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ORIGINAL ARTICLE

Radiofrequency for the treatment of vasomotor rhinitis

Vazomotor rinit tedavisi için radyofrekans uygulaması

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Objectives: We assessed the efficacy of submucosal application of radiofrequency to the inferior turbinate for the treatment of vasomotor rhinitis.

Patients and Methods: Twenty patients with vasomotor rhinitis (9 males, 11 females; mean age 29.2 years; range 20 to 40 years) were treated with radiofrequency applied to the inferior turbinate. Symptoms such as nasal obstruction, sneezing, and watery nasal discharge were graded with the use of a visual analog scale (VAS) before, and on days 1, 3, 7, 30, 60, 90, and 180 after the treatment.

Results: The severity of symptoms began to decrease following the first week after the application. Maximum relief was achieved between 30 to 60 days after the intervention. The highest rate of improvement (85.4%) was reported in sneezing, followed by nasal obstruction (76.4%) and nasal discharge (67.7%). The mean VAS scores showed a significant improvement in all symptoms between 7 to 180 days after the procedure ($p<0.05$). The rate of patient satisfaction was 90% for the relief of nasal obstruction and sneezing, and 80% for nasal discharge. Complaints about vasomotor rhinitis increased up to a severity near the pretreatment level in eight patients on the 180th postoperative day and the procedure was repeated.

Conclusion: These findings indicate that radiofrequency may be used as an alternative treatment option in patients with vasomotor rhinitis.

Key Words: Catheter ablation; nasal mucosa/ surgery; nasal obstruction/pathology; patient satisfaction; rhinitis, vasomotor/therapy; turbinates/surgery.

Amaç: Bu çalışmada inferior konkaya submukozal radyofrekans uygulamasının vazomotor rinit tedavisindeki etkinliği araştırıldı.

Hastalar ve Yöntemler: Çalışmaya vazomotor rinitli 20 hasta (9 erkek, 11 kadın; ort. yaş 29.2; dağılım 20-40) alındı. Tüm hastalar inferior konkaya radyofrekans uygulamasıyla tedavi edildi. Hastaların burun tıkanıklığı, hapşırma ve sulu burun akıntısı şikayetleri tedaviden önce ve işlem sonrası 1, 3, 7, 30, 60, 90 ve 180. günlerde görsel analog skala ile değerlendirildi.

Bulgular: Tüm hastalarda semptomların ciddiyeti radyofrekans uygulamasından bir hafta sonra azalmaya başladı. En fazla iyileşmenin işlemden 30 ile 60 gün sonra elde edildiği görüldü. En yüksek iyileşme oranı hapşırmada (%85.4) elde edilirken, bunu burun tıkanıklığı (%76.4) ve burun akıntısındaki (%67.7) iyileşme izledi. Tedaviden sonra yedi ile 180. günler arasında bütün semptomlardaki iyileşme derecesi anlamlıydı ($p<0.05$). Hastaların %90'ı burun tıkanıklığı ve hapşırmadaki düzelmeden, %80'i burun akıntısındaki iyileşmeden memnundu. Ameliyat sonrası 180. günde sekiz hastada vazomotor rinite bağlı yakınmalar tedavi öncesi düzeye yükseldi ve işlem tekrarlandı.

Sonuç: Bu bulgular radyofrekans uygulamasının vazomotor rinitli hastalarda bir tedavi yöntemi olarak kullanılabileceğini gösterdi.

Anahtar Sözcükler: Kateter ablasyonu; burun mukozası/ cerrahi; burun tıkanıklığı/patoloji; hasta memnuniyeti; rinit, vazomotor/tedavi; turbinat/cerrahi.

