Original Article

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Assessment of Plasma Electrolytes, Urea and Creatinine of Patients for Adenotonsillectomy

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Abstract

Objective: Adenotonsillectomy is commonly performed for children with recurrent adenotonsillitis. Electrolyte derangement could be a source of complication or even mortality if not properly corrected. This study was therefore carried out to assess the plasma electrolytes, urea, and creatinine levels of patients for adenotonsillectomy in our hospital.

Materials and Methods: This was a prospective study that was carried out at the Ear, Nose, Throat, Head, And Neck Surgery Clinic of the University of Benin Teaching Hospital, Benin City, between January 2009 and February 2012, of patients who underwent adenotonsillectomy. Both a thorough history, to ascertain relevant information, and a specific examination were done for the patients. The patients were tested for plasma sodium, potassium, chloride, bicarbonate, urea, and creatinine levels, using established standardized laboratory assay methods with reference intervals interpreted in accordance with established procedures.

Results: 49 patients completed the study, made up of 33 males and 16 females, with a mean age of 6.62 years. 25 patients (51.02%) had normonatremia while 24 (48.97%) had hyponatremia. 41 patients (83.67%) had normokalemia, two (4.08%) had hyperkalemia while 6 (12.24%) had hypokalemia. 11 patients (22.45%) had acidosis, 37 (75.51%) had normal bicarbonate levels while only one (2.04%) had alkalosis. 45 patients (91.84%) had normochloremia, while one (2.04%) each had hyponatremia and another one (2.04%) had hyperchloremia. Low urea was seen in nine (18.37%) and normal urea in 40 (81.63%) patients. Normal creatinine levels were seen in 31 (63.27%) and low creatinine in 10 (20.41%) patients.

Conclusion: Electrolytes, urea, and creatinine derangement; especially hyponatremia, exists in patients admitted for adenotonsillectomy, mainly due to their inability to feed properly. These electrolytes should be assessed and corrected before surgery, to avoid fatal complications.

Key words: *Assessment, plasma, electrolytes, urea, creatinine, adenotonsillectomy*

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Introduction

Adenotonsillectomy is commonly performed for children with recurrent adenotonsillitis [1], if they meet the approved indications [2,3]. The most dreaded complication of this procedure is post-tonsillectomy hemorrhage. Although no fatality has been recorded in patients undergoing adenotonsillectomy in our practice, electrolyte derangement could be a source of complications or even mortality if not properly corrected [4].

Maintenance of osmotic pressure, water distribution, pH, proper heart and muscle function, oxidation-reduction reactions, and co-factors for enzymes are processes

that are sub-served primarily by four major electrolytes; sodium (Na+), potassium (K+), chloride (Cl-) and bicarbonate (HCO3-) [5]. It therefore follows that with a derangement of these electrolytes, the maintenance of water homeostasis, paramount for life and which is greatly required in a surgical procedure, could be at risk [6].

Some patients for adenotonsillectomy usually present with dysphagia, odynophagia and sore throat on a chronic basis [7], impeding feeding and causing abnormalities in fluid and electrolytes level. This can portend danger for the patients and open the practice to medico-legal jurisprudence.

This study was therefore carried out to assess the plasma electrolytes, urea, and creatinine levels of patients for adenotonsillectomy. This is needed to document the presence of abnormal levels and to ensure that this abnormality is looked out for and corrected before performing the surgery.

Materials and Methods

This was a prospective study that was carried out at the Ear, Nose, Throat, Head, and Neck (ENTH&N) Surgery Clinic of the University of Benin Teaching Hospital Benin City, between January 2009 and February 2012. All patients that underwent adenotonsillectomy/tonsillectomy within this period were assessed to be recruited for the study. A thorough history and examination were done for each patient. Information retrieved from patients included age, sex, presence of history of refusal of food, drooling of saliva, recurrent sore throat, odynophagia and/or dysphagia. Their tonsils and the tonsillar pillars were also examined to determine whether they were hyperaemic.

