Frequency of Serum Sodium Monitoring in Patients Receiving Intravenous 3% Sodium Chloride After Elective Cranial Surgery

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Introduction

Intravenous 3% sodium chloride (NaCl) is commonly used as an osmotic diuretic to reduce vasogenic edema, intracranial pressure, and to prevent hyponatremia. 3% NaCl is traditionally administered at low rates (<50cc/hr), during which serum sodium levels are checked frequently. Strict monitoring is necessary to prevent hypernatremia and central pontine myelinolysis (>12mmol/L/24hr). Here we evaluate the value of frequent serum sodium monitoring (every 6 hours) for patients receiving 3% NaCl following elective brain tumor surgery.

Learning Objectives

By the conclusion of this session, participants should be able to:

1.) Recognize that monitoring serum sodium levels more frequently than once daily is **unnecessary** in asymptomatic patients receiving hypertonic saline at low rates after elective craniotomies for brain tumors.

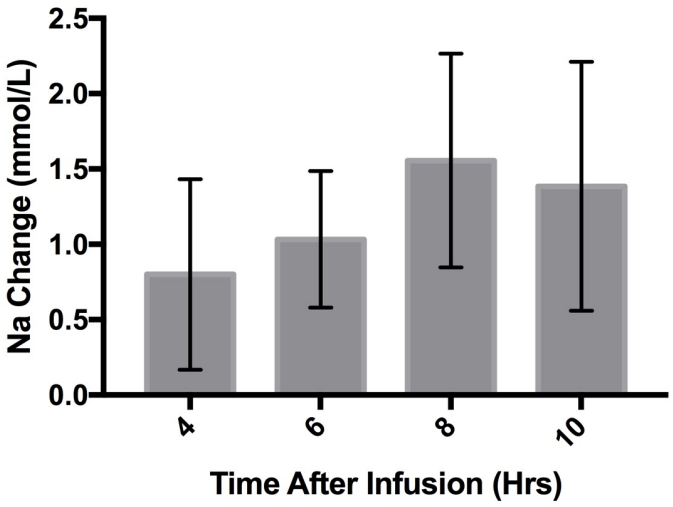
2.) Understand the **economic cost** of treating patients with hypertonic saline.

3.) Appreciate that frequent serum sodium checks increase patient **discomfort** without improving the **quality** of care provided.

Methods

A retrospective analysis was conducted of 99 adult patients who had elective supratentorial brain tumor surgery between 2013 to 2015 at UCLA and received preoperative intravenous 3% NaCl. Patients with sellar region pathologies or those with duplicate or erroneous sodium values were excluded. Serum sodium was checked every 6 hours and checks occurring outside of this institutional guideline were also included for comparison purposes. The rate of change in serum sodium was compared to the rate of 3% NaCl infusion. Cost analysis was conducted using data obtained from the Centers from Medicare & Medicaid Services 2016 Clinical Laboratory Fee Schedule. The total number of craniotomies performed in the United States for primary supratentorial brain tumors was estimated from published figures (Baker et al. 2005) sodium was compared to the rate of 3% NaCl infusion. Cost analysis was conducted using data obtained from the Centers from Medicare & Medicaid Services 2016 Clinical Laboratory Fee Schedule. The total number of craniotomies performed in the United States for primary supratentorial brain tumors was estimated from published figures (Baker et al. 2005). The proportion of national patients requiring preoperative intravenous 3% NaCl was estimated based upon the prescribing patterns observed at our institution.

Figure 1



Change in serum sodium vs. time of initial check.

Results

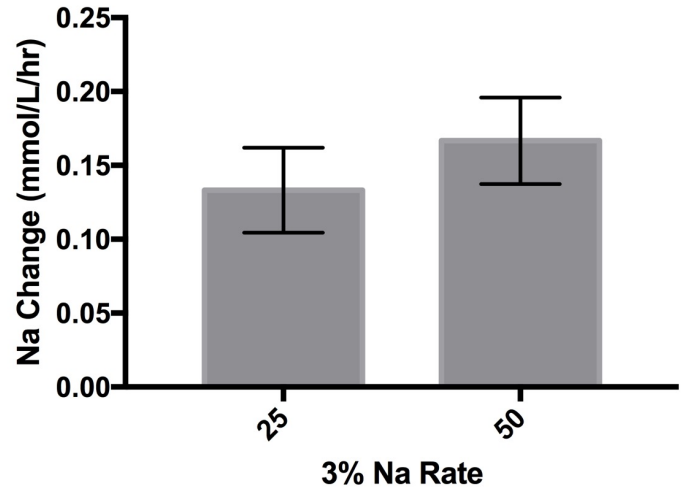
No patient developed clinical signs of symptomatic hypernatremia nor did the rate of serum sodium correction exceed 12mmol/L/24hr. Serum sodium was significantly raised compared to baseline when checked in as little as 4 hours. The differences in serum sodium change between 4, 6, 8 and 10 hours were not statistically different ($p>0.05$) (Figure 1). Effects of 25cc/hr (0.14±0.02) vs 50cc/hr (0.17±0.02) did not show statistical difference ($p=0.23$) when checked at 6 hours (Figure 2). The total additional cost of frequent serum sodium checks compared to daily blood draws from these patients is estimated at $27,542 or $244 per patient (Table 1).

Table 1

	Brain tumor surgeries	Patients requiring 3%	Total Na checks	Cost per Na Check	Total Cost	Potential savings
UCLA	537	113	1914	$14.39	$27,542	$1,377
Nationally	~30,000	~6,312	~106,927	$14.39	$1,538,679	$76,933

Cost analysis 2013-2015.

Figure 2



Change in serum sodium at different rates of 3% NaCl.

References

Barker FG, Curry WT, Carter BS. Surgery for primary supratentorial brain tumors in the United States, 1988 to 2000: The effect of provider caseload and centralization of care. Neuro-Oncology. 2005;7(1):49-63.

Conclusions

Frequent serum sodium checks do not add value to the care of patients receiving 3% NaCl at rates <50cc/hr after elective craniotomies for brain tumors. Our data suggests that 3% NaCl, at low rates, causes modest increases serum sodium, well below the accepted safety threshold. More frequent blood draws unnecessarily increase patient discomfort and medical cost.