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Vasomotor rhinitis is a noninfectious chronic rhinopathy, which has most of the symptoms of allergic rhinitis without an allergic basis. These patients mainly complain of nasal blockage, nasal secretion and less frequently sneezing.[1,2] Medications, which give good results in allergic rhinitis, may have a poor benefit in vasomotor rhinitis.[3] Many other treatment modalities including local application of silver nitrate and botulinum toxin, vidian neurectomy, laser cautery, submucosal diathermy and cryotherapy have also been used for the treatment of patients with vasomotor rhinitis.[4-8] All of these treatment methods have their own drawbacks like the eye dryness of vidian neurectomy, increased postoperative pain and prolonged healing period after cryotherapy, osteonecrosis of the turbinate bone after submucosal diathermy, and anosmia after application of silver nitrate.[6-9] In recent years successful treatment of these patients by local application of capsaicin was reported but it causes local irritation and severe nose burning during the procedure.[10]

Recently RF has successfully been used for inferior turbinate hypertrophy.[11-14] No complication was reported by the authors except mild to moderate pain in some of the patients during the procedure and transient nasal obstruction due to edema of the turbinate after RF application.[11-13] No crusting, bleeding or synechia of the turbinate has been reported because RF energy had been delivered submucosally. The mucosa of the turbinate remains healthy to maintain normal function after the procedure.[15]

Previous studies with RF application in rhinology have mainly focused on nasal obstruction due to inferior turbinate hypertrophy in any origin. In this study we aimed to evaluate the efficacy of submucosal application of RF on symptoms of vasomotor rhinitis, including nasal discharge and sneezing in addition to nasal obstruction.

PATIENTS AND METHODS

Twenty patients with vasomotor rhinitis, 9 men and 11 women with a range of ages, between 20 to 40 years (mean 29.2 years) were included in the study. Ten of these patients were included into control group during the first two months. A written informed consent form was taken before being included in the study, which was approved by the ethical committee of Gülhane Military Medical School. All patients had a history of different degree of nasal discharge, nasal obstruction and sneezing, which were reported to be refractory, or got only a poor relief from topical steroid. Examination included anterior rhinoscopy and nasal endoscopy in all patients to evaluate colour of mucosa, swelling of turbinates, features of secretion, anatomical variations and any other pathologic changes of the nasal passages. Paranasal sinuses were evaluated with computerized tomography, which was taken on the coronal plane.

Nasal smear and skin prick test (SPT) were performed at the Department of Allergic Diseases. SPT was carried out by using 55 common aeroallergens (pollens commonly found in atmosphere, molds, house dust mites and animal dander (Greer Lab, Lenoir, USA). Saline solution was used for negative controls and histamine was used for positive controls. SPT was performed with disposable lancets and the diameter of the erythema and the wheal were recorded at 15 minutes. Reactions with a wheal diameter larger than or equal to 3 mm were considered to be positive. Intradermal tests were also performed in patients whose preceding SPT was negative. Grass, weed and tree pollen and house dust mites extracts were used (Greer Lab, Lenoir USA). A wheal and flare reaction larger than negative control was accepted positive. Patients with symptoms and findings of vasomotor rhinitis who had no eosinophils on nasal smear and showed a negative SPT and a negative intradermal test were included in the group of vasomotor rhinitis.

Patients who had previous nasal surgery, had findings of sinusitis on physical examination or on computerized tomography, had any kind of rhinitis (drug induced, endocrine, infectious) except vasomotor rhinitis, had nasal polyps or anatomical variations of the nasal structures and had a history of using topical steroid in the last one month were excluded from the study.

Each patient used a 10 cm visual analog scale to grade symptoms. A score of “0” indicated very little or no symptoms, while a score of “10” represent the most severe degree of symptoms. Patients filled the VAS for nasal obstruction, sneezing and nasal discharge preoperatively and on days 1, 3, 7, 30, 60, 90, and 180 after the procedure. Examination of nasal passage and inferior turbinates were also performed on the same dates.

Procedure

All procedures were performed with the patients under local anaesthesia. Cotton pledges, soaked with 2% pantocaine were placed into the nasal passage for 10 minutes. Then the pledges were removed and inferior turbinates were injected with 1% lidocaine. Ellman Surgitron EMC unit, which had an output 3.8 MHz, was used as radiofrequency generator. RF was delivered into the inferior turbinates on coagulation mode (partially rectified waves) by using bayonet type 45-mm long bipolar turbinate probe. The probes were placed in the anterior portion of the inferior turbinate and deeply inserted along the medial face of the turbinate bone. A power of 30 watts was used to deliver radio wave emissions into the turbinate for 20 seconds. The same procedure was performed in the lower, middle and upper portion of the inferior turbinates. Nasal packing was not used after the procedure. Paracetamol was used for pain control. Thick mucus that accumulated in the nasal passage was removed by aspiration during the first week after the procedure. The same procedure was performed in the control group without delivering radiofrequency at first. This group underwent a second procedure to apply radiofrequency as in the other patients at the end of 2 months follow-up period. They were also subjected to the same follow-up procedure as in the treatment group after this period.

