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Ringer-Lactate solution versus isotonic saline solution on mucociliary function after nasal septal surgery

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Abstract

Irrigation with isotonic saline is one of the most frequently used solutions after nasal surgery. However, the effect of saline solutions on mucociliary clearance is not well known. In a previous study, it was found that isotonic saline solution had a negative effect on ciliary beat frequency but Ringer-Locke solution had no effect *in vitro*. In this study we compared the effects of Ringer-Lactate solution and isotonic saline solution on mucociliary transport time before, and after, nasal septal surgery in patients with nasal septal deviation. We found that patients who used Ringer-Lactate solution as irrigation after surgery had a significantly better mucociliary transport time than the patients using isotonic saline solution ($p<0.05$). In conclusion, it is better to use Ringer-Lactate solution instead of 0.9 per cent saline solution for nasal irrigation.

Key words: Nose; Surgical Procedures, Operative; Nasal Lavage Fluid; Sodium Chloride; Isotonic Solutions

Introduction

Physicians have recommended nasal irrigation for patients with sinonasal disease and the post-operative period of rhinological operations for more than a century. Clearance of secretions, debris, crusts, reducing the risk of post-operative adhesions, rapid mucosal healing and early symptomatic relief are major objectives of nasal irrigation.[1] Isotonic saline is one of the most frequently used solutions for irrigation after nasal surgery. However, the effect of saline solutions in different concentrations on mucociliary clearance is not well known. According to Boek *et al*., isotonic saline solution has a negative effect on ciliary beat frequency which is one of the most important parameters of mucociliary clearance in an *in vitro* siutation, but Ringer-Locke solution does not affect CBF.[2] In this study, we aimed to determine the effect of Ringer-Lactate solution and isotonic saline solution on mucociliary clearance in the patients who were operated on for nasal septal deviation.

Materials and methods

Thirty-two patients aged 18 and 61 years (mean 30.3) were selected to participate in the study. Nineteen were male and 13 were female. None of the 32 patients had any history of upper respiratory infection symptoms, allergic rhinitis, smoking, recent medication of systemic or topical sympathomimetics, parasympathomimetics or antihistaminic drugs or any kind of nasal surgery. The main surgical indication was nasal obstruction due to nasal septal deviation. A standard Cottle technique of septoplasty was performed on all of the patients under general endotracheal anaesthesia. Bilateral Merocel® nasal tamponades were introduced for two days. After the tamponades were removed, the patients were divided randomly and equally in two groups. In Group A, patients used Ringer-Lactate solution (the composition of this solution is 3.1 g sodium lactate, 6.0 g NaCl, 0.3 g KCl, 0.2 g $CaCl2.2H_2O$ in one litre of water) and in Group B isotonic saline solution (NaCl 0.9 per cent) for cleaning the nasal cavities. Both solutions were introduced to the nose with a handheld atomizer four times daily for three weeks. The nasal septum was straight in all cases and no minor or major surgical complications were revealed after the operation. Mucociliary clearance time was assessed by using the saccharin clearance test method.[3] The test was performed pre-operatively as well as three weeks after septoplasty under the same climatic conditions (room temperature 23°C, relatively humidity 60 per cent). The patient was asked to sit head upright and a 5 mg saccharin granule was placed on the medial aspect of the inferior turbinate. The period until the patient noticed a sweet taste was recorded. According to the previous studies, 30 minutes was accepted as the upper limit of the normal multiciliary clearance time.[4] This was evaluated in deviated and non-deviated sides pre- and post-operatively. The effect of treatment was determined for each group using Student's *t*-test and paired samples *t* test. The results were considered to be significant at $p<0.05$.

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TABLE I
MUCOCILIARY CLEARANCE TIME IN GROUP A AND B (PAIRED SAMPLES T TEST)

	Correlation	*p*
Ringer-Lactate solution		
Deviated side		
Pre-op–Post-op	0.519	0.039
Non-deviated side		
Pre-op–Post-op	0.065	0.810
Isotonic saline solution		
Deviated side		
Pre-op–Post-op	–.185	0.492
Non-deviated side		
Pre-op–Post-op	0.296	0.266

p = statistical significance.

Results

The results were summarized in Table I. The mucociliary clearance time was found to be significantly lower in the deviated side (average 9.98) than the non-deviated side (average 8.48) ($p<0.05$). The mucociliary clearance time was compared before, and after, septoplasty in each group. In Group A, the post-operative mucociliary clearance time was found to be significantly better than the pre-operative mucociliary clearance time in the deviated side ($p<0.05$) but in Group B, the mucociliary clearance time did not change significantly ($p>0.05$).

Discussion

Deitmer and Erwig found that when the one side of nose was obstructed, the mucociliary clearance time was longer than the opposite open side.[5] Also Ginzel and Illum demonstrated an improvement in mucociliary clearance time after septoplasty but Passali *et al.*, concluded that hypertrophy of the inferior turbinate and deviation of the nasal septum did not interfere with mucociliary clearance time significantly.[4,6] Shone *et al.*, did not find any significant improvement in mucociliary clearance time after septoplasty in the early weeks (three weeks).[7] Deitmer and Erwig explained that nasal obstruction may cause superfluent production of moisture, which leads to changes in viscosity or disturbances in the mucous layers.[5] Our results suggested that the mucociliary clearance time was longer in the deviated side than the non-deviated side and after septoplasty a significant improvement was observed in Group A.

Several different solutions (isotonic or hypertonic saline solution, isotonic Ems salt solution, bicarbonate solution, ocean water etc.) have been used for symptomatic and physiological relief without enough documented data.[1,8] Talbot *et al.*, investigated the effect of buffered hypertonic saline solution on the mucociliary clearance time using the saccharin test and obtained better results than the isotonic saline solution.[1] Boek *et al.*, made one of the most comprehensive studies on the effect of saline solutions of different concentrations.[2] They investigated the effects of 0.9 per cent, seven per cent and 14.4 per cent saline solutions on ciliary beat frequency (CBF) *in vitro* and compared this data with the results measured in Ringer-Locke solution. It was concluded that Ringer-Locke solution had no effect on CBF, 0.9 per cent saline solution had a moderately negative effect on CBF, seven per cent saline solution led to a complete but reversible ciliostasis within five minutes and 14.4 per cent saline solution had a irreversible ciliostatic effect. We used Ringer-Lactate solution instead of Ringer-Locke solution (the composition of this solution is 7.72 g NaCl, 0.42 g KCl, 0.16 g $CaCl_2.2H_2O$, 0.15 g 0.15 g $NaHCO_3$, 1.00 g glucose anhydrous in one litre of water). These isotonic solutions are similar; sodium lactate instead of glucose anhydrous and absence of $NaHCO_3$ are the main differences. Our results with Ringer-Lactate solution supported this study on a clinical basis. Ringer-Lactate solution has a composition that more closely approximates the extracellular fluids and is more deserving of the adjective 'physiological'.[2] This isotonic solution does not affect CBF and has no local or systemic side-effects. Also it is inexpensive.

Conclusion

We found a significant difference between irrigation with Ringer-Lactate solution and isotonic saline solution for the mucociliary clearance function after nasal septal surgery, therefore we propose using Ringer-Lactate solution instead of 0.9 per cent saline solution for nasal irrigation.

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