The Laryngoscope
Lippincott Williams & Wilkins, Inc., Philadelphia
© 2003 The American Laryngological,
Rhinological and Otological Society, Inc.

A Randomized Trial of the Canalith Repositioning Procedure

Kwanchanok Yimtae, MD; Somchai Srirompotong, MD; Supaporn Srirompotong, MD;
Patchareeporn Sae-seaw, MD

Objective: **To compare the effectiveness and complications of our adaptation of the canalith repositioning procedure (CRP) with the expectation treatment for benign paroxysmal positional vertigo.** ***Study Design:*** **A randomized, controlled trial in the setting of a neurotological clinic in Thailand.** ***Methods:*** **Fifty-eight patients with posterior benign paroxysmal positional vertigo were randomly assigned to treatment and control groups using a block of four. The treatment group was treated with the modified CRP technique until the nystagmus disappeared. A mastoid oscillator was not used, nor were any instructions given for patients after the maneuver. Both groups recorded the daily grading of symptoms and the amount of anti-vertiginous drugs (cinnarizine) taken. Objective and subjective assessments were made weekly until the nystagmus disappeared or until 4 weeks had passed since treatment began.** ***Results:*** **The rates of effectiveness of CRP treatment and the control treatment for benign paroxysmal positional vertigo were 75.9% and 48.2%, respectively. There was a significant difference in the treatment outcomes of the CRP and control groups ($P = .03$). The CRP group used significantly fewer drugs than the control group ($P = .001$). Complications in the CRP group, such as lateral canalithiasis and fainting, were observed in 13.8% of the patients.** ***Conclusions:*** **The CRP was more effective than the expectation treatment for benign paroxysmal positional vertigo insofar as it provided faster recovery and required less dependence on medication. Complications of CRP were limited to 13.8% of patients.** ***Key Words:*** **Benign paroxysmal positional vertigo, canalithiasis, treatment, canalith repositioning procedure, particle repositioning maneuver.**

Laryngoscope, **113:828–832, 2003**

From the Department of Otolaryngology, Faculty of Medicine, Khon Kaen University, Thailand.

Supported by a Medical Research Grant from the Faculty of Medicine, Khon Kaen University, Thailand.

Editor's Note: This Manuscript was accepted for publication January 21, 2003.

Send Correspondence to Kwanchanok Yimtae, MD, Department of Otolaryngology, Faculty of Medicine, Khon Kaen University, 40002, Thailand. E-mail: kwayim@kku.ac.th

INTRODUCTION

Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo. It is characterized by the sudden onset of dizziness or vertigo precipitated by a specific position. Most frequently, it affects the posterior semicircular canal (PSC). The diagnosis of BPPV of a PSC is confirmed by the classic response to the Dix-Hallpike maneuver.[1]

Benign paroxysmal positional vertigo is usually idiopathic in origin. It may be seen in combination with, and possibly as a consequence of, other vestibular diseases and head trauma.[2,3] To explain the classic nystagmus of BPPV, Schuknecht[4] in 1962 and Hall et al.[5] in 1979 proposed the hypotheses of cupulolithiasis and canalithiasis, respectively.

The clinical course of BPPV is self-limiting within weeks or months,[6,7] and anti-vertiginous medications have been found to be ineffective in controlling it.[8] Surgical treatments, such as singular neurectomy or posterior canal occlusion, are reserved for intractable, chronic cases.[9,10] Vestibular habituation training, liberatory maneuvers, and the canalith repositioning procedure (CRP) achieve remediation in 70% to 90% of cases.[11–15] The CRP, introduced by Epley[13] and modified in various ways, is the most popular maneuver.[16–19]

The third Epley position and multiple treatments in one session significantly improved the effectiveness of CRP.[20] Therefore, we modified the third and the fourth Epley positions (Fig. 1), freeing 89.5% of patients from nystagmus and relieving 100% of symptoms. Ours was a prospective study with control groups to compare the effectiveness and complications (ie, lateral semicircular canalithiasis and vagal reflex) of a modified CRP technique. The absence of nystagmus on the Dix-Hallpike test was used as the primary objective outcome measure, whereas the vertigo, a subjective symptom, served as the secondary outcome measure.