Paired Student t test was used for statistical analysis and a *p* value of less than 0.05 was considered to be statistically significant.

RESULTS

All of the 20 patients had different degree of symptoms of vasomotor rhinitis preoperatively. Preoperative mean symptom scores did not change significantly in the control patients (8.54±0.1, 8.03±0.2 and 8.46±0.6 respectively for mean degree of nasal obstruction, sneezing and nasal discharge preoperatively and 8.51±0.2, 8.04±0.1, 8.44±0.6 respectively for the same symptoms between 30 to 60 days postoperatively) at the end of second postoperative month ($p>0.05$). These patients underwent a second procedure to apply radiofrequency after this period and were included in the treatment group. Mean degree of nasal obstruction, sneezing and nasal discharge, scored by all the patients preoperatively were 8.64±0.1, 8.14±0.2 and 8.57±0.6 respectively. Symptoms increased during the first three days after the RF procedure (9.64±0.1, 9.35±0.1 and 8.71±0.5 for nasal obstruction, sneezing and nasal discharge respectively). Symptomatic relief began after the first week with mean scores 5.00±0.3, 5.40±0.3 and 5.21 ±0.4 for nasal obstruction, sneezing and nasal discharge respectively (Table I). Degree of improvement at the end of first postoperative week was statistically significant as compared with preoperatively ($p<0.05$).

Symptomatic improvement reached maximum between days 30 and 60 after the intervention (Fig. 1). Mean symptom scores, reported by patients on 30th postoperative day were 2.07±0.2 for nasal obstruction, 1.19±0.2 for sneezing and 3.28±0.3 for nasal discharge. The highest rate of improvement was reported in sneezing (85.38%) and the lowest rate of relief was in nasal discharge (61.72%) on 30 Th postoperative day (Table I). Mean symptom scores, reported on 60th postoperative day were 2.71±0.4, 1.80±0.3, and 3.71±0.3 for nasal obstruction, sneezing and nasal discharge respectively. Rate of improvement, reported on days 30 and 60 after the RF procedure was statistically significant as compared with preoperatively ($p<0.05$). On the other hand when patients' symptoms evaluated one by one 16 (80%) of the 20 patients reported that improvement rate of nasal discharge between 30 to 90 days postoperatively was satisfactory. Patients' satisfaction was 90% (18 of 20 patients) with the improvement rate of nasal obstruction and sneezing in this period.

Symptomatic relief was seen to be decreased on postoperative 90th day but rate of improvement was still statistically significant ($p<0.05$). Reported mean symptom scores were changed as 4.14±0.3, 3.50±0.5 and 5.14±0.5 for nasal obstruction, sneezing and nasal discharge respectively. Although symptom scores of vasomotor rhinitis were continued to increase slowly in sixth month postoperatively (4.71±0.4, 4.57±0.4 and 5.42±0.5 for nasal obstruction, sneezing and nasal discharge respectively), the difference between mean symptom scores as compared with preoperatively was still statistically significant ($p<0.05$). However complaints of patients increased up to a level near the preoperative degree in 8 patients and the procedure was repeated. Other 12 patients reported that they were still satisfied with their symptomatic relief.

Anterior rhinoscopy and nasal endoscopy revealed involution of inferior turbinate, continuing

TABLE I

MEAN SYMPTOM SCORES (SCORED BY USING VISUAL ANALOG SCALE) REPORTED BY 20 PATIENTS PREOPERATIVELY AND ON DAYS 1, 3, 7, 30, 60, 90, AND 180 AFTER THE TREATMENT

