

Title: IN VITRO CYANIDE RELEASE FROM SODIUM NITROPRUSSIDE IN THE DIFFERENT INTRAVENOUS SOLUTIONS

Authors: S. Ikeda, M.D., J.F. Schweiss, M.D., P.A. Frank, B.A., S.M. Homan, Ph.D.

Affiliation: Departments of Anesthesiology and Community Health, St. Louis University, St. Louis, Mo. 63104

Introduction. The package insert of sodium nitroprusside (SNP) states that SNP is only to be used as an infusion with 5% dextrose in water (D5W). Reasons for using only D5W are not mentioned in the package insert.

Vesey and his associates in England reported the use of a saline solution to mix SNP.¹ They did not mention the reasons for using a saline solution nor the problems with using it.

Cyanide (CN⁻), a toxic metabolite of SNP, is known to be released from SNP in vitro as well as in vivo. CN⁻ concentration has been shown to have no significant change for 72 h in the light-protected D5W solution.² However, CN⁻ released from SNP dissolved in other intravenous solutions has not been reported.

This study was performed to determine if the concentration of CN⁻ changed in different intravenous solutions in which SNP was dissolved.

Method. Twenty-five mg of SNP was dissolved with 250 ml of six different solutions; 1) D5W, 2) 10% dextrose in water (D10W), 3) distilled water (DW), 4) 0.9% sodium chloride (NS), 5) lactated Ringer's (LR), and 6) lactated Ringer's with D5W (LR/D5W). Five bags of each solution were exposed to 300 foot candles of fluorescent lamp throughout the 72 h experiments. Polyvinylchloride bags were not wrapped with aluminum foil. CN⁻ concentration was measured directly by the cyanide ion-specific electrode at 0, 4, 8, 24, 48 and 72 h.

Results. The results are shown in the table. None of the solutions have statistically different means for up to 48 h when CN⁻ concentration in D5W was compared with that in each of the other five solutions. At 72 h, LR, LR/D5W, and NS have statistically lower mean CN⁻ concentrations than D5W.

For D5W and DW, the mean CN⁻ concentration statistically increased at 24 h. The concentration of CN⁻ in D10W and NS showed no statistically significant increase until 72 h. There are no statistical differences in mean CN⁻ levels across time between LR and LR/D5W solutions.

Discussion. Solutions tested have different pH, osmolarity and electrolyte contents. CN⁻ concentrations were statistically lower in the electrolyte solutions at 72 h than in the non-electrolyte solutions. However, it is not possible to say that one of the cations in the solution combined with CN⁻, effecting a lower CN⁻ concentration in the electrolyte solutions as opposed to those in the non-electrolyte solutions. There was no difference in CN⁻ concentration between LR and LR/D5W. In these solutions, an increase in mean CN⁻ concentration at 72 h did not achieve statistical significance at P < 0.05. We assume that dextrose and/or osmolarity had little effect on releasing CN⁻. Vesey* stated that reasons for using dextrose solutions are:

1) SNP has not been adequately tested for stability in other solutions, and 2) any degradation of SNP is more obvious in dextrose solutions because of the more distinct color change.

Conclusion. From this in vitro study, it is prudent to say that solutions other than D5W can safely be used for dilution of SNP if the use of a dextrose-containing solution is not medically desirable.

References

- Vesey CJ, Cole PV, Linnell JC, Wilson J: Some metabolic effects of sodium nitroprusside in man. *Br Med J* 2: 140-142, 1974
- Ikeda S, Schweiss JR, Frank PA, Homan SM: In vitro cyanide release from sodium nitroprusside. *Anesthesiology* 66: 381-385, 1987

Table - Comparison of Mean Cyanide Concentrations in Six Solutions across a 72-Hour Period.

TIME		D5W	D10W	DW	NS	LR	LR/D5W
CONTROL	X	0.105	0.091	0.054	0.092	0.142	0.147
(0 HRS)	SD	0.005	0.005	0.006	0.003	0.019	0.011
4 HOURS	X	0.160	0.190	0.130	0.113	0.179	0.177
	SD	0.004	0.018	0.016	0.008	0.016	0.010
8 HOURS	X	0.287	0.304	0.337	0.313	0.429	0.225
	SD	0.095	0.125	0.033	0.016	0.100	0.067
24 HOURS	X	3.66	2.08	2.47	2.08	1.85	1.17
	SD	1.07	0.52	0.24	0.32	0.26	0.12
48 HOURS	X	6.06	4.09	5.35	3.56	1.49	1.06
	SD	0.41	0.19	0.18	0.48	0.05	0.61
72 HOURS	X	9.12	7.36	7.47	4.57*	1.91*	2.08*
	SD	2.25	1.08	0.27	0.28	0.22	0.19

CN⁻ concentration expressed as ppm mean (x) and standard deviation (SD)

*Statistically significant difference when compared with D5W.

*Personal Communication