# National Survey of Pediatric Anesthesia Practice in Thailand

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***Objective:*** *To assess current pediatric anesthesia practice for further education from Royal College of Anesthesiologists of Thailand*

***Material and Method:*** *A questionnaire was sent to 500 anesthetists in public hospitals in January 2010 to investigate preoperative data, intraoperative data, postoperative pain management, ambulatory anesthesia, and pediatric anesthesia training requirement*

***Results:*** *Response rate was 30.6%. Preoperative fasting and infective endocarditis (IE) prophylaxis were appropriate except that half the anesthesiologists preferred giving antibiotics in non-cyanotic heart diseases and ordering complete blood count as a routine investigation in healthy patients undergoing minor surgery. Premedication was preferred in children and adolescents. Parental presence during induction was most often selected in children (74.5%). Modified Ayre T-piece was the most popular breathing circuit used during induction while circle circuit was more likely used during maintenance period. Manual ventilation was preferred in neonates. Scavenging system was rarely used. Intraoperative fluid was given based on Holliday & Segar Law (> 90%). Isotonic fluid without glucose was preferred for replacement of third space loss and hypotonic fluid with glucose was preferred for maintenance fluid. Transfusion trigger was inversely correlated with age. Postoperative pain scales were more often used in children and adolescents. Fentanyl was more popular in younger age group. Intermittent intravenous administration was the most preferred route. Age group of infants and older were predominantly accepted to be anaesthetized on an ambulatory basis. Pediatric advanced life support was seldom performed. Intermittent training was more popular than certified fellowship training.*

***Conclusion:*** *Routine investigation in healthy patients, IE prophylaxis in non-cyanotic patients, intraoperative fluid replacement, and pediatric advanced life support and postoperative pain management were the issues recommended for further education.*

***Keywords:*** *Survey, Pediatric, Anesthesia, Practice*

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Provision of anesthesia care for pediatric patients is more complicated than for adults, especially in neonates and premies. According to Thai Incidents Study (THAI Study) which included 20 hospitals in Thailand, adverse events related to anesthesia in pediatric patients especially infants were also higher than in adults (4.6% versus 1.2%)[1,2]. The majority of pediatric patients were anesthetized by general anesthesiologists in general hospitals. To date, knowledge and practice in pediatric anesthesia during the perioperative period have been changing. Under the patronage of the Royal College of Anesthesiologists of Thailand, this study conducted the national survey of current practices in anesthesia care in pediatric patients for the purposes of organizing a continually evolving medical education.

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## Material and Method

This study was exempted from the Institution Review Board. Five pediatric anesthesiologists developed questionnaires from current guidelines and articles related to perioperative care for pediatric patients.

***Contents in questionnaires***

Preoperative data included fasting guidelines, preoperative testing in healthy patients who underwent minor surgery, prophylaxis for infective endocarditis (IE), premedication and parental presence.

Intraoperative data included breathing circuit and anesthesia ventilator selection, guidance for fluid management and transfusion trigger. Postoperative data included postoperative pain assessment and management. Ambulatory anesthesia, pediatric cardiopulmonary resuscitation and training requirement were also included.

Questionnaires were sent to 500 anesthesiologists by postal according to the addresses obtained from the Royal College of Anesthesiologists in Thailand is January 2010. The participant were asked to return the answers in the return envelope within 1 month. All data were analyzed by using descriptive statistics.

**Results**

The response rate was 30.6% (n = 153). The respondents were 39 men (25.5%) and 114 women (74.5%). Mean age was 37.5 $\pm$ 8.4 years, majority of respondents' age were less than 45 year old (69.4%), and their experiences in anesthetic practice were predominantly under 10 years (62.7%).

Working hospitals of respondents were secondary care hospitals (30.2%), tertiary care hospitals (32.2%) and university hospitals (37.6%).

The patients were mainly children. Eighty-three percent of respondents frequently provided anesthesia care to children for more than five cases/month. The majority of them seldom took care of infants. Sixty-three percent of respondents provided anesthesia care to infants at less than five cases/month.

