Influence of Rehabilitation Medicine Residency Training in Performing Chemodenervation in Children with Cerebral Palsy in Thailand

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Background: *Chemodenervation (CD) involves injecting drugs such as phenol, botulinum toxin, or alcohol to reduce muscle spasticity. However, they interfere with daily activities of children with cerebral palsy (CP). Rehabilitation residency training in Thailand currently requires performing a minimum of five CD procedures. However, the effect of this policy on post-training practice is unknown.*

Objective: *To explore the influence of CD training during residency on post-training clinical practice and their current use of it in treating CP patients.*

Material and Method: *The questionnaires were sent to 431 Thai physiatrists nationwide by both electronic and postal mails. The responses were collected within a three-month period.*

Results: *Of 116 (27%) respondents with usable questionnaires, 85 (73%) were trained during their residency to perform CD and 46 (40%) performed it in their practice. Those trained to perform CD were more likely in their subsequent practice to do so ($p = 0.0140$), and younger age was associated with performing it ($p = 0.0055$). The number of CD procedures performed during residency correlated directly with reported confidence in performing the procedure in later practice ($p<0.0001$). The most common reasons for not performing CD were few CP cases in their care, and unavailable equipment or injection agent.*

Conclusion: *Although only a cross-sectional study, the findings suggest that increasing the number of CD procedures required in rehabilitation residency may increase the use of CD to benefit CP patients in future clinical practice.*

Keywords: *Rehabilitation medicine, Residency training, Chemodenervation, Cerebral palsy*

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Chemodenervation (CD) is a method to reversibly and selectively reduce the focal spasticity of certain muscles in patients with cerebral palsy (CP), which relieves pain and difficulty with therapy, and improves care and function. It is performed by injecting intramuscular neuromuscular blocking agents such as botulinum toxin, phenol, and alcohol[1,2]. Despite its benefits, performing CD in clinical practice can be challenging due to its complexity, equipment, and technical experience. As an invasive procedure, it is even more challenging in pediatric patients[3].

Residency training in rehabilitation medicine in Thailand began in 1982[4]. A requirement to learn CD was added to its standard curriculum in the 1990s, which now requires performing on a minimum of five CP patients[5]. This number, however, may be insufficient to provide adequate experience confidently to perform CD in the future clinical practice of rehabilitation medicine. To explore the influence of CD training during residency on post-training clinical practice, we surveyed practicing physiatrists throughout Thailand for their experience in CD training and their current use in treating CP patients.

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Material and Method

Subject recruitment

The present study was reviewed and approved by the Research Ethics Committee Number 4 of the Faculty of Medicine of Chiang Mai University, Chiang Mai, Thailand. Upon investigator request in 2013, the Royal College of Physiatrists of Thailand provided its member registration contained 476 active members who had completed their rehabilitation-medicine training between the first residency-completion year of 1985 and the year 2013. Three hundred forty three

members had one email address in the register, 107 had none, and 26 had more than one, yielding 398 different e-mail addresses. Complete physical postal addresses were available for only 64 of the 107 members without any email address.

In a first round, formal questionnaires were sent out by email to all 398 e-mail addresses of the 369 members. Sixty-five (17.6%) responses were received either by return email or on postal-mailed paper printouts.

In a second solicitation round one month later, emails with the questionnaire were sent to 337 email addresses of the 304 members who did not respond on the first round, an additional 54 (17.8%) responded. A third round one month later, of the 283 emails sent to the remaining 250 non-responders yielded seven (2.8%) more return questionnaires. Thus, 126 (34.1%) responses were received by one or more email solicitations.

Simultaneous with emailing solicitations, paper questionnaires were mailed by regular postal service to the known, complete physical addresses of the 64 Royal College members without any email address, which yielded nine responses (14%) by return mail. (Two letters were returned by the postal service because the addressees were no longer there.) Thus, 135 questionnaires were received from the 431 Royal College members (31.3%) solicited by either email or postal letter.

Questionnaire

The questionnaire was developed using the REDCap™ application (Research Electronic Data Capture, Vanderbilt University, Nashville, Tennessee, USA)[6], covered demographics, current work status, the practice of CD, and if not performing, give the reasons, workplace facilities related to CD, past residency training experience, including the number of CD procedures performed on children with CP, current confidence in performing CD, their opinion on whether residency training should include more CD procedures, and their own need for additional training in CD.

Statistical analysis

The data were analyzed using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA). The association of residency training factors on post-graduate practice was analyzed by Cochran-Mantel-Haenszel Chi-square, as well by binary logistic regression, adjusting for covariates of age, gender, years, and place of training[7]. Results were considered significant at a p-value of <0.05.

