

CASE REPORT

Correlation of Iatrogenic Mild Hyperkalaemia and Bradyarrhythmia: A Problem of Polypharmacy in Elderly

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ABSTRAK

Hiperkalemia ringan selalunya tidak menyebabkan gejala yang melibatkan jantung. Akan tetapi bagi pesakit tua yang menggunakan ubat penghalang atrio-ventrikular (AV), hiperkalemia ringan sekalipun boleh membawa musibah. Kami melaporkan satu kes bradialithmia berpanjangan disebabkan hiperkalemia iatrogenik pada seorang pesakit yang menggunakan ubatan penghalang AV. Seorang wanita berusia 81 tahun yang mengambil pelbagai ubatan kerana beberapa masalah perubatan telah datang dengan gejala bradialithmia. Malah beliau mempunyai dua jenis ubat preskripsi penghalang AV yang berbeza iaitu penghalang beta dan amiodaron. Tahap potassium beliau agak tinggi sedikit disebabkan kerosakan buah pinggang akut. Gejala bradikardia beliau berterusan dan beliau bergantung kepada ubat isoproterenol sehingga fungsi buah pinggang kembali normal. Kes ini menekankan paras yang berbeza untuk manifestasi gejala hiperkalemia berlaku kepada kumpulan pesakit yang semakin ramai: pesakit tua yang mempunyai pelbagai masalah kesihatan dan polifarmasi.

Kata kunci: bradialithmia, bradikardia, orang tua, hiperkalemia, polifarmasi

ABSTRACT

Mild hyperkalaemia does not typically cause cardiac symptoms. However, for an elderly patient on atrio-ventricular (AV) nodal blocker, even mild hyperkalaemia may result in disastrous outcome. We report a case of persistent bradyarrhythmia caused by iatrogenic hyperkalaemia in a patient who had concomitant use of AV nodal medication. An 81-year-old lady with multiple comorbidities and a long list

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of medications presented with symptomatic bradyarrhythmia. She, in fact, had two AV nodal blockers in her prescription, a beta-blocker and amiodarone. Her potassium level was found to be mildly elevated due to acute renal failure. She remained bradycardic despite initial treatment and was subsequently dependant on intravenous isoproterenol until her renal function improved. This case highlights the different threshold for manifestation of hyperkalaemic symptoms in a growing group of patients: elderly patients with multiple comorbidities and polypharmacy.

Keywords: bradyarrhythmia, bradycardia, elderly, hyperkalaemia, polypharmacy

INTRODUCTION

Hyperkalaemia is a condition where the serum level of potassium is elevated due to various factors. Potassium affects the generation of action potential in myocardial tissue where at a higher level may cause atrial and ventricular arrhythmias including heart blocks and asystole. Serum level above 5.0 mmol/L is considered as hyperkalaemia. Typically mild elevation between 5.1 to 6.0mmol/L does not usually cause any cardiac symptoms. However, mild hyperkalaemia in the setting of concomitant use of atrio-ventricular (AV) nodal blocker may be hazardous for a patient, especially in the elderly population.

CASE REPORT

An 81-year-old lady presented to the Emergency Cardiac Assessment Unit of a specialized Cardiac Centre with 2 days history of chest discomfort over central chest which was associated with giddiness and lethargy. Otherwise, she denied having chest pain, breathlessness or palpitation. She was mildly hypertensive on arrival with

blood pressure of 165/74mmHg but bradycardic with heart rate of 33 beats/min. Other vital signs were within normal range. Physical examinations were unremarkable.

Electrocardiogram (ECG) on arrival showed absence of P wave with slow ventricular rate (Figure 1). Her renal profile was deranged with potassium of 5.8 mmol/l, urea of 29.4mmol/l and creatinine of 272 mmol/l. Meanwhile, her international normalized ratio (INR) was 3.2 and her activated prothrombin time (aPTT) was 69.2. Her full blood count (FBC), electrolytes and cardiac enzymes were within normal range.

There was limited information regarding her baseline medical condition. It was known that her past medical illnesses include diabetes mellitus, hypertension, dyslipidaemia, ischaemic heart disease as well as atrial fibrillation for which she was under follow up by a private centre elsewhere. She was on a number of oral medications that included bisoprolol, amiodarone, rivaroxaban, ezetimibe, amlodipine, spironolactone, slow K and subcutaneous insulin. She was unsure regarding the duration that she has had the medications for.

