

# EBM notebook

## Practice corner: the first symptom of hyperkalaemia 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 non-pharmaceuticals, 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 computerised, with permanent internet access from the doctor's desktop.

### THE PATIENT

An anxious laboratory technician phoned the practice with a serum potassium concentration of 7.3 mmol/l found 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 hyperkalaemia is death,"* I wondered whether she would turn up and what I should do? When she arrived, I checked her medications to be sure that she wasn't on any that would raise her potassium, and arranged an urgent repeat of the potassium and other electrolytes (to rule out a spurious elevation and check renal function, etc) and an electrocardiogram (ECG). While I was 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). To capture both English and US terms I typed in "hyperkal\* AND (ECG OR EKG)," which yielded half a dozen articles including a review of doctors' abilities to detect hyperkalaemia from the ECGs of 220 consecutive patients with potassium over 6.5 mmol/l. The sensitivity was at best 62% and thus the ECG would miss nearly half the cases and was clearly not a SnOut (a sensitive test for which a negative result rules the diagnosis out).

Clicking on the "related articles" to this article yielded a report of 2 patients with potassium concentrations greater than 9.0 meq/l for whom the ECGs did not show any signs of hyperkalaemia. Another report of a series of 127 hospital patients with hyperkalaemia showed electrocardiographic abnormalities in only 14% of cases.<sup>2</sup>

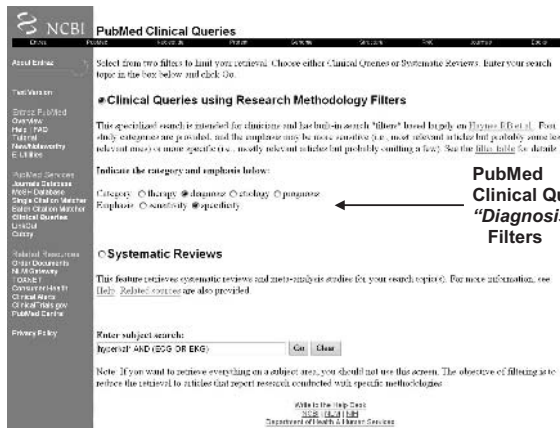
Our patient's ECG was normal and we arranged a cup of tea for her as we anxiously awaited the urgently repeated electrolytes test, which confirmed the original reading.

### 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 bluntly refused. It appeared she was one of the many patients who had been so abused and humiliated by their previous hospital experiences that they would rather die than return to hospital. I considered Resonium A, but unfortunately it costs around \$AUS100, which she could not afford. What was I to do?

### THE SEARCH

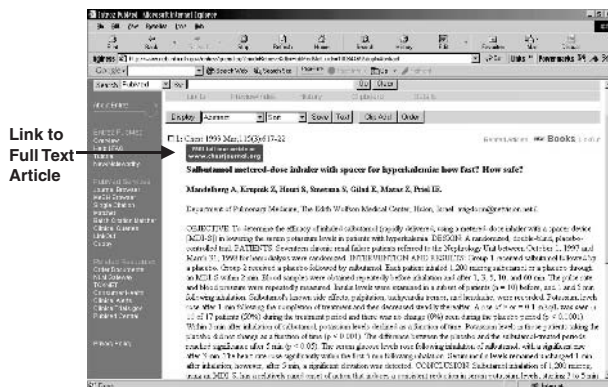
The second ECG article that I retrieved during the above search also mentioned that the treatments used for the 127 patients were: exchange resin (51%), insulin (46%), calcium (36%), bicarbonate (34%), and albuterol (4%). Since I already had PubMed: Clinical Queries open, I searched for (hyperkalem\* OR hyperkalaem\*) using the therapy filter. Alerted by the use of albuterol, I came across several helpful trials of the use of  $\beta$  agonists such as salbutamol for the treatment of hyperkalaemia. Particularly useful was a small placebo crossover trial of 17 patients with chronic renal failure and hyperkalaemia,<sup>3</sup> for which PubMed gave the FREE full text link. The trial appeared properly randomised, with 100% follow up and blinded outcome measurements. Patients were treated prior to dialysis with 1200  $\mu$ g of nebulised salbutamol or placebo. Blood samples were taken at 1, 3, 5, 10 and 60 minutes and the serum potassium concentration showed a small rise of 0.1 mmol/l in the first minute, but thereafter a drop of almost 1 mmol/l. This finding was consistent with



PubMed Clinical Queries "Diagnosis" Filters



Related Articles



those from several other studies 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.

With the patient attached to an ECG monitor and some trepidation, I gave her the nebulised salbutamol and then started a 4 hourly puffer (continued 4 hourly until her potassium concentration was near normal), and organised daily potassium tests for the next few days. The next day her potassium concentration was 6.4 and it subsequently came down to normal over the next few days. As with asthma, using salbutamol for hyperkalaemia is only symptomatic treatment, and the underlying causes of hyperkalaemia need to be determined and treated. In her case, it had been caused by the combination of mild renal failure and a number of high potassium foods and beverages (in the hot part of summer her diet had been mostly mangoes and fruit juice), which were 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 note too that hypokalaemia is listed as an adverse effect of salbutamol in the product information. The lowering of potassium concentrations 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 hyperkalaemic paralysis.<sup>5</sup> 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*<sup>3</sup> or access to the website ([www.eboncall.org](http://www.eboncall.org)) in my clinic (because the local internet firewall only allows a limited list of websites), as this would have saved me further time. As Brian Haynes has suggested, the ideal search

**Evidence-Based On Call**  
[www.eboncall.org](http://www.eboncall.org)

**Hyperkalaemia**

**Investigations**

Review of study being done in order to assemble some, obtain ECG while waiting repeat?

Look for:

- raised T waves,
- small P waves
- or worse and about P waves like QRS, burial of ST and T
- or worse yet, sine wave pattern

**Notes:**

ECG diagnosis of hyperkalaemia is poor

Patient	Target Disorder and Reference Standard	Diagnostic Test	LR+ (95% CI)	Post-test Probability	LR- (95% CI)	Post-test Probability
asymptomatic hyperkalaemia or mild hyperkalaemia	type I Kalium-201 scintigraphy	ECG	2.8 (1.2-6.2)	65%	0.38 (0.26-0.54)	31%

cascade consists of the sequence of systems, then synopsis, then systematic reviews, and finally (primary) studies.<sup>6</sup>

Both the insensitivity of an ECG to hyperkalaemia 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 under 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 pre-appraised 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 "plus the evidence resources in your office."

\*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.

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- 1 Wrenn KD, Slovis CM, Slovis BS. The ability of physio to predict hyperkalemia from the ECG. *Ann Emerg Med* 1991;**20**:1229–32.
- 2 Acker CG, Johnson JP, Palevsky PM, et al. Hyperkalemia in hospitalised patients. *Arch Intern Med* 1998;**158**:917–924.
- 3 Mandelberg A, Krupnik Z, Hourii S, et al. Salbutamol metered-dose inhaler with spacer for hyperkalemia: how fast? How safe? *Chest* 1999;**115**:617–22.
- 4 CM Ball, RS Phillips, editors. *Evidence-based on call: acute medicine*. Edinburgh: Churchill Livingstone, 2001.
- 5 Wang P, Clausen T. Treatment of attacks in hyperkalaemic familial periodic paralysis by inhalation of salbutamol. *Lancet* 1976;**1**(7953):221–3.
- 6 Haynes RB. Of studies, syntheses, synopses, and systems: the "4S" evolution of services for finding current best evidence. *Evidence-Based Medicine* 2001;**6**:36–38.