Symptoms	Mean scores, reported by the patients							
	preoperatively	day-1	day-3	day-7	day-30	day-60	day-90	day-180
Nasal obstruction	8.64±0.1	9.64±0.1	9.64±0.1	5.00±0.3	2.07±0.2	2.71±0.4	4.14±0.3	4.71±0.4
Improvement rate %	–	–	–	42.12	76.04	68.63	52.08	54.48
Sneezing	8.14±0.2	9.35±0.1	9.20±0.1	5.40±0.3	1.19±0.2	1.80±0.3	3.50±0.5	4.57±0.4
Improvement rate %	–	–	–	32.43	85.38	77.88	57.00	43.85
Nasal discharge %	8.57±0.6	8.71±0.5	8.70±0.1	5.21±0.4	3.28±0.3	3.71±0.3	5.14±0.5	5.42±0.5
Improvement rate	–	–	–	39.20	61.72	56.70	40.02	36.75

parallel with symptomatic course. Inferior turbinates were pale and hypertrophic in all patients preoperatively and were seen to be swollen during first week after the intervention. Patients were called to repeated examination and thick mucus, accumulated between turbinate and nasal septum was removed in this period. Inferior turbinates were reduced in volume during first and second month after the treatment. Thick mucus was seen in the control group after the early postoperative period but the inferior turbinates did not reduce in volume in these patients.

All patients tolerated the procedure well and completed the study. Transient nasal obstruction in the first week after the procedure was the only minor complication, encountered.

DISCUSSION

Vasomotor rhinitis is a nonspesific chronic rhinopathy, which is accepted an exclusion of diagnosis.[16] Nasal smear for eosinophils and skin tests for specific allergens are negative in these patients. Mast cells have been found in nasal secretions of patient with vasomotor rhinitis but the significance of this finding is not clear. The mechanism is therefore nonallergic and most likely related to an abnormality of the autonomic nervous system. Over activity of parasympathetic innervation of nose, which is triggered by exposure to non-specific environmental factors such as sudden change in temperature or humidity and by emotional factors, initiates symptoms of vasomotor rhinitis. Symptoms of these patients are generally perennial and respond poorly

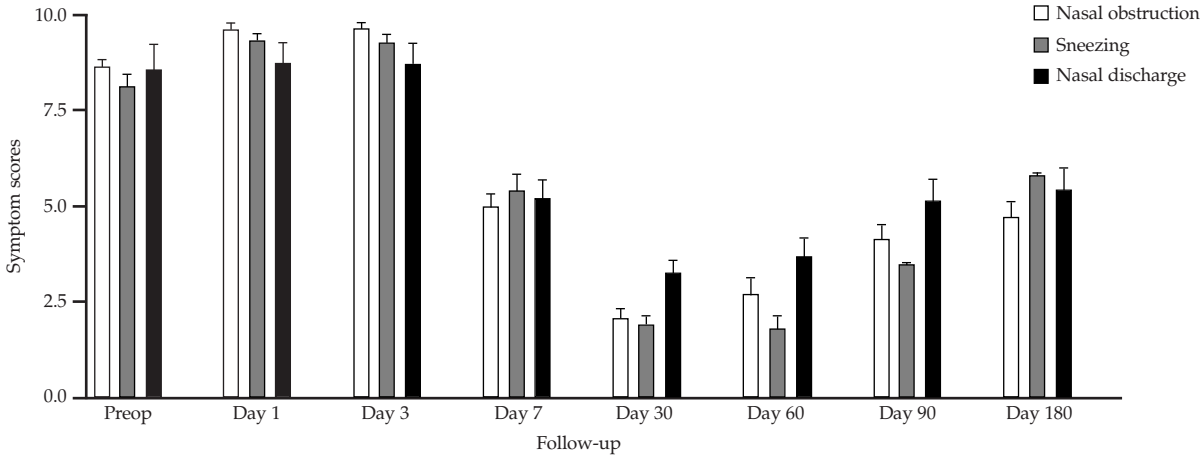

Fig. 1 - *Course of mean symptom scores preoperatively and on days 1, 3, 7, 30, 60, 90, and 180 after the treatment in 20 patients.*

to antiallergic medications including antihistamines, decongestants, corticosteroids and cromolyn sodium.[17]

RF application into the inferior turbinate was used for the treatment of vasomotor rhinitis in this study. The mechanism of RF is based on the passage of energy through an electrode to the surrounding tissue in a radial fashion. The energy, coming from the source spreads into the surrounding tissue from the active electrode. Active electrode does not produce heat by itself. The current induces an ionic agitation in the tissue and this leads to protein friction and heat liberation.[1] Heating leads to protein denaturation when 49.5 °C is reached. The factors that mainly affect degree of heating are current intensity (in watts), time (in seconds), and electrode size and length. An increase in any of these factors will increase tissue heating.[18] High frequency radio waves cause a coagulation necrosis in the submucosal tissue by heating. Consequently the circumscribed area of submucosal necrosis is replaced over time by fibrotic tissue without any damage of epithelial surface.[19]

