Occasional Survey

Obstetric anesthesia practice in Canada

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Purpose: To describe obstetric anesthesia in Canada as practiced in 1997: to identify practices at variance with the literature and the opinions of experts: and to identify questions for future research.

Methods: In 1997, a detailed postal questionnaire asking about the practice of obstetric anesthesia was mailed to all 1,539 specialist anesthesiologist members of the Canadian Anaesthetists' Society residing in Canada. Non-responders were mailed a second questionnaire three months later.

Results: There were 865 completed questionnaires returned for analysis (56.2%). Of these, 522 anesthesiologists practiced obstetric anesthesia (60.3%). The data were subdivided into those from anesthesiologists with a full or part-time university based practice (40.1%) and those from a community based practice (59.9%). University based and community-based anesthesiologists have very similar patterns of practice. Specific areas where anesthesia practice was different from current recommendations included: (1) information provided when obtaining consent for labour epidural analgesia, (2) use of opioids and local anesthetics for initiation of epidural analgesia, (3) use of coagulation testing in preeclampsia, (4) the common use of cutting spinal needles, (5) use of neuraxial morphine and nonsteroidal anti-inflammatory agents after Cesarean deliveries, (6) optimal treatment of neuraxial opioid side effects, (7) when to insert an endotracheal tube for general anesthesia after delivery, and (8) withdrawing epidural catheters through epidural needles.

Conclusions: This survey presents reference data on the practice of obstetric anesthesia in Canada in 1997. Anesthesiologists with university affiliation have very similar practices to those without university affiliations.

Objectif : Décrire l'anesthésie obstétricale pratiquée au Canada en 1997; identifier les pratiques qui diffèrent des pratiques documentées et des opinions d'experts et proposer des sujets de recherches ultérieures.

Méthode : En 1997, un questionnaire détaillé sur la pratique de l'anesthésie obstétricale a été posté aux 1 539 anesthésiologistes membres de la Société canadienne des anesthésiologistes résidant au Canada. Trois mois plus tard, un second questionnaire a été posté à ceux qui n'avaient pas encore répondu.

Résultats : Il y a eu 865 questionnaires remplis et analysés (56,2 %). De ce nombre, 522 provenaient d'anesthésiologistes pratiquant l'anesthésie obstétricale (60,3 %). Les données ont été subdivisées selon le lieu de pratique, en milieu universitaire à temps complet ou partiel (40,1 %) ou en d'autres centres (59,9 %). Les modèles de pratique étaient très similaires. Certaines activités spécifiques différaient des recommandations courantes : 1) l'information fournie pour obtenir le consentement à l'analgésie épidurale pendant le travail, 2) l'usage d'opioïdes et d'anesthésiques locaux pour amorcer l'analgésie épidurale, 3) l'utilisation d'épreuve de coagulation en prééclampsie, 4) l'usage courant d'aiguilles rachidiennes tranchantes, 5) l'administration neuraxiale de morphine et l'usage d'anti-inflammatoires non stéroïdiens après la césarienne, 6) le traitement optimal des effets secondaires de l'opioïde neuraxial, 7) le moment d'insertion d'une tube endotrachéal pour l'anesthésie générale après l'accouchement et 8) le retrait des cathéters épiduraux au travers de l'aiguille épidurale.

Conclusion : Cette enquête présente des données de référence sur la pratique de l'anesthésie obstétricale au Canada en 1997. Les anesthésiologistes affiliés ou non à une université ont une pratique très similaire.

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REFERENCE values for the practice of obstetric anesthesia in Canada have not been determined. At national and international meetings, many anesthesiologists are often struck by the differences in practice amongst their colleagues. New drugs and techniques are being introduced into practice (e.g., neuraxial opioids, patient controlled epidural analgesia, combined spinal epidural analgesia, ropivacaine) and some long-held beliefs are being re-examined (e.g. timing of epidural analgesia, test doses, the effect of epidural analgesia on the progress of labour and method of delivery). The extent to which new or changing ideas are reflected in practice is unknown. The purpose of this study was: (1) to describe obstetric anesthesia as practiced in Canada in 1997, (2) to identify practices at variance with the literature and the opinions of experts, and (3) to identify questions for future research.

Methods

Published surveys of obstetric anesthesia practice were reviewed to design the first draft of a questionnaire.[1–4] The questionnaire was circulated at the Obstetric Section luncheon of the 1996 Canadian Anaesthetists' Society annual meeting and the results were used to improve the questionnaire. A revised questionnaire was then sent to all specialist anesthesiologist members of the Canadian Anaesthetists' Society residing in Canada in February 1997; non-responders were mailed a second questionnaire three months later. A copy of the 19-page questionnaire can be obtained from Dr. Breen. The data were entered into an SPSS database for summary. No statistical analysis was attempted.

Results

Data were obtained from anesthesiologists working in each province (Table I) with the return rate mirroring the number of specialist anesthesiologists in each province. Practitioners of obstetric anesthesia tended to be younger, newer into practice and more likely to have undertaken additional training in obstetric anesthesia. Of the 865 anesthesiologists returning questionnaires, 522 practiced obstetric anesthesia (60.3%). The data presented in this report come from these anesthesiologists and are stratified into anesthesiologists who worked partly or entirely in a university-based environment (UBA- university-based anesthesiologists) and those who were community based (CBA – community-based anesthesiologists).