PATIENTS AND METHODS

Patients

We included all patients having vertigo with classic nystagmus (as per the Dix-Hallpike test) who presented themselves to the Neurotological Clinic, Srinagarind Hospital (Khon Kaen Uni-

Copyright © The American Laryngological, Rhinological and Otological Society, Inc. Unauthorized reproduction of this article is prohibited.

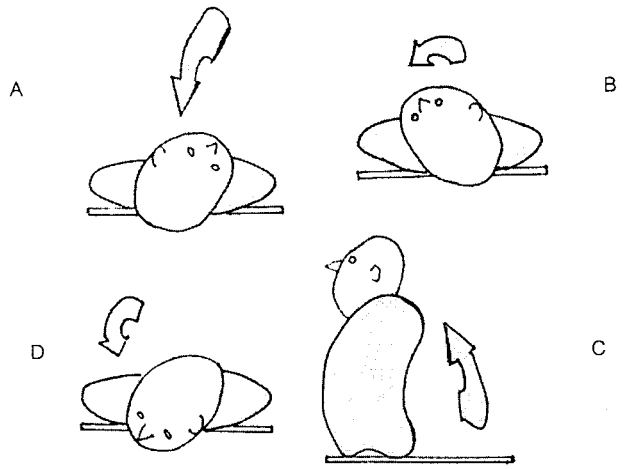

Fig. 1. Our technique of canalith repositioning procedure for the affected right ear. (**A**) The Dix-Hallpike position. (**B**) Head of the patient turns to the opposite side (the second Epley position). (**C**) The patient rolls to the prone position with the head 180° from the first position. (**D**) The patient turns in a circle to the sitting position. General note: Pause at each position until the induced nystagmus nearly stops or 20 seconds if there is no nystagmus.

versity, Thailand) between January 1999 and December 2000. Patients who had a neck problem or unstable cardiopulmonary status or who did not intend to join the project were treated but were excluded from the study.

Estimation of Sample Size

The sample size of 29 was calculated to yield an 80% power to detect a difference between the control and treatment groups of 40% at a significance level of 0.05, assuming a 20% dropout rate.

Method

Each patient had a complete neurotological examination and was classified according to the chronicity of his or her symptoms. Patients who had paroxysmal positional vertigo in the 2 weeks before presentation were classed as "acute" cases, as were those who had recurrent episodes more than a year apart. We classed as "chronic" cases patients having intermittent paroxysmal positional vertigo for more than 2 weeks or those having a recurrence within a year. The patients within each group were randomly assigned to treatment and control groups using a block of four. The patients in the treatment group were treated using our CRP technique for not more than five cycles per session (Fig. 1) until the nystagmus had resolved. The number of cycles of CRP in each session was recorded, as were complications. The patients then received a subjective assessment questionnaire and an antivertiginous drug (cinnarizine) with instructions to take it for vertigo. We did not give any instructions for patients after the maneuver (such as telling patients to avoid a known provoking position or sitting upright for 48 h). The control group received the same medication and instructions. Patients were asked to grade the severity of vertiginous symptoms (ie, worse, stable, mild improvement, marked improvement, or no symptoms) and to record the number of times they took the medication.

Assessment

The patients were scheduled for follow-up a week later. Another doctor performed the objective assessment without being apprised of the treatment. Any nystagmus that developed during the static positional test or Dix-Hallpike maneuver was recorded. Patients not experiencing nystagmus received the subjective assessment questionnaire, medication, and an appointment for follow-up 4 weeks later. Patients who still had nystagmus were sent back to the first doctor. Patients in the CRP group received the same maneuver and were scheduled for weekly follow-up; patients in the control group were reassured and scheduled for follow-up. If the nystagmus persisted after a month of treatment, it was classed "not cured"; any nystagmus that disappeared before this was classed as "cured."

Statistical Analysis

We used the χ^2 and the Fisher Exact tests to compare proportions. The Student t test was used to compare the continuous variables. Time to recovery of BPPV was analyzed using the Kaplan-Meier product limit method. The difference in the median survival time was calculated using the approach of Altman et al.[21] A P value of less than .05 indicated a significant difference in the outcome between the CRP and control groups.

TABLE I.
Clinical Manifestations at the Initiation of the study.