***Preoperative data***

Among preoperative investigations in healthy patients undergoing minor surgery, a majority of anesthesiologists (>50%) usually ordered complete blood count as a routine testing. They ordered urine analysis or chest x-ray only in specific cases (Fig. 1).

According to fasting orders, a majority of the responses were fasting from water/clear fluid for 2 hours (85.9%), breast milk for 4 hours (79.2%), formula milk for 6 hours (85.9%), soft diet for 6 hours (75.8%) and heavy meals for 6-8 hours (99.3%) (Fig. 2).

Antibiotics for infective endocarditis (IE) prophylaxis in dental, gastrointestinal and genito-urinary procedures were considered essential in cyanotic heart diseases, prior IE and previous cardiac surgery with prosthetic graft (> 90% of respondents). However, for IE prophylaxis of non-cyanotic heart diseases, about half of the respondents (55.9%) considered it appropriate (Table 1).

Premedication in children and adolescents was more popular than in infants. Parental presence was the most popular in children (74.5% of respondents) (Table 2).

***Intraoperative data***

During induction, Ayres T-piece was the most common one used especially in neonates and infants (Fig. 3). During maintenance, Ayres T-piece was only popular for spontaneous or controlled ventilation in neonates. Circle circuit was preferred in the older age groups. Even in neonates, 41.2% of respondents used circle circuit for controlled ventilation (Fig. 4).

A majority of respondents preferred manual ventilation instead of an anesthesia ventilator in neonates and infants. In infants, pressure preset ventilator was more likely used, whereas both pressure and volume preset ventilator were popular in older children (Fig. 5).

While using Ayres T-piece, a scavenging system and a humidification providing system were seldom added (36% and 34% of respondents). Heat and moisture exchanger (HME) was preferred to heated humidifier (26.2% vs. 6% of respondents).

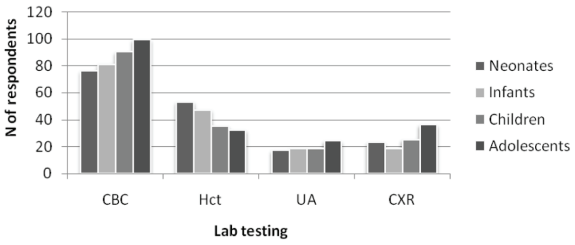



**Fig. 1** Routine preoperative lab testing in healthy children under going routine surgery

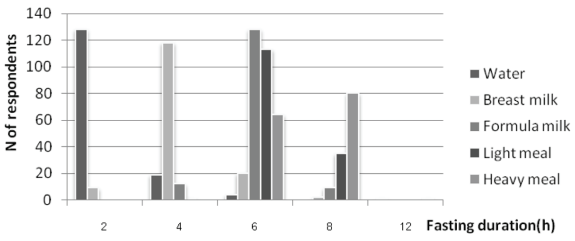



**Fig. 2** Preoperative fasting

**Table 1.** Antibiotic prophylaxis for infective endocarditis in dental, gastrointestinal, genitourinary surgery/ procedure

| Type of heart diseases | IE prophylaxis n (%) | Total (n) |
|---|---|---|
| Non-cyanotic heart diseases | 81 (55.9%) | 145 |
| Cyanotic heart diseases | 139 (95.2%) | 146 |
| S/P cardiac surgery with prosthesis | 138 (94.5%) | 146 |
| History of infective endocarditis | 144 (99.3%) | 145 |

**Table 2.** Premedication/parental presence

| Age group | Premedication n/total (%) | Parental presence n/total (%) |
|---|---|---|
| Neonates | 3/149 (2%) | 24/128 (18.8%) |
| Infants | 24/144 (17.7%) | 57/132 (43.2%) |
| Children | 86/148 (58.1%) | 102/137 (74.5%) |
| Adolescents | 83/140 (56.1%) | 80/135 (59.3%) |

***Fluid replacement***

Most anesthesiologists (> 94%) replaced fluid based on Holliday and Segar's law. Varying strength of saline with 5% glucose was preferred as maintenance fluid. Fluid replacement for fasting period by preoperative clear liquid drinking was used in less than half of respondents (46.3%). Amount of clear liquid was 2-10 ml/kg. Regarding intravenous fluid replacement, full strength of saline without glucose (49.2% of respondents) was commonly used. Some respondents (~30%) used a varying strength of saline with 5% glucose. In addition, more than 90% of respondents preferred the full strength of saline without glucose for replacement of third space loss.