TABLE I Practice location (province) of anesthesiologists returning questionnaires

Province of anesthesia practice	*Number of responses from each province*	*Percentage of total number of responses*	*Distribution of active specialist members of the CAS (year 2000)*
British Columbia	128	16.8%	17.4%
Alberta	89	11.7%	9.0%
Saskatchewan	35	4.6%	3.6%
Manitoba	33	4.3%	4.9%
Ontario	286	37.5%	38.6%
Québec	106	13.9%	17.0%
New Brunswick	25	3.3%	2.6%
Prince Edward Island	3	0.4%	0.3%
Nova Scotia	45	5.9%	5.0%
Newfoundland	12	1.6%	1.7%

TABLE II Definitions

Abbreviation	Definition
BP	Blood pressure
CAS	Canadian Anesthesiologists' Society
CBA	Community-based anesthesiologists
Combitube™	A modified esophageal obturator airway
CSE	Combined spinal epidural
CVP	Central venous pressure catheter
ETT	Endotracheal tube
FHR	Fetal heart rate
GA	General anesthesia
im	Intramuscular
iv	Intravenous
iv PCA	Intravenous patient controlled analgesia
L&D	Labour and delivery unit
LFT	Liver function tests
LMA	Laryngeal mask airway
N_2O	Nitrous oxide
NICU	Neonatal Intensive Care Unit
NSAID	Nonsteroidal anti-inflammatory drug
PCA	Patient controlled analgesia
PCEA	Patient controlled epidural analgesia
PROM	Prolonged rupture of the membranes
RT	Respiratory therapist
TENS	Transcutaneous electrical nerve stimulation
Trach Light™	A flexible stylet with a distal light source that can be placed at the end of the endotracheal tube
UBA	University-based anesthesiologists, in whole or in part
UTI	Urinary tract infection

Discussion

This paper presents information covering a diverse range of obstetric anesthesia topics. Selected items are commented upon because of their potential interest or controversial nature. The reader is referred to standard texts for information and recommendations on most questions of the survey.[5,6]

Oral intake during labour

Most anesthesiologists (94.5%) allowed some oral intake in the latent phase of labour (Table IV). During

active labour, anesthesiologists became more restrictive about the type and amount of oral intake allowed, a finding similar to a U.S. survey.[7] Some authors have questioned the need for a restrictive practice of oral intake during labour and Elkington suggested that "unless parturients are not candidates for regional anesthesia, a nonparticulate diet should be allowed."[8] A recent review article concluded that, "the incidence of pulmonary aspiration in general surgical patients is small, and only slightly greater in obstetric and pediatric patients. The resulting morbidity per anesthetic is low and mortality very small."[9] Given that pulmonary aspiration of gastric contents is rare, no restrictive oral intake policy guarantees an empty stomach, and clear liquids are rapidly absorbed from the stomach, a more liberal policy of oral intake of clear liquids during labour may be considered.

Patient education and consent for labour analgesia

Canadian women want to be informed of all possible complications associated with epidural analgesia.[10] We found that accidental dural puncture was mentioned by > 80% of anesthesiologists, paralysis was mentioned by 56% of anesthesiologists and death by 22% (Table VI). This finding contrasts with the Canadian Medical Protective Association (CMPA) recommendation that patients be informed of common, non-serious side effects or complications, and rare but serious complications.[11]

Laboratory evaluation

A majority of anesthesiologists did not require any laboratory testing before placing a labour epidural catheter (Table VII). The minimum platelet count

TABLE III Comparison between community based and university based anesthesiologists who practice obstetric anesthesia

Variable	*CBA*	*UBA*
Male/total	256/310 (82.6%)	159/208 (76.4%)
Age (yr)	44.5 ± 11.1	44.0 ± 7.5
Yr practicing anesthesia	13.3 ± 9.2	13.0 ± 7.7
Additional training in obstetric anesthesia	15/311 (4.8%)	29/208 (13.9%)
Primary care centre	60/310 (9.4%)	5/208 (2.4%)
Secondary care centre	182 310 (58.7%)	14/208 (6.7%)
Tertiary care centre	68/310 (21.9%)	187/208 (89.9%)
Teach anesthesia residents	89/311 (28.6%)	199/208 (95.7%)
% of practice in OB	11.2%	14.0%
Dept. produces labour pain management brochure	185/303 (61.1%)	156/200 (78.0%)
Dept. teaches pain relief in labour classes	72/306 (23.5%)	112/202 (55.4%)
Anesthesiologists cover OR and OB simultaneously	292/309 (94.5%)	138/207 (66.7%)
Anesthesiologists cover > 1 hospital simultaneously	35/307 (11.4%)	12/204 (5.9%)
Manage labour analgesia from outside the hospital	87/266 (32.7%)	5/197 (2.5%)

TABLE V Analgesia options available and the use of *iv* PCA opioid analgesia during labour

	CBA	*UBA*
Epidural analgesia	280/300 (93.3%)	201/207 (97.1%)
Intramuscular opioids	286/295 (96.5%)	191/202 (95.0%)
Nitrous oxide – oxygen	216/282 (76.6%)	166/194 (85.6%)
Showers	219/276 (79.3%)	161/194 (83.0%)
Intravenous opioids	178/270 (65.9%)	170/194 (87.6%)
Pudendal nerve blocks	184/268 (68.7%)	106/170 (59.2%)
Combined spinal epidural analgesia (CSE)	116/252 (46.0%)	156/194 (80.4%)
Bath tubs	141/261 (54.0%)	105/185 (56.8%)
Paracervical blocks	117/246 (47.6%)	63/166 (38.0%)
TENS	51/234 (21.8%)	59/172 (34.3%)
Water blocks	27/227 (11.9%)	15/161 (9.3%)
Acupuncture	2/226 (0.9%)	13/162 (8.0%)
Hypnosis	1/224 (0.4%)	2/159 (1.3%)
The number of times in the last year that each anesthesiologist has provided *iv* PCA opioid analgesia during labour	0.4	1.1
The number of anesthesiologists who have used *iv* PCA fentanyl for labour analgesia	16/43 (37.2%)	49/81 (60.5%)