Wound contraction due to fibrosis, results in volumetric reduction of the turbinate, leading to relief of nasal obstruction in-patients with vasomotor rhinitis. Submucosal fibrosis and obliteration of venous sinusoids in these patients due to RF may alter the response to various stimulants as described in submucosal diathermy.[20] Submucosal heating during RF may also cause degeneration of the C fibers containing different neuropeptides, which are assumed to play an important role in the mechanism of aspecific nasal hyperreactivity. Inferior turbinate is accepted to be an important trigger zone, of which stimulation leads to sneezing and rhinorrhoea.[7] RF relieves symptoms of vasomotor rhinitis by reducing response of the inferior turbinate to various stimulations but further studies are needed to reveal exact mechanism.

Elwany et al.[15] used a RF unit with a bipolar probe in patients with hypertrophied inferior turbinates and 76% of the patients reported a significant improvement of their nasal obstruction one year postoperatively. In the same study electron microscopic examination of the nasal mucosa revealed an intact healthy epithelium as well as intense fibrosis of the underlying stroma at the end of follow-up period.[15] Lin et al.[21] reported significant improvement of nasal obstruction, sneezing and nasal discharge one year after the RF application to the turbinates in patients with allergic rhinitis. In our study improvement of symptoms (nasal obstruction, sneezing and nasal discharge) began after the first week postoperatively ($p<0.05$). Maximum relief was detected between 30 and 60 days after the intervention. The best result was detected in sneezing with 85.38 % of improvement rate and the lowest improvement rate (61.72%) was reported in nasal discharge on the postoperative 30th day after the intervention by the patients (Table I). Ninety percent of the patients reported that the improvement rates of nasal obstruction and sneezing were satisfactory between 30 to 90 days postoperatively. In the previous studies symptomatic improvements were reported to be maintained during 1-year follow-up period.[14,15] In our study reported symptomatic relief was seen to be slowly decreased between 60 to 180 days after the intervention (Fig. 1). By six months after the treatment there was still a statistically significant difference between mean sore of symptoms as compared with preoperatively ($p<0.05$). However 8 patients reported that their complaints due to vasomotor rhinitis increased up to uncomfortable level and the procedure was repeated.

No significant complication was reported after submucosal application of RF to the inferior turbinates in the previous studies.[12,14,22,23] In a recent study Sapci et al. reported obstruction was significantly improved after the radiofrequency tissue ablation of the inferior turbinate with preserving normal nasal mucociliary function.[24] In this study postoperative nasal obstruction, which results from swelling of the inferior turbinates and as a result of accumulation of thick mucus in the nasal passage were detected in all patients in the first postoperative week. Mild pain controlled with acetminophen and accumulated mucus was removed by aspiration. Aggravation of sneezing and nasal discharge that has been observed during the first three days due to inflammation began to relieve after the postoperative first week. No other complication was encountered.

In conclusion submucosal application of RF to the inferior turbinates was seen to be a safe surgical procedure, significantly reducing symptoms of vasomotor rhinitis in most of the patients at least

during the 3 months period. It is also an easy office procedure that can be applied with minimal discomfort of the patients and without any pathologic change of nasal mucosa. These findings indicate that submucousal application of RF to the turbinates may be used as an alternative treatment option in patients with vasomotor rhinitis and is candidate further clinical and laboratory investigations.