***Blood transfusion***

In the view point of most anesthesiologists, the transfusion trigger were 10-12 g/dl in neonates, 10 g/dl in infants, 9-10 g/dl in children and 8-10 g/dl in adolescents (Table 3).

***Postoperative pain management***

In neonates and infants, pain was predominantly evaluated by clinical assessment. Pain scale was more likely used in older age groups (Fig. 6).

Fentanyl was preferred in neonates and infants whereas morphine was the most prescribed in adolescents (Table 4). A majority of respondents (> 70%) preferred intermittent intravenous administration of opioids. However, some anesthesiologists (5-9%) still prescribed an intramuscular route (Table 5).

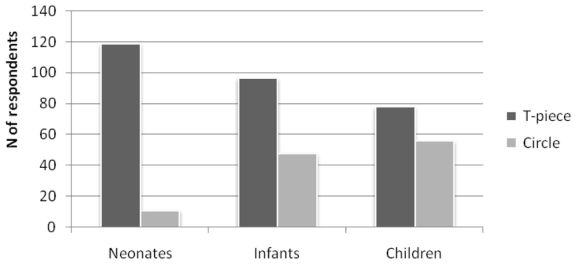
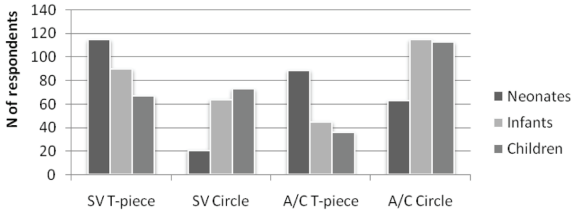



**Fig. 3** Breathing circuit during induction




SV = spontaneous ventilation
A/C = assisted/controlled ventilation

**Fig. 4** Breathing circuit during maintenance

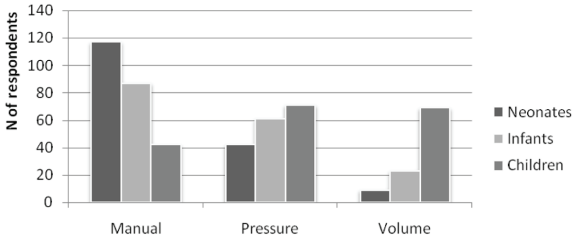



**Fig. 5** Type of ventilator used during maintenance

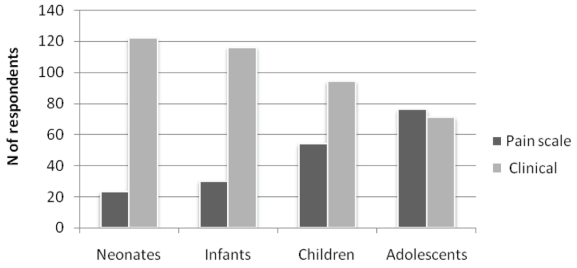



**Fig. 6** Methods of pain assessment

**Table 3.** Transfusion trigger

| | Hb(g/dl), n (%) | | | |
|---|---|---|---|---|
| | 8 | 9 | 10 | 12 |
| Neonates (total = 140) | 10 (7.1%) | 8 (5.7%) | 75 (53.6%) | 47 (33.6%) |
| Infants (total = 141) | 15 (10.6%) | 16 (11.3%) | 99 (70.2%) | 11 (7.8%) |
| Children (total = 142) | 27 (19%) | 38 (26.8%) | 75 (52.8%) | 2 (1.4%) |
| Adolescents (total = 141) | 55 (39%) | 35 (24.8%) | 50 (35.5%) | 1 (0.7%) |

