



นิพนธ์ต้นฉบับ

Comparison of Phenol and Ethanol in Decreasing Spastic Calf Muscle in Cerebral Palsy*

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Objective: To determine the efficacy of phenol and ethanol for treatment of spastic gastrosoleus muscles in cerebral palsy. **Design:** Double-blinded, randomized clinical trial. **Setting:** Department of Physical Medicine and Rehabilitation, Phramongkutklao Hospital. **Material and Methods:** The 51 individuals (28 boys, 23 girls) with mean age of 88.7 months were recruited and randomly assigned into 2 groups. **Intervention:** Intramuscular neurolysis of spastic gastrosoleus muscles managed by 5% phenol and 50% ethyl alcohol in group I and II, respectively and followed-up immediately and then at 7 days, 28 days, and 84 days. **Outcome Measures:** The severity of spasticity as assessed by Modified Ashworth Scale (MAS) score and the ankle passive range of motion (PROM). **Results:** Both groups had significant improvement in all outcomes at follow up statistically significant within 84 days. **Conclusion:** Phenol and ethanol preliminary provide good relief of spastic gastrosoleus in cerebral palsy in this limited study. The results emphasize the additional investigation in a long term follow-up.

Key Words: • Intramuscular neurolysis • Phenol • Ethanol • Spasticity • Cerebral palsy

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In cerebral palsy children, one of their important problem is muscular spasticity effects poorer life quality from various complications, especially, difficulty in standing and walking.

In management of spasticity, Biner and Eng¹ men-

tioned that spasticity treatment by taking medicine can temporary reduce spasticity with some results i.e. being weak, drowsy and disturbed daily activity and learning of patients. Local treatment by peripheral nerve block and motor point block by 5% phenol and 50% ethanol is more suitable for those patients.

So, for severe spasticity patients, treatment by chemical neurolysis such as phenol, ethanol and botu-

ได้รับต้นฉบับเมื่อ 18 สิงหาคม 2547 ได้ให้ตีพิมพ์เมื่อ 14 กันยายน 2547
ต้องการสำเนาต้นฉบับติดต่อ พ.อ.อารมณัฐ ชูนาฮี กองเวชศาสตร์ฟื้นฟู
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*Approved by the Ethic Committee of Phramongkutklao Hospital

linum toxin is the option before surgery². Phenol solution³ contains a lot of chemical substances which are crystalline phenol, sodium bisulfate, sodium EDTA and water. It is different from ethanol solution⁴ as it contains of ethanol in water only. The resemblance is phenol effected by reducing fat and denaturing tissue protein⁵; ethanol effected by inducing protein coagulation and protoplasm dehydration⁶. Five percent of more concentration of phenol effects some protein coagulation and tissue necrosis⁷ causing segmented demyelination and thrombosis of blood vessel supplies the nerve and development of Wallerian degeneration afterwards and finally muscular spasticity reduction. Ethanol effects by separating fat from nerve and precipitation of protein⁷, which effects swelling of Schwann cell and separation from myelin sheath causes Wallerian degeneration resulting reduction of muscular spasticity.

Both solutions are useful for spasticity management because of their effectiveness and their cost are not expensive. There are a lot of previous studies reported about their usefulness^{1,4,7-18} but there is no any studied comparing their effectiveness. Thus, the purpose of this research is to compare the efficacy for muscular spasticity treatment between phenol and ethanol.

Material and Methods

Sample groups

Patients of Department of Physical Medicine and Rehabilitation Department of Phramongkutklo Hospital during December 1, 2002 -March 12, 2003 were sampling by stratified by stratified randomization. They were grouped according to Modified Ashworth Scale score (MAS score)¹⁹.

And random treated by these two solutions. Patients of the research were between 5 - 16 years with equines or equinovarus foot from spasticity of gastrosoleus muscle with MAS score between 2 to 4. There was neither history allergy to phenol and ethanol. Nor kidney or liver diseases, nor chemical neurolysis. The second injection must be done after the first at least six months. The patients had to stop taking anti-spasticity drug at least 1 week before injection and throughout the research period. One leg was deemed as a case. Before being a part of the research, the patients and their cousins or parents acknowledged through information sheet, explained and replied to their questions, and consented in written to be a part of this research.

