Practice Corner: The first symptom of hyperkalemia is death

How do we find out about new useful treatments? For new pharmaceuticals, you are likely to be inundated with information and dinners. But for nonpharmaceuticals, complementary medicines, or simple but effective uses of old pharmaceuticals, updates and reliable information are less accessible. This issue's clinical scenario is set in a busy suburban primary care practice. However, the practice has the still-unusual advantage of being computerized, with permanent Internet access from the doctor's desktop.

THE PATIENT

An anxious laboratory technician phoned the practice after finding a serum potassium level of 7.3 mmol/L on a routine blood test of a 50-year-old woman. She was not my patient, but because of this test result, she was booked to see me urgently. Recalling a renal physician's adage that *"the first symptom of hyperkalemia is death,"* I wondered whether she would turn up and what I should do. When she arrived, I made sure that she wasn't taking any medications that would raise her potassium and arranged an urgent repeat test of the potassium and other electrolytes (to rule out a spurious elevation and check renal function) and electrocardiography (ECG). While waiting for the ECG, I decided to do a quick search on the question: *Does a normal ECG rule out a serious elevation of potassium?*

THE SEARCH

For diagnostic accuracy questions, I usually try PubMed Clinical Queries first (using the "diagnosis" and "specific" buttons) (Figure 1). To capture both British and U.S. terms, I typed in "hyperkal* AND (ECG OR EKG)," which yielded half a dozen articles, including a review of doctors' abilities to detect hyperkalemia from the ECGs of 220 consecutive patients with potassium > 6.5 mmol/L (1). The sensitivity was at best 62%, thus the ECG would miss nearly half the cases and was clearly not a SnNout (a sensitive test for which a negative result rules out the diagnosis) (2).

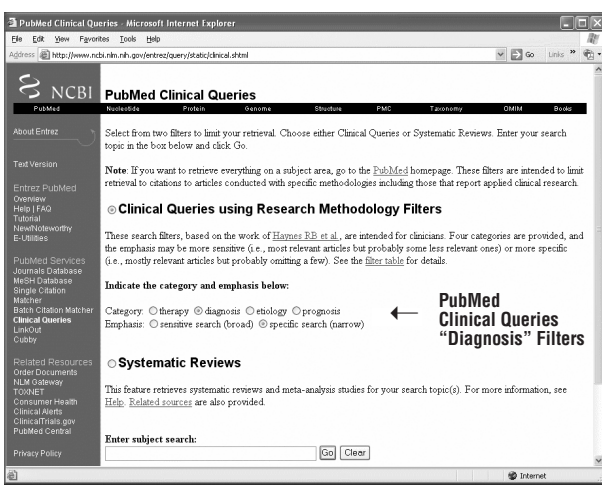

Figure 1.

Clicking on the "related articles" to this article yielded a report of 2 patients with potassium levels > 9.0 mEq/L for whom the ECGs did not show any signs of hyperkalemia (Figure 2). Another report of a series of 127 hospital patients with hyperkalemia showed ECG abnormalities in only 14% of cases (3).

The ECG was normal, so we arranged a cup of tea for her as we anxiously awaited the urgently repeated electrolytes, which confirmed the original reading.

Figure 2.

THE NEXT CLINICAL QUESTION

When I suggested to her that, despite her feeling perfectly well, she was in imminent danger and needed to go to hospital for treatment, she flatly refused. It appeared that she was 1 of many patients who had been so abused and humiliated by previous hospital experiences that they would rather die than return to hospital. I considered Resonium A, but unfortunately it costs about AUS $100, which she could not afford. What was I to do?

THE SEARCH

The second ECG article that I retrieved during the above search also mentioned that the treatments used for the 127 patients were exchange resin (51%), insulin (46%), calcium (36%), bicarbonate (34%), and albuterol (4%). Since I already had PubMed Clinical Queries open, I searched for (hyperkalem* OR hyperkalaem*) using the therapy filter. *(To pick up all studies on a drug class, I would now find the MeSH term for that class—in this case "adrenergic beta-agonist"—which would have simplified the search by reducing the "hits" to the 8 most relevant articles.)*

Alerted by the use of albuterol, I came across several helpful trials of the use of β-agonists such as salbutamol for the treatment of hyperkalemia. Particularly useful was a small placebo crossover trial of 17 patients with chronic renal failure and hyperkalemia (4), for which PubMed gave the free full-text link (Figure 3). The trial seemed to be properly randomized, with 100% follow-up and blinded outcome measurements. Patients were treated before dialysis with 1200 µg of nebulized salbutamol or placebo. Blood samples were taken at 1, 3, 5, 10, and 60 minutes, and the serum

potassium level showed a small increase of 0.1 mmol/L in the first minute but decreased thereafter by almost 1 mmol/L. This finding was consistent with those from several other studies found in MEDLINE. Fortunately, I had a little time during the clinic to complete the searches and look at these articles before moving on to the final treatment decision.

