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Review

The relevance of hyponatraemia to perioperative care of surgical patients

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ABSTRACT

Background: Hyponatraemia is the most common electrolyte disturbance in hospitalized patients. There is an increasing awareness of the impact of hyponatraemia on the peri-operative management of surgical patients.
Methods: We performed a literature review. We have included relevant data from different surgical disciplines for analysis. In this review we discuss the differential diagnosis of hyponatraemia, and explain the specific relevance of hyponatraemia to pre-, peri- and post-operative care.
Results: Hyponatraemia is common during the preoperative period and is associated with an increase in subsequent peri-operative complications, such as wound infection, pneumonia, higher mortality rate and higher direct and indirect costs. Furthermore, data shows poorer surgical outcomes when plasma sodium concentration drops. Careful preoperative evaluation of the hyponatraemic patient enables assessment of surgical risk and individualization of the management of hyponatraemia.
Conclusions: We outline a practical guide to the assessment of the cause of hyponatraemia, which dictates the correct management of hyponatraemia and the correct selection of perioperative fluids. Finally, for the therapeutic role of the new vasopressin antagonist drugs in the treatment of surgical hyponatraemia is discussed in two illustrative surgical clinical cases.

Introduction

Hyponatraemia is usually defined as a serum sodium level below-135 mmol/l and it is the most common electrolyte disturbance found in clinical practice.[1] The prevalence of hyponatraemia at the time of hospital admission varies between 2 and 5%, but in some series, up to 30% of in patients have been reported to be affected.[2] In comparison with patients with normal serum sodium levels, patients who develop hyponatraemia have been reported to have an increase in mortality rate,[3–5] longer duration of hospital stay,[4,6] higher readmission rate and increased direct and indirect costs associated with their care.[6]

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Although hyponatraemia has traditionally been viewed as a condition relevant to internal medicine, and managed principally by endocrinologists, nephrologists and geriatricians, there is an increasing evidence base which documents the relevance of hyponatraemia to the perioperative management of surgical patients. Firstly, hyponatraemia is common in the peri-operative period. In a recent observational study of over a million patients undergoing major surgery, 7.8% of patients presented with preoperative hyponatraemia. Hyponatraemia in this large cohort was particularly common in patients undergoing cardiac surgery (11.8%), perhaps because of the high rate of diuretic therapy in cardiac patients. However, hyponatraemia was also common in patients presenting for vascular surgery (11.2%), with lower rates in patients admitted for general surgical procedures (7.5%), orthopaedic operations (7.1%), and other (6.1%) procedures. Patients with hyponatraemia tended to be older, male and with higher rates of comorbid conditions; hyponatraemia was also commoner in patients admitted for urgent surgery. The authors concluded that hyponatraemia was associated with increased morbidity, including increased risk of coronary events, pneumonia and wound infection, and higher mortality and prolonged length of stay.[7] It was not clear whether the increased morbidity was related to the hyponatraemia per se, or whether hyponatraemia was simply a marker for patients with complex co-morbidities which predisposed them to worse outcomes. The results of this study have been reproduced in other small surgical studies and subgroup analyses,[4,8] which emphasizes the risk of perioperative complications associated with preoperative hyponatraemia. Hyponatraemia is also common in a variety of neurosurgical conditions such as traumatic brain injury (20%), subarachnoid haemorrhage (50%) and transsphenoidal hypophysectomy (10%).[9] There is also evidence that patients admitted to surgical-ICUs are at high risk of developing hyponatraemia, with higher prevalence rates following organ transplantation, cardiovascular procedures and surgery for trauma or gastroenterological conditions.[10]

The second issue with hyponatraemia is the poorer outcome when plasma sodium concentration drops perioperatively. Studies in surgical patients entering intensive care units have demonstrated a clear association of worse surgical outcomes, including excess mortality, with postoperative hyponatraemia.[11] Furthermore, symptomatic hyponatraemia predisposes the patient to gait instability,[12] frequent falls[12] and increased fracture rate,[13] complications which compromise post-operative rehabilitation, particularly in the elderly. Preoperative evaluation and appropriate management of hyponatraemia offers the opportunity to improve perioperative care,[14] to assess surgical risk and to individualize the treatment including type and amount of fluids used for each patient.[15]

For these reasons, hyponatraemia is relevant to surgical patients, and therefore to surgeons. In this review we will discuss the differential diagnosis of hyponatraemia, and explain the specific relevance of hyponatraemia to pre-, peri- and post-operative care.

Differential diagnosis of hyponatraemia

There are a large number of different syndromes which may lead to the development of hyponatraemia. The treatment of hyponatraemia depends on the underlying aetiology so it is of paramount importance to be accurate in diagnosing the cause of the biochemical abnormality; inaccurate diagnosis leads to inappropriate and potentially damaging treatment. There are a number of clinical algorithms available to aid the approach to the patient with hyponatraemia, some of which give simple guidelines, whereas others are valuable for more complex conditions. A simple, easy to use algorithm is shown in Table 1. The first clinical step is to make an estimate of blood volume, in order to classify the patient as hypovolaemic, euvolaemic or hypervolaemic. It is usually straightforward by basic clinical examination to identify a patient who is hypervolaemic, or fluid overloaded. However, it can be more difficult to differentiate between euvolaemia and mild hypovolaemia. Nevertheless, using a combination of clinical and biochemical parameters, an experienced clinician can be accurate in assessing blood volume in hyponatraemic patients. The next step is to classify hyponatraemia on the basis of urine sodium concentration. Low urine sodium concentrations indicate appropriate renal sodium conservation, usually due to secondary hyperaldosteronism, and are nearly always indicative of hypovolaemia; elevated urine sodium usually indicate SIADH, or renal sodium losses. In the post-operatively setting, it is important to remember that potent pathophysiological stimuli for the release of ADH, such as

Table 1 – Differential diagnosis of aetiology of hyponatraemia based on the accurate assessment of the patient's volume status and measurement of urinary [Na+].

	Urine [Na+]<30 mmol/L	Urine [Na+]>30 mmol/L	Treatment
Hypovolaemia (Dry tongue, decreased BP, increased pulse, decreased CVP, increased urea, orthostatism)	Vomiting, diarrhoea, burns, skin losses	Diuretics, salt-losing nephropathy, Addison's, cerebral salt wasting syndrome	IV saline + Treat underlying cause
Euvolaemia	Hypothyroidism Any cause and hypotonic fluids	SIADH Glucocorticoid deficiency Drugs	Fluid restriction Vaptan therapy
Hypervolaemia (Oedema, ascites, increased JVP and CVP)	Congestive cardiac failure, Chirrosis, Nephrotic Syndrome	Renal failure, any cause with diuretics use	Diuretic therapy

BP = blood pressure; CVP = central venous pressure; JVP = jugular venous pressure.