Materials

1. Five percents of phenol in water was equally contained 3 mL. It was clear, mentioned by code instead of its exact medicine name, which would be disclosed after the research end.
2. EMG (Medelec V premier plus). Electrode and stimulator
3. Teflon coated 22 gauge needle, and 5 mL. syringe
4. Goniometer

Procedure

The solutions were prepared by medical personal and the doctor who made intramuscular neurolysis⁸ did not know what solution was given to the patient. And all injections were done by the same doctor. The procedure were done by using surface stimulator to find the proper area for injection. Then, intramuscular neurolysis was done with Teflon coated 22-gauge needle and the intensity of electricity is 1 mA., 0.1 ms. or less.

Measurement

The examiner who measure MAS score and PROM

will not know what solution that the patient was given. The measurement were done in supine position. PROM of ankle joint were done²⁰. For grading MAS score were done in 0,1,2,3,4,5 instead of 0,1,1+,2, 3,4 for the convenient in calculation. The measurements were done in every subjects before injection, immediate after injection, 7th day, 28th day, and 84th day post injection.

Result

There were 51 subjects. They are 28 boys and 23 girls. The first group: 24 patients treated by phenol were 11 boys (45.80%) and 13 girls (54.20%) at average age 93.46 ± 24.75 months (67-143 months), with average weight 18.34 ± 4.29 kg (10.4-26 kg). MAS level 2 was found in 8 patients (33.30%), level 3 was 11 patients (45.80%), level 4 was 5 patients (20.80%). Average MAS score was between 3.88 ± 0.74 (3-5) while average PROM was 42.50 ± 10.53 (20-65 degree). The second group: 27 patients treated by ethanol were 17 boys (63%) and 10 girls (37%) at average age of 83.89 ± 24.38 months (54-137 months). Average weight 17.47 ± 3.67 kg (11-26 kg). MAS level 2 was found in 8 patients (29.60%), level 3 in 11 patients (40.70%), level 4 in 8 patients (29.60%). Average MAS score was between 4.00 ± 0.78 ³⁵ while average PROM was 40.93 ± 9.91 degree (20-60 degree).

There is no significant difference between phenol and ethanol group in age, body weight, and dose as show in table 1, 2 and 3

Comparison of average MAS score between phenol and ethanol group was found no significant difference before injection, immediate after injection, 7th day, 28th day, and 84th day post injection. And The MAS score between before treatment and after treatment is significant different in both groups ($p < 0.001$) as shown in figure 1 and table 4.

The comparison of average ankle PROM between phenol and ethanol group showed no significant difference before injection, immediate after injection, 7th day, 28th day, and 84th day post injection. And the ankle PROM between before treatment and after treatment is significant different in both groups ($p < 0.001$) as shown in figure 2 and table 5.

Average MAS score in phenol group and ethanol group were found significant difference between before injection and after injection (immediate after injection, 7th day, 28th day, and 84th day post injection) as shown in table 6 and 7 ($p < 0.001$)

Average ankle PROM in phenol group and ethanol group were found significant difference between before injection and after injection (immediate after injection, 7th day, 28th day, and 84th day post injection) as shown in table 8 and 9 ($p < 0.05$)

From this study we found 3 allodynia cases which spontaneous recovery in 2 cases and cure after treatment in 1 case.

Discussion

Because of various differences of technique means

Table 1 Age (months) of group1 (phenol) and 2 (ethanol)

Age	group	N	\bar{X}	SD	t-value	df	p-value
	Phenol	24	93.46	24.75	1.389	49	0.171
	Ethanol	27	83.89	24.38			

