Influence of Coconut Water on Hemostasis

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Coconut water (CNW) can be used as short-term intravenous hydration and resuscitation fluid. We investigated the influence of coconut water on plasma coagulation in vitro. Either CNW or physiological saline (PS) was added to citrated plasma of 8 healthy volunteers. Coagulation capability of diluted plasma was evaluated by thrombelastography (TEG). Replacement of up to 50 % of citrated plasma by CNW or PS did not influence initiation of coagulation as indicated by split point and reaction time, respectively. Strength of fibrin clot as expressed by maximum amplitude (MA) of TEG recording dose dependently declined in both groups. Replacing 50 % of citrated plasma by CNW or PS reduced MA by 39% and 32%, respectively. The influence of coconut water on hemostasis as assessed by TEG does not differ from the effect caused by an identical volume of PS. (Am J Emerg Med 2001;19:287-289. Copyright © 2001 by W.B. Saunders Company)

Coconut water (CNW) serves as intravenous hydration fluid, if standard intravenous fluids are not available. Campbell-Falck et al recently reported a case from Solomon Island and reviewed the use of CNW since World War II.[1] CNW is the free fluid present inside the immature coconut, an acidic solution of sugars, amino acids, and electrolytes with a specific gravity of approximately 1.020. Its electrolyte components resembles intracellular fluid more closely than extracellular fluid and consists mainly of potassium, calcium, magnesium, and chloride. Sodium is found in much lower concentration than in human plasma.[1] Although this composition does not make coconut water the ideal resuscitation fluid, its successful use has been reported in several cases with infusion up to 3,000 mL in 6 to 12 hours.[2]

Until now no data were available about interference of CNW and the plasmatic coagulation. In this study we evaluated the influence of CNW on hemostasis in healthy humans in vitro.

METHODS

Thromelastography (TEG; Fig 1) is a global function test of hemostasis as described previously.[3,4,5] Blood was drawn from 8 healthy volunteers, 2 men and 6 women, who were not taking any medication that could impact the clotting system. Citrated plasma was obtained by mixing 9 aliquots of blood with 1 aliquot of sodium citrate (0.11 mol/L) and centrifugation. Ten aliquots of citrated plasma were mixed with either 2, 4, or 10 aliquots of coconut water or physiological saline (PS) for elimination of effects simply caused by dilution of platelets and coagulation factors resulting in citrated plasma concentrations of approximately 80%, 70%, and 50%, respectively. Undiluted citrated plasma served as baseline. Immediately before analysis 20 μL of a 2 molar solution of calcium chloride were added to 245 μL of probe

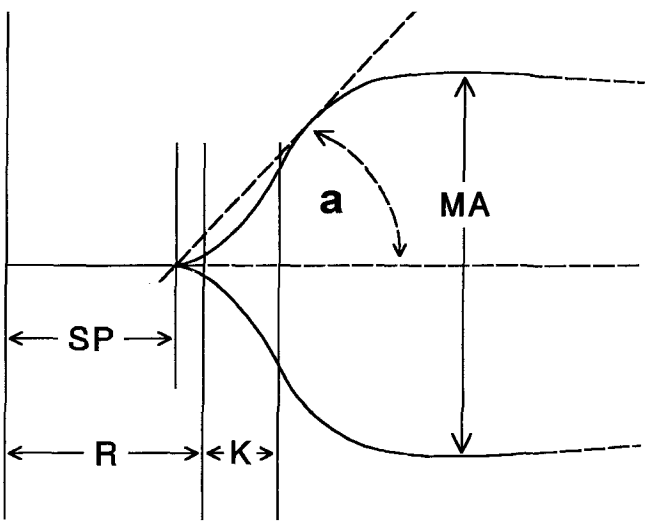

FIGURE 1. Thrombelastography (TEG) enables a global assessment of hemostatic function to be obtained from a single blood sample, documenting the interaction of platelets with the protein coagulation cascade from the time of the initial platelet-fibrin interaction, through platelet aggregation, clot strengthening, and fibrin cross-linkage to eventual clot lysis in a global and functional coagulation test. Abbreviations: SP, split point, the distance from recording start to the first sign of divergence; R, reaction time, the interval between recording start and the time at which the amplitude of the TEG reaches 2 mm; it represents the rate of thromboplastin generation and reflects the function of the intrinsic coagulation system; K, kinetic time, the time from R to a level of clot firmness of 20 mm. The coagulation time (R+K) reflects the function of the intrinsic system, platelets and fibrinogen; MA, maximum amplitude, represents the largest amplitude reached and is a function of the elasticity of the blood clot. The platelet function, fibrinogen and factor XIII have an influence on MA; a, growth angle, clot formation rate (a) is the speed with which a solid clot forms and is known to be a function of fibrinogen and platelets.

