
ORIGINAL ARTICLE

The Use of Young Coconut Water in
Pediatric Cholera

by

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Abstract

Eighty-six children suffering from cholera, aged 2 - 12 years, admitted to the Dr. Sutomo Hospital, Surabaya, were treated intravenously with Ringer Lactate as initial rehydration. Concomitantly young coconut water was given orally ad libitum until complete rehydration was achieved.

The effectiveness was proven by serum-electrolytes and E.C.G. determinations and the findings of no signs of clinical hyperkalemia. Only one patient died, possibly due to encephalopathy.

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Introduction

Oral fluid therapy for cholera was proven to be effective and practical in hospital and in the field in endemic areas. It reduces the cost of treatment and can be performed in areas where intravenous fluids are scarce or probably expensive (Nalin and Cash, 1974).

Cholera oral electrolyte solution in conjunction with Ringer Lactate as initial intravenous administration for cholera has been used since several years in the Department of Child Health of the Dr. Sutomo Hospital, Surabaya.

The cholera oral solution contains :

Na : 85 mEq/l. HCO_3^- : 30 mEq/l.

K : 15 mEq/l. Glucose 120 mosm/l.

Ca : 70 mEq/l.

However not all drugs and intravenous fluids can reach in time the small hos-

pital, moreover in isolated villages especially in small islands.

An ideal method for cholera management using drugs and fluids available, that can rapidly and easily reach the common people who need them, should be found out. This has led the authors to investigate the use of coconut water for the sake of cholera patient.

The composition of coconut water has been investigated by the Medical Department of Dr. Sutomo Hospital in 1973, revealing that contains enough electrolytes and glucose as seen in Table 1 below.

The coconut tree can grow everywhere in Indonesia and coconut water, especially of the young fruit, is very popular among the people to quench thirst or to cure several complaints like urticaria, intoxication etc.

TABLE 1: *Electrolyte composition of young & ripe coconut (by the Medical and Clinical Paediatric Department Airlangga University, Surabaya).*

	Young coconut			Ripe coconut	
	Yellow (5)	Green (5)	Brown (5)	Green (6)	Brown (6)
Na mEq/l	0.86 (0.9 — 1.3)	0.53 (0.26 — 1.37)	0.35 (0.26 — 0.49)	2.35 (0.38 — 1.5)	9.35 (2.6 — 11.0)
K mEq/l	45.10 (42.4 — 47.6)	41.42 (37.3 — 46.5)	37.22 (36.7 — 39.9)	48.73 (41.9 — 58.8)	43.40 (36.1 — 65.2)
Cl mEq/l	39.40 (38.0 — 42.0)	32.30 (29.0 — 35.0)	31.00 (27.0 — 34.0)	32.83 (32.0 — 43.0)	29.08 (27.3 — 30.5)
CO ₂ mEq/l	4.99 (3.2 — 10.6)	3.68 (3.2 — 4.8)	2.12 (2.0 — 2.3)	5.47 (3.2 — 6.8)	2.425 (1.45 — 3.2)
PH	5.0	4.8 (3.2 — 5.5)	5.0	5.9 (5.5 — 6.0)	5.08 (3.5 — 5.5)
Glucose mg %	(260 — 340)	(360 — 840)		(840 — 1160)	(168 — 1080)

Material and Method

All cases diagnosed as suspected cholera aged 2-12 years and admitted to the Pediatric Department of the Dr. Sutomo Hospital beginning February 1, 1977 were chosen for this study until approximately 80 cases were obtained.

The patient was put in the "Cholera Cot", a simple bed, where a hole just above the middle is made for defecation. A bucket or pail is placed under the hole to collect stools, which is measured every four hours.

Thirty ml/kg Ringer Lactate was given intravenously during the first hour. In the following hours the rate was reduced to 10-20 ml/kg/hour depending on the amount of fecal loss. Every four hours the stool loss was collected.

Additional Ringer Lactate equivalent to the volume of this stool should be given in the next four hours.

The observation of the appearance, pulse and blood pressure, should be done every 15-30 minutes. As soon as the patient was able to drink, coconut water should be given ad libitum. The intravenous fluid was then reduced to 6-8 drops/minute, after the diarrhea ceased, which occurred usually after the first four hours.

The adequacy of fluid replacement should be evaluated every four hours by physical examination, determination of urine, fecal output and body weight.

To limit the diarrhea, tetracyclin was given 30-50 mg/kg divided in 3 doses for 3 days.

Fresh young coconuts were bought from the neighbouring market. Serum sodium, potassium, CO_2 combining power and E.C.G. were obtained from the patients prior to therapy and 24-36 hours after admission.

Serum sodium and potassium were determined by flamephotometry, CO_2 combining power was obtained by the Van Slyke method.

The E.C.G. test was recorded by an electrocardiograph ("Cardiosuny 501 A"). Plasma protein was determined by the refracto method.

The routine laboratory test included faeces and urine examinations. Rectal swabs were cultured into alkaline-pepton and Clair Blair medium and were taken on three consecutive days.

On the second day when the condition was more suitable, the intravenous infusion and also the oral coconut water should be stopped.

Normal feeding should be resumed as soon as the patient was able to eat.

Results

The number of patients who was given young coconut water consisted of 86 children, 83 of them had vibrio cholera (+), 3 vibrio cholera (—).

Seventy six children were recorded as having undergone E.C.G. test, serum electrolytes and protein plasma examination at the time of entering the hospital (Tables 2, 3).