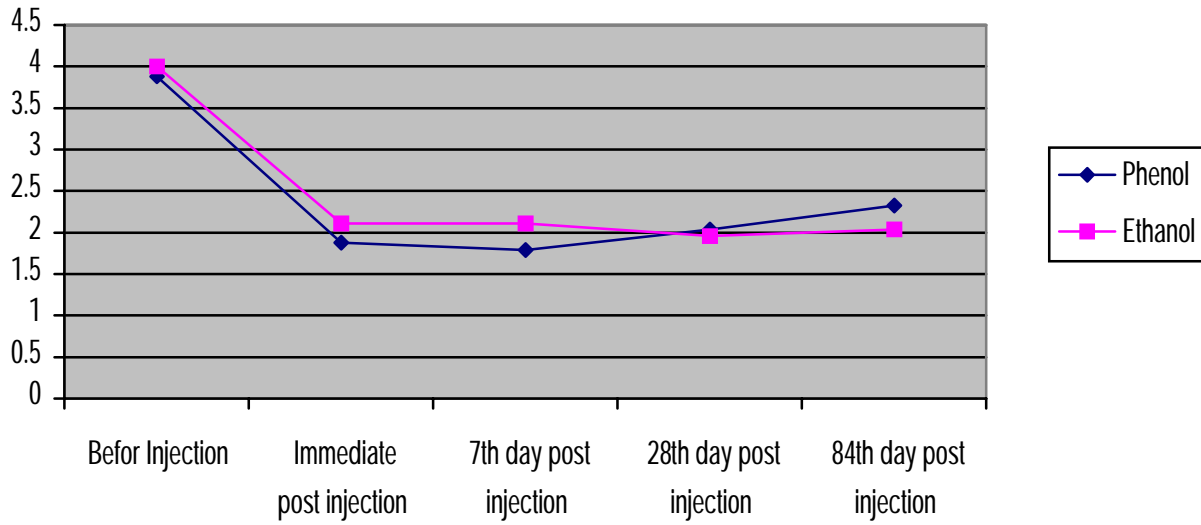


Table 2 Weight (Kg) of group 1(phenol) and 2 (ethanol)

Weight	group	N	\bar{X}	SD	t-value	df	p-value
Phenol		24	18.34	4.29	0.780	49	0.437
Ethanol		27	17.47	3.67			

Table 3 Quantity of both substances (CC) for treatment of group 1 (phenol) and 2 (ethanol)

Quantity	group	N	\bar{X}	SD	t-value	df	p-value
Phenol		24	3.48	0.906	0.378	49	0.707
Ethanol		27	3.40	0.735			

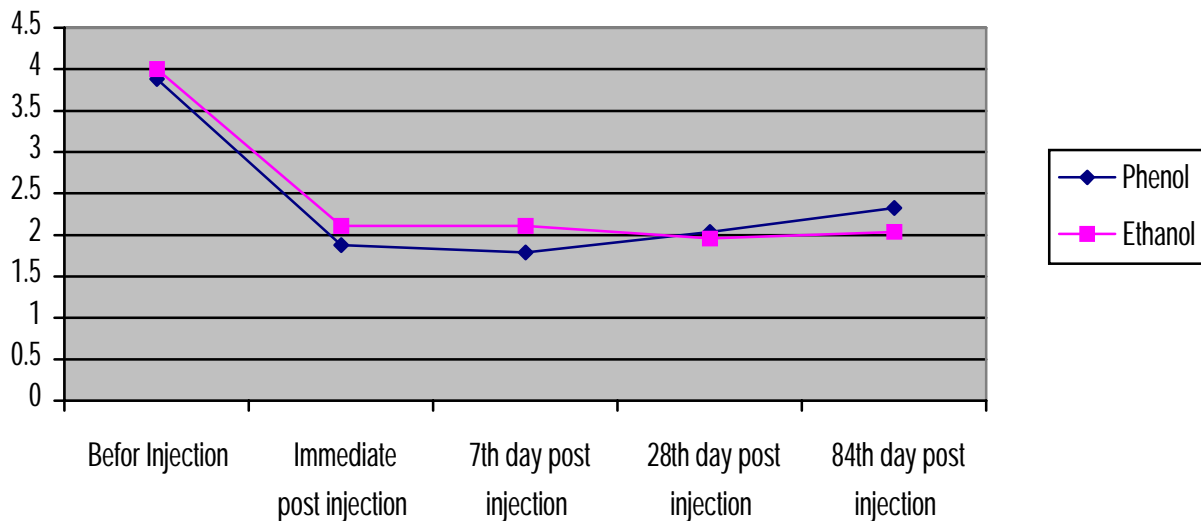


Figure 1 Show MAS score in average of group 1 and 2 by following up for a period after treatment test

Table 4 Show an analysis of variance of MAS score between group 1 (phenol) and 2 (ethanol)

ANOVA Source	SS	df	MS	F	p-value
Between subject	214.737	50			
Between groups	0.237	1	0.237	0.054	0.817
Error within group	214.500	49	4.378		
Within subject	224.54	204			
Between time	149.121	4	37.280	101.121	0.000
Between time with group	3.160	4	0.790	2.143	0.077
Between time with error within group	72.259	196	0.369		
Total	439.277	254			

