Life Span and Efficiency Analysis of a Solid Phase Lithium Hydroxide CO2 Absorber-Spiralith™

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Background/Introduction: Traditional CO2 absorbers use calcium hydroxide-based soda lime as absorbent and can generate compound A and carbon monoxide (1, 2). Other disadvantages of soda lime granules are desiccation and random channeling, leading to inconsistent life span and volatile anesthetic waste. SpiraLith is a solid phase CO2 absorbent comprised of pure lithium powder bound to a polymer matrix engineered in solid sheets with pre-formed channels. Solid lithium hydroxide absorbent does not desiccate nor generate compound A and CO at any fresh gas flow rates (1). We aim to evaluate the performance of SpiraLith under normal fresh gas flow and low flow conditions. To our knowledge, this is the first clinical study of the lithium absorbent SpiraLith in terms of absorber life span and efficiency of volatile anesthetic usage with Sevoflurane (3).

Methods: General anesthesia cases utilizing Sevoflurane were included in the study using Drager Apollo machine with SpiraLith absorber. Normal Flow group (n=45 cases); Low Flow group (n=36 cases). Preoxygenation was conducted with oxygen flow at 10 L/min. After IV induction and airway establishment, oxygen flow was reduced to 4 L/min until patients achieve 0.5 MAC as calculated by age on the anesthesia machine. Then, combined O2 and air flow was reduced to 2 L/min for Normal Flow, 1 L/min for Low Flow, until all patients reach 1 MAC. The 1 MAC volatile anesthesia was maintained at the respective flow rates while intraoperative care continued by IV balanced technique until emergence, at which time the total fresh gas flow was turned up to 10 L/min until extubation. Data points were collected from the Drager Apollo machine DataLog, including duration of general anesthesia, O2 and air consumption, Sevoflurane consumption and uptake in liquid ml. The time from surgery end to extubation was also collected. Data were entered and analyzed in Excel spreadsheet. Statistical analysis was performed using unpaired Student's t-Test in Excel; statistical significance is defined as $p<0.01$.

Results: The average life span of SpiraLith absorber was 1668 min for Normal Flow, 1120 min for Low Flow. The efficiency of Low Flow resulted in Sevoflurane waste of only 28%, compared to 57% Sevoflurane waste for Normal Flow ($p<0.001$). The average case length was similar, 111 min Normal Flow, 124 min Low Flow ($p=0.13$), and the average time to extubation

was not significantly different (4.7 min Normal Flow vs. 6.2 min Low Flow, p=0.11).

	Normal Flow	Low Flow	p value
n (# cases)	45	36	
Case length (min)	111	124	0.13
Absorber life span (min)	1668	1120	<0.001
Sevoflurane waste (%)	57	28	<0.001
Time to extubation (min)	4.7	6.2	0.11

Conclusion: We have now defined the life span of SpiraLith absorber in two commonly used clinical settings. More importantly, SpiraLith absorber has significantly lower Sevoflurane volatile anesthetic waste at low flow conditions, potentially saving overall anesthetic cost by employing low flow technique with Sevoflurane, without the risk of toxic by-product generation using the solid lithium CO2 absorber.

References:

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3. Hendrickx JF et al: In Vitro performance of prefilled CO2 absorbers with the Aisys. J Clin Monit Comput. 2015 May 8 (Epub ahead of print).