Results

Among the 135 questionnaires returned from the 431 physiatrists solicited, 116 (86%) were completed sufficiently for analysis of training experience and current CD practice. The other 19 were excluded from analysis. Of the 116 analyzed questionnaires, 80 (68.9%) were completed by female physiatrists (Table 1), which was similar to both the female proportion (320, 67.2%) of all 476 Royal College members, as well as the female proportion (299, 69.4%) of the 431 members who received emails or postal-mailed solicitations. The mean age of the 116 respondents was 38.2 years (SD ±8.3); among the 46 who reported currently performing CD in CP children mean age was 35.5 years (SD ±5.3), compared to 40.1 years (SD ±9.4) in those who did not. Most respondents (98, 84.5%) worked in the public sector, such as medical schools or public hospitals, and most (82, 70.7%) also finished residency training within 10 years. Among the 116 respondents, 46 (39.7%) currently performed CD in children, whereas 70 (60.3%) did not. On logistic regression analysis, younger physiatrists, especially below 40 years of age, were more likely to practice CD in CP children, controlling for sex, years, and place of training (p = 0.0055) (data not shown).

Among the 45 physiatrists trained in CD but did not currently practice in children, the most common reasons were having few CP patients in their practices, limited resources of supplies and equipment such as an electrostimulator, and the other physicians handle the CP cases (Table 2.). A significant association was found by logistic regression analysis between physiatrists not practicing CD and the unavailability at their institution of upper-extremity orthosis (p = 0.0371) and CD drugs (p = 0.0034), as the two hospital-infrastructure obstacles to practice.

Three-quarters of respondents (85, 73%) were trained to perform CD in CP children during residency, and they were more likely to perform this procedure later in their practice (p = 0.0140) (Table 3). As the number of treated cases during residency training increased, so did the reported confidence of respondents in performing the procedure in their practice (p<0.0001). Binary logistic regression analysis found that approximately 10 procedures in CP children during residency training were the minimum to achieve at least greater than 50% confidence in performing the

procedure in future practice (95% confidence interval 4.3 to 15.6). Indeed, those who performed less than five procedures during training wished they had performed 11 or more.

Of the 85 trained physiatrists, 56 (66%) kept a CD procedure log during training. Of these, 44 indicated they had performed six or more procedures during training, and 36 reported 11 or more (p<0.0001). Binary logistic regression also suggested that performing around 12 cases (95% confidence interval 9 to 16) in training would result in more than 50% of physiatrists felt adequate training experience.

Table 1. Demographic and educational characteristics of 116 respondents to survey on chemodenervation (CD) practice in children with cerebral palsy (CP), December 2013 through February 2014

Respondents characteristics	Number currently performing CD in CP children		Total (n = 116)
	Yes (%) (n = 46)	No (%) (n = 70)	
Sex			
Male	10 (29.4)	24 (70.6)	34 (100)
Female	35 (43.7)	45 (56.3)	80 (100)
Not reported	1 (50.0)	1 (50.0)	2 (100)
Present employment status			
Medical school instructor	19 (50.0)	19 (50.0)	38 (100)
Ministry of Public Health employee	22 (45.8)	26 (54.2)	48 (100)
Other public hospital	3 (33.3)	6 (66.7)	9 (100)
Private hospital	2 (13.3)	13 (86.7)	15 (100)
No longer practice rehabilitation medicine	0 (0)	5 (100)	5 (100)
Not reported	0 (0)	1 (100)	1 (100)
Years since completion of residency training			
<5 years	20 (44.4)	25 (55.6)	45 (100)
5 to 10 years	19 (51.4)	18 (48.6)	37 (100)
11 to 20 years	7 (28.0)	18 (72.0)	25 (100)
>20 years	0 (0)	8 (100)	8 (100)
Not reported	0 (0)	1 (100)	1 (100)

Table 2. Reasons for not practicing chemodenervation (CD) among 45 physiatrists trained in the procedure, in survey December 2013 through February 2014 (more than one answer could be selected)

Reasons for not practicing CD	Number (%) selecting this reason (n = 45)
Inadequate cases presenting	24 (38)
Limited supply and equipment e.g., no electrical stimulator, no phenol	17 (27)
Other colleagues are responsible for this	14 (22)
Difficulty getting child's cooperation	4 (6)
Procedure is expensive	3 (5)
Procedure offers little benefit	1 (2)
Total number of reasons selected	63

Table 3. Reported confidence in performing chemodenervation (CD), by number of procedures reported in residency training and by current practice of CD