Only 41 patients were completely examined after 24-36 hours, while the

rest got either only the E.C.G. test or only serum electrolyte examination, due to the following reasons :

1. At the time of admission, the patient was trembling due to shock so that the E.C.G. was useless.
2. Failure in the examination of serum electrolytes was due to various reasons vis :

The technique of taking blood sample was not done carefully, which resulted in haemolysis.

Too long storage of blood samples in the refrigerator could also cause haemolysis, or the laboratory probably was wasteful in using blood samples so that they had run out,

before all serum electrolytes could be examined (e.g. the sodium, potassium and chloride content could be examined but that of CO₂ combining power could not be examined because of shortage of blood.

Of the 86 children who were given young coconut water, only one child died. The vibrio cholera culture was negative and the cause of death was considered encephalopathy probably.

The quantity of coconut water to be given was between 1000 cc - 2500 cc, an average of 1750 cc per child.

The quantity of Ringer Lactate used was about 5 bottles per child.

TABLE 2 : *E.C.G. obtained from 41 Paediatric Cholera patients prior to therapy and 24 — 36 hours after admission*

	I.	II.
	(Prior to therapy)	(After 24 — 36 hours)
Heart rate		
: range	(72 — 168)	(68 — 188)
mean	120/minute	128/minute
PR interval		
: range	(0.08 — 0.20)	(0.08 — 0.16)
mean	0.14	0.12
Q. T.		
: range	(0.24 — 0.44)	(0.24 — 0.48)
ST depr.	normal	normal
T changes	normal	normal

TABLE 3: Serum electrolytes and plasma protein obtained from 41 Paediatric Cholera Patients prior to therapy and 24 — 36 hours after admission

		I.	II
		(Prior to therapy)	(After 24 — 36 hrs)
K (mEq/l)	Range	(1.69 — 4.92)	(2.89 — 6.76)
	Mean	3.305	4.825
Na (mEq/l)	Range	(112.09 — 157.08)	(120 — 160.30)
	Mean	134.58	140.15
Cl (mEq/l)	Range	(84 — 156)	(87 — 140)
	Mean	120	115.5
CO ₂ (mEq/l)	Range	(10.90 — 35.31)	(13.52 — 28.31)
	Mean	23.105	20.91
Plasma Protein (mg%)	Range	(6.5 — 11.5)	(5 — 10.5)
	Mean	9.00	7.525

Discussion

In accordance with the above results the use of coconut water could be justified as a substitute for electrolyte solutions for the management of cholera in children in conjunction with Ringer Lactate. Young coconuts were not difficult to obtain, especially in villages and in the markets, and the price was relatively low.

Out of 86 children only one child died, the main cause of death was considered to be suspected encephalopathy and probably not due to coconut water.

Of the 41 patients with complete test after 24 - 36 hours, the E.C.G. showed no signs of hyperkalemia although in a few cases the serum potassium-level exceeded 6.5 mEq/l.

According to the literature the E.C.G. changes appeared when the potassium level in plasma was higher than 6.5 mEq/l. though they could occur also at the level of 5.5 mEq/l., sometimes early E.C.G. changes showed the existence of peaking of the T-wave, but this was not specific for hyperkalemia.

Other characteristics changes in hyperkalemia usually consisted of :

Tall, peaked T-waves in Lead III and possibly negative T-waves in Lead V₁, lowering of R-waves and deeper S-waves, widening followed by disappearance of P-waves, broadening of the QRS, prolonged P-R interval, ST-depression, rhythm is possibly not regular and atrial fibrillation can happen.

The administration of only intravenous Ringer Lactate should not be justified in children like in adults, because of the danger of hypernatremia, due to several differences :

1. A child has more difficulty to retain the bodywater balance than adults,

because of the relatively more extensive body surface.

The daily requirement of sodium is less than in adults.

2. The sodium less in the feces of children with cholera is also not so much compared with in adults as shown in Table 4 :

TABLE 4: Comparative cholera stool composition upon admission.

	Number	Mean age/yr	Na ⁺ m/q/l.	K ⁺ mEq/l.	Total Na ⁺ K ⁺ mEq/l.	Total CO ₂ mEq/l.	
Cholera	32	3.5	101	27	128	92	32
					Mahalanabis et al., 1974		
Below 5 yrs	39	4.7	101	33	134	89	30
					Griffith et al., 1967		
2 — 5 yrs	40	3.3	96.2	32.8	—	106.5	33.6
					Harun Nurasid et al., 1976		
5 — 10 years	20	7.6	107	28	133	88	30
					Mahalanabis et al., 1974		
6 — 10 years	23	7.9	92.8	27.9	—	95.3	35.6
					Harun Nurasid et al., 1976		
Adults							
18 — 67 years	15	41	140	13	153	104	44
					Mahalanabis et al., 1974		
15 — 83 years	11	35	137	16	153	107	45
					Watten et al., 1959		

The use of young coconut water is not practical for adults because a greater quantity is needed. An adult patient at least needs 20 coconuts. In case of an epidemic, how many coconuts should then be required?

Further investigation should be done on whether coconut water could be used at an early stage of dehydration before the critical condition occurs. By this time infusion of intravenous Ringer Lactate is not yet necessary.

For this purpose, a joint investigation should be done together with the community health service, particularly during an epidemic.

In addition it is necessary to investigate the replacement of Ringer Lactate by saline solution i.v. in combination with young coconut water orally. The deficiency of potassium and bicarbonate in saline can be overcome by young coconut water which contains a large quantity of the needed electrolytes.

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