REFERENCES

1. Banov CH, Lieberman P. Vasomotor Rhinitis Study Groups. Efficacy of azelastine nasal spray in the treatment of vasomotor (perennial nonallergic) rhinitis. Ann Allergy Asthma Immunol 2001;86:28-35.
2. Lindberg S, Malm L. Comparison of allergic rhinitis and vasomotor rhinitis patients on the basis of a computer questionnaire. Allergy 1993;48:602-7.
3. Mikaelian AJ. Vasomotor rhinitis. Ear Nose Throat J 1989;68:207-8.
4. Shaari CM, Sanders I, Wu BL, Biller HF. Rhinorrhea is decreased in dogs after nasal application of botulinum toxin. Otolaryngol Head Neck Surg 1995;112:566-71.
5. Fernandes CM. Bilateral transnasal vidian neurectomy in the management of chronic rhinitis. J Laryngol Otol 1994;108:569-73.
6. McCombe AW, Cook J, Jones AS. A comparison of laser cautery and sub-mucosal diathermy for rhinitis. Clin Otolaryngol 1992;17:297-9.
7. Bhargava KB, Shirali GN, Abhyankar US, Gadre KC. Treatment of allergic and vasomotor rhinitis by the local application of different concentrations of silver nitrate. J Laryngol Otol 1992;106:699-701.
8. Bumsted RM. Cryotherapy for chronic vasomotor rhinitis: technique and patient selection for improved results. Laryngoscope 1984;94:539-44.
9. el-Guindy A. Endoscopic transseptal vidian neurectomy. Arch Otolaryngol Head Neck Surg 1994;120:1347-51.
10. Marabini S, Ciabatti PG, Polli G, Fusco BM, Geppetti P. Beneficial effects of intranasal applications of capsaicin in patients with vasomotor rhinitis. Eur Arch Otorhinolaryngol 1991;248:191-4.
11. Rhee CS, Kim DY, Won TB, Lee HJ, Park SW, Kwon TY, et al. Changes of nasal function after temperature-controlled radiofrequency tissue volume reduction for the turbinate. Laryngoscope. 2001;111:153-8.
12. Coste A, Yona L, Blumen M, Louis B, Zerah F, Rugina M, et al. Radiofrequency is a safe and effective treatment of turbinate hypertrophy. Laryngoscope 2001;111:894-9.
13. Utley DS, Goode RL, Hakim I. Radiofrequency energy tissue ablation for the treatment of nasal obstruction secondary to turbinate hypertrophy. Laryngoscope 1999;109:683-6.
14. Smith TL, Correa AJ, Kuo T, Reinisch L. Radiofrequency tissue ablation of the inferior turbinates using a thermocouple feedback electrode. Laryngoscope. 1999;109:1760-5.
15. Elwany S, Gaimaee R, Fattah HA. Radiofrequency bipolar submucosal diathermy of the inferior turbinates. Am J Rhinol 1999;13:145-9.
16. Jones AS, Lancer JM. Vasomotor rhinitis. Br Med J (Clin Res Ed) 1987;294:1505-6.
17. McDonald TJ. Nasal disorders in children. Allergic rhinitis, vasomotor rhinitis, and nasal polyps. Postgrad Med 1987;81:65-8, 70, 72 passim.
18. Guilleminault C, Chervin R, Palombini L, Powell N. Radiofrequency (pacing and thermic effects) in the treatment of sleep-disordered breathing. Sleep 2000;23 Suppl 4:S182-6.
19. Courey MS, Fomin D, Smith T, Huang S, Sanders D, Reinisch L. Histologic and physiologic effects of electrocautery, CO2 laser, and radiofrequency injury in the porcine soft palate. Laryngoscope 1999;109:1316-9.
20. Jones AS, Wight RG, Kabil Y, Beckingham E. Predicting the outcome of submucosal diathermy to the inferior turbinates. Clin Otolaryngol 1989;14:41-4.
21. Lin HC, Lin PW, Su CY, Chang HW. Radiofrequency for the treatment of allergic rhinitis refractory to medical therapy. Laryngoscope 2003;113:673-8.
22. Fischer Y, Gosepath J, Amedee RG, Mann WJ. Radiofrequency volumetric tissue reduction (RFVTR) of inferior turbinates: a new method in the treatment of chronic nasal obstruction. Am J Rhinol 2000;14:355-60.
23. Li KK, Powell NB, Riley RW, Troell RJ, Guilleminault C. Radiofrequency volumetric tissue reduction for treatment of turbinate hypertrophy: a pilot study. Otolaryngol Head Neck Surg 1998;119:569-73.
24. Sapci T, Sahin B, Karavus A, Akbulut UG. Comparison of the effects of radiofrequency tissue ablation, CO2 laser ablation, and partial turbinectomy applications on nasal mucociliary functions. Laryngoscope 2003;113:514-9.