Number of CD procedures in training	Currently performing CD in clinical practice (n = 40) No. (% of column)	Confidence in performing CD procedure		
		Yes (n = 49) No. (% of row)	No (n = 35) No. (% of row)	Total (n = 84) No. (% of column)
1 to 5	9 (22)	4 (24)	13 (76)	17 (20)
6 to 10	12 (30)	11 (46)	13 (54)	24 (29)
11 to 20	6 (15)	10 (67)	5 (33)	15 (18)
≥21	13 (33)	24 (86)	4 (14)	28 (33)

Discussion

We performed the present study because our experience suggested that CP children in Thailand were not getting relief from impaired muscular function and spasticity, because the CD was not performed often enough by the physiatrists who cared for them. Our respondents indicated that inadequate number of CD procedures during training was the most common reason for not practicing, which confirmed our expectation that the five CD procedures currently required in rehabilitation residency were insufficient. Thus, to overcome this problem is to increase the number to 10 or 12 of CD procedures in training. We also found that the use of a procedure log in training to monitor resident experience in CD to ensure the requirement was met. Other practical ways to increase the training experience include encouraging more procedure participation with the teaching staffs and arranging elective period at the institutes where CDs are performed often.

Although there appear to be no similar prior studies of CD for CP care, the situation can be compared with another common procedure. The minimal residency training experience recommended for electrodiagnostics (EDx), which includes both electromyography (EMG) and nerve conduction studies (NCS), is 120 procedures by the Royal College of Physiatrists of Thailand[5], and 200 by the American Board of Electrodiagnostic Medicine[8]. Compared to these minimums, our suggestion to increase to about a dozen of CD procedures required in training is modest, and might increase exposure to different patterns of spasticity found in CP children.

Our findings and conclusions are similar to those in other specialties who studied the impact of required procedures in residency training on future practice, such as urology[9] and orthopedics[10]. The latter study reported that 69% of orthopedic residents believed that case logs of surgical procedures during residency training were the effective means of monitoring and evaluating their training.

In the practice of urology, lack of confidence in performing laparoscopy was correlated with inadequate training in the procedure[9], similar to what we found for CD in rehabilitation residency in Thailand. The lack of needed equipment and drugs as the obstacle for performing CD by our respondents were similar to what found in a study of anesthesiologists, who refrained from using regional blocks in practice because of similar lack of needed materials[11].

A survey among members of the American Academy of Physical Medicine and Rehabilitation reported 80% with moderate to high satisfaction with the adequacy of their residency training[12]. However, when focused on training experience for specific conditions, such as evaluation and management of low back pain, only half of residents in another survey felt they had received sufficient training[13]. This suggests that adequate general experience in training does not necessarily equate with sufficiency for specific procedures.

Lack of confidence among our survey respondents in performing CD may be justified because the procedure carries some risk of complications. First, needles placed in soft tissues may cause bleeding, infection, pain, and swelling. Second, the nerve block may induce overcorrection, overstretching, and temporary loss of useful motor function. Third, the injected agent has side effects[3], such as temporary sensory loss and dysesthesias caused by phenol and alcohol[14].

The weaknesses in the present study included response rate of a little less than one-third, as well as the bias which may have resulted from the use of email solicitations, which may have yielded sample younger (average age 38 years) than all Royal College members. Younger physiatrists may be more likely to respond and easily reply to emailed surveys, which take less effort than mailing back paper questionnaires. Another limitation may have been poor recall in older respondents versus younger ones in how accurately they remember the number of procedures performed during training many years ago.

Among several obstacles to perform CD in Thailand is the use of phenol as the least-expensive drug for this purpose. Because it has few usages, hospital pharmacies are reluctant to stock it. An alternative drug, botulinum toxin, is expensive and cannot be approved for reimbursement by the National Universal Healthcare Scheme[15] if a patient would apply for such cost. Another limiting factor is that CD often afterwards requires the use of an orthotic brace on the affected limb(s), which is usually custom-made by occupational therapists or orthotists, thus expensive and often unavailable in smaller hospitals.

Conclusion

The authors found that to increase numbers of CD procedures performed during rehabilitation residency associates positively with post-training practice, particular for young physiatrists. To encourage

such experience, residency programs might reach out to community pediatricians and therapists to refer more CP patients for such specialized treatment. Future research on this issue might help guide training policies to make CD more available to CP patients for their benefits.

What is already known on this topic?

CD procedure has been known to help relieves the disability from focal spasticity in CP children and it has been included as a part of rehabilitation medicine residency training. Despite its benefits, implementing CD in real practice can be challenging.