Characteristics	CRP Group (n = 29)	Control Group (n = 29)
Age (mean)	44 years	48 years
Sex (no.) F:M	25:4	18:11
Chronicity (mean)	31 days	39 days
Acute (no.)	14	15
Chronic (no.)	15	14
Frequency of vertigo/week (episode)	19	20
Cause (no.)		
Idiopathic	20	19
Minor head trauma	9	10
Provoking position (no.)		
Turning in bed	17	15
Neck extension	9	14
Bending forward	5	12
Getting up	7	17
Lying down	4	2
Characteristics of vertigo (no.)		
Room spinning	25	25
Spinning in head	3	2
Dizziness	1	2
Duration of vertigo (no.)		
Seconds	16	16
Minutes	13	13
Functional level score (no.)		
Class I	4	1
Class II	24	24
Class III	1	4
Affected side (no.) R:L:B	17:10:2	18:10:1
Mean latency of nystagmus	4.4 sec	3.7 sec
Mean duration of nystagmus	14.6 sec	11.0 sec
Other canal involvement (no.)		
Lateral canal	4	5
Anterior canal	1	0

Copyright © The American Laryngological, Rhinological and Otological Society, Inc. Unauthorized reproduction of this article is prohibited.

RESULTS

The clinical manifestations revealed no remarkable difference between the CRP (treatment) and control groups (Table I). Two patients in the control group never came for follow-up. The resolution of nystagmus was achieved in 22 patients from the treatment group, but in only 13 patients from the control group. The rates of effectiveness of the CRP treatment and the control treatment for BPPV were 75.9% and 48.2%, respectively. There was a significant difference between the treatment outcome of the CRP (treatment) and control groups (difference = 27.7%; 95% CI, 2.41%–48.9%) (P = .03). The time course for a cure based on a negative result on the Dix-Hallpike test was analyzed using the Kaplan-Meier survival test (Fig. 2), and the CRP (treatment) group resolved significantly faster than the control group (median difference = 3; 95% CI, 2.55%–3.45%) (P = .02).

The subjective assessment is presented in Table II. The difference between the symptom scores for the CRP (treatment) and control groups was only significant during the first 3 weeks. By the end of the study, symptoms of vertigo improved in 96% of the CRP (treatment) group and 90% of the control group. The time course of recovery, based on a subjective assessment, was analyzed using the Kaplan-Meier survival function test (Fig. 3). Although the CRP (treatment) group recovered faster than the control group, the difference was not statistically significant (median difference = 15; 95% CI, −2.75%–32.75%).

Mean total drug use for the CRP (treatment) group was 5.8 ± 2.01, whereas it was 23.0 ± 4.43 for the control group (mean difference = 17.2; 95% CI, 7.34%–27.08%) (P = .001). The mean total number of cycles of CRP used for the cured BPPV patients was 2.18 ± 0.35, whereas it was 8.00 ± 1.72 for the uncured ones, a significant difference (mean difference = 5.82; 95% CI, 1.61%–10.03%) (P = .014). Patients who were not cured required more than six cycles of CRP in the first 2 weeks. Patients not responding to CRP after a month were treated with the liberatory maneuver, and all were cured after one or two sessions.

Complications from CRP occurred in four patients. Two had fainting, pallor, and sweating after undergoing repeated maneuvers in one session, but the reaction resolved after the maneuvers were stopped. Two other patients (6.9%) had immediate symptoms of lateral BPPV on the same side but responded immediately to prompt CRP of the lateral canalithiasis (360° rotation technique).

DISCUSSION

The effectiveness rate of our modified Epley technique in curing nystagmus was 75.9%. The effectiveness of our method corresponded to previous reports at the 1-month assessment (ie, 76.5%).[7,13–20] The effectiveness of the control treatment for BPPV in our study was 48.2%. The time course of recovery for patients receiving CRP treatment, as assessed by the Dix-Hallpike test, was significantly faster than for the patients in the control group. Moreover, use of medication among patients in the CRP (treatment) group was significantly reduced compared with patients in the control group. Our results confirmed the benefits of the CRP over the expectation treatment for patients with BPPV as more effective, providing faster recovery, and requiring less anti-vertiginous medication.