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TABLE 1. In Vitro Determination of the Effect of Coconut Water (CNW) or Physiological Saline (PS) on the TEG Parameters in 8 Healthy Volunteers

		Units Citrated Plasma:Units CNW			Units Citrated Plasma:Units PS		
Parameter	Baseline	10:2	10:4	10:10	10:2	10:4	10:10
SP (min)	9.2 ± 0.69	7.8 ± 0.80	7.9 ± 0.59	8.5 ± 0.59	9.3 ± 0.65	8.8 ± 0.55	9.1 ± 0.48
R (min)	9.9 ± 0.81	9.1 ± 0.61	8.3 ± 0.60	9.2 ± 0.63	10.2 ± 0.79	9.5 ± 0.53	9.9 ± 0.42
K (min)	3.5 ± 0.20	3.4 ± 0.23	4.2 ± 0.30	6.8 ± 0.53*	3.6 ± 0.25	4.0 ± 0.28	5.8 ± 0.24*
MA (mm)	54.7 ± 1.76	50.5 ± 1.77*	46.9 ± 2.00*	33.4 ± 1.46*	51.2 ± 1.20*	46.4 ± 1.21*	37.3 ± 1.22*
α (deg)	68.0 ± 1.34	65.9 ± 1.42	65.9 ± 1.14	56.4 ± 1.76*	66.5 ± 1.52	66.7 ± 1.42	59.0 ± 0.92*

NOTE. Data are expressed as mean ± SEM; paired t-test was performed to compare CNW with baseline or PS.
* $P < .05$ *v* baseline; there was no significant difference between CNW and PS.

for recalcification. For TEG measurements a computerized coagulation analyzer Thrombelastograph (Hemoscope Corp., Morton Grove, IL) was used. Split point (SP), reaction time (R), kinetic time (K), maximum amplitude (MA), and growth angle (a) were recorded and expressed as group means and standard error of the mean (SEM). Each concentration of coconut water was compared with baseline and the corresponding concentration of PS by paired Student's *t*-test and *P* values below .05 were accepted as significant.

RESULTS

SP and R were not affected by CNW or PS in all 3 dilution states tested. Replacement of 50% of citrated plasma with either CNW or PS prolonged K and reduced growth angle. Lower concentrations of CNW or PS had no effect on K and growth angle (Table 1). The effect on maximum amplitude was also independent of the added component. Both fluids reduced MA in a dose dependent manner and to a similar extent (Table 1, Fig 2).

DISCUSSION

CNW has been reported to be a useful intravenous rehydration solution, if standard fluids are not available. Previous studies of intravenous administration of CNW in humans focused on body fluid and electrolyte homeostasis, because CNW contains potassium as predominant cation and may cause an increase in serum potassium level particularly when given in boluses.[2] Until now there was no information available, whether CNW alters plasmatic coagulation.

This study investigates the influence of CNW on hemostasis measured by TEG. TEG is an uncomplicated method for global assessment of hemostasis of proven clinical value for patient monitoring during surgical procedures.[6,7,8]

Our results show, that CNW and PS have no influence on coagulation initiation as seen in cases with quantitative or qualitative coagulation factor deficiency, even if half of the plasma is replaced by the fluid. Velocity of early coagulation phase as indicated by K and growth angle is reduced with 50 % replacement fluid, but not with lower concentrations of CNW or PS. CNW has no additional effect on coagulation speed, neither inhibiting nor activating probabilities.

Maximum clot firmness depends on platelet function and concentration and is reflected by the maximum amplitude of TEG recording.[3] With rising concentration of replacement fluid MA declines in a dose dependent manner. The reduction achieved by CNW was not different from the effect of PS on MA suggesting, that CNW has no additional effects on platelet function compared with PS.

These findings indicate, that CNW added to human plasma in volume doses up to 50% of original plasma volume has no other effects on haemostasis, that are detectable by TEG, as a standard physiological solution of sodium chloride.

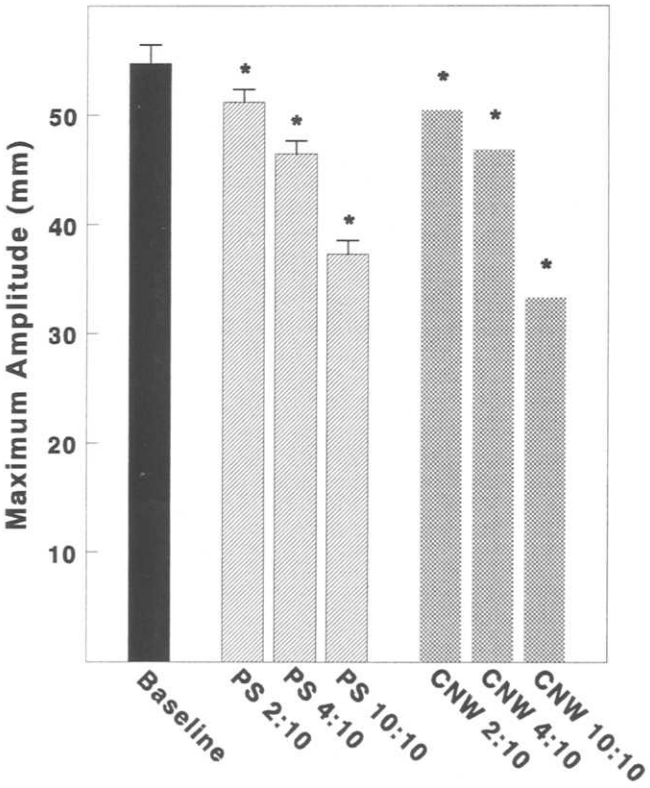

FIGURE 2. Maximum amplitude (MA) is reduced by coconut water (CNW) and physiological saline (PS) to a similar extent in a dose dependent manner. * $P < .05$ *v* baseline; there was no significant difference between CNW and PS.

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