

Analytical Evaluation of Heparin Concentration in GEM® Draw Syringes

Jennifer DiStasio, Michael Pistorino

Instrumentation Laboratory, 180 Hartwell Rd, Bedford, MA, USA

Heparin is a common anticoagulant used in blood collection devices. It acts as an anticoagulant by catalyzing the activation of antithrombin III and accelerating the inhibition of thrombin to prevent clotting. The most common forms of heparin used in blood collection devices are lithium, sodium, and ammonium. Heparin can influence the results obtained due to 1) dilution 2) the type of heparin used and 3) binding of ionized calcium by heparin (CLSI C46A2 page 23). In order to maintain analytical accuracy, it is recommended that the final concentration should be no more than about 20 IU/mL (CLSI C46A2 page 23).

GEM Draw® Syringes contain varying amounts of dry Lithium Heparin. It is estimated that dry lithium heparin decreases measured mean sodium in adult blood by -2.1 to -3.1 mmol/L at 150 IU/mL heparin (*Clin Chem*, 45, 10, 1999, page 1880). In order to evaluate the effect of dry lithium heparin concentration on sodium results, preliminary testing was conducted in order to quantify the amount of heparin that would cause a clinically significant shift in sodium results (± 2 mmol/L). Testing was conducted on the GEM Premier 4000 Analyzer® (Instrumentation Laboratory, Bedford, MA) using four types GEM Draw® Syringes containing varying amount of dry lithium heparin outlined in Table 1. Per this study using a one-sided confidence interval ($\alpha=0.05$) on the correlation between heparin concentration and Na⁺ bias, it was found that heparin concentration could reach as high as 85 IU/mL before having a clinically significant shift of -2 mmol/L on sodium results (Figure 1). The amount of over heparinization required to induce a clinically significant bias on calcium (± 0.10 mM) with these syringes was higher than that of sodium.

Table 1. Results from GEM Draw Testing

GEM Draw Syringe	IU Heparin	<20 IU/mL per CLSI C46A2		<85 IU/mL per testing	
		Required Fill	Minimum Fill Volume	Required Fill	Minimum Fill Volume
1cc Safety Draw®	56.5	>100%	>1 mL	66.1%	.66 mL
3cc Easy Draw®	113	>100%	>3mL	44.1%	1.32 mL
1cc Safety Draw Lite®	3.2	16.0%	0.16 mL	3.7%	0.04 mL
3cc Easy Draw Lite®	7.9	13.2%	0.39 mL	3.1%	0.09 mL

Based on these results, we recommend use of the GEM Safety Draw Lite® or GEM Easy Lite® syringes in order to maintain accuracy of electrolyte results. Collection devices with high concentrations of Heparin, even those containing balanced Li heparin, have the potential to provide erroneous electrolyte results when under filled.