There are several reasons for our modification of the CRP technique: 1) We have no mastoid oscillator; 2) our patients complained of neck pain and instability while maintaining lateral decubitus during vertigo; 3) our third position, with the head turned as in the Epley technique

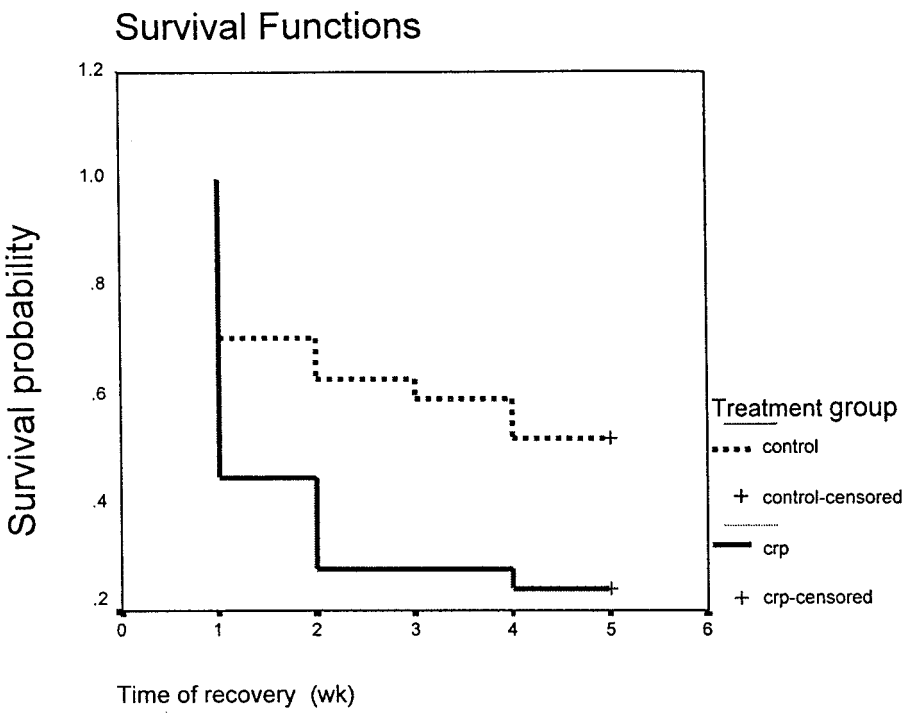

Fig. 2. The time course of cure based on negative Dix-Hallpike test result.

Copyright © The American Laryngological, Rhinological and Otological Society, Inc. Unauthorized reproduction of this article is prohibited.

TABLE II.
Subjective Assessment.

	Week 1		Week 2		Week 3		Week 4	
Symptom Grading	CRP (n = 29)	Control (n = 27)	CRP (n = 26)	Control (n = 25)	CRP (n = 25)	Control (n = 23)	CRP (n = 25)	Control (n = 20)
Stable/worse	3	4	0	8	1	1	1	2
Improvement	14	22	9	15	7	17	8	11
No symptom	12	1	17	2	17	5	16	7
Chi-square	$P = .005$		$P = .000$		$P = .014$		$P = .336$	

while the trunk was prone, made patients feel more comfortable; and, 4) we modified the fourth Epley position because turning in a circle should move the particle out of the canal more easily than turning the patient on his or her back.

Our technique was more easily accomplished and less time-consuming and was well tolerated by patients. We did not use premedication, bone vibration, or instructions for patients after the maneuver, which suggests that use of a mastoid oscillator and instructions for patients after the maneuver are not necessary. Hain et al.[22] showed that vibration applied during the CRP did not improve results or prevent recurrence of BPPV. Instructions for patients after the maneuver were used in several CRP studies[7,13–19] but led to more discomfort because patients were told to keep the head upright for 48 hours, to wear soft collars, and to avoid any provoking position. Nuti et al.[23] reported that it was not necessary for patients to avoid certain positions or movement after liberatory maneuvers. Our study only suggests that this observation may apply to CRP as well.

The total number of CRP cycles in cured BPPV patients was significantly less than those not cured. Those not cured required >6 cycles of CRP in the first 2 weeks, but they responded to one or two sessions of liberatory maneuvers. Herdman et al.[14] reported that the liberatory maneuver and CRP are equally effective as single-treatment approaches for BPPV. Although this might indicate that the pathophysiology of BPPV in these patients was cupulolithiasis, the condition would have resolved spontaneously over time anyway. Asawavichianginda et al.[7] also showed that the treatment outcome of CRP was significantly better than the treatment outcome for the control group in the first month, but not afterward. To decrease the time of recovery for BPPV patients, we recommend using the liberatory maneuver should there be no response to six cycles of CRP.