Laboratory assay methods:

10 ml of free flowing fasting venous blood was obtained at 8.00 am from the ante-cubital veins after routine aseptic procedure without tourniquet. The blood was dispensed into lithium heparin specimen bottles and was thereafter centrifuged at 3000 rpm for 10 minutes. The plasma was harvested with clean Pasteur pipettes into plasma bottles and stored frozen in deep freezers (at -200C) until the analysis was done within 12 h of collection. The measured electrolytes were sodium, potassium, chloride, bicarbonates, urea, and creatinine. Sodium and potassium were measured in plasma using a flame photometer. Bicarbonate and chloride were also measured in plasma using simple titration methods [8]. Urea and creatinine were measured using assay kits according to previously reported protocols [9,10]. All assay methods were established standardized methods. Hemolyzed and visibly lipemic samples were excluded. All assays were performed in duplicate and QC sera analyzed with each assay batch and the intra- and inter-assay CVs were 5.0% and 8.0%, respectively, in our laboratory.

All reference intervals were interpreted in accordance with established procedures [11]. Normonatremia was defined as plasma sodium concentration between 135–145 mmol/l, <135 mmol/l as hyponataemia, and above 145 mmol/l as hypernatremia. Plasma K+ of <3.3 mmol/l was taken as hypokalemia, >5.0 mmol/l as hyperkalemia and between 3.3–5.5 mmol/l as normal. Plasma bicarbonate concentration of <20 mmol/l was described as acidosis, >30 mmol/l as alkalosis, and between 20–30 mmol/l as normal. Plasma chloride concentrations of <95 mmol/l was defined as hypochloremia, >110mmol/l as hyperchloremia and between 95–110 mmol/l as normal.

Statistical analysis was performed using the InStat GraphPad software version 2.05a. Means and standard deviations were determined for quantitative data and frequency determined for categorical variables. An unpaired 't' test was used when comparing two means. Analysis of variance (ANOVA) was used to compare multiple values. A P value of ≤0.05 was considered significant.

Results

49 patients completed the study, made up of 33 males and 16 females, with a male to female ratio of 2.06:1. Ages of patients ranged between 1.5 to 40 years with a mean age of 6.62 years. The mean plasma sodium was 135.6 ± 4.9 mmol/l, potassium 4.0 ± 0.6 mmol/l, bicarbonate 21.5 ± 2.9 mmol/l, chloride 102.4 ± 5.2 mmol/l, and creatinine 0.68 mg/dl (Table 1). 24 patients (48.97%) presented with hyponatremia. There was no case of hypernatremia (Table 2). However, six patients (12.24%) presented with hypokalemia while two patients (4.08%) had hyperkalemia. The hydration status of the patients as indicated by plasma urea showed that nine (18.37%) had plasma urea below the reference range whereas the majority (40 [81.63 %])

had plasma urea within the reference interval. None of the patients had renal impairment as shown by plasma creatinine within the reference interval for all patients (0.6–1.2 mg/dl). 11 patients (22.45%) had metabolic acidosis with plasma bicarbonate below 20 mmol/l and only one (2.04%) patient had metabolic alkalosis.

Table 2 showed that hyponatremia was the commonest abnormality in patients (48.97%), followed by acidosis (22.45%). The commonest complaint from patients with adenotonsillitis was refusal to feed (30.77%), followed by sore throat (28.21%), and odynophagia (15.38%) as shown in Table 3. Table 4 shows the clinical features that were present in patients with plasma electrolyte abnormalities.

Table 1: Plasma electrolytes concentration mean ±SD.

	Urea	Na	K	HCo3	CL	Crea
Mean	22.5	135.6	3.97	21.5	102.4	0.68
Sample size	49	49	49	49	47	41
SD	8.23	4.93	0.64	3.00	5.24	0.20
SEM	1.18	0.70	0.09	0.41	0.80	0.03
Medium	21.00	135.00	3.80	21.00	100.00	0.70
Lower% 95C1	20.13	134.20	3.79	20.63	100.82	0.62
Upper% 95C1	24.86	137.01	4.16	22.30	103.90	0.75
Minimum	9.00	128.00	2.80	16.00	94.00	0.30
Maximum	42.00	158.00	5.30	31.30	125.00	1.10

Table 2: Plasma electrolytes, urea, and creatinine disposition of patients.