TABLE IV Eating and drinking in labour

Amount of food ± liquid you allow women to ingest during:	*The latent phase of labour*		*Active labour*	
	CBA	*UBA*	*CBA*	*UBA*
Small amounts of clear liquids to clear liquids ad lib	190/301 (63.1%)	133/205 (64.9%)	142/303 (46.9%)	114/204 (55.9%)
Ice chips only	43/301 (14.3%)	29/205 (14.1%)	124/303 (40.9%)	72/204 (35.3%)
Light meals	38/301 (12.6%)	27/205 (13.2%)	-	-
No restrictions	13/301 (4.3%)	5/205 (2.4%)	-	-
Nothing by mouth	-	-	19/303 (6.3%)	14/204 (6.9%)

TABLE VI Risks of epidural analgesia as explained to parturients

	CBA	*UBA*
Dural puncture	252/268 (94.0%)	171/183 (93.4%)
Inadequate block	182/268 (67.9%)	133/183 (72.7%)
Back pain after delivery	176/268 (65.6%)	128/183 (69.9%)
Hypotension	162/268 (60.4%)	105/183 (57.4%)
Nerve injury	151/268 (56.3%)	102/183 (55.7%)
Paralysis	152/268 (56.7%)	100/183 (54.6%)
Intravenous injection	97/268 (36.2%)	49/183 (26.8%)
Epidural abscess/hematoma	85/268 (31.7%)	55/183 (30.1%)
Allergy	80/268 (29.9%)	53/183 (29.0%)
Total spinal	79/268 (29.5%)	43/183 (23.5%)
Pruritus	72/268 (26.9%)	46/183 (25.1%)
Death	70/268 (26.1%)	30/183 (16.4%)

TABLE VII Laboratory testing and coagulopathy

	CBA	*UBA*
Minimum lab data required to initiate epidural analgesia:		
None	178/308 (57.8%)	137/204 (67.2%)
CBC	122/308 (39.6%)	65/204 (31.9%)
CBC, PT, aPTT	4/308 (1.3%)	2/204 (1.0%)
Minimum platelet count you will accept and still provide epidural analgesia:		
Platelet count	80,600 ± 18,800	79,500 ± 18,000
Would place an epidural catheter if the platelet count were 50,000	45/308 (14.6%)	33/204 (16.2%)
In what situations do you determine a bleeding time?		
Never	197/302 (65.2%)	146/200 (73.0%)
All parturients with platelet counts < 100,000	63/302 (20.9%)	29/200 (14.5%)
Preeclampsia with platelet counts 100,000-150,000	13/302 (4.3%)	8/200 (4.0%)
Is thromboelastography (TEG) used in your centre?		
No	284/300 (94.7%)	172/201 (85.6%)
Yes, on an experimental basis	12/300 (4.0%)	25/201 (12.4%)
Yes, it is readily available for clinical use	2/300 (0.7%)	3/201 (1.5%)

required by most anesthesiologists for placement of an epidural catheter was 80,000 ± 18,000, and approximately 15% of anesthesiologists would insert epidural catheters if the platelet count was as low as 50,000. The literature now contains several reports of epidural anesthesia in patients with thrombocytopenia, including one patient with a platelet count of 2,000-4,000 who received an epidural without sequelae.[4,12–15] More information is needed to determine the safety of epidural analgesia in the presence of thrombocytopenia. Investigations have shown that the bleeding time does not predict bleeding in remote sites (e.g., the epidural space) and its use has dropped significantly.[16,17] Some investigators are exploring the use of thromboelastography (TEG) in the settings of thrombocytopenia and preeclampsia.[18,19] Whether or not TEG will provide useful information to obstetric anesthesiologists remains unknown.

Labour epidural analgesia

The majority of anesthesiologists administered a "test dose" prior to a "labour analgesia" dose (Table IX), with CBA favouring a bupivacaine and UBA lidocaine-epinephrine. The need for, and efficacy of, the lidocaine-epinephrine test dose has been questioned.[20–22] Many anesthesiologists favour incremental injection of epidural medications where each dose administered is "safe" if inadvertently placed in the subarachnoid or intravascular spaces.[3,23] The lidocaine-epinephrine test dose has recently been shown to hinder patient mobility and, therefore, may not be desirable for anesthesiologists aiming to provide ambulatory epidural analgesia during labour.[24] Labour analgesia was most commonly initiated with bupivacaine 0.25% without opioids. Studies have shown that by adding a lipophilic opioid the dose of epidural local anesthetic needed for labour analgesia can be reduced by up to 50%, often termed the "bupivacaine sparing effect."[25] These lower doses of bupivacaine and fentanyl (or sufentanil) have been associated with: (1) improved analgesia,[26] (2) less motor blockade,[27] (3) more ambulation,[27,28] (4) a decreased need for oxytocin,[28] (5) a shorter 2nd stage of labour,[27] (6) fewer instrumental vaginal deliveries,[26–29] and (7) a decreased Cesarean section rate.[28] The UBA were more likely to use patient controlled epidural analgesia (PCEA) than CBA (Table X). PCEA has many potential advantages for labour epidural analgesia, both in small and large maternity units.[30] Patient satisfaction is high and anesthesiologists get fewer calls for top-ups. With proper programming and protocols in place, PCEA may be safely used, even when the anesthesiologist is out of the hospital or busy in the operating room, a view supported by the current Canadian Anesthesiologists' Society Guidelines for Obstetric Anesthesia. Hospitals and departments of anesthesia looking to acquire infusion pumps for labour and delivery suites might want to consider PCEA pumps rather than simple infusion pumps.