**Table 4.** Analgesic use (total = 153)

| Age group | Analgesic, n (%) | | | |
|---|---|---|---|---|
| | Fentanyl | Pethidine | Morphine | Tramadol |
| Neonates | 136 (88.9%) | 15 (9.8%) | 10 (6.5%) | 2 (1.3%) |
| Infants | 135 (88.2%) | 37 (24.2%) | 27 (17.6%) | 4 (2.6%) |
| Children | 89 (58.2%) | 79 (51.6%) | 97 (63.4%) | 8 (5.2%) |
| Adolescents | 67 (43.8%) | 78 (51%) | 131 (85.6%) | 12 (7.8%) |

**Table 5.** Narcotic administration (total = 152)

| Age group | IM, n (%) | | IV, n (%) | | |
|---|---|---|---|---|---|
| | Intermittent | Fixed interval | Intermittent | Fixed interval | Infusion |
| Neonates | 9 (5.9%) | 0 (0%) | 113 (74.3%) | 17 (11.2%) | 23 (15.1%) |
| Infants | 12 (7.9%) | 0 (0%) | 113 (74.3%) | 23 (15.1%) | 27 (17.8%) |
| Children | 14 (9.2%) | 0 (0%) | 117 (77%) | 38 (25%) | 27 (17.8%) |
| Adolescents | 14 (9.2%) | 1 (0.7%) | 108 (71.1%) | 46 (30.3%) | 34 (22.4%) |

***Ambulatory anesthesia***

Anesthesia for outpatient surgery or procedures were predominantly preferred in older age groups (neonates of 21.1%, infants of 60%, children of 84.1% and adolescents of 87.3%).

***Cardiopulmonary resuscitation***

A majority of respondents (> 80%) rarely performed cardiopulmonary resuscitation for all age groups during the last five years (Table 6).

***Training of pediatric anesthesia***

Intermittent training as short course, workshop, or academic meeting was more popular than certified fellowship training (66.2% vs. 10% of respondents). Topics needed were neonatal anesthesia, pediatric advanced life support, peripheral nerve block, and postoperative pain management in pediatric patients.

**Discussion**

The low response rate of this survey (30%) might be related to incorrect postal address and frequent change of anesthesiologists' work place. The distribution of respondents was approximately similar in all levels of hospitals. Most of anesthesiologists took care of patients older than 1 year of age.

Comparing current practices and recent guidelines, the routine requests of complete blood count in healthy patients who underwent minor surgery were overused[3,4]. The attitudes about fasting order were appropriate[5], especially as 84% of respondents

**Table 6.** Pediatric cardiopulmonary resuscitation

| Age group | Frequency of CPR performed in last 5 years, n (%) | |
|---|---|---|
| | 0-1/year | > 1/year |
| Neonates (total = 143) | 118 (82.5%) | 25 (17.5%) |
| Infants (total = 145) | 126 (86.9%) | 19 (13.1%) |
| Children (total = 145) | 122 (84.1%) | 23 (15.9%) |
| Adolescents (total = 146) | 122 (83.6%) | 24 (16.4%) |

agreed with two hours for fasting water or clear liquid. This order would reduce patients' thirst, restlessness, and intraoperative fluid replacement.

According to IE prophylaxis in patients with congenital heart diseases undergoing dental, gastrointestinal and genitourinary procedures from American Heart Association (AHA) guidelines (2007)[6], most of the respondents' opinions (> 90%) were appropriate in giving IE prophylaxis in cyanotic heart diseases, post cardiac surgery with prosthesis or post cardiac transplant. The contradictory attitude was evident for IE prophylaxis in non-cyanotic heart diseases. Half of our respondents agreed with the IE prophylaxis, which was not recommended in AHA guideline[6]. The reason might be related to higher IE incidence in our country, which outweighs the risk of IE prophylaxis[7].

