Comparison of 25 and 27 Gauge Needle in Spinal Anesthesia Learning Curve for Anesthesia Residency Training

Somrat Charuluxananan MD, MSc, FRCAT*,
Oranuch Kyokong MD, MSc, FRCAT*,
Pornthep Premsamran MD, FRCAT**

** Department of Anesthesiology and Clinical Epidemiological Unit, Faculty of Medicine, Chulalongkorn University*
*** Department of Anesthesiology, Faculty of Medicine, Chulalongkorn University*

Background and Rationale: *Size of spinal needle may be a factor which influences the success rate of spinal anesthesia.*
Objectives: *To compare learning curves of using 25G and 27G quincke spinal needle for spinal anesthesia.*
Setting: *Department of Anesthesiology, Faculty of Medicine, Chulalongkorn University and King Chulalongkorn Memorial Hospital.*
Design: *Prospective randomized control trial.*
Material and Method: *Ten new first year anesthesia residents were randomized to 2 groups: Group I (n = 5) used 25G Quincke spinal needle, Group II (n = 5) used 27G Quincke spinal needle to perform 200 consecutive cases of spinal anesthesia. Number of success and failure was recorded by each individual resident anonymously. The learning curves of plotted by cumulative sum of success rate revealed an initial rapid improvement of success during the first 20 cases in both groups. The overall success rate of group I was 84% (95CI, 66.5-100) and group II was 87% (95%CI, 61.5-100); p = 0.89. The widest difference between the 2 learning curves at 20 attempts intervals was at the twentieth attempts with a success rate of 76.0% VS 65.0% in group I and group II respectively; p = 0.54.*
Conclusion: *The learning curves of spinal anesthesia using 25G and 27G Quincke spinal needle showed rapid improvement of success rate at the first 20 spinal block and high overall success rate with no significant difference between the groups.*

Keywords: *Anesthesia, Spinal anesthesia, Learning curve, Training, Needle size*

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After the introduction of structured training, trainees may be required to demonstrate that they have attained minimum standards of competence. This would be to ensure uniform standards of training and allow comparisons among different institutions and for audit[1]. Variability between residency training programs in teaching of anesthesia technical skill exists among institutions in Thailand. Data on the acquisition of manual proficiency in anesthesia are scarce[2,3]. To develop rational training programs, the necessary number of cases per anesthetic procedure should be determined to achieve an optimal rate of success. Few studies have investigated this topic in anesthesia[3-5].

The success rate of regional anesthesia lies on a set of factors such as selection of the adequate technique, skill and proper training from the part of anesthesia providers and use of right equipment. The needle, as a prolongation of the hand of the anesthesiologists, must provide references in technique either by self or joined to an objective method of nerve localiza-

Correspondence to : Charuluxananan S, Department of Anesthesiology, Faculty of Medicine, Chulalongkorn University, Rama IV Rd., Pathumwan, Bangkok 10330, Thailand. Phone: 0-2256-4295, 0-2252-1699, Fax: 0-2256-4294

tion, this will result in a high percentage of success without iatrogenesis. Spinal anesthesia is the most frequent regional anesthesia procedure performed at King Chulalongkorn Memorial Hospital, and the mean recommended case loads for an anesthesia resident is 112 cases to achieve 80 percent success rate with 27-gauge Quincke spinal needle[5]. Because of excessive flexibility of fine-gauge needles, their use might be associated with a higher failure rate of spinal anesthesia. The authors, therefore postulated that a bigger (25 gauge) needle might improve learning manual skill in conduction of spinal anesthesia during the early phase of residency training.

The aim of this prospective randomized control study was to compare 25-gauge and 27-gauge Quincke spinal needle in learning curves of conduction of spinal anesthesia among new first year residents.

Material and Method

The institutional ethics committee approved the study. Ten new first year residents were evaluated using a standardized self-evaluation questionaire. The setting was at the Department of Anesthesiology, Faculty of Medicine, Chulalongkorn University and King Chulalongkorn Memorial Hospital, a 1500-bed university hospital with an annual case load of more than 18,000 anesthetics of which 48 percent were performed under regional anesthesia. The success or failure of the consecutive spinal anesthesia procedure was documented each day by the residents themselves. To promote good compliance and a high response rate, data collection and analysis were anonymous. The clinical duties of all the first year anesthesia residents were supervised by a staff member (two to three operating rooms per attending anesthesiologists) at all times. For the individual procedure, there was no preselection of patients with regard to the American Society of Anesthesiologist physical status classification. Patients who had contraindication to spinal anesthesia were excluded.

At the beginning of the training program, 10 first year anesthesia residents were randomly assigned to 2 groups according to random number table. Residents in group I used a 25-gauge Quincke spinal needle and residents in group II used a 27-gauge Quincke spinal needle. Spinal anesthesia was performed in the left lateral decubitus position with a paramedian approach.