A complication of CRP was observed in 13.8% of cases. Moving otoliths to the lateral canal occurred in two cases (6.9%), in comparison with the findings of Herdman and Tusa.[24] It suggests the relocation of the particle rather than vestibular adaptation as the mechanism of

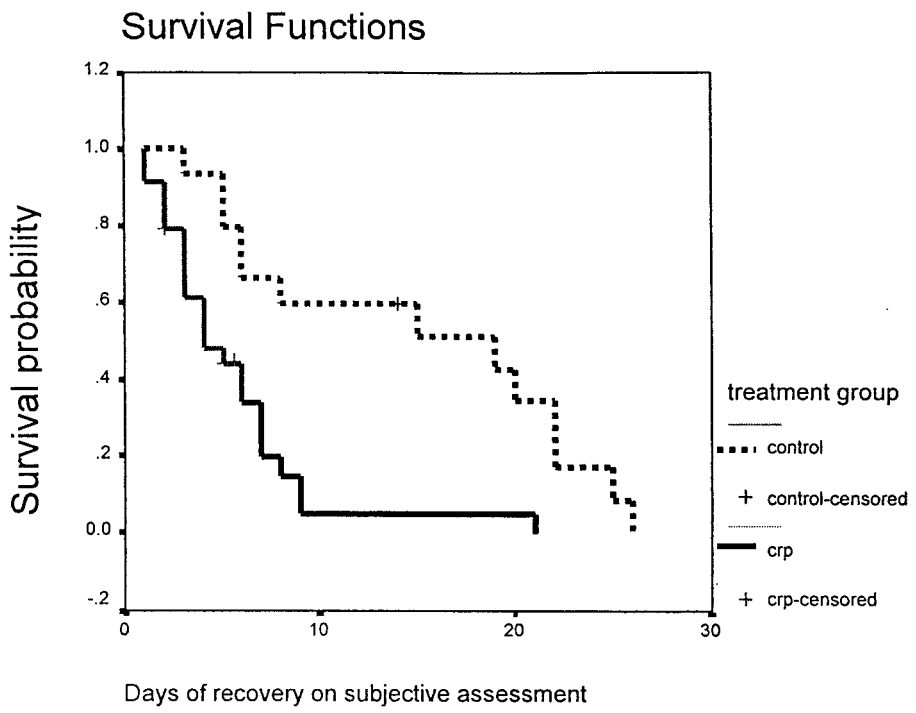

Fig. 3. The time course of recovery based on subjective assessment.

Copyright © The American Laryngological, Rhinological and Otological Society, Inc. Unauthorized reproduction of this article is prohibited.

CRP in curing BPPV. Fainting, sweating, pallor, and hypotension might be caused by activation of the limbic system because of repeated, procedure-induced vertigo as found in 6.9% of our patients, although not mentioned in other studies. These two patients were not cured by means of the CRP and, although they responded to the liberatory maneuver, it was too early to conclude that the cupuliths caused more severe vertigo than the canaliths.

CONCLUSION

The CRP is more effective than the expectation treatment for BPPV insofar as it provides faster recovery and decreased drug consumption. Complications of CRP, such as fainting or lateral canalithiasis, occurred in 13.8% of patients.

Acknowledgments

The authors thank their departmental colleagues for recruiting patients; Sompon Tuksananiyom and staff at the Clinical Epidemiology Unit, Faculty of Medicine, Khon Kaen University, for comments on research methodology; Bandit Thinkumrop, PhD, for his statistical advice; Bryan Roderick Hamman for assistance with the English-language presentation; and Kwanjai Keworn for typing the manuscript.