In infants, parental presence during induction was preferred to premedication. For older age groups, the anesthesiologists were more likely to use combination of premedication and parental presence. These were controversial issues in several countries based on their beliefs, cultures and laws[8].

The practice concerning breathing circuits in this study was similar to the practice in United Kingdom, except that using the scavenging system with Ayres T-piece in United Kingdom was more frequent than in this study[9]. The reason might be due to insufficient scavenging system and lack of pollution concerns here.

Regarding controlled ventilation during anesthesia, a majority of anesthesiologists preferred manual ventilation in neonates and infants to the ventilator. In older infants and small children, pressure preset ventilator was more popular than volume preset ventilator. The reasons might be related to air leakage around the uncuffed endotracheal tube, which was not suitable for a volume-preset ventilator. However, volume preset ventilator could be used to deliver adequate ventilation to the infants and neonates by setting the compensated volume for air leak around uncuffed tube and air-filled in corrugated tube of breathing circuit. Pressure gauge should be monitored closed to the endotracheal tube to guarantee the inflow-air[10]. In older children that can safely insert cuffed endotracheal tube, any kind of ventilator can also be used[11].

In order to conserve heat and humidity when using Ayres T-piece, the respondents preferred heat and moisture exchanger (HME) to heated humidifier. HME was a simple and light weight equipment that rarely increased airway resistance during controlled ventilation[12] whereas heated humidifier was cumbersome, more complicated, and water produced in circuit often increased airway resistance.

Most of respondents (> 90%) replaced intraoperative fluid based on Holliday and Segar's Law. Even though recent evidence recommended that 2% glucose was sufficient to prevent hypoglycemia or hyperglycemia, this strength was not available in our country[13]. Therefore, 5% glucose with hypotonic solution for maintenance and isotonic solution without glucose for replacement of third space fluid loss were the most popular regimen used.

In spite of the fact that 84% of respondents knew that oral fluid could be given two hour before surgery, only 46% of respondents would apply this knowledge. Most of them preferred the intravenous route to replace fasting fluid. The reason might be related to unpredictable surgical schedules.

Transfusion triggers in all age groups from the majority of respondents were at the upper limit of the normal range of international guidelines[14].

Pain scales were rarely used for postoperative pain assessment in this survey. Continuous monitoring of age-specific pain scales as a fifth vital sign and a proper cut-off point for making a decision to treat including appropriate guidance for analgesic

prescription would be beneficial for postoperative pain management in pediatric patients[15-18].

Anesthesia for outpatient surgery in this study was predominantly performed in children and adolescent. Twenty-one percent of respondents provided anesthesia for neonates in ambulatory basis. This issue is still controversial[19].

Pediatric advanced life support (PALS) for pediatric patients were rarely performed by anesthesiologists. Mainly, severe adverse events in pediatric patients were attributable to respiratory problems[1]. Immediate relief of problems would prevent cardiac arrest. The inexperience of anesthesiologists regarding PALS needs remedy through regular training.

According to pediatric anesthesia training, short courses, workshop or academic activities for updating current or novel topics should be organized for all members of the Royal College of Anesthesiologists of Thailand. However, a fellowship-training program is essential for anesthesiologists from tertiary care hospitals or university hospitals.

In conclusion, some findings from this survey deviated from current guidelines, such as routine preoperative testing in healthy patient undergoing minor surgery, postoperative pain assessment and management including IE prophylaxis in non-cyanotic heart diseases. Some procedures needed regular training, such as PALS.

