

Lesson of the Week

Pseudohyperkalaemia

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A spuriously raised serum potassium concentration may be caused by lysis of leucocytes or platelets during venepuncture or separation of serum. This was first described in a patient with severe thrombocytosis¹ and termed pseudohyperkalaemia. It was subsequently documented in acute² and chronic³⁻⁵ myeloproliferative syndromes where the white cell or platelet count was very high and may also be found in chronic lymphocytic leukaemia.⁶ Failure to appreciate the presence of pseudohyperkalaemia may lead to inappropriate potassium lowering treatment. We report two cases.

Case 1

A 71 year old man presented with a two week history of increasing effort dyspnoea and paroxysmal nocturnal dyspnoea. He had rheumatic aortic valve disease and heart failure and was taking digoxin, frusemide, amiloride, and isosorbide dinitrate. A diagnosis of polycythaemia rubra vera had been made two years previously and he had received both radiophosphorus and repeated venesections. The physical signs suggested left ventricular failure, and this was confirmed radiologically. He responded well to morphine, frusemide, and oxygen.

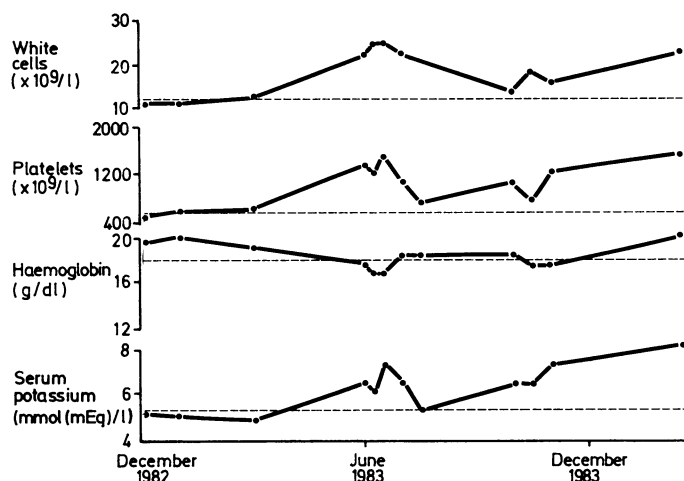
Immediate investigation disclosed a serum potassium concentration of 8.0 mmol(mEq)/l; concentrations of other electrolytes, urea, and creatinine were normal. The electrocardiogram showed left ventricular hypertrophy and digoxin effect but no evidence of hyperkalaemia. The hyperkalaemia was assumed to be secondary to amiloride and he was treated conventionally with intravenous calcium, insulin, and glucose. Two hours later the serum potassium concentration was unchanged and the electrocardiogram unaffected. Subsequent haematological examination showed a haemoglobin concentration of 20.1 g/dl, a white cell count of $22.1 \times 10^9/l$, and a platelet count of $1500 \times 10^9/l$. In view of the lack of electrocardiographic evidence of hyperkalaemia and the blood picture we considered the possibility of pseudohyperkalaemia. No further potassium lowering treatment was given and he remained well.

Different methods of sample collection were evaluated. Using whole blood from a single venepuncture, serum (entailing platelet reaction and delay for blood clotting) and plasma potassium concentrations were compared (Technicon mark 4 autoanalyser). The effects of forearm exercise, venous stasis, and needle bore were also assessed. The table gives the results. In the previous 18 months blood had been taken on 12 occasions for blood count and serum potassium estimations. Both tests had been performed on the same venepuncture sample. Evidently (figure) there was appreciable hyperkalaemia at times when the white cell and platelet counts were raised. There was no relation between potassium concentration and haemoglobin value, implying that leucocyte or thrombocyte (rather than erythrocyte) lysis in vitro accounted for the hyperkalaemia.

When the serum potassium concentration is raised and there is no clinical or electrocardiographic evidence of hyperkalaemia pseudohyperkalaemia must be considered

Case 1. Evaluation of methods of sample collection. Values are means of four separate samples processed without delay

Needle size	Mode of venepuncture	Serum potassium (mmol(mEq)/l)	Plasma potassium (mmol(mEq)/l)
14 gauge (large)	Without tourniquet	7.5	6.1
	With tourniquet	7.5	5.9
	With tourniquet and forearm exercise	7.8	6.1
21 gauge (small)	With tourniquet	7.9	6.0



Case 1. Relations between simultaneously determined serum potassium and haemoglobin concentrations and platelet and white cell counts. Dotted lines represent upper limits of normal ranges.

Case 2

A 71 year old woman was admitted with a six month history of anorexia, weight loss, and malaise. There was a 16 year history of controlled hypertension, for which she took Viskaldix (pindolol 10 mg and clopamide 5 mg) one tablet daily. She looked pale and unwell; a vague mass was palpable in the right side of the abdomen. Blood pressure was 150/90 mm Hg.

Haematological investigation yielded a haemoglobin concentration of 8.6 g/dl, white cell count of $34 \times 10^9/l$ (68% mature neutrophils), and platelet count $783 \times 10^9/l$. Serum biochemical values were: sodium 140 mmol(mEq)/l, potassium 7.7 mmol/l, chloride 109 mmol(mEq)/l, bicarbonate 14 mmol(mEq)/l, urea 21.5 mmol/l (130 mg/100 ml), and creatinine 232 $\mu\text{mol/l}$ (2.6 mg/100 ml). The electrocardiogram showed no evidence of hyperkalaemia. Results of intravenous pyelography and abdominal ultrasound

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suggested a tumour of the right kidney. Marrow examination was technically inadequate, but chromosomes were normal and the leucocyte alkaline phosphatase score increased.

