Stability of Buffered Lidocaine in Glass Vials

At the author's institution, the use of buffered lidocaine before painful treatment procedures has increased dramatically over the past 4 years, and more than 4500 vials are now used each year. Most vials are used by the peripherally inserted central catheter (PICC) team for insertion of central lines, and the rest are used to aid in insertion of peripheral lines. The benefits of buffered lidocaine as a skin infiltrate during painful procedures relate to the rapid onset of action after injection and the longer duration of sensory blockade.[1]

The addition of sodium bicarbonate to commercial 1% lidocaine hydrochloride (at a 1:10 ratio) results in a solution containing about 50% of the local anesthetic as the free base. Solutions prepared this way have a final pH of about 8.0 (pKa 7.9). This change to the free base increases the rate of penetration of lidocaine into the nerve cell, which in turn significantly decreases the burning sensation at the time of infiltration and speeds up the onset of anesthesia.[2-6]

Although buffered lidocaine has been used in the clinical setting for several years, its long-term physical and chemical stability remains unclear. Two studies examined the chemical stability of buffered lidocaine with and without epinephrine.[4,7] As a result of the work by Stewart and others,[7] the author's hospital assigned an arbitrary expiry period of 7 days to solutions of buffered lidocaine 1%; however, this was extrapolated from data generated for 2% lidocaine solutions. More recently, Pascuet and others[8] clarified the stability of 1% and 2% buffered lidocaine with and without epinephrine packaged in plastic syringes. The period of stability, with refrigerated storage, was 7 days for solutions containing epinephrine and 28 days for epinephrine-free solutions.

The purpose of the study reported here was to determine the physical compatibility and chemical stability of 1% buffered lidocaine solution packaged in glass vials and stored at room temperature with exposure to light or at 5°C with protection from light.

A stock solution of 1% buffered lidocaine was prepared by adding 10 mL of sodium bicarbonate 8.4% (Hospira Healthcare Corporation, Saint-Laurent, Quebec; lot 54-202-EV, expiry June 2009) to 100 mL of 1% lidocaine solution (Astra-Zeneca Canada Inc, Mississauga, Ontario; lot 9924619-1, expiry April 2010). The solution was filtered through a 0.2-µm filter, and 3-mL aliquots were transferred into thirty-six 5-mL glass vials (APP Pharmaceuticals, Schaumburg, Illinois; lot 404079, expiry June 2011). On day zero, 6 vials were collected and frozen at –70°C for later analysis. The rest of the vials were divided into 2 groups: half were stored at 5°C with protection from light and the other half were stored at 23°C with exposure to light. On days 7, 14, 28, 56, and 91, 3 vials were removed from each storage condition and frozen at –70°C for later analysis.

Table 1. Stability of Buffered Lidocaine 1% Solution in Glass Vials

	Storage Temperature; % of Initial Concentration Remaining*	
Study Day	**23°C**	**5°C**
Initial concentration, mg/mL†	8.5 ± 0.08	10.9 ± 0.12
Day 7	99.8 ± 0.9	98.1 ± 1.4
Day 14	99.4 ± 1.3	99.3 ± 0.9
Day 28	95.9 ± 0.8	97.3 ± 0.6
Day 56	96.4 ± 1.0	97.2 ± 1.0
Day 91	96.7 ± 0.6	99.6 ± 1.8

*Percent of initial concentration remaining is reported as mean ± standard deviation, based on 3 samples, assayed in duplicate (n = 6).
†Initial concentration is reported as mean ± standard deviation, based on 3 samples, assayed in duplicate (n = 6).

On the day of analysis, all vials were allowed to thaw for 2 h. The samples were further diluted, and an internal standard was added. Each sample was then analyzed in duplicate by a previously validated stability-indicating high-performance liquid chromatography (HPLC) method.[8] The pH of each solution was measured with a calibrated pH meter, and colour and clarity were determined by the unaided eye against white and black backgrounds.

The concentration of all samples remained above 90% for a total of 91 days under both storage conditions (Table 1). The pH rose slightly over the study period (from a mean of 7.89 to a mean of 8.01). All solutions remained clear and colourless for the duration of the study.

On the basis of the information presented here, solutions of 1% buffered lidocaine packaged in glass vials may be stored at 23°C with exposure to light or at 5°C with protection from light for up to 91 days.

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Recent Data from the Canadian Hospital Pharmacy Residency Matching Service

The national Residency Matching Service was introduced by the Canadian Hospital Pharmacy Residency Board (CHPRB) in 2003 in an effort to provide a single process for assigning residents to residency positions that is efficient, effective, and equitable for all involved. All CHPRB-accredited and accreditation-pending residency programs in pharmacy practice must participate in the CHPRB Residency Matching Service. In addition, 4 nonaccredited programs utilize the Residency Matching Service.

The CHPRB is responsible for establishing the policies of the matching service and for monitoring its implementation and use. This letter serves as an update to data presented in 2007.[1]

Overall, since 2003, more than 1400 candidates have sought residency positions through the Residency Matching Service. The data indicate increasing numbers of residency positions in Canada and of candidates applying for residencies. However, growth in the number of residency programs and positions has not met the demand for residency positions. In 2003, 70% of applicants (59 of 84) were matched, but this proportion declined to 29% (86 of 296) in 2011 (Table 1).

A provincial breakdown of 2011 data from the Residency Matching Service suggests that the number of applicants in each province is 2 to 3 times greater than the number of residency positions available (Table 2).

By 2015, the profession of hospital pharmacy aims that all new pharmacists entering practice in hospitals and related health care settings will have completed a residency accredited by the CHPRB.[2] Also, with the addition of a new school of pharmacy in Ontario and an increase in class sizes for existing schools of pharmacy, the demand for residency positions is anticipated to increase in the future. Hospitals and related health care settings are encouraged to start residency programs for pharmacists and to expand existing residency programs to keep up with the larger number of pharmacists graduating each year and to meet our professional goals.

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Table 1. Residency Matching Service of the Canadian Hospital Pharmacy Residency Board: First 9 Years

Variable	2003	2004	2005	2006	2007	2008	2009	2010	2011
Programs registered	28	29	30	31	29	30	30	31	30
Positions available	61	60	64	71	72	76	80	82	86
Registered candidates	84	80	92	128	151	179	183	213	296
Matched candidates	59	51	62	69	72	76	80	82	86

Table 2. Provincial Breakdown of Matched Candidates

Province	2003	2004	2005	2006	2007	2008	2009	2010	2011	Unmatched Candidates 2011
Alberta	6	2	6	9	10	10	10	9	9	18
British Columbia	17	14	19	21	19	24	25	24	26	32
Manitoba	3	2	1	2	2	2	2	2	3	6
New Brunswick	2	1	2	2	2	2	2	4	4	1
Nova Scotia	1	2	2	2	2	2	2	2	2	7
Ontario	21	27	28	30	31	31	33	36	36	104
Saskatchewan	3	3	4	3	5	5	6	5	6	21
Total	53*	51	62	69	71†	76	80	82	86	189‡

*Six candidates who were matched declined their match.
†One candidate who was matched decline the match.
‡In addition to the unmatched candidates listed here, there were 13 unmatched foreign candidates, 5 unmatched candidates from the United States, 2 unmatched candidates from Quebec, and 1 unmatched candidate from Newfoundland and Labrador, for an overall total of 210 unmatched candidates.