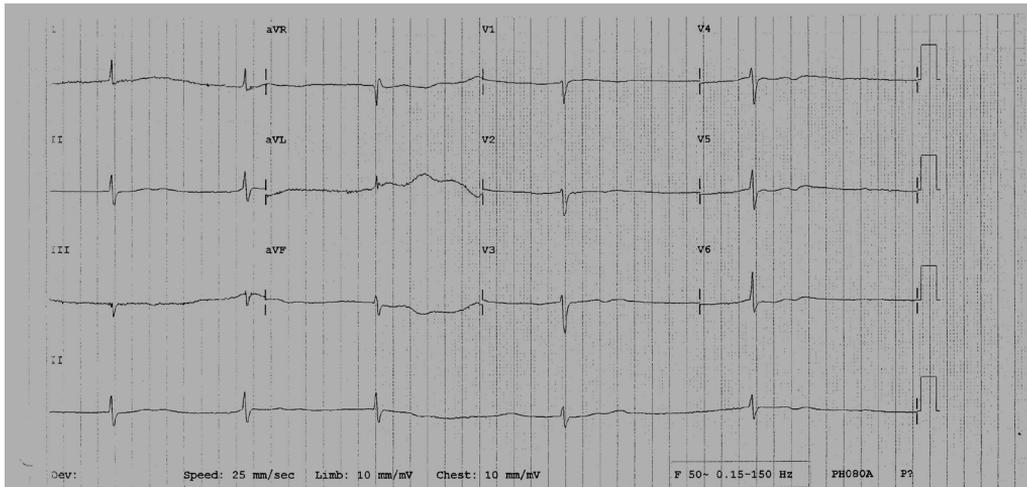


Figure 1: Initial electrocardiogram (ECG) during arrival to the emergency cardiac unit showing no P wave and slow ventricular rate of 33 beats per minute.

Intravenous atropine 0.5mg was given twice (total of 1mg) to no effect. She was started on intravenous isoproterenol infusion and was monitored in the Coronary Care Unit (CCU). Echocardiogram (ECHO) showed good cardiac function with no obvious regional wall motion abnormalities. In the ward, her potassium level normalized following gradual improvement of her kidney function without requiring dialysis. She was dependant on intravenous isoproterenol infusion to maintain her heart rate above 40 beats/min (Figure 2) for about 2 weeks.

Her persistent bradycardia was attributed to beta blocker and amiodarone overdose. She was initially planned for temporary pacemaker insertion. However, after the improvement of her renal function, her heart rate remained within the normal range without isoproterenol support (Figure 3).

DISCUSSION

The percentage of elderly population above the age of 65 yrs has increased in the past few years and it is estimated to reach 1.2 billion in 2025. A shift in focus of health-care and medical needs to cater for this population essentially aligns with the demographic transformation (Puska & Kalache 2013). Elderly patients are particularly at risk of drug-drug interaction as they are typically ardent user of medications. In addition, their age-related physiological changes further influences individual drug effects (Lee et al. 2011). This case report highlighted the diagnosis and challenges encountered in managing an elderly patient with bradyarrhythmia due to effect of iatrogenic mild hyperkalaemia with concomitant use of multiple AV blockers.

Drug-induced hyperkalaemia is a significant health-care concern as it reflects the failure of managing

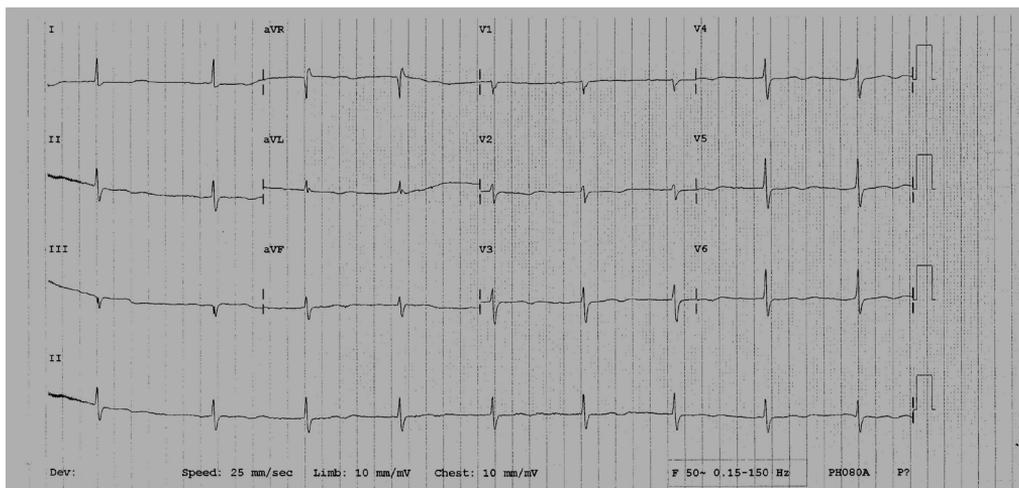


Figure 2: Electrocardiogram (ECG) on day 7, whilst on intravenous isoprenaline infusion 60mcg per ml per hour. There is absent of P wave and ventricular rate of 50 beats per minute.