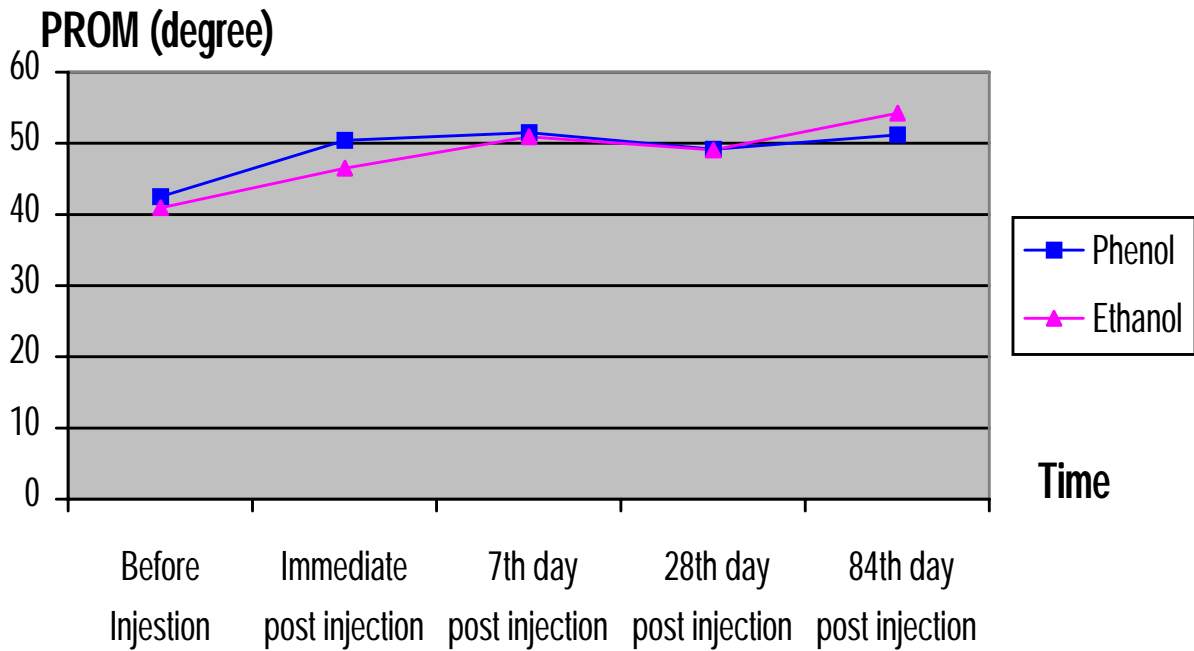


Figure 2 Show average scores of ankle PROM from of group 1 and group 2 by following up for a period after treatment test

Table 5 Show ANOVA result of ankle PROM. between group 1 (phenol) and 2 (ethanol)

ANOVA Source	SS	df	MS	F	p-value
Between subject	11,729.608	50			
Between groups	24.816	1	24.816	0.104	0.749
Error within group	11,704.792	49	238.873		
Within subject	17,108.274	204			
Between time	3,643.764	4	910.941	13.585	0.000
Between time with group	322.195	4	80.549	1.201	0.312
Between time with error within group	13,142.315	196	67.053		
Total	28,837.882	254			

Table 6 Compare the MAS score differences at any determined times for group 1 (Phenol)

Time		Mean difference	Standard error	Sig.
Before injection	Immediate post injection	2.00	0.31	0.000
	7 th day post injection	2.08	0.31	0.000
	28 th day post injection	1.83	0.31	0.000
	84 th day post injection	1.54	0.31	0.000

Table 7 Compare the MAS score differences at any determined times for group 2 (Ethanol)

Time		Mean difference	Standard error	Sig.
Before injection	Immediate post injection	1.89	0.30	0.000
	7 th day post injection	1.89	0.30	0.000
	28 th day post injection	2.04	0.30	0.000
	84 th day post injection	1.96	0.30	0.000

Table 8 Compare the PROM differences of ankles at any determined times for group 1 (Phenol)

Time		Mean difference	Standard error	Sig.
Before injection	Immediate post injection	-7.92	2.93	0.008
	7 th day post injection	-8.96	2.93	0.003
	28 th day post injection	-6.67	2.93	0.025
	84 th day post injection	-8.75	2.93	0.003

Table 9 Compare the PROM differences of ankles at any determined times for group 2 (Ethanol)

Time		Mean difference	Standard error	Sig.
Before injection	Immediate post injection	-5.56	2.72	0.043
	7 th day post injection	-10.00	2.72	0.000
	28 th day post injection	-8.15	2.72	0.003
	84 th day post injection	-13.33	2.72	0.000

and concentration of solution for spasticity treatment so there are various differences of results from the previous of studies^{1,4,8,9,10,11,12,13,14,15,16}. Aim of this research is to study only on efficiency of a treatment of 5% phenol comparing with 50% ethanol by intramuscular neurolysis technique.

