyperglycemia and subsequent DKA. ■

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