Fever and epidural analgesia and anesthesia

Approximately two thirds of anesthesiologists would provide epidural analgesia in the presence of moderate systemic infection (Table XII). However, with a more severe systemic infection only 45% of anesthesiologists would place an epidural catheter. While there are data to support the use of epidural analgesia in the setting

TABLE VIII Pulling epidural catheters back through epidural needles

Do you pull epidural catheters back through epidural needles if you are only able to insert the epidural catheters:	*1-2 cm through the needle*		*≥ 3 cm through the needle*	
	CBA	*UBA*	*CBA*	*UBA*
Uncommonly, and only if there is no resistance	110/310 (35.5%)	75/205 (36.6%)	59/309 (19.1%)	47/203 (23.2%)
Commonly, but only is there is no resistance	101/310 (32.6%)	71/205 (34.6%)	11/309 (3.6%)	14/203 (6.9%)
Never	99/310 (31.9%)	59/205 (28.8%)	238/309 (77.3%)	141/203 (69.5%)

	CBA	*UBA*
Percentage having had an epidural catheter break leaving a piece of catheter in a patient	16/310 (5.2%)	10/205 (4.9%)

TABLE IX Initiation of labour analgesia

	CBA	*UBA*
% providing epidural analgesia at < 3 cm	166/308 (53.9%)	134/208 (64.4%)
% providing epidural analgesia at 3-7 cm	298/307 (97.1%)	204/206 (99.0%)
% providing epidural analgesia at 8-10 cm	279/304 (91.8%)	194/204 (95.1%)
Which local anesthetic do you use in your usual test dose?		
Bupivacaine	136/295 (46.1%)	56/201 (27.9%)
Lidocaine	104/295 (35.3%)	126/201 (62.7%)
Do not use a test dose	52/295 (17.6%)	19/201 (9.5%)
2-Chloroprocaine	2/295 (0.7%)	0/201 (0%)
Which local anesthetic do you use when initiating labour analgesia?		
Bupivacaine	257/298 (86.2%)	158/201 (78.6%)
Lidocaine	29/298 (9.7%)	32/201 (15.9%)
What percentage of bupivacaine do you use to initiate analgesia?		
0.25%	183/256 (71.5%)	104/158 (65.8%)
0.125%	37/256 (14.5%)	20/158 (12.7%)
0.1%	9/256 (3.5%)	11/158 (7.0%)
What opioid do you add to the local anesthetic for initiation of labour analgesia?		
Fentanyl	111/298 (37.2%)	84/201 (41.8%)
Sufentanil	8/298 (2.7%)	8/201 (4.0%)
None	171/298 (57.4%)	103/201 (51.2%)
Percentage using CSE	56/301 (18.6%)	88/202 (43.6%)
Why do you not use CSE in your practice?		
No advantages	131/242 (54.5%)	72/119 (60.5%)
Not available	47/242 (19.4%)	14/119 (11.8%)
Not familiar	32/242 (13.2%)	15/119 (12.6%)

TABLE X Maintenance of labour analgesia

	CBA	*UBA*
Labour epidural analgesia is maintained by:		
Intermittent top-ups	24/286 (8.3%)	17/195 (8.6%)
Continuous infusions	238/286 (83.2%)	148/195 (75.9%)
Patient Controlled Epidural Analgesia (PCEA)	17/286 (5.9%)	25/195 (12.8%)
Local anesthetic that labour analgesia is maintained with:		
Bupivacaine	283/286 (99.0%)	192/195 (98.5%)
Concentration of bupivacaine used in infusions to maintain analgesia:		
0.125%	108/279 (38.7%)	70/191 (36.6%)
≤ 0.10%	102/279 (36.6%)	93/191 (48.7%)
Opioid added to your labour epidural infusions:		
Fentanyl	202/286 (70.6%)	134/195 (68.7%)
Sufentanil	6/268 (2.1%)	16/195 (8.2%)
What rate do you run your labour epidural infusions at?		
Average infusion rate ($ml \cdot hr^{-1}$)	9.3 ± 2.3 (n=267)	9.7 ± 2.2 (n=184)
Why do you not use patient controlled epidural analgesia (PCEA) in your practice?		
Not available	173/293 (59.0%)	97/180 (53.9%)
No advantages	56/293 (19.1%)	48/180 (26.7%)
Not familiar	28/293 (9.6%)	12/180 (6.7%)

of presumed chorioamnionitis,[31,32] there are very few data about the safety of epidural analgesia in the setting of severe systemic infection. Epidural analgesia in parturients is a rare cause of central nervous system infection with large survey studies showing a very low incidence of infection.[33–37] Indeed, one study suggested that repeated epidural anesthesia in the presence of infection might be safe![38] For a Cesarean section in the setting of a fever, 55% of anesthesiologists would use spinal anesthesia for delivery, with 27% of UBAs and 41% of CBAs using general anesthesia. One laboratory showed that with appropriate antibiotic coverage (usually unknown), spinal anesthesia might be safely performed.[39,40] There is a need for more and better information about the risks and benefits of epidural and spinal analgesia/anesthesia in the presence of systemic infection.