BIBLIOGRAPHY

1. Dix R, Hallpike CS. The pathology, symptomatology and diagnosis of certain common disorders of the vestibular system. *Proc R Soc Med* 1952;54:341–354.
2. Baloh RW, Honrubia V, Jacobson K. Benign positional vertigo: clinical and oculographic features in 240 cases. *Neurology* 1987;37:371–378.
3. Hughes CA, Proctor L. Benign paroxysmal positional vertigo. *Laryngoscope* 1997;107:607–613.
4. Schuknecht HF. Positional vertigo: clinical and experimental observations. *Trans Am Acad Ophthalmol Otolaryngol* 1962;66:319–332.
5. Hall SF, Ruby RRF, McClure JA. The mechanics of benign paroxysmal vertigo. *J Otolaryngol* 1979;8:151–158.
6. Blakley BW. A randomized, controlled assessment of the canalith repositioning maneuver. *Otolaryngol Head Neck Surg* 1994;110:391–396.
7. Asawavichianginda S, Isipradit P, Snidvongs K, et al. Canalith repositioning for benign paroxysmal positional vertigo: a randomized controlled trial. *Ear Nose Throat J* 2000;79: 732–734.
8. Fujino A, Tokumasu K, Yosio S, et al. Vestibular training for benign paroxysmal positional vertigo: its efficacy in comparison with antivertigo drugs. *Arch Otolaryngol Head Neck Surg* 1994;120:497–504.
9. Gacek RR. Singular neurectomy update II: review of 102 cases. *Laryngoscope* 1991;101:855–862.
10. Parnes LS, McClure JA. Posterior semicircular canal occlusion for intractable benign paroxysmal positional vertigo. *Ann Otol Rhinol Laryngol* 1990;99:330–334.
11. Norre ME, Forrez G, Beckers A. Benign paroxysmal positional vertigo: clinical observations by vestibular habituation training and by posturography. *J Laryngol Otol* 1987; 101:443–447.
12. Semont A, Freyss G, Vitte E. Curing the BPPV with a liberatory maneuver. *Adv Otorhinolaryngol* 1988;42:290–293.
13. Epley JM. The canalith repositioning procedure for treatment of benign paroxysmal positional vertigo. *Otolaryngol Head Neck Surg* 1992;107:399–404.
14. Herdman SJ, Tusa RJ, Zee DS, et al. Single treatment approaches to benign paroxysmal positional vertigo. *Arch Otolaryngol Head Neck Surg* 1993;119:450–454.
15. Steenerson RL, Cronin GW. Comparison of the canalith repositioning procedure and vestibular habituation training in forty patients with benign paroxysmal positional vertigo. *Otolaryngol Head Neck Surg* 1996;114:61–64.
16. Li JC. Mastoid oscillation: a critical factor for success in the canalith repositioning procedure. *Otolaryngol Head Neck Surg* 1995;112:670–675.
17. Lynn S, Pool A, Rose D, et al. Randomized trial of the canalith repositioning procedure. *Otolaryngol Head Neck Surg* 1995;113:712–720.
18. Lempert T, Wolsley C, Davies R, et al. Three hundred sixty–degree rotation of the posterior semicircular canal for treatment of benign positional vertigo: a placebo-controlled trial. *Neurology* 1997;49:729–733.
19. Radtke A, Nauhavse H, von Brevern M, et al. A modified Epley's procedure for self-treatment of benign paroxysmal positional vertigo. *Neurology* 1999;53:1358–1360.
20. Yimtae K, Srirompotong S, Kraitrakul S. Treatment of benign paroxysmal positional vertigo by canalith repositioning procedure: experience from Srinagarind Hospital. *J Med Assoc Thai* 2000;83:1478–1485.
21. Altman DG, Machin D, Bryant TN, et al. *Statistics With Confidence*, 2nd ed. London: BMJ Books, 2000.
22. Hain TC, Helminski JO, Reis IL, et al. Vibration does not improve results of the canalith repositioning procedure. *Arch Otolaryngol Head Neck Surg* 2000;126:617–622.
23. Nuti D, Nati C, Passali D. Treatment of benign paroxysmal positional vertigo: no need for postmaneuver restrictions. *Otolaryngol Head Neck Surg* 2000;122:440–444.
24. Herdman SJ, Tusa RJ. Complications of the canalith repositioning procedure. *Arch Otolaryngol Head Neck Surg* 1996; 122:281–286.

Copyright © The American Laryngological, Rhinological and Otological Society, Inc. Unauthorized reproduction of this article is prohibited.