The patient's condition suddenly deteriorated and she died. Necropsy showed a perforated duodenal ulcer and a clear cell carcinoma of the right kidney.

The haematological picture was attributed to a leukaemoid reaction to her renal tumour. The raised potassium concentration was initially ascribed to her renal impairment and treated with intravenous insulin and glucose. Potassium values ranged widely between 6.0 and 7.7 mmol/l, and it was noted that serum processed immediately resulted in values some 2.0 mmol/l lower than those estimated routinely and entailing a delay of a few hours. Hyperkalaemia was then thought to be spurious and related to the high peripheral white cell and platelet counts.

Comment

Hyperkalaemia in patients with an increased peripheral white cell or platelet count, in the absence of appropriate clinical or electrocardiographic abnormalities, should raise the suspicion that this is

an epiphenomenon due to cellular lysis *in vitro*. This phenomenon is of no clinical importance, save that it must be distinguished from true hyperkalaemia so that inappropriate and potentially dangerous treatment can be avoided. It is possible to minimise the degree of artefact by using a large bore needle, avoiding a tight tourniquet and forearm exercise,⁷ and processing a plasma (rather than serum) sample without delay.

References

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Medicine and the Media

THOUGH MEDICINE seems to have become an increasingly political issue, most doctors are politically naive. When suddenly faced with a major storm the rules of the game of politics have to be learnt, and learnt fast to survive. The experiences of the past few months have taught me many of the basic skills of this new dimension of medical practice and for that I must be grateful.

During November 1984 the junior doctors at the Battle Hospital, where I was working as part of my general practice vocational training, decided to participate in the British Medical Association's scheme to send a black bordered card to the members of parliament of any constituent who had died of a disease related to their having smoked. These cards, while not naming the patient, informed the MP of a death and that the death was associated with smoking. Duly enthused by our corporate decision to become active in the campaign against smoking we carried out our intentions.

It was only after Christmas that the storm broke. A letter arrived from Sir William van Straubenzee, the MP for Wokingham, in response to a card I had sent him, in which he told me: "You have chosen a particularly ghoulish method of informing me of a constituent's death. In order that I may investigate the matter carefully, I now call on you to give me the name and address of the constituent concerned."

"I appreciate, of course, that this request will cause distress to the relatives of the deceased. I very much regret this. But it is you and not I that have chosen to give publicity to the death of my constituent."

"I know too you will understand that because of public interest in the matter I am releasing this letter to the press."

The matter was now going to escalate, especially if the local press were to take up the story. A rather desperate telephone call to the BMA's press department resulted in the advice to reply to the letter and contact the local papers to ask them to refer to me were they to use the story.

Meanwhile, I replied to the letter: "I am sorry that you have misinterpreted the postcard for its intentions are merely to draw your attention to the large numbers of your constituents who are dying due to cigarette smoking; professional ethics would allow us to do no more. However, I am pleased that the card has made you aware of this issue and would appreciate the publicity given to the continuing killing of the people of this area by tobacco products."

That publicity came fast and strong with headlines proclaiming "Sir Bill Attacks Doctor's 'Death Notice'," and more threateningly, "I will hunt Dr Ingram. I will make life very troublesome for him even if I have to draw attention to him through parliament." There was, however, still room for humour as Sir William's reported medical theories were noted, "The biggest single killer is obesity" and his assertion that tobacco advertising was comparable to that of sweets and cakes. (*Wokingham Times* 1985 Jan 17:1.) In the same newspaper the writer of a leading article warmed to the prospect of a good fight: "Until now Dr Ingram has never been in a war, and certainly not the sort of war of words that MP Sir Bill has declared on him...freely translated [his letter] means 'I am going to see to it that the general public crucifies you.'... If Dr Ingram has any skeletons in his cupboard he would be well advised to dissolve them in a bath of sulphuric acid," ran on the "comforting" words.

Fortunately, all these dramatic tales of forthcoming doom were countered by an immense wave of support. That from my colleagues and all the staff at the hospital was alone strong enough to counter what I had been subjected to, but in addition I started to receive letters and phone calls from many local people. All except one were letters of support urging me not to give in to Sir William and wishing me well in the campaign. The effect of all this was to change my view of the position that I occupied. I was transformed from an innocent on the sharp end of a parliamentary boot to a person sharing the opinions and wishes of people in the area. Another encouragement was the attitude of the BMA, which declared itself behind me and allowed me to peek into their political arsenal to boost my morale.

As the conflict began to command increasing attention from the media it was important to use the resulting opportunities to put over messages about smoking rather than let the affair degenerate into a personality battle. The switch to the offensive could only take place once I thought that Sir William's tactics were hollow and could safely be discounted. This change took place during the first week, and within a few days a letter had been sent to Sir William from the junior staff at Battle Hospital. After condemning his tactics they suggested that if Sir William found the black edged cards "ghoulish" they "would like to suggest that he sees for himself the disease and ill health caused by smoking." They put forward the case again, stating that "100 000 people a year die prematurely from