TABLE XI Intrapartum monitoring and neonatal resuscitation after routine vaginal delivery

	CBA	*UBA*
Use of continuous fetal heart rate monitoring in "low risk" women receiving epidural analgesia		
Almost always	204/301 (67.8%)	128/202 (63.4%)
Often	54/301 (17.9%)	31/202 (15.3%)
Only after top-ups	34/301 (11.3%)	36/202 (17.8%)
Never	8/301 (2.7%)	7/202 (3.5%)
Providers of neonatal resuscitation for routine vaginal deliveries:		
L&D nurse	127/308 (41.2%)	93/203 (45.8%)
Nursery/NICU nurse ± RT	60/308 (19.5%)	38/203 (18.7%)
Pediatrician/Neonatologist	33/308 (10.7%)	28/203 (13.8%)
Anesthesiologist responsible for mother	30/308 (9.7%)	22/203 (10.8%)
Family physician	38/308 (12.3%)	13/203 (6.4%)
Obstetrician	19/308 (6.2%)	9/203 (4.4%)
Number of anesthesiologists who inserted pulmonary artery catheters in women allowed to labour in the last year	2/310 (0.6%)	17/205 (8.3%)
Number of anesthesiologists who inserted pulmonary artery catheters to assist with management during Cesarean delivery in the last year	6/310 (1.9%)	17/205 (8.3%)

TABLE XIII Preeclampsia

	CBA	*UBA*
Minimum lab testing required before providing epidural analgesia to a parturient with preeclampsia (BP 150/95, 1-2 g·day^{-1} proteinuria):		
CBC, PT, aPTT	135/302 (44.7%)	100/201 (49.8%)
CBC, PT, aPTT, LFT	69/302 (22.8%)	51/201 (25.4%)
CBC	82/302 (27.1%)	37/201 (18.4%)
None	6/302 (2.0%)	7/201 (3.4%)
For a parturient with preeclampsia (BP 160/105) that has mildly elevated LFTs and a falling platelet count (300,000 1st trimester, 125,000 yesterday, 80,000 one hour ago), would you provide epidural analgesia?		
Never	105/305 (34.4%)	76/201 (37.8%)
If repeat platelet count ≥ 80,000	107/305 (35.1%)	49/201 (24.4%)
Yes, and place epidural catheter now	41/305 (13.4%)	41/201 (20.4%)
If repeat platelet count ≥ 60,000	17/301 (5.6%)	13/201 (6.5%)
If the bleeding time is normal	21/305 (6.9%)	7/201 (3.5%)
For a parturient with preeclampsia (BP 160/105) that has mildly elevated LFTs and a falling platelet count (120,000 yesterday, 80,000 eight hours ago, 58,000 one hour ago), would you provide epidural analgesia?		
Never	197/302 (74.8%)	155/204 (76.0%)
If repeat platelet count ≥ 50,000	29/305 (9.5%)	21/204 (10.3%)
If the bleeding time is normal	21/305 (6.9%)	9/204 (4.4%)
Yes, and place the epidural catheter now	11/305 (3.6%)	5/204 (2.5%)
What anesthetic is your usual choice for Cesarean section in the setting of moderate to severe preeclampsia?		
Epidural	192/305 (63.0%)	137/200 (68.5%)
Spinal	70/305 (23.0%)	44/200 (22.0%)
General	41/305 (13.4%)	16/200 (8%)
CSE	2/309 (0.6%)	3/205 (1.5%)

TABLE XII Regional analgesia/anesthesia in the presence of fever

Provision of labour epidural analgesia for a patient in the following clinical scenarios:	Suspected UTI (pyuria, T=38.5°C), has received two doses of ampicillin		Presumed chorioamnionitis (PROM x 4 days, T=39.8°C), on ampicillin and gentamicin (morphine 15 mg *im* one hour ago was ineffective)	
	CBA	*UBA*	*CBA*	*UBA*
Provide epidural	210/305 (68.8%)	138/205 (67.3%)	16/308 (5.2%)	21/203 (10.3%)
Refuse	49/305 (16.1%)	22/205 (10.7%)	70/308 (22.7%)	36/203 (17.7%)
Wait until afebrile, the provide epidural	27/305 (8.9%)	29/205 (14.1%)	-	-
Explain risks, provide epidural if wanted	11/305 (3.6%)	11/205 (5.4%)	127/308 (41.2%)	66/203 (32.5%)
iv PCA	-	-	75/308 (24.4%)	70/203 (34.5%)
Single intrathecal injection	-	-	6/308 (2.0%)	5/203 (2.5%)

Anesthesia for Cesarean section in patients without a working epidural catheters who are febrile (T=38.5°C), presumed to have chorioamnionitis, and have received two doses of ampicillin:	*CBA*	*UBA*
Spinal	156/309 (50.5%)	128/205 (62.4%)
General	126/309 (40.8%)	56/205 (27.3%)
Epidural	25/309 (8.1%)	18/205 (8.8%)
CSE	3/309 (0.6%)	3/205 (1.5%)

TABLE XIV The frequency with which anesthesiologists would provide epidural analgesia in a number of uncommon medical conditions

	CBA	*UBA*
Harrington rods	200/302 (66.2%)	161/201 (80.1%)
Multiple sclerosis	231/302 (76.5%)	180/204 (88.2%)
Sciatica during the last month of pregnancy	268/304 (88.2%)	180/201 (89.6%)
Previous lumbar disc surgery	280/307 (91.2%)	192/201 (95.5%)
Recent history of a prolapsed lumbar disc	202/300 (67.3%)	135/202 (66.8%)
"Stable" thoracic spine fracture in a neurologically intact parturient	190/299 (63.5%)	148/198 (74.7%)
Paraplegia	232/301 (77.1%)	171/198 (86.4%)
Intracranial tumour	65/291 (22.3%)	51/197 (25.9%)
Recent intracranial hemorrhage, aneurysm, not clipped	116/292 (39.7%)	95/199 (47.7%)
Positive HIV status	229/300 (76.3%)	172/204 (84.3%)
AIDS	210/298 (70.5%)	163/203 (80.3%)
Moderate aortic stenosis (valve area 1-1.5 cm^2)	246/302 (81.5%)	177/203 (87.2%)
Severe aortic stenosis (valve area < 1 cm^2)	68/296 (23.0%)	86/204 (42.2%)
Significant pulmonary hypertension	133/285 (46.7%)	151/201 (75.1%)
Eisenmenger's syndrome	79/285 (27.7%)	106/195 (54.4%)