What this study adds?

To the authors' knowledge, this is the first article aiming to discover the influence of residency training to post-training CD practice. The study discovered that the number of cases performed during residency training to enable adequate and confident practice should be at least 10. As the number of treated cases increased, so did the reported confidence. Also, training experience in CD influences positively on future practice. However, major present practice obstacles are having few CP patients for practice and limited resources of equipment, and medical supplies. The authors hope that this information could be helpful for planning residency training program and encouraging the practice of this procedure in the future.

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Potential conflicts of interest

None.

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อิทธิพลจากการฝึกอบรมแพทย์ประจำบ้านเวชศาสตร์ฟื้นฟูต่อการทำหัตถการสลายประสาทกับเด็กอัมพาตสมองใหญ่

มนธนา บุญตระกูลพูนทวี, ทิโมธี อี โอไบรอัน, อภิชนา โฆวินทะ

ภูมิหลัง: *หัตถการสลายประสาทคือการฉีดสารต่าง ๆ เช่น ฟีนอล โบทูลินัมท็อกซิน หรือ แอลกอฮอล์ เพื่อลดภาวะกล้ามเนื้อหดเกร็งที่รบกวนการทำกิจวัตรประจำวันของเด็กอัมพาตสมองใหญ่ ปัจจุบันการเรียนการสอนแพทย์ประจำบ้านเวชศาสตร์ฟื้นฟูในประเทศไทยตั้งเกณฑ์ไว้ว่าให้ทำหัตถการนี้ระหว่างฝึกอบรมอย่างน้อย 5 ครั้งขึ้นไป อย่างไรก็ตาม ยังไม่พบว่ามีการศึกษาผลของเกณฑ์ดังกล่าวต่อการนำหัตถการไปปฏิบัติจริง*

วัตถุประสงค์: *การศึกษานี้ทำขึ้น เพื่อศึกษาอิทธิพลของการฝึกอบรมหัตถการสลายประสาทต่อการทำเวชปฏิบัติภายหลังการฝึกอบรม และสภาพการทำหัตถการโดยแพทย์เวชศาสตร์ฟื้นฟูที่เป็นอยู่ ณ ปัจจุบัน*

วัสดุและวิธีการ: *สร้างแบบสอบถามประสบการณ์การฝึกอบรมและการทำหัตถการปัจจุบันในรูปแบบอิเล็กทรอนิกส์และแบบธรรมดา ทำการสำรวจแพทย์เวชศาสตร์ฟื้นฟูทั่วประเทศจำนวน 431 คน ทั้งทางจดหมายอิเล็กทรอนิกส์และจดหมายธรรมดา*

ผลการศึกษา: *มีผู้ตอบแบบสอบถามที่ข้อมูลเพียงพอกลับคืนมา 116 คน (27%) ในจำนวนนั้น 85 คน (73%) ได้ฝึกทำหัตถการสลายประสาทระหว่างการเป็นแพทย์ประจำบ้าน และมี 46 คน (40%) ที่ยังคงทำหัตถการดังกล่าวในเวชปฏิบัติ แพทย์ที่ได้รับการฝึกทำหัตถการสลายประสาทขณะเป็นแพทย์ประจำบ้านมีแนวโน้มสูงกว่าว่าจะทำหัตถการดังกล่าวในเวชปฏิบัติภายหลัง ($p = 0.0140$) อายุแพทย์ที่น้อยก็มีความสัมพันธ์กับการทำหัตถการดังกล่าว ($p = 0.0055$) จำนวนครั้งของการทำหัตถการในช่วงการฝึกอบรมแพทย์ประจำบ้านสัมพันธ์ไปในทางเดียวกันกับความมั่นใจเมื่อไปทำหัตถการในเวชปฏิบัติ ($p<0.0001$) สาเหตุส่วนใหญ่ของการไม่ทำหัตถการสลายประสาทคือมีจำนวนผู้ป่วยเด็กอัมพาตสมองใหญ่ไม่มาก กับมีข้อจำกัดด้านอุปกรณ์ ยาที่ฉีด*

สรุป: *อย่างไรก็ตาม แม้รูปแบบการศึกษานี้เป็นแบบตัดขวาง ผลการศึกษาชี้ให้เห็นว่าการเพิ่มจำนวนครั้งของเกณฑ์การทำหัตถการระหว่างการฝึกอบรมแพทย์ประจำบ้าน น่าจะช่วยให้เกิดการนำหัตถการไปปฏิบัติจริง เกิดประโยชน์กับผู้ป่วยเด็กอัมพาตสมองใหญ่มากยิ่งขึ้น*