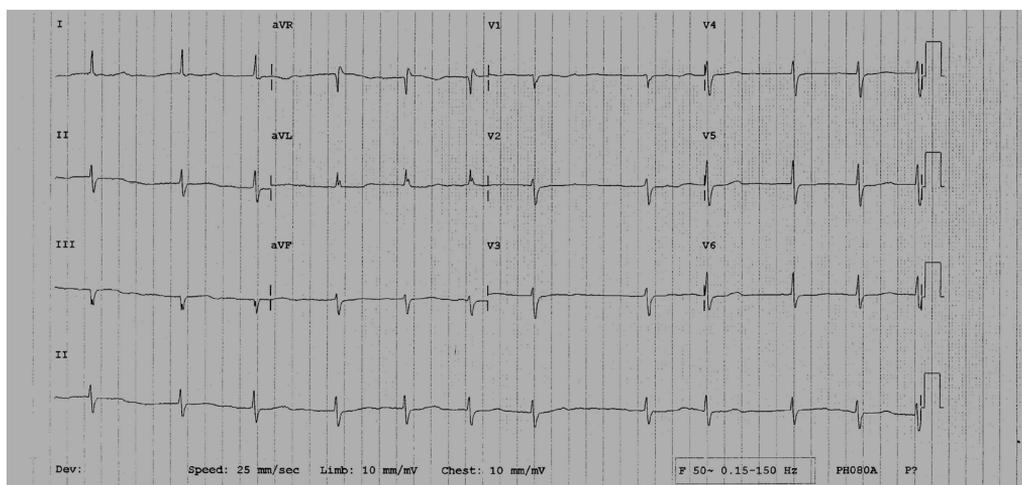


Figure 3: Electrocardiogram prior to patient discharge, showing atrial fibrillation with left axis deviation. The ventricular rate documented on the ECG was 73 beats per minute.

polypharmacy, which is seen more commonly in geriatric population due to multiple co-morbidities. Numerous factors may lead to the occurrence of iatrogenic hyperkalaemia in elderly including age-related decline in glomerular filtration rate, volume depletion of various causes, use of certain medications linked to diseases such as diabetes mellitus,

cardiovascular disease or renal disorders as well as from overzealous potassium diets (Aziz et al. 2011). Elderly population is also more prone to hospital admissions. It was noted that there was a significant increase in the number of potential drug-drug interaction from admission to discharge and hyperkalaemia was the most prevalent potential adverse effect

observed (Straubhaar et al. 2006). This finding is parallel with another study that found 85% of patients treated with numerous cardiovascular diseases medications in outpatient setting have elevated renal function parameters upon their admission to hospital (Wozakowska-Kaplon & Janowska-Molenda 2009).

Elevation of potassium level on its own can provoke arrhythmia and heart blocks through its effects on the myocardial tissue irrespective of the degree of increment from normal level. Even mild hyperkalaemia may precipitate underlying cardiac conduction disturbances leading to severe bradyarrhythmias (Palmisano et al. 2014). In a small study of 26 patients, 81% of patients with mild to moderate hyperkalaemia presented with complete heart block with half of them requiring temporary pacing (Aziz et al. 2011). A study on seasonal distribution incidence of severe life-threatening bradyarrhythmias requiring temporary cardiac pacing in elderly noted that there is a significant increase in the number of patients in the hottest months of the year (Palmisano et al. 2014). Apart from the risk acquired from several types of medications that predispose to renal failure or those with potassium sparing mechanism, elderly in Malaysia are constantly susceptible to dehydration and intravascular volume depletion attributable to Malaysia's hot and humid weather.

An interesting article summarizes the relationship between renal failure with hyperkalaemia and bradycardia with concomitant use of atrio-ventricular

(AV) node blocker by defining the combination as BRASH syndrome (a mnemonic for bradycardia, renal failure, AV node blocker, shock and hyperkalaemia) (Farkas 2016). The main pathophysiologic key of BRASH syndrome is said to be the synergistic effect of hyperkalaemia caused by renal failure with AV node blockers to cause bradycardia (Farkas 2016; Hegazi et al. 2012). Bradycardia will subsequently lead to hypoperfusion that in turn worsens the renal failure and eventually perpetuates a vicious cycle. This syndrome may occur in the setting of mild hyperkalaemia along with ECG findings of bradycardia in the absence of other features of hyperkalaemia, differentiating it from bradycardia caused solely by hyperkalaemia. On the other hand, the features that differentiate BRASH syndrome from AV node blocker overdose alone is the presence of hyperkalaemia which is not typically present and the absence of history suggesting drug overdose (Farkas 2016).

The occurrence of bradyarrhythmias in this patient may be explained by the presence of multiple elements. Each factor may not be independent of one another. Instead, they correlate to establish an entity that is new and under-recognized. Nevertheless, it is essential to recognize the risk for bradyarrhythmias in patients on AV blocker in the setting of acute renal failure with even mild hyperkalaemia.

CONCLUSION

In an elderly patient with polypharmacy, bradyarrhythmias may develop due to

even mild iatrogenic hyperkalaemia caused by acute renal failure when there is concurrent use of AV nodal medications.

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