TABLE XV Anesthesia for elective Cesarean section

	CBA	UBA
Usual anesthetic technique for elective Cesarean section:		
Spinal	249/306 (81.4%)	181/205 (88.3%)
Epidural	45/306 (14.7%)	19/205 (9.3%)
General	6/306 (2.0%)	1/205 (0.5%)
CSE	4/306 (1.3%)	3/205 (1.5%)
Usual type of spinal needle used:		
Quincke	207/272 (76.1%)	151/195 (77.4%)
Sprötte	32/272 (11.8%)	21/195 (10.8%)
Whitacre	24/272 (8.8%)	17/195 (8.7%)
Gauge of spinal needle most commonly used:		
25G	177/273 (64.8%)	110/195 (56.4%)
27G	42/273 (15.4%)	48/195 (24.6%)
24G	29/273 (10.6%)	17/195 (8.7%)
26G	15/273 (5.5%)	13/195 (6.7%)
Local anesthetic most commonly used for spinal anesthesia?		
Bupivacaine	197/269 (73.2%)	186/195 (95.4%)
Lidocaine	62/269 (23.0%)	8/195 (4.1%)
% adding fentanyl to spinal local anesthetics	140/208 (67.3%)	116/178 (65.2%)
Epidural anesthesia for Cesarean section:		
% using CO_2 lidocaine	167/297 (56.2%)	116/205 (56.6%)
% using plain lidocaine	85/297 (28.2%)	64/205 (31.2%)
% using bupivacaine	35/297 (11.8%)	15/205 (7.3%)
% adding fentanyl to epidural local anesthetic	200/297 (67.3%)	143/205 (69.8%)
Use of phenylephrine to treat hypotension after major conduction block		
% using phenylephrine	95/283 (33.6%)	94/191 (49.2%)
% using phenylephrine ≤ 10% of the time	78/95 (82.1%)	80/94 (85.1%)

Preeclampsia

Almost one half of anesthesiologists wanted to review a CBC, PT and aPTT before providing epidural analgesia in the setting of preeclampsia (Table XIII). In preeclamptic patients, thrombocytopenia occurs before abnormalities are detected in the PT and aPTT and a normal platelet count is highly predictive of a normal PT and aPTT.[41–43] Therefore, if the platelet count is normal, a PT and aPTT are not needed. In the setting of severe preeclampsia, 65% of anesthesiologists would use epidural anesthesia for Cesarean delivery and 23% spinal anesthesia. A recent retrospective study suggested that spinal anesthesia may be safely used in these patients.[44] Although most anesthesiologists believe general anesthesia should be avoided, if possible, especially because of airway concerns, the literature does support appropriate use of general anesthesia in severe preeclamptic patients.[45,46] Thus, anesthesiologists should assess each patient and choose the form of anesthesia with which they are most comfortable and familiar.[47]

Anesthesia for Cesarean delivery

Most anesthesiologists used spinal anesthesia for elective Cesarean sections (84%) and Quincke spinal needles were used for more than ¾ of spinal anesthetics (Table XV). In general, fewer and less severe post dural puncture headaches are seen with non-cutting spinal needles.[48–50] In addition, smaller needles produce fewer and less severe headaches than larger needles but bend more easily. Thus, the smallest non-cutting needle that allows easy access to the cerebrospinal fluid is recommended.

Urgent and emergency Cesarean delivery

Cesarean deliveries are frequently urgent or emergency operations. When anesthesiologists have 10-15 min, more than 95% would use a working epidural catheter (Table XVI). In the same situation but without a working epidural catheter, 17% of CBA would choose general anesthesia, as would 6% of UBA. Current literature suggests that maternal mortality, especially in the emergency situation, is considerably higher with general anesthesia than with regional anesthesia.[51,52]

TABLE XVI Anesthesia for urgent and emergency (stat) Cesarean section

Anesthesia most commonly chosen for an urgent Cesarean section when you have 10-15 min before skin incision:				
	Working epidural catheter in situ		*No epidural catheter in situ*	
	CBA	*UBA*	*CBA*	*UBA*
Epidural	292/307 (95.1%)	199/205 (97.1%)	13/309 (4.2%)	4/205 (2.0%)
Spinal	9/307 (2.9%)	5/205 (2.4%)	243/309 (78.6%)	186/205 (90.7%)
General	6/307 (2.0%)	1/205 (0.5%)	53/309 (17.2%)	13/205 (6.3%)
CSE	-	-	0/309 (0%)	2/205 (1.0%)
Anesthesia most commonly administered for a stat Cesarean section (FHR = 60 for two minutes):				
	Working epidural catheter in situ		*No epidural catheter in situ*	
	CBA	*UBA*	*CBA*	*UBA*
General	184/307 (59.9%)	108/203 (53.2%)	282/308 (91.6%)	171/204 (83.8%)
Spinal	7/307 (2.3%)	13/203 (6.4%)	26/308 (8.4%)	33/204 (16.2%)
Epidural	116/307 (37.8%)	81/203 (39.9%)	-	-

TABLE XVII Management of inadequate regional anesthesia for Cesarean section

When the patient is not yet prepped for surgery and the epidural block is inadequate, your usual approach is:		
	CBA	*UBA*
Spinal	125/302 (41.4%)	121/202 (58.9%)
General	143/302 (47.4%)	63/202 (31.2%)
Repeat the epidural	34/302 (11.3%)	18/202 (8.9%)
When you give a spinal anesthetic after a failed epidural anesthetic, your dose of intrathecal local anesthetic is:		
	CBA	*UBA*
Decreased	97/230 (42.2%)	94/172 (54.7%)
Not changed	133/230 (57.8%)	78/172 (45.3%)

When the block is inadequate, your first strategy to manage the anesthetic is:

	Before delivery of the baby		*After delivery of the baby*	
	CBA	*UBA*	*CBA*	*UBA*
GA with ETT	153/305 (50.2%)	93/200 (46.5%)	87/295 (29.5%)	67/199 (33.7%)
N_2O ± other	50/305 (16.4%)	40/200 (20.0%)	14/295 (4.7%)	10/199 (4.9%)
Ketamine ± other	22/305 (7.2%)	29/200 (14.5%)	13/295 (4.4%)	23/199 (11.6%)
Reassure	26/305 (8.5%)	14/200 (7.0%)	5/295 (1.7%)	2/199 (1.0%)
Opioid ± other	22/305 (7.2%)	12/200 (6.0%)	128/295 (43.4%)	83/199 (41.7%)
Propofol ± other	14/305 (4.6%)	4/200 (2.0%)	36/295 (12.2%)	7/199 (3.5%)
Local anesthesia infiltration of the wound	16/305 (5.2%)	2/200 (1.0%)	-	-
Midazolam ± other	-	-	6/295 (2.0%)	4/199 (2.0%)

Spinal anesthesia after inadequate epidural anesthesia

When an inadequate epidural block was detected before preparing a patient for surgery, 49% of anesthesiologists would remove the epidural catheter and administer a spinal anesthetic (Table XVII). Approximately half of those anesthesiologists would use their usual spinal dose of local anesthetic and half a lower dose. The use of a lower dose of local anesthetic reflects the possible increased risk of high spinal anesthesia when a spinal anesthetic is used after a failed epidural anesthetic.[53]

Failure to intubate the trachea or ventilate the lungs during Cesarean delivery

In the setting of an elective Cesarean section under general anesthesia when the anesthesiologist could ventilate but not intubate the patient's trachea, 60% of anesthesiologists would awaken the patient immediately and switch to regional anesthesia (Table XVIII). A panel of Canadian anesthesiologists recently recommended "after two failed attempts at oral intubation, if it is possible to ventilate the lungs by face mask with

TABLE XVIII *First step* in the management of unable to intubate/unable to ventilate situations

	Elective Cesarean sections			
	Can ventilate, cannot intubate		*Cannot ventilate, cannot intubate*	
	CBA	*UBA*	*CBA*	*UBA*
Awaken patient, provide regional anesthesia	188/307 (61.2%)	115/199 (57.8%)	175/302 (57.9%)	91/195 (46.7%)
Trach Light™ assisted intubation	35/307 (11.4%)	28/199 (14.1%)	17/302 (5.6%)	20/195 (10.3%)
Fibreoptic assisted endotracheal intubation	20/307 (6.5%)	23/199 (11.6%)	14/302 (4.6%)	14/195 (7.2%)
Gum elastic bougie assisted tracheal intubation	26/307 (8.5%)	16/199 (8.0%)	11/302 (3.6%)	7/195 (3.6%)
LMA	24/307 (7.8%)	10/199 (5.0%)	64/302 (21.2%)	44/195 (22.6%)
Transtracheal jet ventilation	-	-	9/302 (3.0%)	5/195 (2.6%)
	Stat Cesarean sections			
	Can ventilate, cannot intubate		*Cannot ventilate, cannot intubate*	
	CBA	*UBA*	*CBA*	*UBA*
LMA	121/309 (39.2%)	62/200 (31.0%)	124/306 (40.5%)	81/200 (40.5%)
Trach Light™ assisted intubation	53/309 (17.2%)	42/200 (21.0%)	36/306 (11.8%)	31/200 (15.5%)
Fibreoptic assisted endotracheal intubation	37/309 (12.0%)	23/200 (11.5%)	16/306 (5.2%)	7/200 (3.5%)
Face mask general anesthesia	33/309 (10.7%)	25/200 (12.5%)	-	-
Gum elastic bougie assisted tracheal intubation	28/309 (9.1%)	19/200 (9.5%)	-	-
Awaken patient, provide regional anesthesia	7/309 (2.3%)	4/200 (2.0%)	58/306 (19.0%)	24/200 (12.0%)
Combitube™	3/309 (1.0%)	6/200 (3.0%)	3/306 (1.0%)	10/200 (5.0%)
Transtracheal jet ventilation	-	-	10/306 (3.3%)	4/200 (2.0%)
Tracheostomy	-	-	8/306 (2.6%)	4/200 (2.0%)

TABLE XIX Analgesia after Cesarean delivery

	CBA	*UBA*
Most common method of providing analgesia after Cesarean section:		
Neuraxial morphine	176/309 (57.0%)	157/201 (78.1%)
im opioids	86/309 (27.8%)	22/201 (10.9%)
iv PCA opioids	33/309 (10.7%)	16/201 (8.0%)
PCEA or epidural infusions	6/309 (1.9%)	0/201 (0%)
Adjuncts routinely ordered as part of postoperative analgesia:		
Codeine ± acetaminophen	138/176 (78.4%)	99/157 (63.1%)
NSAIDs	81/186 (46.0%)	114/157 (72.6%)
Acetaminophen	62/176 (35.2%)	62/157 (39.5%)
iv PCA opioids	16/176 (9.1%)	14/157 (8.9%)
im opioids	5/176 (2.8%)	6/157 (3.8%)
PCEA	2/176 (1.1%)	3/157 (1.9%)
Do the surgeons usually infiltrate the incision with local anesthesia for postoperative analgesia?	19/305 (6.2%)	11/205 (5.4%)
Drug used most commonly to treat neuraxial opioid-induced pruritus:		
Diphenhydramine	176/298 (59.1%)	112/202 (55.4%)
Naloxone	45/298 (15.1%)	35/202 (17.3%)
No drug treatment	42/298 (14.1%)	21/202 (10.4%)
Nalbuphine	24298 (8.1%)	25/202 (12.4%)

cricoid pressure applied, the patient should be woken up."[54] When the trachea could not be intubated or the lungs ventilated, 53.5% of anesthesiologists stated that their first step would be to awaken the patient. The expert panel recommended that anesthesiologists maintain cricoid pressure and use either a laryngeal mask airway (LMA) or Combitute™ to establish ventilation, proceeding if needed to a transtracheal airway.