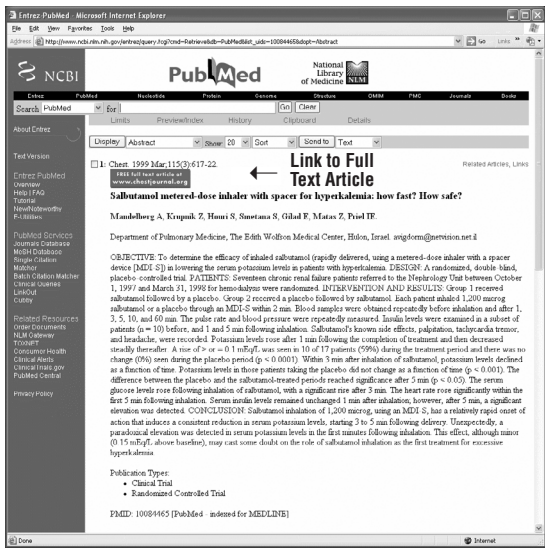

Figure 3.

With the patient attached to an ECG monitor and some trepidation, I administered the nebulized salbutamol and then started a 4-hourly puffer (continued every 4 h until the potassium level approached normal) and arranged daily potassium tests for the next few days. The next day her potassium level was 6.4 mmol/L, and returned to normal over the next few days. As with asthma, using salbutamol for hyperkalemia is only symptomatic treatment and the underlying causes of hyperkalemia needed to be determined and treated. In this case, it resulted from mild renal failure and overconsumption of high-potassium foods and beverages (in the hot part of summer her diet had consisted mostly of mangoes and fruit juice), which was ceased.

Given that I have a couple of patients in my practice with chronic renal failure, I was pleased to have another simple, effective tool in my therapeutic armamentarium. It is interesting to also note that hypokalemia is listed as an adverse effect of salbutamol in the product information. The lowering of potassium levels by adrenaline has been known for more than half a century, but this effect was not used clinically until 1976 when a case report in the *Lancet* showed its usefulness for treating periodic hyperkalemic paralysis (5). After this episode, I checked several texts and guidelines and found that they either did not cover the topic or mentioned only the standard intravenous insulin and glucose regimen. It was unfortunate that I didn't have a copy of *Evidence-Based On Call* (6) or access to the Web site (www.eboncall.org) in my clinic (the local Internet firewall only allows a limited list of Web sites), as this would have saved me further time (Figure 4). As Brian Haynes has suggested, the ideal search cascade consists of the sequence of systems, then synopsis, then systematic reviews, and finally (primary) studies (7).

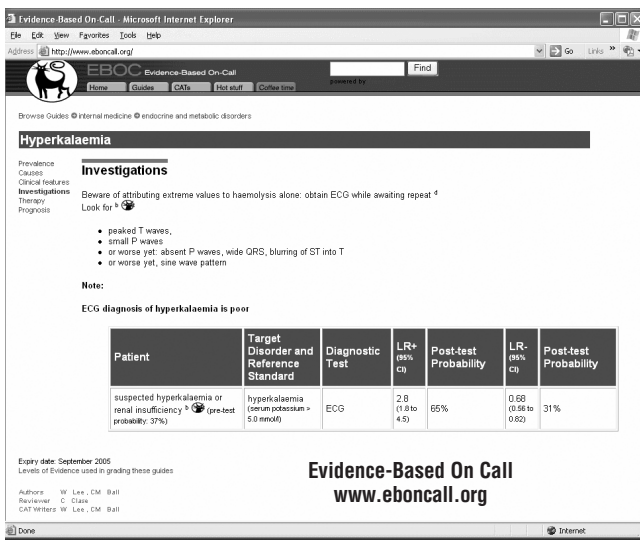

Figure 4.

Both the insensitivity of an ECG to hyperkalemia and use of salbutamol for its management were described in this very useful evidence-based emergency medicine resource, and I was able to access this information in less than 1 minute. Indeed, it contained additional details and warnings that I had not discovered in my own literature search, highlighting the value of a good, preappraised resource. It brings to mind Oscar London's rule that "You're only as effective as the consultants you pick," to which I would add, "and the evidence resources in your office."

Paul Glasziou, MBBS, PhD
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