hypoglycemia that may be present in 30% and even more patients; 4) usually good insulin sensitivity (making the patients more sensitive to even smaller doses of insulin, especially if added to their regular daily doses) (5). We believe that in these patients, special attention should be paid when administering insulin in the treatment of hyperkalemia, especially if the glucose level prior to insulin administration is in or close to the normal values. As some of the above-mentioned features could be present in type 2 diabetes patients, we also advise that special attention should be paid to those treated with insulin or sulfonylurea derivates.

Our second remark is related to the use of insulin analogues in the treatment of hyperkalemia in patients with renal failure. The authors correctly noted that their half-lives are not prolonged in renal insufficiency patients because they are not eliminated chiefly via renal excretion: some studies therefore showed a lower risk of hypoglycemia. But, as the gluconeogenesis is impaired in the kidneys of those patients, a higher risk of hypoglycemia is, to some extent, still present (2).

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☐ RISKS OF HYPOGLYCEMIA WITH INSULIN THERAPY FOR HYPERKALEMIA

☐ The Reply:

Thank you, Dr. Brož, for your insights regarding the risk of hypoglycemia with insulin therapy for hyperkalemia. Dr. Brož brings to light several important considerations regarding hypoglycemia in his discussion of insulin therapy for hyperkalemia, especially in patients with diabetes and end-stage renal disease (1–3). Several studies suggest that risk factors for hypoglycemia with insulin therapy for hyperkalemia include lower patient weight (<60 kg), patients without prior history of diabetes, and patients with lower pretreatment glucose levels (1,4). As Dr. Brož states, one major contributor to hypoglycemia is lower serum glucose levels in patients without diabetes, as the elevated serum glucose levels in diabetic patients may protect them from hypoglycemia (5). End-stage renal disease also results in prolonged insulin duration of action due to reduced insulin clearance (1–3).

Dr. Brož, in his letter, further states that patients with insulin-dependent diabetes (formerly type 1 diabetes) demonstrate difficulty clearing circulating insulin and possess a higher sensitivity to even small doses of insulin, decreased glucose threshold for counterregulatory hormone release, and impaired awareness of hypoglycemia (5). In non-insulin-dependent diabetic patients (formerly

type 2 diabetes), insulin analogues may contribute to greater risk of hypoglycemia due to impaired gluconeogenesis (3,5). However, these medications are not predominantly eliminated through the renal system, and the half-lives of these medications are not typically prolonged in patients with end-stage renal disease (1–3,5).

As discussed in our article, several insulin-dosing strategies may be utilized for hyperkalemia (2). Unfortunately, studies evaluating hypoglycemia associated with insulin therapy predominantly consist of retrospective cohorts. Most studies evaluated intravenous (i.v.) insulin 10 units (high dose) compared with 5 units or weight-based dose (0.1 units/kg) (low dose) (6–10). Rates of hypoglycemia range from 6.7% to 22.6% in lower-insulin-dose groups, vs. 5.8% to 33% in higher-dose groups (6–10). Although rates of hypoglycemia were similar or slightly decreased in patients receiving lower insulin doses, mean post-insulin serum potassium values were similar between lower and higher insulin therapy groups (6–10). One of the largest studies to date evaluated insulin 5 units vs. 10 units for hyperkalemia in patients with renal insufficiency, finding an approximate 9% decrease in hypoglycemia rates with 5 units, with no difference in serum potassium decrease between the two groups (7). Thus, lower insulin doses (5 units or 0.1 unit/kg weight-based dose) likely result in similar rates of serum potassium decrease, with potentially reduced risk of hypoglycemia compared with standard 10-unit doses. Our article also discusses short-acting insulins, which may be associated with reduced risk of hypoglycemia (2).

Dextrose is typically provided in conjunction with insulin, most commonly dextrose 25 g as an i.v. bolus. However, insulin's hypoglycemic effects may last up to several hours in specific patient populations, much longer than a single dextrose bolus (1–3). Hypoglycemia most commonly occurs 2.5–3.5 h after insulin administration (4,8,11,12). Providing a dextrose bolus followed by infusion or dextrose infusion alone over several hours may reduce hypoglycemia risk (2,11,12). Serum glucose monitoring every hour for at least 3–4 h post insulin administration is reasonable to ensure that hypoglycemia is rapidly diagnosed and treated.

Insulin is a necessary component for hyperkalemia management. By utilizing lower insulin doses, dextrose infusion, and serum glucose monitoring, the risk of hypoglycemia in the setting of hyperkalemia therapy with insulin may be decreased. Prospective data are needed evaluating optimal insulin and dextrose strategies.

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