**Potential conflicts of interest**

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## *การสำรวจเวชปฏิบัติทางวิสัญญีวิทยาสำหรับเด็กในประเทศไทย*

***สุวรรณี สุรเศรณีวงศ์, อัญชลี อัตชู, รื่นเริง ลีลานุกรม, อุษา เจริญสวรรค์, เดือนเพ็ญ ห่อรัตนเรือง***

***วัตถุประสงค์:*** *เพื่อประเมินแนวทางการปฏิบัติเกี่ยวกับวิสัญญีสำหรับผู้ป่วยเด็กในปัจจุบันเพื่อการจัดการศึกษาต่อเนื่องของราชวิทยาลัยวิสัญญีแพทย์แห่งประเทศไทย*

***วัสดุและวิธีการ:*** *ส่งแบบสอบถามไปยังวิสัญญีแพทย์จำนวน 500 คน ในโรงพยาบาลของรัฐเมื่อเดือนมกราคม พ.ศ. 2553 เพื่อสอบถามแนวปฏิบัติทางวิสัญญีสำหรับผู้ป่วยเด็ก (1) ก่อนผ่าตัด (2) ระหว่างผ่าตัด (3) การระงับปวดหลังผ่าตัด (4) วิสัญญีในผู้ป่วยนอก (5) ความต้องการฝึกอบรมวิสัญญีวิทยาสำหรับผู้ป่วยเด็ก*

***ผลการศึกษา:*** *มีผู้ตอบแบบสอบถาม ร้อยละ 30.6 ความเห็นส่วนใหญ่เกี่ยวกับการงดน้ำ และอาหารตลอดจนการป้องกัน infective endocarditis (IE) เหมาะสม ยกเว้นการให้ยาปฏิชีวนะในผู้ป่วยโรคหัวใจตั้งแต่กำเนิดชนิดไม่เขียว และส่งตรวจ complete blood count ในเด็กแข็งแรงที่มารับการผ่าตัดเล็ก สำหรับยา premedication นิยมให้ในเด็กโต และเด็กวัยรุ่น การให้พ่อแม่เข้ามาอยู่ด้วยขณะนำสลบ ส่วนใหญ่ทำในเด็กโต (ร้อยละ 74.5) วงจรดมยาสลบยอดนิยมระหว่างการนำสลบคือ Modified Ayre T-piece ขณะที่นิยมใช้ circle circuit ในช่วง maintenance การ ventilate ทารกแรกเกิดนิยมควบคุมการหายใจด้วยมือพบว่า มีการใช้ scavenging system หรือ humidifier กับวงจร T-piece น้อยมาก วิสัญญีแพทย์ส่วนใหญ่ (> ร้อยละ 90) ให้สารน้ำระหว่างผ่าตัดโดยอิงกฎของ Holliday และ Segar การทดแทนสารน้ำสำหรับ third space loss นิยมใช้สารน้ำ isotonic ที่ไม่มีน้ำตาล ขณะที่การทดแทน maintenance fluid นิยมใช้สารน้ำ hypotonic ที่มีน้ำตาลสำหรับระดับฮีโมโกลบิน ที่นิยมให้เลือดแปรผกผันกับอายุ การประเมินความปวดหลังผ่าตัดโดย pain scale นิยมใช้ในเด็กโต และเด็กวัยรุ่น ยาแก้ปวดที่นิยมใช้ในทารก ได้แก่ fentanyl สำหรับวิธีที่นิยมที่สุดได้แก่ การฉีดยาทางหลอดเลือดดำเป็นครั้งคราว วิสัญญีแพทย์ส่วนใหญ่คิดว่าช่วงอายุตั้งแต่ทารกถึงเด็กโตน่าจะให้การระงับความรู้สึกแบบผู้ป่วยนอกได้ สำหรับ pediatric advanced life support วิสัญญีแพทย์ได้ทำในเวชปฏิบัติน้อยมาก ส่วนการฝึกอบรมวิสัญญีวิทยาเฉพาะทางสำหรับผู้ป่วยเด็ก ผู้ตอบนิยมแบบระยะสั้น, เป็นครั้งคราวมากกว่า*

***สรุป:*** *เรื่องที่น่าจะจัดให้ความรู้ต่อเนื่องได้แก่ routine investigation ในผู้ป่วยสุขภาพดี การป้องกัน infective endocarditis ในผู้ป่วยที่ไม่เขียวสารน้ำที่ให้ทดแทนระหว่างผ่าตัดการช่วยฟื้นคืนชีพสำหรับเด็ก และการดูแลระงับปวดหลังผ่าตัด*