Success was defined as an adequate technical performance. When the procedure was successfully terminated without any physical help from a staff member, it was rated 1, when the spinal block showed no or inadequate analgesia or physical assistance by a staff member was required, it was rated 0 or failure. Verbal comments or suggestions were allowed. The staff anesthesiologist took over after a maximum of three attempts or an elapsed procedure time period of 10 minutes for spinal anesthesia procedure. Besides success or failure, no other detailed analysis was documented, nor was the type of help given by a staff member recorded.

Two hundred consecutive cases of spinal anesthesia per one resident were recorded for analysis. The procedures were equally distributed among the residents. Statistical analysis was as follows: to generate confidence interval, consecutive success were calculated as a modified cusum analysis and divided by the number of performed procedures[6]. Individual rates of success were generated from these numbers. These success rates were pooled according to randomization among all participants. To compare the learning curves, student's t-test with. Bonferroni's correction for multiple comparisons was used as appropriate. A p value < 0.05 was considered significant.

Results

The records of failure or success in conduction of spinal anesthesia were collected after completion of 200 consecutive cases from each new first year resident of the Department of Anesthesiology, King Chulalongkorn Memorial Hospital. Baseline characteristics of the residents in the 2 groups are comparable as shown in Table 1. Consecutive success were calculated as a modified cusum analysis and divided by the number of performed and plotted as learning curves of the residents who used 25G and 27G Quincke spinal needle as shown in Fig. 1.

The process of learning manual skill in spinal anesthesia was characterized by a rapid improvement of success during the first 20 attempts with a final suc-

Table 1. Baseline characteristics of anesthesia who used Quincke spinal needle 25G and 27G

	Group I Spinal needle 25G	Group II Spinal needle 27G
Age (years)	26.6 (0.8)	27.2 (0.8)
Years after graduation (years)	2.4 (0.5)	1.8 (0.8)
Grade point average (GPAX)	3.2 (0.5)	2.8 (0.3)

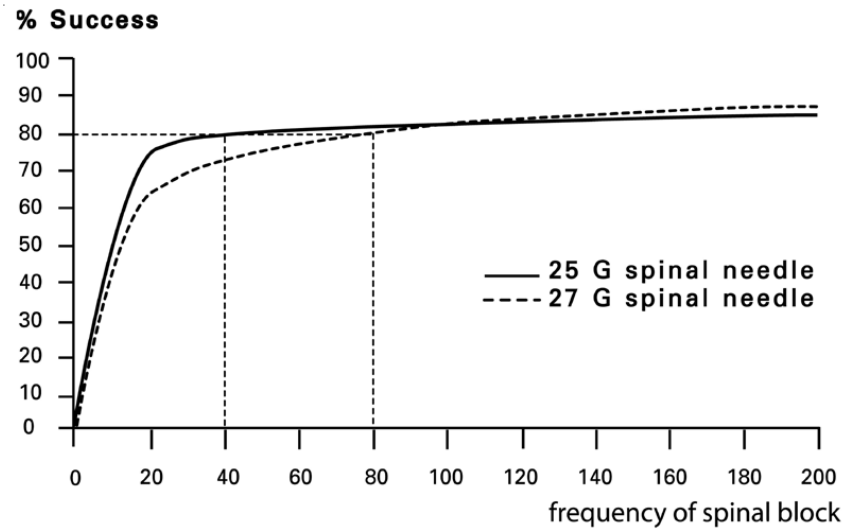

Fig. 1 Learning curves of spinal anesthesia using Quincke spinal needle size 25G and 27G

cess rate of 84.0%, 95%CI 65.5% - 100.0% in group I (Quincke spinal needle 25G) and 87.0%, 95% CI 66.5% - 100.0% in group II (Quincke needle 27G); p = 0.89. To reach a success rate of 80% with spinal needle 25G and 27G, 40 and 80 attempts were required, with no clear effect on the confidence interval. The widest difference between the 2 learning curves at 20 spinal block intervals was at the twentieth block with a success rate of 76.0% vs 65.0% in group I and group II respectively, which was not statistical significantly different (p = 0.54). There was no report of postdural puncture headache and other serious adverse events from spinal anesthesia.

Discussion

Variability between training programs in the teaching of regional anesthetic techniques existed, not only in the United States[7], but also in Thailand. Regional anesthesia continues to grow in popularity. Approximately one-fourth of patients undergoing surgery in Thailand are anesthetized by spinal anesthesia.

The present study focused on the acquisition of manual skill of spinal anesthesia. The end points were defined as complete success or as failure as in the authors' previous study[5]. Complete success excluded any physical help by the attending anesthesiologists and was meant to indicate a technically perfect procedure with clinical functionality. Failure included manual assistance by the attending anesthesiologist and the necesessity to change the anesthetic technique. The presented learning curves examined only the technical part of the procedure.