Electrolytes and the reference ranges	Nos. within reference range	Nos. below reference range	Nos. greater than reference range
Na^+ 135–145 mmol/l	25	24	0
K^+ 3.3–5.0 mmol/l	41	6	2
Cl^- 95 -110 mmol/l	45	1	1
Bicarbonate 20–30 mmol/l	37	11	1
Urea 15–40 mg/dl	40	9	0
Creatinine 0.6–1.2 mg/dl	31	10	-

Hyponatremia	48.97%	Low urea	18.37%	Low creatinine	20.41%
Normonataemia	51.02%	Urea (Normal)	81.63%	Normal creatinine	63.27%
Hypernatremia	0%	Uremia	0%	High creatinine	0%
Acidosis	22.45%	Hypochloremic	2.04%	Normokalemia	83.67%
Normal	75.51%	Normochloremic	91.84%	Hyperkalemia	4.08%
Alkalosis	2.04%	Hyperchloremic	2.04%	Hypokalemia	12.24%

Table 3: Presenting symptoms and signs.

	Dysphagia	Odynophagia	Refusal to feed	Sore throat	Drooling of saliva	Fever	Vomiting	Hyperemia of tonsillar pillars	Total
Freq	3	6	12	11	2	1	1	3	39
%	7.69	15.38	30.77	28.21	5.13	2.56	2.56	7.69	99.9

Commonest presenting symptom: Refusal to feed (30.77%)
Least presenting symptom: Fever and Vomiting (2.56% each)

Table 4: Clinical features in patients with electrolyte abnormalities.

Electrolyte Abnormality	Clinical Feature	Frequency
Low urea (9cases)	Odynophagia	2
	Sore throat	1
Low Na^+ (24 cases)	Sore throat	7
	Refusal of feed	6
	Dysphagia	1
	Odynophagia	2
	Hyperemic tonsils	1
	Fever	1
	Vomiting	1
Low K^+ (6 cases)	Fever	1
	Refusal of feed	2
	Sore throat	1
	Vomiting	1
High K^+ (2 cases)	Drooling of saliva	1
Low Cl^- (1 case)	Sore throat, Fever, Refusal of feed, vomiting	
High Cl^- (1 case)	-	
Low creatinine (10 cases)	Refusal to feed	3
	Sore throat	5
	Drooling of saliva	
	Odynophagia	3
	Hyperemic tonsils	
	dysphagia	
High $HCO3^-$(1 case)	-	
Low $HCO3^-$(11 cases)	Sore throat	1
	Refusal of feed	3
	Hyperemic tonsils	1

Discussion

Hyponatremia was the commonest abnormality reported in patients undergoing adenotonsillectomy in this study. It is easily deducible that with refusal to feed being the commonest symptom of patients admitted for adenotonsillectomy, the inadequate intake of food, which is the main source of sodium in the body, is the likely culprit in this abnormality. This finding is corroborated by a study, in which the incidence of electrolyte disturbance in patients requiring hospital care was found to be high and hyponatremia was reported as the commonest disorder [10]. Our patients presented with symptoms/signs that could cause/aggravate hyponatremia such as, sore throat, refusal to feed, dysphagia, odynophagia, fever, vomiting, and hyperemic tonsils. The refusal to feed, odynophagia, and dysphagia are also likely to be responsible for the hypopkalemia seen in our patients as their dietary intake of potassium was restricted. The low urea and creatinine were as a result of the patients' attempt to take a lot of water and fluid, to compensate for the inability to eat a solid diet. This therefore resulted in dilution of urea and creatinine in plasma, in the absence of sufficient dietary intake. The consequences of hyponatremia are nausea, generalized weakness, and mental confusion [10]; these could contribute greatly to morbidity and even mortality in patients with adenotonsilitis.

More than 10% of our patients presented with hypokalemia. The consequences of hypokalemia, such as muscle weakness and abdominal distension, could worsen the clinical features of hyponatremia if and when they co-exist. Patients with hyperkalemia may present with cardiac arrhythmias but in our patients hyperkalemia was associated with drooling of saliva.

With these findings, it shows the necessity for assaying for plasma electrolytes, urea and creatinine done routinely by established standardized methods, to detect abnormalities before adenotonsillectomy is carried out. Derangement of these plasma electrolytes when present, should be appropriately corrected by the surgeon using approved methods. It is equally advised that assay of the electrolytes, urea, and creatinine should be repeated after the correction to ensure that the levels are within reference values. This is to avoid unnecessary complications or even mortality from general anesthesia and surgery.

It can therefore be concluded that electrolytes, urea, and creatinine derangement; especially hyponatremia, exists in patients going for adenotonsillectomy, mainly due to their inability to feed properly. It therefore follows that electrolytes, urea, and creatinine levels in the plasma should be assessed and corrected before surgery, to avoid fatal complications.

Conflict of interest statement:

The authors have no conflicts of interest to declare.

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