From this study, we found that the results of 5% phenol and 50% ethanol throughout the period of follow up (84days) are good from MAS score that decreased ($p < 0.001$) and ankle PROM that increased ($p < 0.05$) comparing with the data before injection. However, from Kong and Chua study⁴ found that in stroke patients whom treated by 50% ethanol in management for elbow flexor spasticity, the effect could last for 6 month. In this study we could not study so long as in Kong and Chua study because, for these spastic diplegic children, we should not wait too long to see the effect from only single modality, it is better to combine treatment with other modalities such as physical therapy, orthotic device and surgical management to make the best profit to the patients.

Complications from this study were found only in 3 cases. All of them were allodynia whom 1 case from phenol injection and the other 2 cases from ethanol injection. And in these 3 cases, one case from phenol and the other one from ethanol injection developed spontaneous recovery in 1 week. For the third case, pain was cure after the treatment with oral prednisolone for 1 week. One of the most important factors for this low incidence of complication is the technique that we used which is intramuscular neurolysis technique. Comparing with peripheral nerve block technique that if major mixed nerves with many sensory axons are injected, there are 10% to 30% risk of painful paresthesias^{17,18}.

Summary

Within 84 days of study, 5% phenol and 50% etha-

nol intramuscular neurolysis injection showed a good result in decreased spasticity of gastrocnemius muscle in spastic diplegic children.

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การศึกษาเปรียบเทียบการลดการหดเกร็งของกล้ามเนื้อ ในผู้ป่วยสมองพิการระหว่างฟีนอลและเอทานอล*

อารมย์ ขุนภาษี, เศรษฐพงศ์ ถิ่นซีลอง, สมเกียรติ เหมตะศิลป์, ธิติมา ศิริมาตยาพันธ์, พจน์ เอ็มพันธ์*, ไกรวัชร ธีรเนตร

กองเวชศาสตร์ฟื้นฟู, โรงพยาบาลพระมงกุฎเกล้า, *ภาควิชาเวชศาสตร์ทหารและชุมชน วิทยาลัยแพทยศาสตร์พระมงกุฎเกล้า

วัตถุประสงค์: เพื่อเปรียบเทียบประสิทธิผลของฟีนอลและเอทานอล ที่ใช้ในการรักษาการหดเกร็งของกล้ามเนื้อที่ทำหน้าที่กระดกข้อเท้าลงในผู้ป่วยสมองพิการ **รูปแบบการวิจัย:** Double - blinded, randomized clinical trial **สถานที่ทำการวิจัย:** กองเวชศาสตร์ฟื้นฟู โรงพยาบาลพระมงกุฎเกล้า **กลุ่มที่ถูกรักษา:** ผู้ป่วยสมองพิการ 51 ราย เด็กชาย 28 ราย เด็กหญิง 23 ราย อายุเฉลี่ย 88.7 เดือน แบ่งผู้ป่วยเป็น 2 กลุ่ม **วิธีการ:** กลุ่มที่ 1 จำนวน 24 ราย รักษาโดย 5%ฟีนอล กลุ่มที่ 2 จำนวน 27 ราย รักษาด้วยเอทานอล รักษาการหดเกร็งด้วยวิธี Intramuscular Neurolysis วัดผลโดยการให้คะแนน Modified Ashworth Scale (MAS) และพิสัยการเคลื่อนไหวข้อเท้าโดยใช้แรงของผู้ตรวจ (PROM) ติดตามผลการรักษาทันทีหลังฉีด, หลังฉีด 7 วัน, หลังฉีด 28 วัน, และหลังฉีด 84 วัน **ผลการวิจัย:** ทั้ง 2 กลุ่มมีผลการรักษาดีขึ้นอย่างชัดเจนตลอดเวลาที่ติดตามผล ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติในช่วงเวลาติดตามผล 84 วัน **ผลสรุป:** ในเบื้องต้นฟีนอลและเอทานอลให้ผลการรักษาที่ดีในการลดการหดเกร็งกล้ามเนื้อในผู้ป่วยสมองพิการ เนื่องจากมีข้อจำกัดในการศึกษาควรติดตามผลการรักษาที่นานขึ้น

Key Words: • Intramuscular neurolysis • Phenol • Ethanol • Spasticity • Cerebral palsy

เวชสารแพทย์ทหารบก 2547;57:127-34.

*การศึกษานี้ได้ผ่านการพิจารณาเห็นชอบให้ดำเนินการได้โดยคณะกรรมการจริยธรรมโรงพยาบาลพระมงกุฎเกล้า และสนับสนุนทุนการศึกษาวิจัยโดยโรงพยาบาลพระมงกุฎเกล้า