As in the authors' previous study the success rate of spinal anesthesia is similar and high with both Quincke 25G and 27G needles and in agreement with previous reports[2,5,8]. The present study reveals high success rates of 84.0% and 87.0% by Quincke spinal needle 25G and 27G respectively which are not statistically different. In contrary, Munhall et al showed a lower failure rate of spinal anesthesia[9] that may be due to 1) different definition of failure or success and 2) different experience of performers (anesthesiologists vs new anesthesia residents).

The rapid improvement of spinal anesthesia manual skill at the first 20 spinal block of both Quincke spinal needles 25G and 27G are also not statistically different 76% vs 65% (p = 0.54) which are similar to previous studies[2,5,8]. However, the number of cases to achieve 80% success rate by Quincke spinal needle 25G was 40 spinal block which is less than 80 spinal block by Quincke spinal needle 27G. This can be implicated in the institutions with limited cases of spinal anesthesia to provide adequate cases for each anesthesia resident and to estimate the appropriate numbers of residents in anesthesia residency program as an QA activity in medical education.

The present study showed that needle sizes did not influence the success rate of spinal anesthesia which was similar to the study by Munhall[9]. Needle design also did not affect the success rate of spinal anesthesia[10]. There was no report of postdural punc-

ture headache (PDPH) in the present study. This may be due to institutional low incidence of PDPH or PDPH is not the primary objectives of the study. The limitation of the present study is no sample size calculation because the authors included all new first year anesthesia residents in the study.

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การศึกษาเปรียบเทียบเส้นกราฟการเรียนรู้ของการฉีดยาชาเข้าช่องน้ำไขสันหลังโดยใช้เข็มขนาด 25 และ 27 สำหรับการฝึกอบรมแพทย์ประจำบ้านสาขาวิสัญญีวิทยา

สมรัตน์ จารุลักษณานันท์, อรนุช เกี่ยวข้อง, พรเทพ เปรมสำราญ

ที่มาและเหตุผล: *ขนาดของเข็มฉีดยาเข้าช่องน้ำไขสันหลังอาจมีผลเกี่ยวข้องกับความสำเร็จในการทำหัตถการฉีดยาชาเข้าช่องน้ำไขสันหลัง*

วัตถุประสงค์: *เพื่อศึกษาเปรียบเทียบเส้นกราฟการเรียนรู้ของการฉีดยาชาเข้าช่องน้ำไขสันหลังสำเร็จโดยใช้เข็มเจาะหลังชนิด Quincke ขนาด 25G และ 27G*

สถานที่ทำการศึกษา: *คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โรงพยาบาลจุฬาลงกรณ์*

รูปแบบการวิจัย: *การศึกษาไปข้างหน้าแบบมีกลุ่มเปรียบเทียบโดยการสุ่ม*

วัสดุและวิธีการ: *แพทย์ประจำบ้านใหม่ สาขาวิสัญญีวิทยาชั้นปีที่ 1 จำนวน 10 คน ถูกสุ่มแบ่งเป็น 2 กลุ่ม กลุ่มที่ I ใช้เข็ม Quincke ขนาด 25G กลุ่มที่ II ใช้เข็มขนาด 27G ทำหัตถการฉีดยาชาเข้าช่องน้ำไขสันหลังคนละ 200 ราย ติดต่อกัน แพทย์ประจำบ้าน แต่ละคนทำการบันทึกอัตราการฉีดยาชาเข้าช่องน้ำไขสันหลังสำเร็จของตนเองแบบนิรนาม เส้นกราฟการเรียนรู้ของการทำหัตถการฉีดยาชาเข้าช่องน้ำไขสันหลังสำเร็จคำนวณจากอัตราการทำหัตถการสำเร็จสะสม แสดงให้เห็นว่าทั้ง 2 กลุ่ม มีอัตราการเรียนรู้สำเร็จเพิ่มเร็วมากในช่วง 20 ครั้งแรก อัตราการสำเร็จเมื่อครบ 200 ครั้งเท่ากับ 84% (95%CI, 66.5-100) และ 87% (95%CI, 61.5-100); p = 0.89 จุดที่อัตราการทำหัตถการสำเร็จแตกต่างกันมากที่สุดได้แก่ ครั้งที่ 20 มีอัตราสำเร็จ 76% vs 65% ในกลุ่มที่ I และ II ตามลำดับซึ่งไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ (p = 0.54)*

สรุป: *ขนาดเข็มฉีดยาชาเข้าช่องน้ำไขสันหลัง Quincke ทั้ง 25G และ 27G ไม่ทำให้เกิดความแตกต่างของอัตราการทำหัตถการฉีดยาชาเข้าช่องน้ำไขสันหลังสำเร็จ โดยอัตราการทำหัตถการสำเร็จเพิ่มขึ้นอย่างรวดเร็วระหว่าง 20 ครั้งแรกในทั้ง 2 กลุ่ม*