Analgesia after Cesarean delivery

Approximately two thirds of anesthesiologists reported using neuraxial morphine to provide analgesia after Cesarean delivery (UBA 78% *vs* CBA 57%, Table XIX). While late onset respiratory depression was once feared after neuraxial morphine, with appropriate monitoring guidelines, neuraxial morphine is a safe, effective and easily used method for providing excellent analgesia after Cesarean delivery.[55–57] Nonsteroidal anti-inflammatory drugs (NSAIDs) were used by 59% of anesthesiologists (73% UBAs *vs* 46% CBAs). The NSAIDs improve analgesia and allow a smaller dose of morphine to be used, decreasing the side effects.[58–61] While diphenhydramine was used by more than 50% of anesthesiologists to treat pruritus following neuraxial opioids, evidence suggests that nalbuphine is a better choice.[62–64]

Anesthesia after delivery

General anesthesia without an endotracheal tube was often used for manual removal of a retained placenta (Table XXI) - a very curious finding as most parturients in the immediate postpartum period are still considered "full stomach patients."[65] In contrast, the median duration following delivery before anesthesiologists would provide anesthesia for a tubal ligation

TABLE XX Placenta previa and anesthesia for Cesarean section

Preferred anesthetic for an elective Cesarean section in a patient who has a placenta previa:	*Posterolateral placenta previa*		*Anterior placenta previa*	
	CBA	*UBA*	*CBA*	*UBA*
Spinal	174/305 (57.0%)	111/202 (55.0%)	60/300 (20.0%)	38/201 (18.9%)
Epidural	54/305 (17.7%)	54/202 (26.7%)	38/300 (12.7%)	38/201 (18.9%)
General	74/305 (24.3%)	29/202 (14.4%)	197/300 (65.7%)	118/201 (58.7%)
CSE	3/305 (1.0%)	8/202 (4.0%)	5/300 (1.7%)	7/201 (3.5%)
Additional access or monitoring lines used in the above settings:	*CBA*	*UBA*	*CBA*	*UBA*
2nd *iv*	268/279 (96.1%)	187/189 (98.9%)	283/291 (97.3%)	191/193 (99.0%)
Arterial line	27/154 (17.5%)	18/106 (17.0%)	102/188 (54.3%)	95/146 (65.1%)
CVP	12/149 (8.1%)	4/97 (4.1%)	59/172 (34.3%)	38/115 (33.0%)

TABLE XXI Anesthesia in the early postpartum period

	CBA	*UBA*
Usual anesthetic for manual removal of the placenta in stable (not bleeding) patients without an epidural catheters *in situ*:		
GA without ETT	199/309 (64.4%)	93/205 (45.5%)
Spinal	52/309 (16.8%)	58/205 (28.3%)
GA with ETT	25/309 (8.1%)	38/205 (18.0%)
CSE	15/309 (4.9%)	10/205 (4.9%)
iv nitroglycerin	13/309 (4.2%)	6/205 (2.9%)
Usual anesthetic for postpartum tubal ligations (0-24 hr after delivery):		
Spinal	125/302 (41.4%)	121/202 (62.4%)
General	143/302 (47.4%)	63/202 (31.2%)
Epidural	34/302 (11.3%)	18/202 (8.9%)
Median number of weeks required before you will provide anesthesia, without endotracheal intubation, for a tubal ligation:	20	17

and not require an endotracheal tube was approximately four months.

Limitations

The purpose of this study was to describe obstetric anesthesia as practiced in Canada during 1997. The survey methodology has several limitations. The overall response rate to the questionnaires was 56%, and of those, 60% practiced obstetric anesthesia. While this was fewer than 35% of the anesthesiologists practicing in Canada, it does represent the opinions of over 500 anesthesiologists. Some groups may have been over represented in this survey and others under represented. For example, subspecialist obstetric anesthesiologists may have responded at a greater rate than generalist anesthesiologists (or vice versa). There may have been more (or fewer) responses from UBA than CBA, and, for different reasons. Similarly, there might have been different response rates from large hospital settings compared with that from smaller hospital settings. If a large group all answered questions in a similar fashion, that group may have influenced the results. However, given the size of the survey, number of responses, and resources of the investigators, it was not possible to reduce the data to responses from each centre and to reanalyze the data in that fashion. The data represents the opinions of a large number of practicing specialist anesthesiologists from all parts of the country, and therefore probably reflects common practice.

Conclusion

This study provides reference data for the practice of obstetric anesthesia in Canada. Each anesthesiologist practicing obstetric anesthesia now has the opportunity to compare his/her own practice to this large peer group. The authors hope the study will stimulate anesthesiologists to examine their practice, pursue research to answer clinical questions, and to improve the care given to parturients. In particular, anesthesiologists may wish to: (1) provide more information to labouring women, (2) reconsider the use of test doses, (3) use opioids plus local anesthetics for initiation of epidural analgesia, (4) use PCEA to facilitate maintenance of labour epidural analgesia, (5) order fewer PT and aPTT tests, (6) use non-cutting spinal needles, (7) use neuraxial morphine plus NSAIDs for analgesia after Cesarean deliveries, (8) use nalbuphine rather than diphenhydramine to treat neuraxial morphine side effects, and (9) review the role of general anesthesia without a protected airway in the early postpartum period.

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